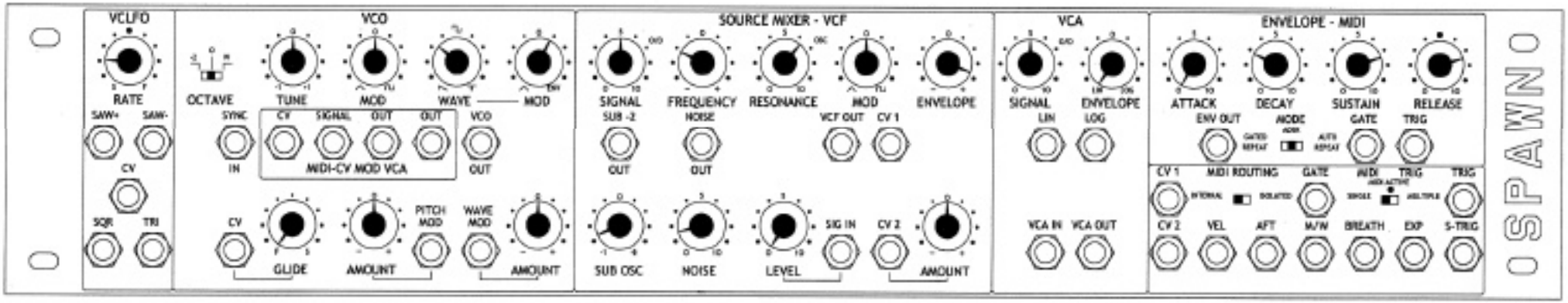
# ANALOGUE SYSTEMS



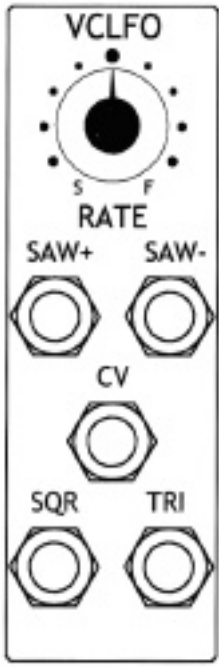

# SPAWN

## OPERATORS MANUAL

# CONTENTS

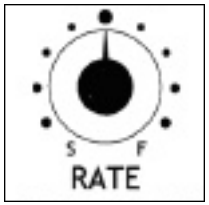
# INTRODUCTION TO SPAWN

SPAWN is a monophonic (one voice) Quasi modular rack synthesizer. It's principle sound source the Voltage Controlled Oscillator (VCO) generates a variable waveform along with two sub squarewaves and a white noise source, these signals can be mixed and introduced into the resonant 24dB per Octave low pass ladder filter (VCF). This stage is followed by a Voltage Controlled Amplifier (VCA). Both the VCF and VCA can be controlled by the four part multi function Envelope Shaper. A Voltage Controlled low frequency Oscillator (VCLFO) is provided for frequency and waveshape modulation.
SPAWN also includes a performance VCA (MIDI - CV MOD VCA) this will accept both audio and control signals and can be controlled by both a control voltage or the internal high performance MIDI - CV convertor.
All signal and modulation routes can be isolated (see Isolation Patch pg 23) allowing for true modular synthesis.
SPAWN is provided with 37 3.5mm Jack sockets to allow signal and modulation patching.



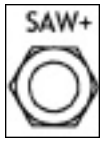

# VCLFO VOLTAGE CONTROLLED LOW FREQUENCY OSCILLATOR

The VCLFO is a wide range oscillator (usually operated in the non audio range) used to modulate control inputs, e.g: used for vibrato, tremolo and trill. It is internally routed to the VCO and VCF (see INTERNAL SIGNAL ROUTE page 3).
Four waveforms are simultaneously available and the Rate can be altered using the linear CV socket.

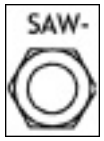



## LFO CONTROL

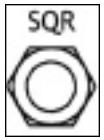
The Rate knob controls the speed of the modulation waveform.
The LED gives a visual indication of the speed of the VCLFO.



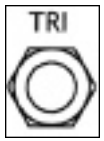

This output gives a positive sawtooth with an output voltage of +/-5 volts.



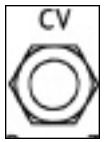

This output gives a negative sawtooth with an output voltage of +/-5 volts.



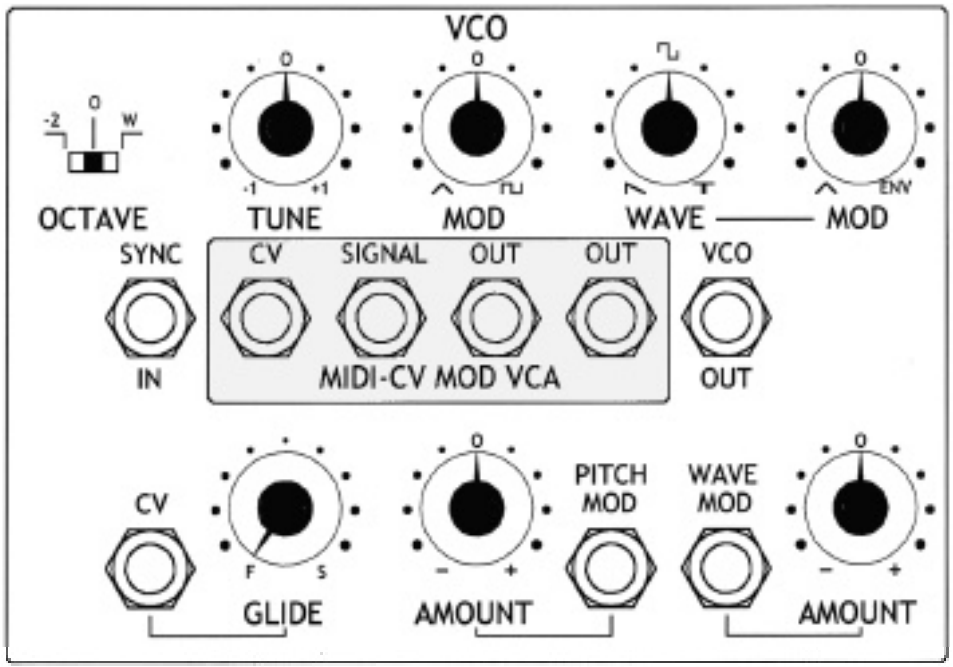

This output gives a squarewave output of +/-5 volts.




This output gives a trianglewave output of +/-5 volts.

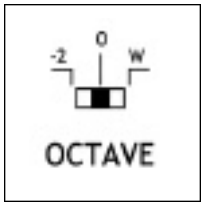



This gives linear control of the VCLFO rate, e.g: from keyboard or envelope.



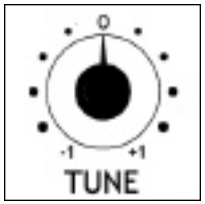

# VCO VOLTAGE CONTROLLED OSCILLATOR

The VCO is the primary sound source within SPAWN.
It creates the raw waveform which is then processed and modified by the other synthesizer circuits.
SPAWN contains a temperature compensated oscillator, conforming to the industry standard logarithmic IV/OCT response. For ease of control an internal patch from the Midi/CV interface has been routed to a CV input of the oscillator, it by passes the Glide control so that the Midi keyboard controls the level of the Glide. This internal route can be isolated using the Midi routing switch in the Midi section.



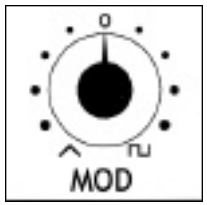

## FREQUENCY CONTROL

**1A.** In the '-2' position the Tune knob controls the initial frequency of 16Hz by +/- one octave.

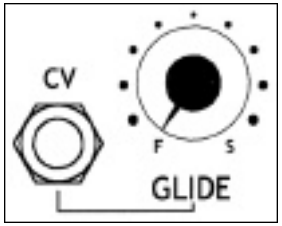



**1B.** In the '0' position the Tune knob controls the initial frequency of 64Hz by +/- one octave.

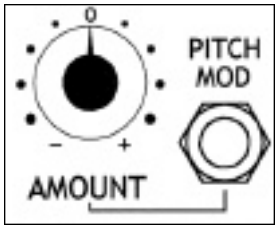
**1C.** In the 'W' position (WIDE) the Tune knob has a range of approximately 12 octaves.



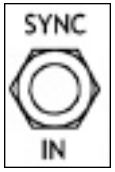

The Modulation knob introduces either triangle, square or no modulation to the oscillators frequency (a maximum of two octaves, from the VCLFO).




The CV socket is the main IV/OCT control input for the VCO. This input will accept +/- control voltages and should be your control input from a CV keyboard/controller such as the A.S French Connection, Sorceror or Demon when used in the analogue mode. With the ‘Glide’ knob turned to the ‘F’ position (fast) no glide will be present. As the knob is turned clockwise a slewing of the INPUT voltage will increase. This glide control is also known as ‘Portamento’ or ‘LAG’. If the Midi Convertor is being used internally this input can still be used, Midi generated CV’s are not routed through the Glide control.

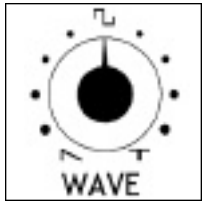



The Pitch Mod Socket and associated Amount Pot is another method of controlling the frequency of the Oscillator. The Amount Pot also acts as an Invertor so that positive and negative frequency sweeps can be achieved from a Positive Control Voltage. For instance the envelope sends out 0 to 9.5 volt, if the ENV OUT was patched to the PITCH MOD INPUT in the full ‘+’ position the frequency of the VCO will increase by 9.5 Octaves. However with the CONTROL knob in the full ‘-’ position the frequency of the VCO will decrease by 9.5 Octaves. Many control VOLTAGE sources are available on a synthesizer both + and - AC or DC, so many types of frequency modulation and sweeping is easily achieved. The closer the knob is to the ‘O’ position the smaller the amount of control.

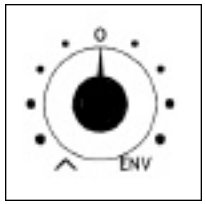



This is a hard sync input used to reset the VCO waveform using a second oscillator. A wide range of frequencies, waveshapes and levels will determine the type of sync generated.

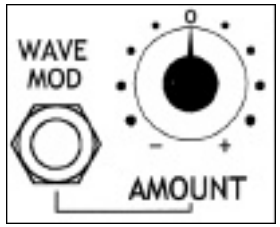
## WAVE SHAPING




The Wave knob controls the initial wave shape from the VCO. In the anti-clockwise position a sawtooth is generated, in the clockwise position a pulse is generated, between the two positions the wave shape alters from sawtooth through various sawtooth/squarewaves to a 5% pulse. The waveform is fully variable with no fixed point.

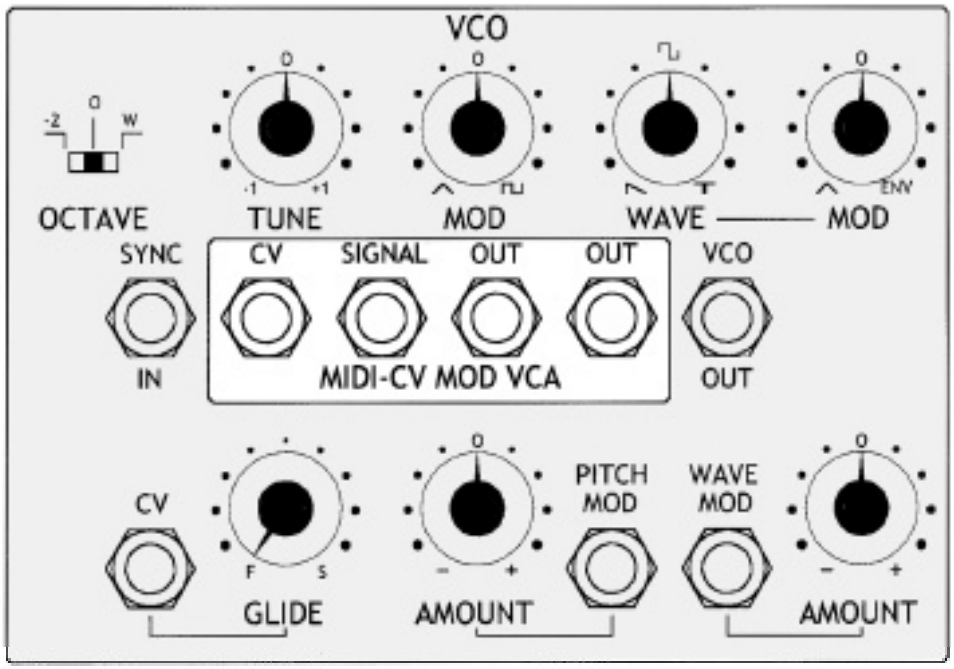



The Mod knob controls the amount of triangle modulation (from the VCLFO) or envelope modulation routed to the waveshape. Pulse width modulation can be created using this method.



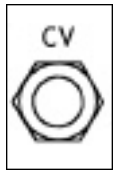

The Wave Mod socket and associated Amount pot is the way of externally controlling the waveshape generated by the VCO. The Amount pot also acts as an invertor. So that the initial wave shape can be swept both positively and negatively. For example the ◹ wave can be converted to a pulse wave using a positive control voltage and having the amount knob turned clockwise (be aware of voltage level and amount knob position) like wise using a positive control voltage but with the control knob turned in the negative position a pulse wave can be converted to a sawtooth. This is a very important control and learning how to use it along with what to use it with will create very unusual waveshapes.


This is the unmodified output of the VCO and has an output voltage of +10v ( in ◹ mode) as it concerts to the 5% pulse the output will have a +/- voltage of 10 volts when the sawtooth component of the wave shape has been removed the square/pulse wave will be approx - 10v.

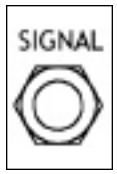



# MIDI - CV MOD VCA

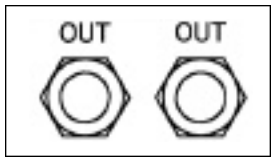
The Midi-CV Mod VCA is a performance orientated VCA , there are two ways of controlling this VCA. The Midi control input is routed to the Midi controlled Mod wheel output (this may be isolated). Although primarily designed to allow modulation control from midi this versatile VCA can also be controlled by an analogue CV patched to the CV socket.



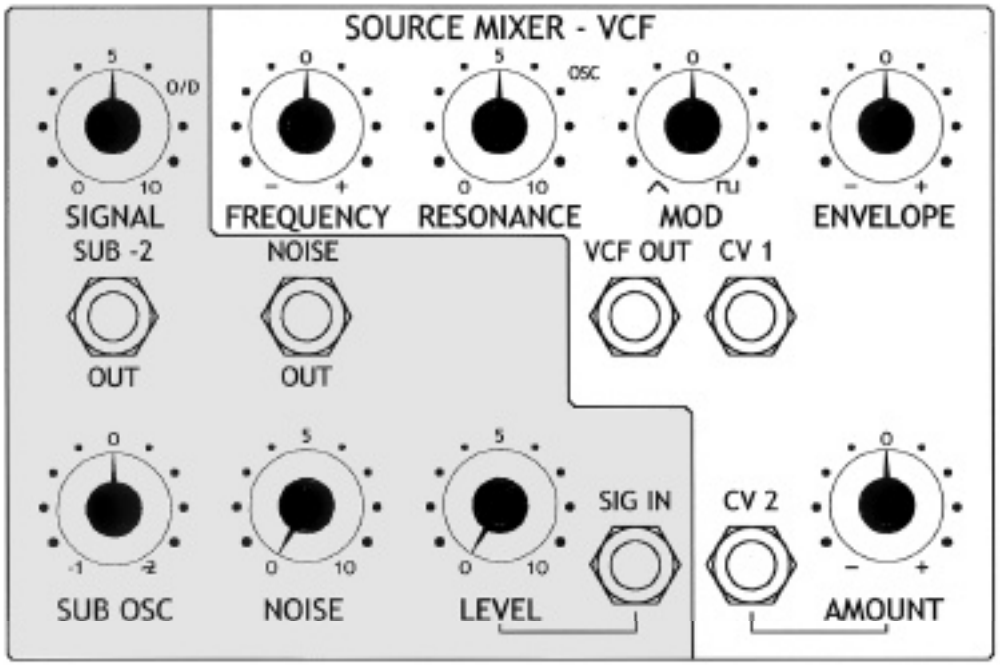

This socket is the control input to open the VCA when used in the CV analogue mode. It can be used even if the internal Midi route is active.




This socket is the signal input to the Mod VCA. Audio and control voltages can be accepted by this input.
**Example 1.**
A waveform from the VCLFO coming into the signal input can have its level controlled by an analogue voltage by the CV this variable level control waveform available at the out socket could then be used to modulate a VCO or VCF.
**Example 2.**
An audio waveform could be sent to the signal input of the VCA as the CV is increased, the output waveform level would increase patched to the ext sig in the VCF, a performance control could increase the level of the external signal into SPAWN.




Two outputs are available from the Mod VCA simultaneous control of VCO pitch and VCF frequency is available.
*Note only Midi is pre-routed, all signal in's, CV in's and outputs must be made using the patch sockets.

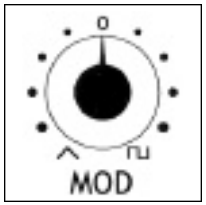



## VCF VOLTAGE CONTROLLED FILTER

The VCF in SPAWN is a low pass 24dB/oct transistor ladder filter. It has the ability to attenuate/eliminate frequencies above the cut off frequency point. This type of filter is associated with the classic American ‘FAT’ analogue sound.

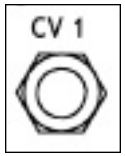

The Frequency knob (full name cut-off frequency) controls the point at which attenuation begins. Frequencies above the cut-off frequency point are attenuated at 24dB/oct.


The Resonance knob is used to accentuate frequencies around the cut-off point, as the resonances increases the filter will begin to ring and will self oscillate at high resonate settings producing a sinewave (the frequency of which is controlled by the cut-off knob).

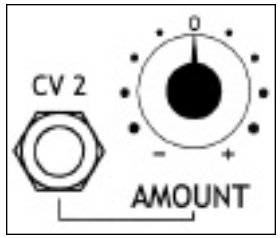



The Mod knob introduces either triangle, square (from the VCFLO) or no modulation to the VCF's cut-off point.


The Envelope knob alters the cut-off point according to the set up of the envelope generator allowing automated shaping of the filter negatively and positively.

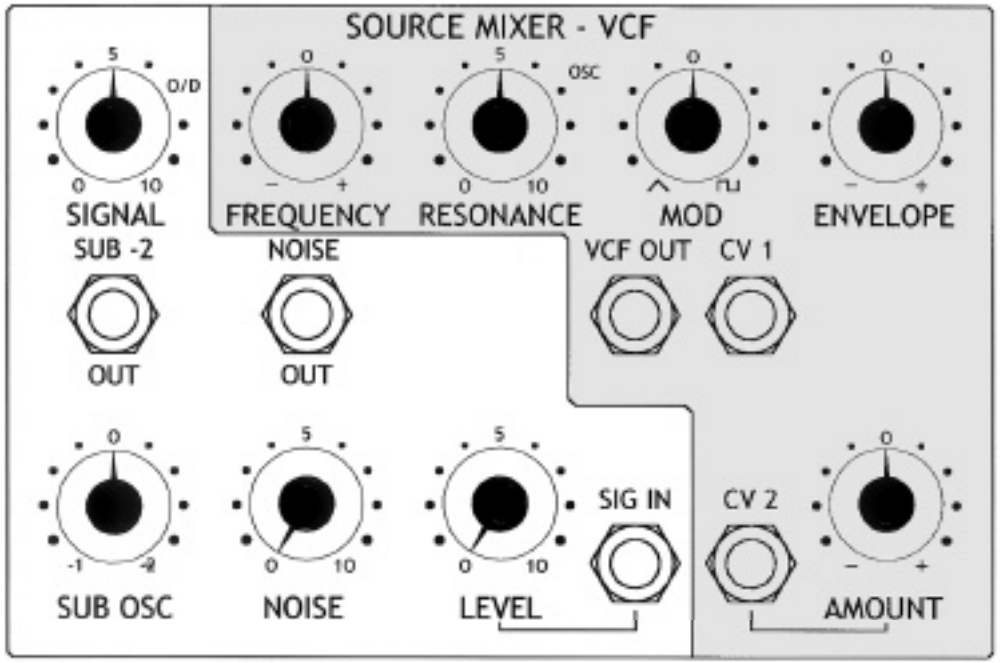



This is the main control voltage input for the VCF and has control characteristics of IV/OCT. An internal patch is provided from the Midi controller. Allowing the filter to 'track' the keyboard, as with other pre-patched Midi routing this can be isolated using the 'Midi Routing' switch in the Midi section. Whether the Midi pre-patch is active or not the CV1 socket can be used to control the VCF frequency.



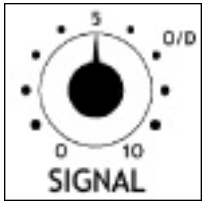

The CV2 socket and associated amount pot is another method of controlling the frequency of the filter.
The Amount pot also acts as an invertor so that positive and negative frequency sweeps can be achieved from a positive control voltage
**Example:** If a keyboard generated control voltage was applied to the CV2 socket and the amount pot was turned approx 95% in the clockwise direction as the keyboard is played the filter would track the keyboard with the IV/OCT characteristics. As the notes are played higher up the keyboard so the filter frequency would increase, if the amount knob is turned approx 95% counter clockwise again the filter would track but at -IV/OCT, effectively the higher you play up the keyboard so the filter would decrease.


This is the audio output of the filter prior to modification by the VCA.

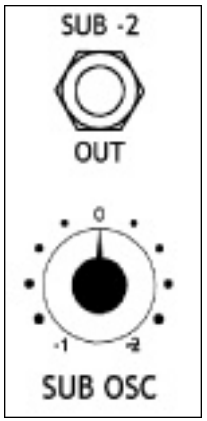



## SOURCE MIXER

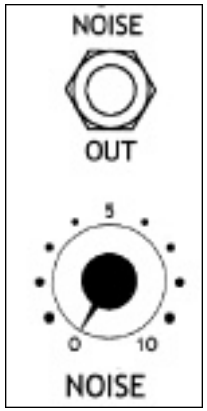
The source mixer is the point at which all internal/external audio signals can be mixed prior to being processed by the VCF.



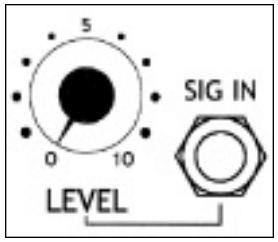

The Signal knob controls the audio signal level coming from the VCO into the VCF. The filter may be over-driven in the range of 7 -10.



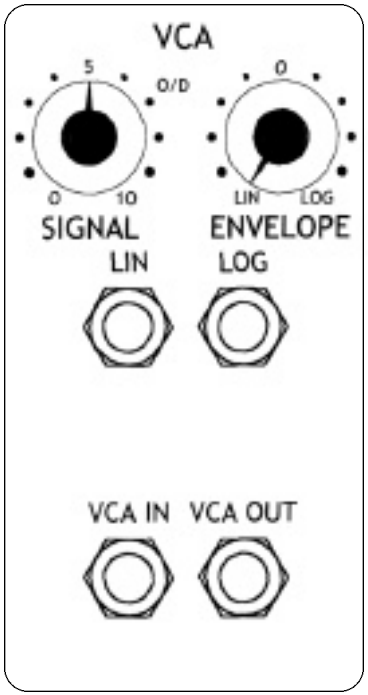

The Sub Octave Generator is a means of creating a squarewave either 1 or 2 octaves lower than the initial frequency of the VCO. If the control knob is turned anti clockwise a squarewave 1 octave below the VCO waveform is introduced into the VCF.
If the control knob is turned clockwise a squarewave 2 octaves below the VCO waveform is introduced into the VCF. The waveshape generated by the VCO will not change the shape of the sub oscillator waveform.
The squarewave 2 octaves lower than the VCO is available at the Sub-2 out socket unatenuated.




The Noise Generator in SPAWN generates white noise. White noise is a signal that contains all the audio frequencies in equal amounts but has no recognisable pitches or tones the knob is a level control of noise signal being introduced into the VCF.
Unatenuated and unfiltered noise is available at the Noise Out Socket.

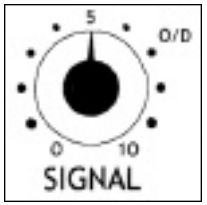



The Sig In socket and associated Level knob is the point at which external audio signals can be introduced into SPAWN. These signals can then be modified by the VCF if required.



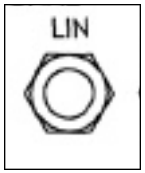

## VCA VOLTAGE CONTROLLED AMPLIFIER

The VCA is an amplifier which allows it's gain to be altered by a control voltage.
The VCA in SPAWN has both logarithmic and linear controls creating unique contours.

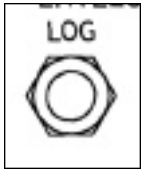



The signal knob controls the audio signal level coming from the VCF into the VCA. The VCA may be over-driven (clipped) in the range of 7 -10.

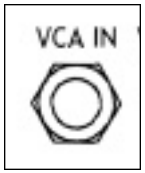

The envelope knob sets the amount of voltage controlled amplification from the envelope generator. Linear and logarithmic control is available giving unique and unusual amplification contours.



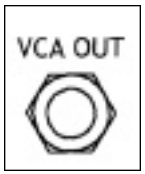

This input allows linear modulation of the VCA by an external source (the usual control input from an envelope generator).



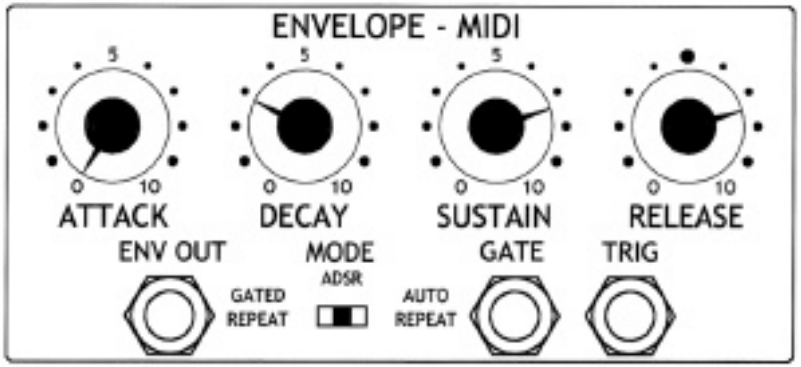

This input allows logarithmic modulation of the VCA by an external source.




This is an external input that allows audio and control signals to be processed by the VCA.

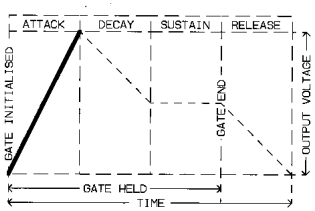


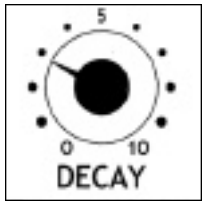

This is the output of the VCA, as it is also the final output when used as a complete synthesizer a 1/4” socket is duplicated on the rear panel for convenient patching to your mixer.



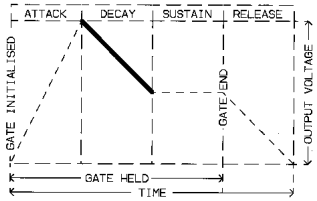

The ENV is a method of generating a control voltage, the waveshape is created in 4 stages: Attack, Decay, Sustain and Release which can be adjusted individually. The output of the ENV can control any voltage controlled input.
In addition SPAWN's envelope has an auto repeat function allowing auto envelope contours.

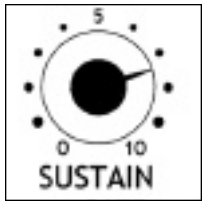

The Attack knob controls the amount of time it takes the output voltage to reach the maximum level once the gate is initialised.



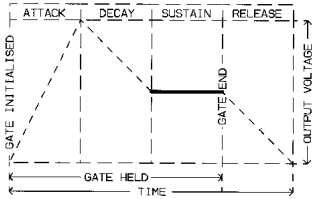




The Decay knob controls the amount of time it takes the output voltage to fall to the sustain level once the attack phase is complete, providing the gate has not already ended.



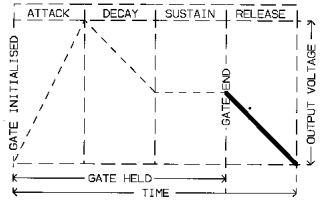



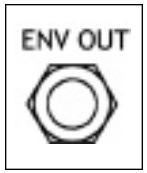

The Sustain knob controls the level of the output voltage until the gate ends.



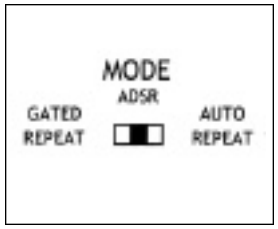


The Release knob controls the amount of time it takes the output voltage to fall to '0' once the gate has ended.
The L.E.D. is a visual indication of ENV activity.

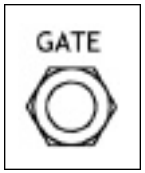




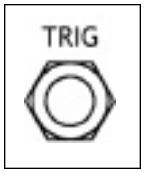

This is the output voltage of the ENV which can be used to control any voltage controlled input.



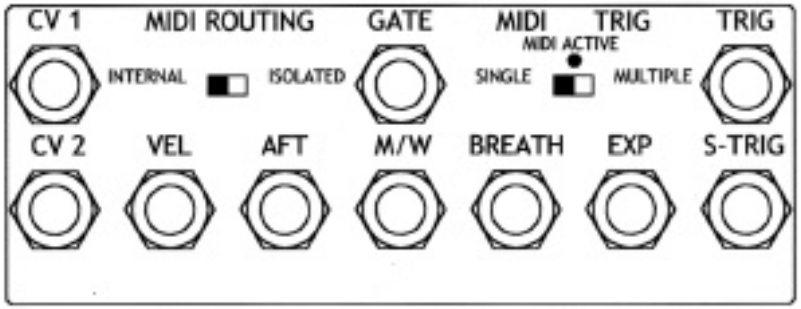

The Mode switch controls the type of contour generated by the envelope. With the switch in the centre position ‘ADSR’ the envelope generates the standard 4-part ADSR envelope on initiation of a gate. There are also 2 auto repeat two part envelope controls, Attack - Decay. In the gated repeat mode the envelope will repeatedly cycle through the A - D parts of the envelope while a gate is present. In the auto repeat mode the envelope will continuously repeat the A + D parts of the envelope without a gate present. In both of these modes the sustain and release controls are non functioning.




This is an input which initialises the ENV cycle (e.g: the gate output from a keyboard/controller with a minimum output of 1 volt).
Midi is internally routed to the gate input allowing easy control from a Midi - Master keyboard/controller.
As with other internally routed Midi controls this can be isolated using the switch in the Midi section.

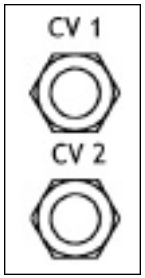



This is the trig/retrig input. A short positive pulse will re-initialise the already gated ENV.

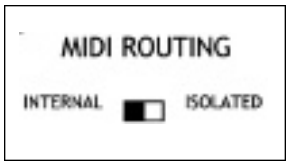



## MIDI CONTROLLER

The Midi Controller in SPAWN is a high spec Midi to CV convertor. Having many functions found on the A.S. RS330 module. Through careful design this midi convertor can not only control many functions on SPAWN but it can also control other analogue synthesizers that do not have Midi built in. For ease of use 5 control routes can be pre-patched to SPAWN allowing instant playability straight from the box




These two sockets are identical outputs of the IV/OCT control voltage from the Midi-CV Convertor.




The Midi Routing switch controls the internal routing from the Midi-CV Convertor to five control inputs within SPAWN. With the switch in the 'Internal Routing' position the following internal patches are made.

**1/ CV to VCO**
Note that this internal patch by-passes the Glide control on SPAWN. If Glide is required when using Midi, Midi controller no.65 must be activated, and rate of Glide controlled by Midi controller 05 (portamento).

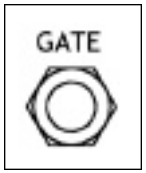
**2/ MOD Wheel.**
To the Midi-CV MOD VCA. Using the MOD Wheel function on your keyboard/controller the Midi CV MOD VCA can be operated.

**3/ CV to the VCF.**
This is a non attenuated control input to VCF the filter will track the keyboard/controller at IV/OCT.

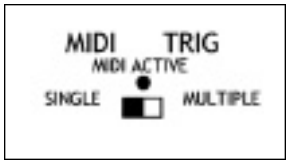
**4/ Expression.**
In addition the cutoff frequency of the VCF can be controlled by Midi controller no11 (expression) this is a powerful function of SPAWN allowing for realtime manipulation of the filter.

**5/ Gate to the Envelope Shaper.**
This will cause the envelope to operate (controlling the VCF and VCA). (Note on note off from the Midi kb/controller).

With the switch in the 'isolated' position none of the forementioned patches are made. Unless externally patched SPAWN will not respond to Midi.
*Note whether the Midi routing switch is in internal or isolated mode all the Midi-CV functions are available on the 10 sockets in the Midi section.




This socket provides the output for the Midi generated gate. When no key is pressed on the controlling keyboard no voltage appears at this socket, when a key is pressed (anywhere) on the keyboard approx 10 volts will be available at this socket. It remains at this level while the key is held and drops back to OV on release of the key. This ‘gate’ initialises the envelope generator.



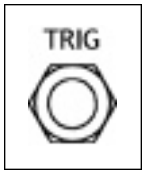

This switch controls the type of keyboard triggering response.

**Single.**

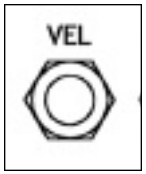
A new trigger is produced only when all previous notes have been released. This causes the pitch of the Oscillator to change but the envelope will not re-trigger.

**Multiple.**

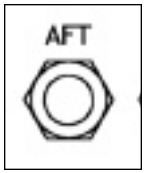
A trigger is produced every time that you press a lower note, whether or not previously held higher notes have been released. This causes the pitch of the Oscillator to change and the envelope to re-trigger.



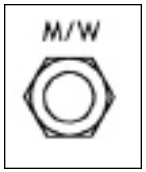

This socket provides the output for the midi generated trigger when a key is pressed on the Midi keyboard a pulse of approx 10 milliseconds with a voltage of 10v is generated. This trigger can re-initialise an already gated envelope.



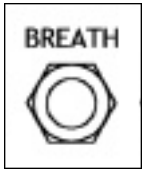

This socket provides a control voltage output relative to the velocity generated by the Midi master keyboard/controller.



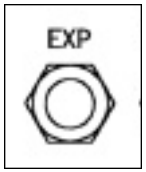

This socket provides a control voltage output relative to the after touch generated by the Midi master keyboard/controller.



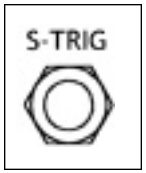

This socket provides a control voltage output relative to the Mod Wheel (Midi CC no1) generated by the Midi master keyboard/controller. There is an internally routed patch (see Midi routing switch note 2).




This socket provides a control voltage output relative to the breath controller (Midi CC no2) generated by a Midi controller. This is a bi-polar controller e.g it can produce +ve and -ve voltages in the range of +/- 5volts.




This socket provides a control voltage output relative to expression (Midi CC no11) this is assignable Midi function generated by a Midi controller. This is a bi-polar controller e.g it can produce +ve and -ve voltages in the range of +/- 5 volts. There is an internally routed patch (see Midi routing switch note 4).




This socket provides the output for the Midi generated s-trig, essentially this is an inverted gate signal, when no note is played on the Midi keyboard the s-trig socket has 10 volts at its output but when a key is pressed this voltage drops to zero volts, this output can drive an envelope requiring a gate for inversion effects  but is primarily designed to initialise the envelope shapers on early Moog™ synthesizers when used as a Midi to CV convertor.

SPAWN offers two standard MIDI connectors on its rear panel, IN and THRU together with a rotary switch that allows you to select the MIDI channel to which SPAWN will respond.

**MIDI IN:**
Connect this to the MIDI OUT of the keyboard, sequencer or other device with which you wish to control
**MIDI THRU:**
Any MIDI data received at SPAWN'S MIDI IN socket will be echoed by the MIDI THRU socket, thus allowing you to connect SPAWN in a 'daisy chain' of MIDI devices.

## MIDI CHANNEL SELECTOR

The MIDI channel selector offers sixteen positions marked in hexadecimal fashion from '0' to 'F'. Use a small tool such as precision screwdriver to choose the MIDI channel on which SPAWN recieves over MIDI, according to the following table:

| Arrow Points Towards | MIDI Channel Selected |
|---|---|
| 0 | 1 |
| 1 | 2 |
| 2 | 3 |
| 3 | 4 |
| 4 | 5 |
| 5 | 6 |
| 6 | 7 |
| 7 | 8 |
| 8 | 9 |
| 9 | 10 |
| A | 11 |
| B | 12 |
| C | 13 |
| D | 14 |
| E | 15 |
| F | 16 |

## SPECIFICATION

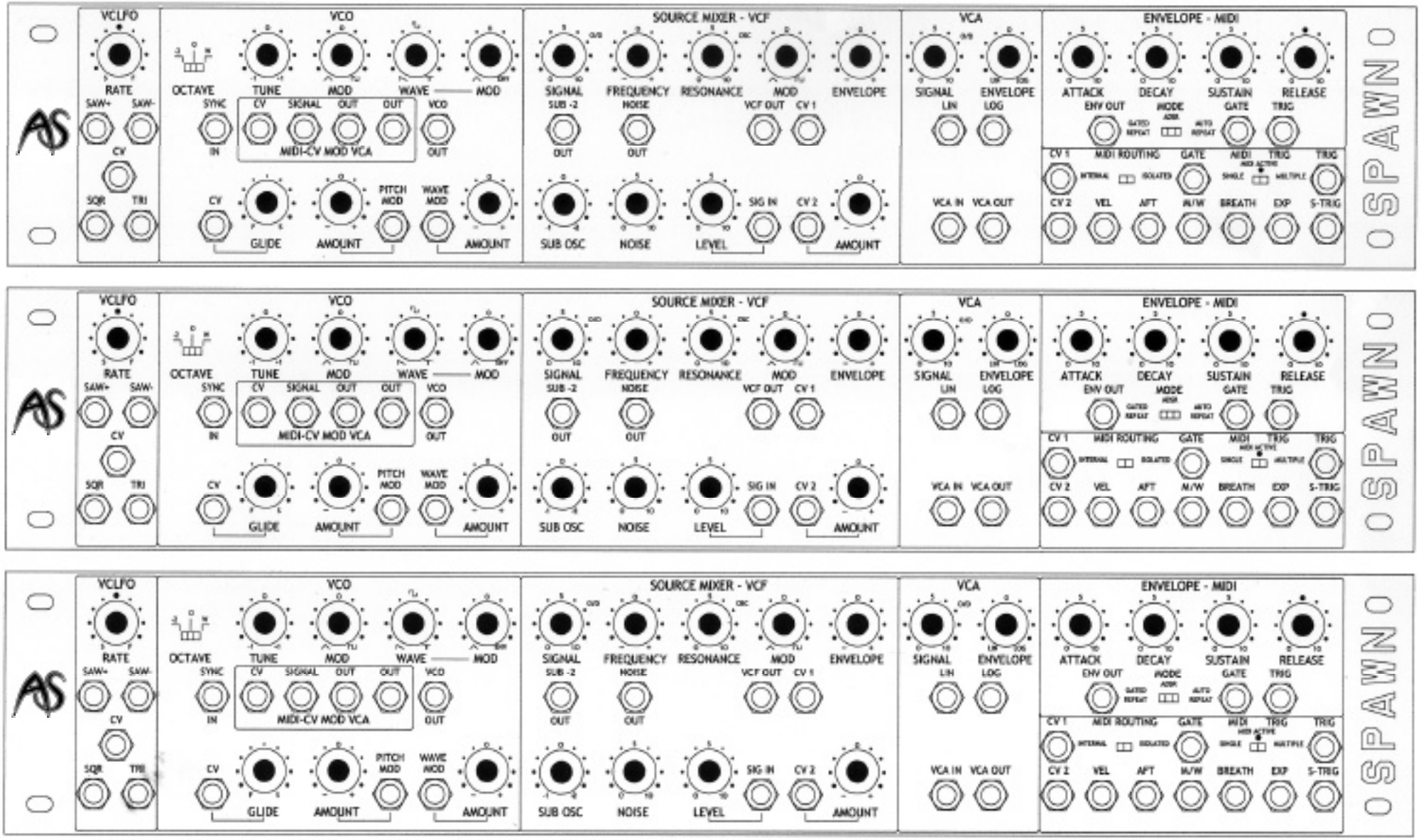
| | |
|---|---|
| VCLFO | |
| Fc Range | 0.055 Hz (one cycle per 18 seconds)<br>33 Hz (33 cycles per second) |
| Waveforms | Positive and negative sawtooth, square and triangle waveforms available simultaneously 10v peak to peak +/- 5v. |
| VCO | |
| Fc Range | 1.5Hz to 16.5KHz Exponential response 1 volt per octave. |
| Internal Fc MOD | Square or triangle +/- 1 octave |
| Waveform | Sawtooth waveform that transfers through square to 5% negative pulse (no fixed point). |
| Internal Wave MOD | Triangle (VCLFO) envelope. Full positive wave control |
| Temp Compensation | Factory set at 80 degrees for minimal drift. |
| Source Mixer | |
| Sub Octave Generator | -1 and -2 octaves. |
| Noise Generator | white noise 10v peak to peak. |
| VCF | |
| Type | 24dB per octave low pass ladder filter. Transistors and capacitors matched at specific temperature with 0% tolerance. |
| Fc Range | 20 Hz to 20 KHz. |
| Internal MOD | Square or triangle +/- 4 octaves (from VCLFO). |
| Resonance | Zero to self oscillation. |
| Envelope MOD | +/- 10 octaves. |
| VCA | |
| Gain Control | Internally routed linear or logarithmic control by envelope generator. |

| ENV | |
|---|---|
| Gate | 1v to 12v positive gate. |
| Trig/Retrig | 1v to 12v positive pulse. |
| Output Voltage | Zero to 10v (approx). |
| Attack Time | 5ms to 7.5 seconds. |
| Decay Time | 5ms to 15 seconds. |
| Sustain Level | Zero to 100%. |
| Release Time | 5ms to 15 seconds. |

| MIDI to CV Convertor | |
|---|---|
| High spec | For internal and external CV controls. |
| Channels | 1 - 16. |
| CV 1 - 2 | + and - 5v. |
| Gate | + 10v. |
| Trig | + 10v - 10ms. |
| Velocity | 0 - 5v. |
| After Touch | 0 - 5v. |
| MOD Wheel | 0 - 5v. |
| Breath | + and - 5v. |
| Expression | + and - 5v. |
| S - Trig | 10 - 0v. |

| | |
|---|---|
| Burn-In | Before final calibration units are burnt-in for a minimum of 96 hours. |
| Power Requirements | UK: 230v AC 50 Hz (220v - 240v).<br>Export: 115v AC 60Hz (100v - 120v). |
| Internal Supply | +/- 12v DC 90 mA. |
| AC Voltage Select | SPAWN has an ‘AC V. SELECT’ switch. It is imperative that this is set correctly. Failure to do so will void warranty and damage the unit beyond repair. |
| Warranty | SPAWN comes with a 12 month (from purchase date) back-to-base warranty, (i.e. customer must arrange and pay for carriage to and from Analogue Systems). |

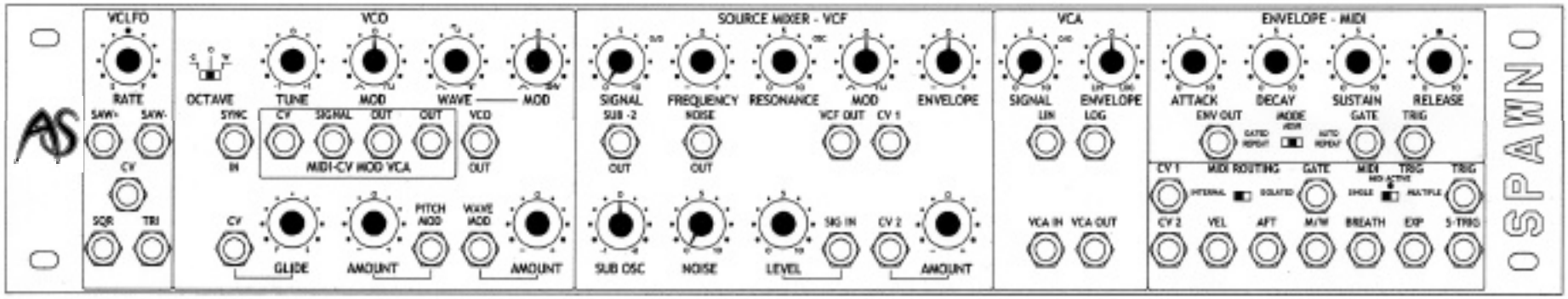
# SPAWN BLANK PATCH SHEETS




VCLFO
RATE
SAW+
SAW-
CV
SQR
TRI
VCO
OCTAVE
TUNE
MOD
WAVE
MOD
SYNC
IN
CV
SIGNAL
OUT
OUT
VCO
OUT
MIDI-CV MOD VCA
CV
GLIDE
AMOUNT
PITCH MOD
WAVE MOD
AMOUNT
SOURCE MIXER - VCF
SIGNAL
FREQUENCY
RESONANCE
MOD
ENVELOPE
SUB -2
NOISE
VCF OUT
CV 1
OUT
OUT
SUB OSC
NOISE
LEVEL
SIG IN
CV 2
AMOUNT
VCA
SIGNAL
ENVELOPE
LIN
LOG
VCA IN
VCA OUT
ENVELOPE - MIDI
ATTACK
DECAY
SUSTAIN
RELEASE
ENV OUT
MODE
GATE
TRIG
CV 1
MIDI ROUTING
GATE
MIDI
TRIG
TRIG
INTERNAL
ISOLATED
SINGLE
MULTIPLE
CV 2
VEL
AFT
M/W
BREATH
EXP
S-TRIG
OSPAWNO

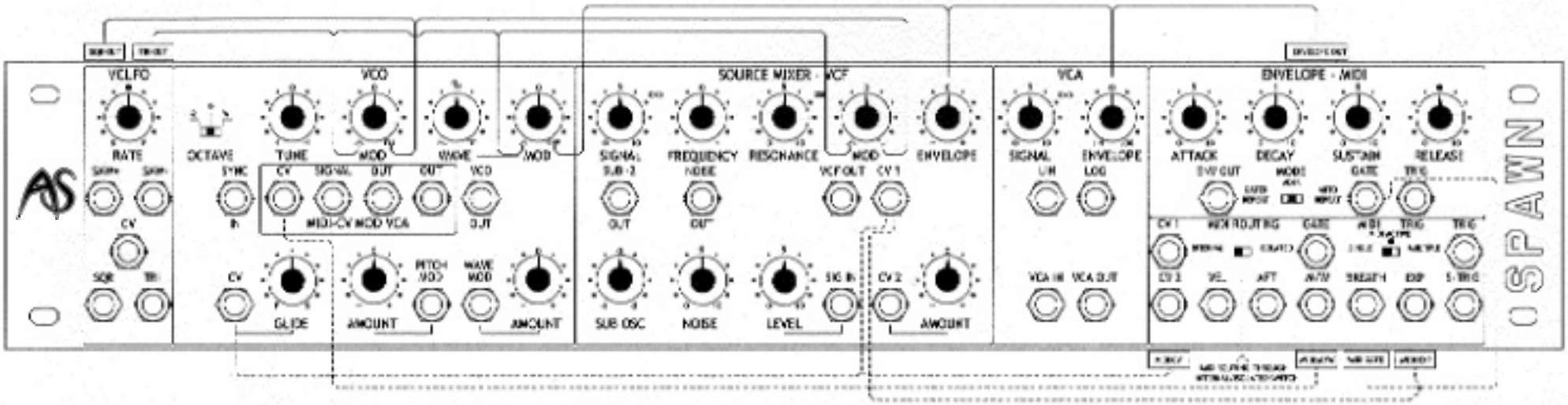
VCLFO
RATE
SAW+
SAW-
CV
SQR
TRI
VCO
OCTAVE
TUNE
MOD
WAVE
MOD
SYNC
IN
CV
SIGNAL
OUT
OUT
VCO
OUT
MIDI-CV MOD VCA
CV
GLIDE
AMOUNT
PITCH MOD
WAVE MOD
AMOUNT
SOURCE MIXER - VCF
SIGNAL
FREQUENCY
RESONANCE
MOD
ENVELOPE
SUB -2
NOISE
VCF OUT
CV 1
OUT
OUT
SUB OSC
NOISE
LEVEL
SIG IN
CV 2
AMOUNT
VCA
SIGNAL
ENVELOPE
LIN
LOG
VCA IN
VCA OUT
ENVELOPE - MIDI
ATTACK
DECAY
SUSTAIN
RELEASE
ENV OUT
MODE
GATE
TRIG
CV 1
MIDI ROUTING
GATE
MIDI
TRIG
TRIG
INTERNAL
ISOLATED
SINGLE
MULTIPLE
CV 2
VEL
AFT
M/W
BREATH
EXP
S-TRIG
OSPAWNO

# SPAWN ISOLATION PATCH




WITH THE HIGHLIGHTED CONTROLS IN THE POSITIONS SHOWN NO INTERNAL SIGNALS OR MODULATION ROUTES ARE ACTIVE.

# SPAWN INTERNAL MODULATION AND MIDI ROUTING




# SPAWN INTERNAL SIGNAL ROUTING