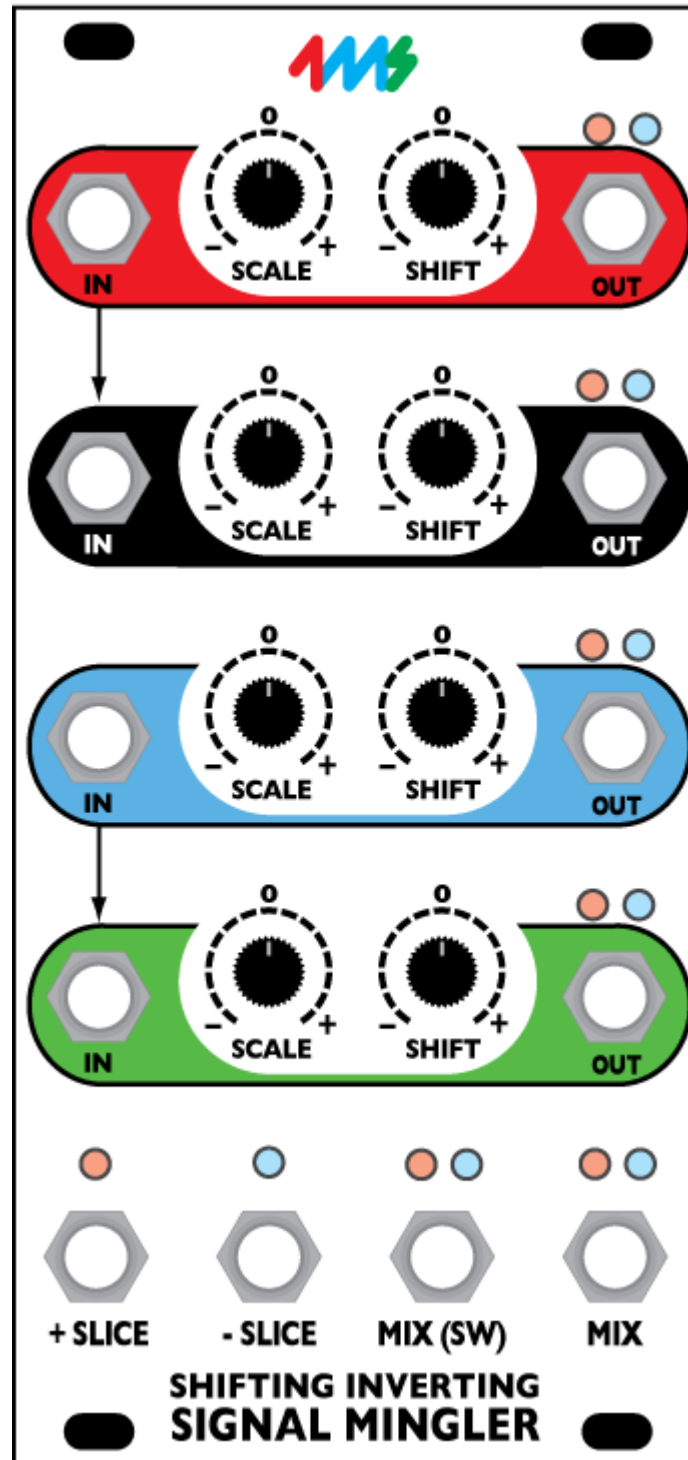


# Shifting Inverting Signal Mingler (SISM)

from 4ms Company  
Eurorack Module User Manual



The Shifting Inverting Signal Mingler (SISM) is a 4-channel voltage manipulator that can scale, invert, attenuate, shift (DC offset), mix, split, and slice your CV and audio signals.

Fourteen red and blue LEDs show exactly what each output jack is doing: red = negative voltage, blue = positive.

Each of the four channels are independent and have an input and output jack, a knob for attenuating/inverting (Scale), a knob for applying positive or negative DC offset (Shift), and two LEDs.

Four jacks on the bottom combine the four channels in different ways. Mix is a straight mix of all four shifted inputs, Switched Mix is a mix of all channels that have nothing plugged into the OUT jack, Positive Slice is the sum of all output voltages greater than zero volts, and Negative Slice is the sum of all negative voltages. The SLICE jacks can be used for sub-mixes, half-wave rectifying, "dirty panning", and creating new CV signals from existing ones.

Each channel has a jumper to make the Scale knob uni-polar (no inverting, attenuate only). This is useful for mixing audio instead of CV. Another jumper connection allows for a maximum of 2x gain. Headers allow for connections to a QCD, QPLFO, VCA Matrix and other manufacturer's modules.

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<http://4mspedals.com/sism.php>

## Basic features:

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- Four independent voltage processor channels and four mix/mingle outputs
- Each channel has:
  - **IN**put jack
  - **SCALE** knob (from inverted unity, to zero, to unity). Center-detented.
  - **SHIFT** knob (adds/subtracts DC offset from -9.5V to +9.5V). Center-detented.
  - **OUT**put jack
  - Red and blue **LEDs** indicate positive and negative signal, respectively. Brighter means more voltage, dimmer means less.
- **MIX** jack outputs sum of all channels
- **MIX SW**itch jack outputs sum of all channels with nothing plugged into their output jack
- **+ SLICE** jack outputs positive portion of mix (voltages greater than 0V)
- **- SLICE** jack outputs negative portion of mix (voltages less than 0V)
- Red and blue **LEDs** on all four mix/mingle jacks indicate positive and negative signal, respectively. Brighter means more voltage, dimmer means less.

## Advanced features:

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- Inputs for channels 1+2 and 3+4 are normalized together:
  - Plugging into Channel 1 (or 3) will split the signal to channels 1 and 2 (or to 3 and 4)
  - A jumper on the back enables/disables this normalization
- Scale knob has three ranges that are selectable with jumpers:
  - Bi-polar: -1x to +1x (inverting unity to unity) — default
  - Uni-polar: 0 to +1x (level fader)
  - Boost: 0 to +2x (twice the voltage gain)
- Input Header (2x4):
  - Connects the output of a QCD or QPLFO to the SISM's inputs
  - Plugging into the SISM input jacks overrides the signal on the header
- Output Header (2x4)
  - Connects the SISM's channel outputs to the input of a VCA Matrix or other compatible module (Mixplexer or Intermix)
- PAD breakout header (2x4)
  - Can connect to an external DIY module that enables a pre-set pad (attenuation) on each channel.

## Usage:

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- Attenuator (quad)
- Inverter (quad)
- Level shifter/DC offset (quad)
- Mixer (4 inputs)
- Splitter (dual 1->2, or single 1->4 using a stackcable or passive mult)
- Bipolar audio mixing: Useful for mixing various filter outputs with the original signal to create new filter curves
- Voltage slicer: + and - portions are separated and outputted to the + and - SLICE jacks
- "Dirty" panning: apply a large slow wave to one channel, and the other channels will "pan" between the SLICE jacks. The signals are half-wave rectified as they span both outputs
- LFO mingler: connect QPLFO outputs to SISM inputs
- Sequencer: connect QCD outputs to SISM inputs (or any clock divider/multiplier) and take the sequencer output from the MIX jack.
- Add attenuation and inversion to any CV jack on other modules
- Keep all your fine-tuning controls for several modules in one place
- Manual voltage generator. With no input connected, each channel outputs a steady DC voltage controlled by the SHIFT knob.

## Specifications

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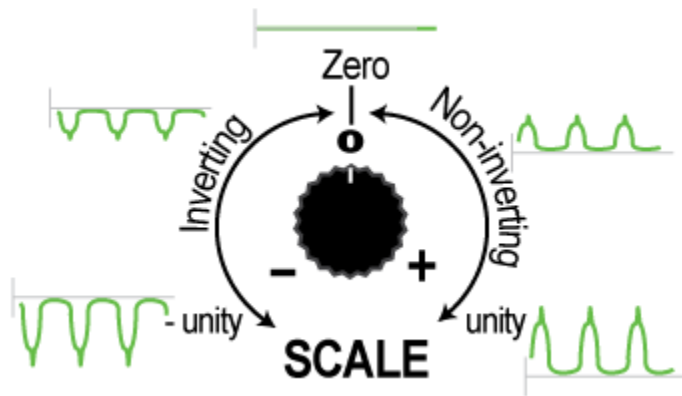
- 12 HP Eurorack format module
- 0.86" (22 mm) maximum depth
- 10-pin to 16-pin power cable (included)
- **+12V rail: 51mA max**
- **-12V rail: 51mA max**
- *The 5V rail is not used*

## Controls

There are four identical channels on the SISM. Each channel has two controls: SCALE and SHIFT.

### SCALE

Controls gain, attenuation, inversion.



The SCALE knob changes the gain of the input signal. If the knob is all the way up (clockwise, or 100%) then the signal will pass un-changed. This is called unity gain (1x).

**Attenuate:** *to lessen, to make more quiet*

If the knob is turned down a little bit, then the signal will be attenuated. For example, if the input voltage was a wave that ranged from +1V to +5V, the output might range from +0.5V to +2.5V (50% attenuation). If you were controlling the pitch of a VCO, then instead of a 4-octave sequence, you would have a 2-octave sequence, your melody would be “squished”.

As the knob approaches center, the signal will become smaller and smaller, until it's zero (silent).

As the knob turns down past center, the signal will start to get louder, but will be inverted. For example, a +1V to +5V wave might become -0.25V to -1.25V (inverted and then attenuated to 25%).

**Invert:** *To make positive voltages into negative, and vice-versa: the signal is “flipped” across 0V*

When the knob is fully down (counter-clockwise), the signal will be the **same amplitude** as the original, but inverted. Our +1V to +5V example wave would now be -1V to -5V. If this was a sequence being fed into a VCO, it would be same as the original, but it would be shifted down 6 octaves and the intervals would be inverted (meaning an upward step would turn into a downwards step, and vice-versa). *Note: you could shift this back up 6 octaves using the SHIFT knob (see next section), and the result would be an inverted melody in the same octave range.*

**Amplitude:** *The difference between the highest and lowest points on a waveform*

The Scale knob has three modes (see “Jumpers” section for how to set the mode). By default the Scale knob ranges from negative unity to positive unity (-1x to +1x), as shown in the diagram above. This is called “Bi-polar” mode because the gain ranges between two “poles” or extremes: negative and positive.

**Bi-polar:** *Ranging between two extremes*

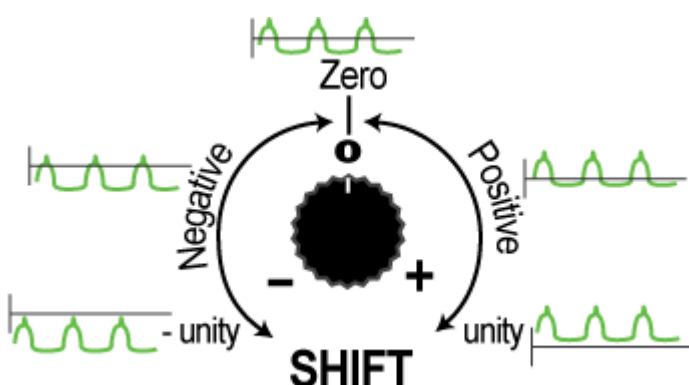
Another mode is called “uni-polar”, which means the gain ranges between 0 and one “pole” (positive). This means that the signal will be zero (silent) with the Scale knob turned all the way down, and will be unity (1x) when the knob is turned all the way up. This is often useful with mixing audio if you don't need to invert the signal and/or you want to quickly turn a channel down without finding the center point.

**Uni-polar:** *Ranging from zero to one extreme*

The third mode is also uni-polar, but ranges from 0 to 2x. This means the signal is boosted by a factor of 2 with the knob all the way up. When the knob is centered, the gain is unity (1x). For example, a +1V to +5V wave would become a +2V to +10V wave (at maximum).

### SHIFT

Adds or subtracts DC offset, shifts signal. Provides steady voltage.



After the signal is scaled, it's shifted up or down along the voltage axis. This is known as applying a “DC offset”. The shape and amplitude of the signal are not changed, it's merely shifted up or down.

**DC offset:** *The amount of voltage a signal is shifted above or below zero volts.*

With the knob at center, no voltage is added, and the signal passes unchanged.

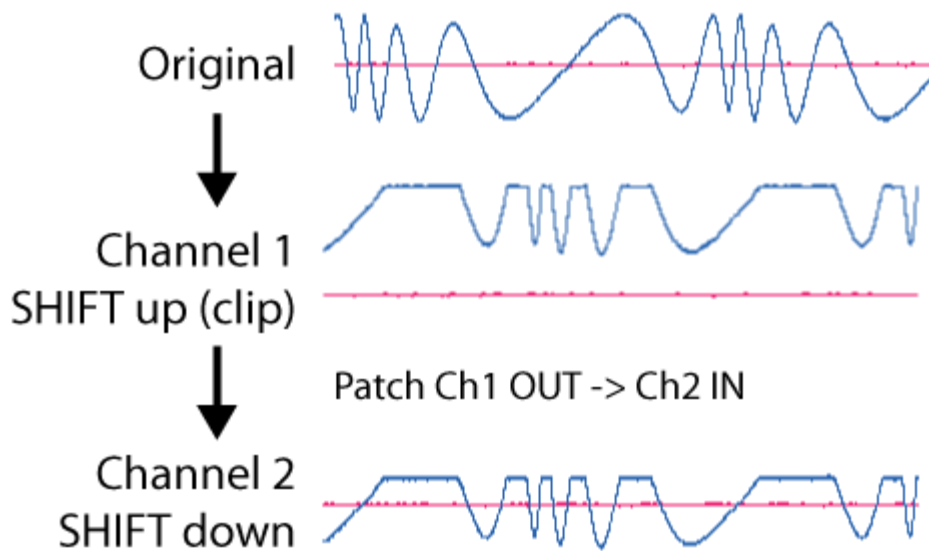
Turning the knob up adds a positive voltage to the signal. If, for instance, the input signal ranged from 0V to +3V, applying a DC offset of 1.5V would make it range from 1.5V to

4.5V. If you were using this to control the 1V/octave pitch of a VCO (for example), the VCO would play one-and-a-half octaves higher (+1.5V = +1.5octaves).

Turning the knob down from center subtracts a steady DC voltage from the signal. Looking at this another way, a negative voltage is added to the signal. If you were to take a signal that ranges from 0V to +3V, subtracting 2V from it would result in a signal that ranges from -2V to +1V. If you were using this to control a VCO, the pitch would drop down 2 octaves.

The SHIFT knob can add or subtract up to -9.5V to +9.5V. This is a large range and can be used to introduce clipping into the signal. The maximum output range of the SISM is -11.4V to +11.4V. Attempting to produce any voltage outside this range will clip the signal to about +11.4V or -11.4V.

So if you had a signal that was -5V to +5V, and you applied +8V of SHIFT, the result should be +3V to +13V. However, 13V is out of range, so the SISM will clip the top of the wave, resulting in an actual waveform of +3V to +11.4V.

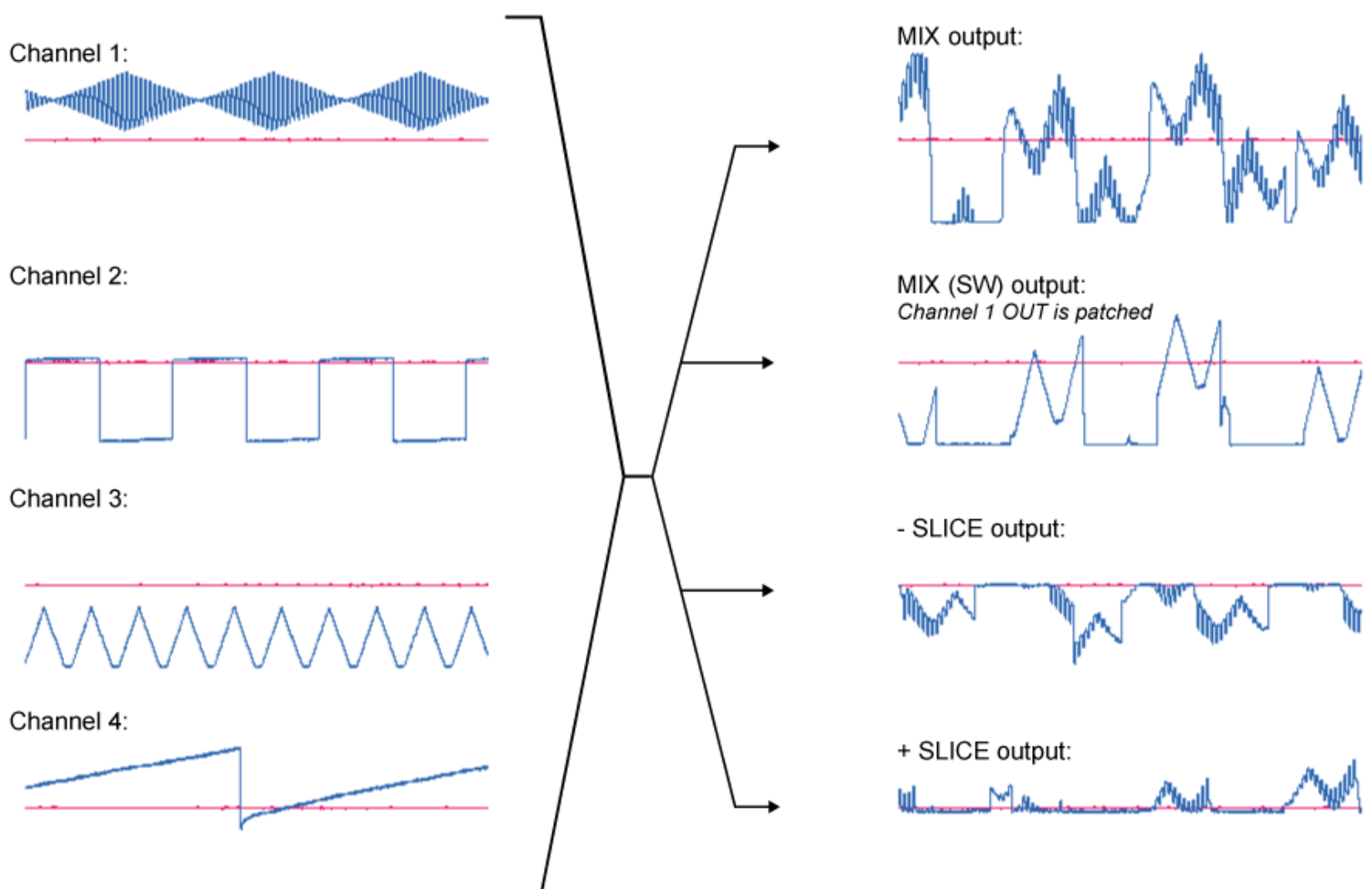


**Clipping:** aka Hard Limiting. Voltages outside max/min allowable voltages are “clipped”: they are limited to the max/min voltage.

Clipping can be useful. One trick is to use one SISM channel to force clipping on a signal, and then use a second channel to scale and shift the clipped signal into a useful range. This adds distortion and can be used to create new waveshapes. It also can be used to ensure a waveform stays within a certain range. For example, if you want to make sure your signal never exceeds +5V, you could SHIFT it up to clip at +11.4V, then use a second channel to SHIFT it down by -6.4V. The result will be a voltage that is clipped at +5V (11.4 - 6.4 = 5).

## Mix/Mingle Outputs

Besides the output jacks for each channel, there are four output jacks on the bottom that are combinations of the four inputs.



## MIX

The MIX jack is a mix of the four channels. All aspects (DC component and AC waveshape) are combined. The MIX output is an arithmetic sum of the four channel outputs (post-SCALE and post-SHIFT). Keep in mind the maximum and minimum voltage of the SISM is +/-11.4V. It's easy to go outside this range when adding four voltages together, so if you have four loud/hot signals on the SISM and are not attenuating them, the MIX output will probably be clipped. If you wish to avoid clipping, simply adjust the SCALE knob on the channels (starting with the loudest) until clipping disappears. Note that the LEDs indicate presence of signal, not clipping. The only way to measure clipping would be to use an oscilloscope such as the Jones O'Tool.

## MIX (SW)

The (SW) stands for "Switch", referring to the internal switches on the output jacks that tell the circuit when something is plugged in.

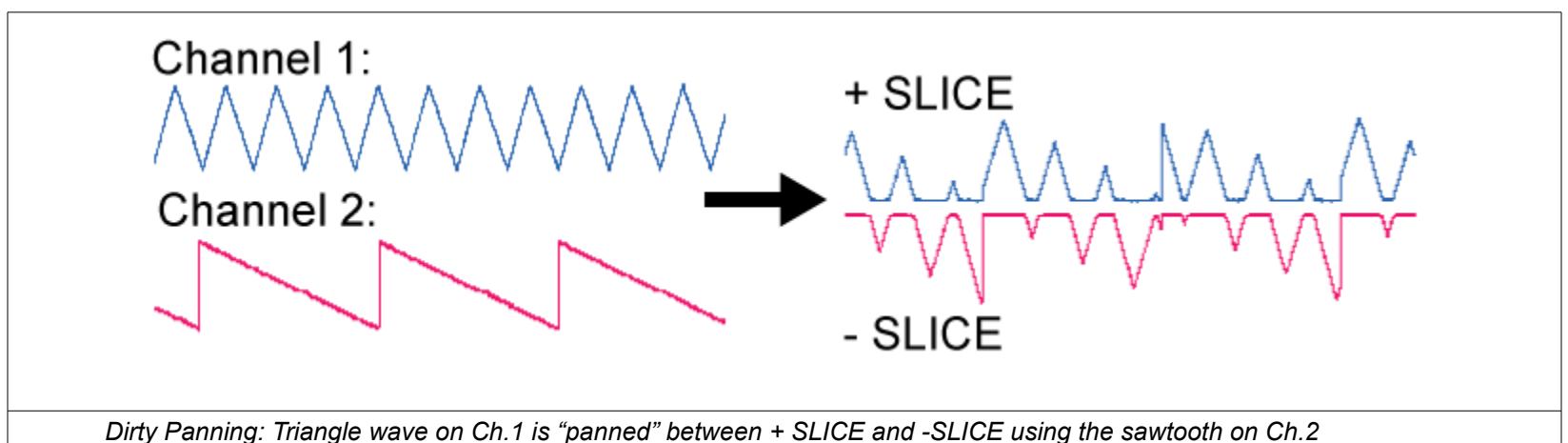
This is identical to the MIX output, but it's the sum of the channels that *have nothing plugged into the OUT jack*. The slight difference between the MIX and MIX (SW) jack allows for some convenient features. See the **Mixer with Master Channel**, and the **Sub-mixer** patch ideas in the *Patch Ideas* section.

## + SLICE and - SLICE

The + SLICE jack (positive SLICE) and the - SLICE jack (negative SLICE) output the positive and negative portions of the signal on the MIX jack, respectively. Whenever the voltage on the MIX jack is greater than 0V, the signal will output on the + SLICE jack. Whenever the voltage on the MIX jack is less than 0V, the signal will output on the - SLICE jack. If you were to combine the two SLICES, the result would be the same as the MIX jack.

*Note: The SLICE jacks actually slice at approximately -250mV (+ SLICE) and +250mV (- SLICE). Thus, there is a small range of overlap where both jacks are outputting.*

## "Dirty Panning"



Dirty Panning can be done using two channels and the SLICE jacks. One channel should contain the source signal to be panned (say, an audio source or an LFO). The other channel should contain the panning control signal. As the panning control signal goes from a positive voltage to a negative voltage, the source signal will shift from the + SLICE jack to the - SLICE jack. As it crosses the threshold between positive and negative, different portions of the source wave will appear on the two jacks. The source wave will be half-wave rectified at a variable point. This is why it's called "dirty panning", because musically it sounds distorted, yet the source signal will appear to "pan" from one output to the other.

It's critical to adjust the SHIFT knob on the control channel so that the control signal ranges from an extreme positive voltage to an extreme negative voltage. Watch the LEDs on the SLICE jacks so that they light up alternately, in tempo with the control signal.

## Patch ideas

### CV processor

Many modules do not have attenuators or inverters on their CV inputs. Patch a CV signal into one channel of the SISM, and patch the output to the CV input of your module. Adjust SCALE and SHIFT to precisely control the modulation. *Bonus: after patching four channels, run the Mix and SLICE jacks to other modules.*

### Mixer (4 channel)

Run four signals into the SISM inputs. The MIX out will be a mix of the four signals. The level of each signal can be controlled by the SCALE knob. For audio signals, keep SHIFT at center (no DC offset).

## Patch ideas (continued)

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### **Mixer with Master Channel**

Run up to three signals into channels 1-3. Patch the MIX (SW) jack into Channel 4 IN. Use Channel 4 OUT as your Master output. Channel 4 is now your master fader and level shifter. Since you have a cable patched into Channel 4 OUT, the MIX (SW) jack will be the sum of channels 1-3.

### **Manual voltage generator**

This is useful for remotely controlling a VCA, testing a CV input on a module, or setting a sweet-spot. At any point, you can fade in a modulation signal instead of a manual voltage, simply by patching something into the IN jack.

Plug nothing into the IN jack, and plug the OUT into something you want to control manually. Adjust the SHIFT knob to vary the voltage between -9.5V and +9.5V. For instance, you can simulate a trigger by turning the SHIFT knob up and then down. Or you can adjust a parameter of another module to find sweet-spots or troubleshoot. *Note: If you are doing this patch on Channel 2, make sure nothing is plugged into Channel 1. If this isn't possible, then plug a dummy cable into the IN jack of Channel 2, or remove the LINK jumper on the back (see LINK Jumpers section). The same applies to Channels 4 and 3, respectively. The reason is that the LINK normalization copies Channel 1 input into Channel 2 and Channel 3 input into Channel 4, and this patch requires a null input.*

### **Precision manual voltage generator (fine tune pitch of a VCO)**

This allows you to create and control a very precise voltage. A common use is fine-tuning the pitch of a VCO. > Plug the OUT of Channel 1 into the IN of Channel 2. Run the OUT of Channel 2 into the module you want to control precisely (for example: the 1V/oct or FM input on a VCO).

*Make sure nothing is plugged into the IN jack of Channel 1 (see the Note on the previous patch idea above).*

Turn Channel 2's SCALE knob just a hair up past center so that it's attenuating heavily.

Channel 2's SHIFT knob will be your **coarse adjustment** (sets the center of the range).

Channel 1's SHIFT knob will be your **fine-tuning adjustment** (sets the precise voltage within the range).

Channel 2's SCALE knob determines the level of precision of Channel 1's SHIFT. The more Channel 2 SCALE attenuates, the more precise Channel 1 SHIFT will be.

*Hint: You can increase precision by patching Ch2 OUT to Ch3 IN, and use Ch3 OUT as your final output.*

### **Bi-polar audio mixer (filters)**

By inverting and mixing various filtered versions of an audio signal, new roll-off curves can be obtained. For example, the Boogie Filter from Malekko has four different sloped curve outputs (-6dB to -24dB) which can be inverted and mixed together to create interesting filter effects. Another idea is to take a Band-Pass output from a filter such as the KOMA SVF-1, invert it with the SCALE knob, and mix it with the original unfiltered signal. This will create a Band-Reject filter.

### **Sub-mixer**

Say you are using the top two SISM channels to scale/shift some modulation sources before running them into CV inputs of some other module. Say you also want to mix together two audio waves. You can use the two empty channels on the SISM by using the MIX (SW) jack. Just make sure Channels 1 and 2 OUTs have something plugged into them, and then run your two audio signals into Channels 3 and 4 INs. The MIX (SW) jack will be a mix of Channels 3 and 4 only.

### **Modulation control center**

By using all four channels of the SISM as CV processors, you can control parameters of multiple modules from just one spot. This can help make a complex patch be easier to adjust and change, as well as making live performance more simple. The red and blue LEDs on the SISM allow you to see what's going on in your patch without having to scan multiple modules. For very large patches, consider several SISM side-by-side.

### **Dirty Panner**

See "Dirty Panning" in the +/- SLICE section

### **Sequencer**

Run four clock signals into the four SISM inputs. Use an RCD, SCM, or use the headers to connect a QCD to the SISM inputs (see Connectivity section). Adjust the SCALE knobs of each channel to control how much that clock/beat will change the sequence. Adjust SCALE

### **Modulation Mingler**

Run four LFOs or other modulation sources into the four SISM inputs. Plug at least one channel OUT jack into something. The MIX, MIX (SW), + SLICE, and - SLICE jacks will all output different signals.

### **Half-wave rectifier**

Plug the signal you want to rectify into one channel. Adjust the SHIFT knob until you see both SLICE jacks lighting up (watch the red and blue LEDs). The positive half-wave rectified signal will appear on the + SLICE jack, and the negative will appear on the - SLICE jack.

## Jumpers

The SISM has several advanced features accessed by jumpers on the rear of the module.



### **LINK jumpers**

By default, if nothing is plugged into Channel 2's input jack, this channel will copy the input of Channel 1. The same applies to Channels 3 and 4. A thin line on the faceplate between IN jacks tacitly indicates these connections.

This feature is made possible by jumpers installed on the back of the PCB.

To disable linking channels 1 and 2, remove the jumper labeled "LINK 1+2".

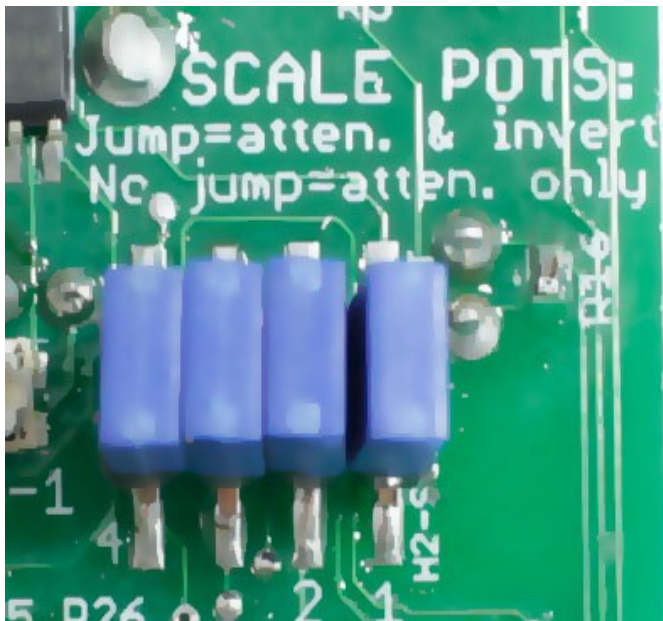
To disable linking channels 3 and 4, remove the jumper labeled "LINK 3+4".



If you are using the INS header to connect another module to the SISM inputs, it's best to remove the LINK jumpers, or else channels 1+2 and 3+4 will be summed at their inputs (in most cases, this is not desirable).

Plugging into Channel 2's input jack will disable the LINK 1+2 feature, and likewise, plugging into Channel 4's input jack will disable the LINK 3+4 feature.

The feature is useful for splitting a signal: plug the signal into Channel 1 (or 3) and take the two outputs from Channel 1 and Channel 2 OUT. Each signal can be SCALE'd and SHIFT'ed independently.



### **SCALE MODES**

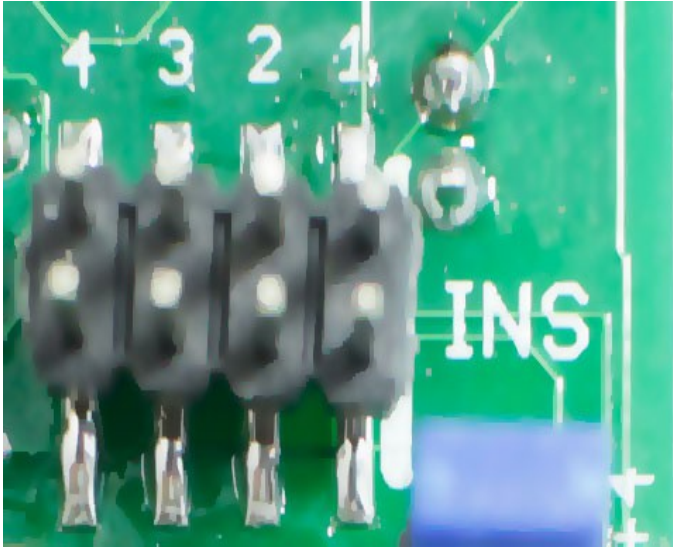
Four jumpers towards the top of the PCB are labelled "SCALE POTS". Below the header are the numbers "4 3 2 1" which indicates which channel each jumper controls. See "SCALE" section above for more discussion.

Jumper on: Default. The SCALE pot will range from negative unity to unity (-1x to +1x). Center is zero.

Jumper off: Uni-polar mode. The SCALE pot will range from zero to unity (0 to 1x).

Jumper wire from bottom pin to ground. Ground can be found on the bottom row of pins on the INS, OUTS, and PADBO headers. Install a wire jumper from the corresponding pin on the bottom row of the SCALE POTS header, to any unused ground pin on the PCB (bottom row of any other header). The SCALE pot will range from zero to double (0 to 2x).

## Connectivity



### **INS**

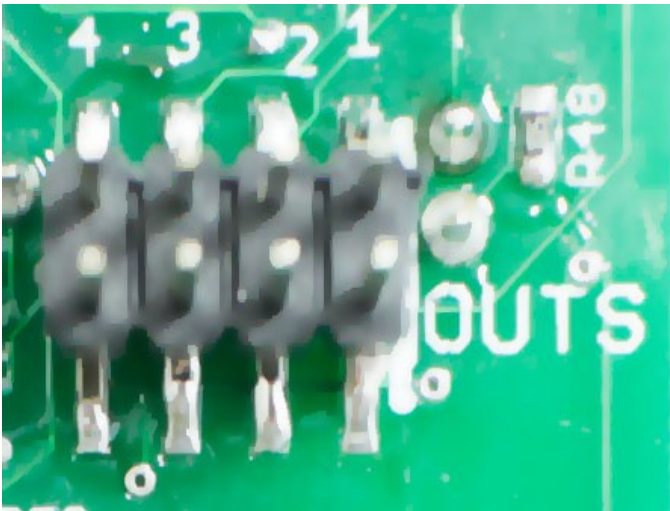
The INS header is a 2x4 header for connecting the output of certain modules to the inputs of the SISM. This gives a behind-the-scenes connection between the SISM and another module such as the QPLFO or the QCD.

To use, connect an 8-pin ribbon cable from the LFO-OUTS header on the QPLFO or the CLOCK-OUTS header on the QCD, to the INS header on the SISM. The four outputs from that module will now automatically be fed into the SISM. To override this connection, just plug something into the input jack on the SISM. This disables the connection for that channel only.

For instance, if you find yourself often patching the four LFO outputs of the QPLFO into the SISM (for shifting and scaling the

LFOs before running them to other modules), connecting the two modules with a ribbon cable will connect all four channels without any patch cables. If you decide you need a SISM channel for something else, simply patch it in as normal—the behind-the-scenes connection will be disabled automatically.

The top row of pins on this header attach directly to the switch tabs of the SISM input jacks. The bottom row of pins are all ground.



### **OUTS**

The OUTS header is a 2x4 header for connecting the channel outputs of the SISM to the inputs of a compatible module.

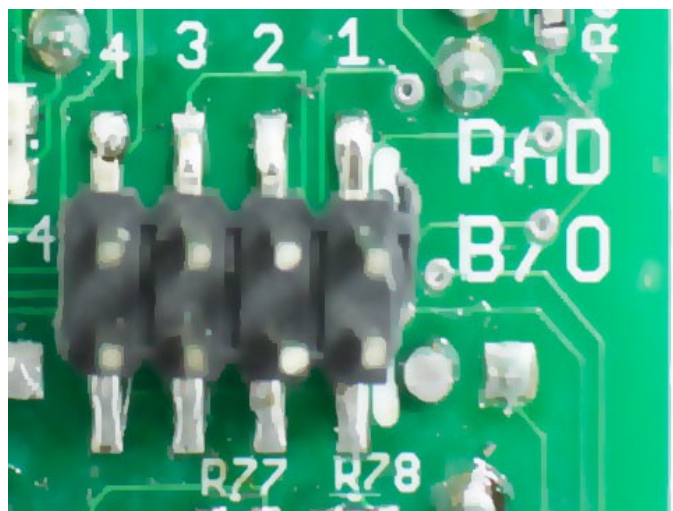
To use, connect an 8-pin ribbon cable from the OUTS header on the SISM to the corresponding header on the destination module. See the manual of that manufacturer's module for details.

Compatible modules include the VCA Matrix (DAISYCHAIN INPUTS header), the Toppobrillo Mixiplexer, and the Circuit Abbey Intermix.

The top row of pins on this header attach to the output of the

final opamp on each channel. The bottom row of pins are all ground.

**DO NOT JUMPER THE OUTS HEADER!**



### **PAD B/O**

The PAD B/O header can be used to connect to a breakout module for providing a set amount of attenuation (pad) for each channel. The breakout module should apply a simple resistance between each pin on the top row and ground (the bottom row of pins are all ground).

A simple DIY module would have a switch for each channel that connected a resistor between the corresponding header pin and ground. This would turn on/off a pre-set pad.

100k → -3.5dB

33k → -8dB

10k → -15dB

4k7 → -21dB