SW3 SPLICE

Wavesplicing made simple. It works both with audio and control signals or a mix of those.

The SW3 is a module to splice (switch) any signal together with something else click free.
It is a fully analog module that doesn't add any latency or phase delay to what is fed through it.

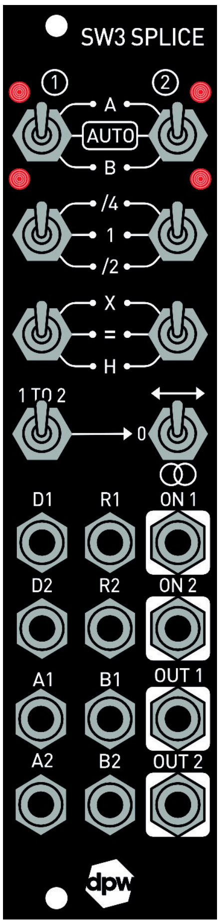
The splicing can be two types of click free switching or traditional hard switching. Manual or CV controlled.

It can be dual mono, stereo coupled or switching mono into stereo for big stereo fields.

The core of this module are two analog switches with some intelligent control to be able to do all sorts of wave splicing. The inputs to the two switches are in on A1 and B1 and out on OUT1 for the first switch. A2 and B2 and out on OUT2 for the second.

It has two equal sides 1 and 2 that are controlled individually. Except when stereo linked then they are both controlled by side 1.

The logic side can also be used like the Z3 Zero module to sync signals, or un-sync them to add swing or probability skipping on signals. See the Z3 Zero module manual and videos for more examples.



Controls

Described below is a description of how switches, inputs and outputs work.
But please explore, there are in-between settings to discover.

A AUTO B

Control switch.
A Selects input A to OUT. The switching to A depends on the mode switch.
AUTO switches automatically between A and B as fast as it can depending on the other switches. That is, it switches everytime A and B are equal and toggles between them. The switching speed can also be controlled by the D input.
B Selects input B to OUT. The switching to B depends on the mode switch.
The LEDs next to the switch show the status of the switch.

/4 1 /2

Division switch. This is to introduce subharmonics in audio switching and other creative effects when switching LFOs and such.
/4 divides the number of times that A and B are equal in 4.
1 no division.
/2 divides the number of times that A and B are equal in 2.

X = H

Mode switch.
X Zero switching. Switches when A and B are equal.Clickfree switching.
= Slope switching. Zero switching with slope detection. Switches when A and B are equal and when the two signals are rising or falling at the same time. Clickfree switching with less artifacts. Works for frequencies from 10 seconds to high audio rate.
H Hard, normal switching. Direct controlled via the D input. Not affected by the division switch.

1TO2

Copies what's in on A1 and B1 to A2 and B2, the second switch. This is used when switching mono to stereo. Or if you for some other reason want the same signals on both switch 1 and 2. If you connect some other signal to for instance A2, that signal will replace A1 on the second switch. The same goes for B2. When the switch is down it is dual mono mode.

Swap 0 Stereo

Stereo switch.

Swap. With the 1TO2 switch up it will send incoming signals on A1 and B1 to OUT1 and OUT2 and swap the outputs every time the signals are equal. This is a way to switch mono signals to stereo. Even if you only have a sound connected to A1 this works as unused A and B inputs are internally connected to 0V. The module is controlled with the 1 side.

0. No stereo connection between the switches. Dual mono mode.

Stereo. For switching stereo signals controlled with side 1. Different divisions on the two sides are possible.

A and B

A and B are inputs to an analog switch and also input to the circuit that controls it.
If nothing is connected both inputs are connected to 0V. This makes it easy to trigger on zero crossings if for instance only A or B is connected.

OUT

The output from the analog switch. Signals from A or B pass through.
If the switch mode is set to H, hard switching. Then the switch can be used in the other direction. That is going in on OUT and out on A or B.

D

Control input for the switching logic. If high then A is connected to OUT. How it switches to A depends on the mode switch.
High is more than 1V. Logic signals or audio can be used.

R

Reset for the toggling of the switch and division. Does a hard reset to A when R goes high, flank triggered.
High is more than 1V. Logic signals or audio can be used.

ON

Logic output. 5V when A is selected. 0V when B is selected.
This is the logic output from the control circuit for the switch. Useful if you want to sync the switching with something else or if you just want to use A, B, D and R for some logic processing.

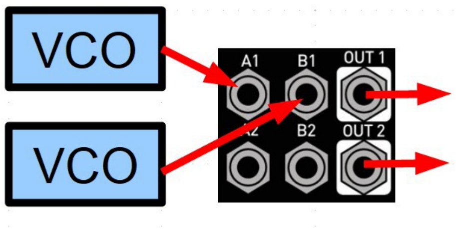
Device specs

Module size:	6 hp wide, 29 mm deep with power connector.
Input impedance:	100 kohm
Out impedance:	3,3 kohm on ON1 and ON2.
Through impedance:	20 ohm through the switch. Keep current under 30 mA not to damage the switch. Max switching frequency more than 200 kHz. The wave-splicing doesn't require Eurorack level. It works equally well with line level. It can handle anything up to high Eurorack level.
Power requirements:	+12V. Max power consumption 15 mA -12V. Max power consumption 10 mA Connect the power cable with the red stripe towards the marking -12V on the board. The unit is protected for reverse power.

Use case examples

A few examples, just to get your imagination going and as a starting point for you to explore the possibilities.

Basic mono and mono to stereo splicing



To start simple, connect a sine wave on A1 and nothing on B1. Set the control switch to AUTO, division to 1 and mode to X.
OUT1 will now give you one period of the sine wave and one period of 0V.
If you set the division switch to /2 you will get two periods of sine and two periods of 0V. Setting it to /4 will make that 4.
Connect a VCO or LFO to the D input and see that you can affect how often it switches with control by D and that the division switch also affects it.
To make this stereo. Set the 1TO2 switch on and connect so that OUT1 is left and OUT2 is your right channel. Set the stereo switch to swap. Your sound will now switch between left and right channel at zero crossings giving a wide stereo field.
If you want to reduce the width of the stereo image then mix in what you connected to on A after the module.

Also try to set the stereo switch to stereo. If left and right end up out of sync you can send a reset pulse to R. But it can also be a cool effect to set the division on side 1 and 2 differently for interesting stereo effects.

Now connect another sine wave to B1. The module will now switch between the two signals when they are equal.
Set the mode switch to = (slope detection). For audio this will give a smoother sound but it will switch less frequently as both slope and zero difference criteria have to be met at the same time.

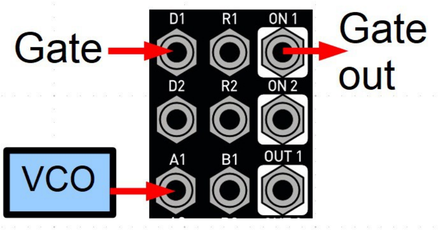
With the above techniques try splicing LFOs, envelopes, samples, VCOs and just experiment.
A few ideas could be splice a sound with a filetered version of the same.
A sound spliced into stereo with a mono reverb or delay.
If you are not satisfied with what you get by splicing two things together then put an oscillator into D to splice at another rate. Sometimes lower rate splicing can turn out more pleasing than high audio rate splicing.

Sometimes setting the mode to H, hard switching can be better than the evaluating X or =. It all depends on your preferences and the material you are splicing.

Stereo splicing

Connect a stereo source to A1 and B1 and another one to A2 and B2.
Set 1TO2 down and the stereo switch to stereo.
This is a click free way to switch between stereo sources. But the evaluation on when to switch is done on the two channels independently of each other. This means that left and right will probably not switch at exactly the same time. That delay can be exaggerated by setting the division switch on one side to /2 or /4.

Jitter generation (swing)

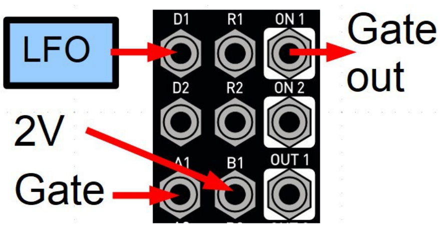


Jitter is when the rising and falling edges of a signal vary around the time where they are expected to be. This is what is called swing in sequencers. A simple example is for drums. Only the logic side of the module is used here.
Connect as the picture. You can set the amount of jitter with the VCO. High frequency low jitter. If you lower the frequency a lot, the jitter will be so extreme that it starts skipping gate signals and you have a random variation in your gate rhythm.

Another example can be to connect it on the sync signal between two VCOs instead of the gate signal. This will give you a very dirty sound out from the two jitter synced VCOs.

Or simply one VCO into D and another VCO to A. Then use the Out signal as your sound source. Can end up as a very aggressive square wave sound.

Synchronizing



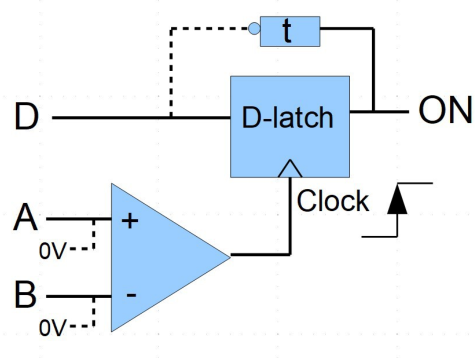
This is like the previous jitter example but syncing signals instead of making them unsynced.

Again the drum example from before but LFO and Gate in have swapped places. This will also generate a varied drum pattern with the frequency of the LFO controlling how many gate signals that will be let through to Out.
The difference from the previous example is that the gate out signals will be in perfect sync with the gate in on A.

The reason there is a 2V signal into B is that B is normalled to 0V and a gate signal from a sequencer (or other logic signal) will not completely go down to 0V. It can actually be 0,1V and then the gate signal will never pass the detection threshold on B. So you need to feed the circuit with a voltage between 1V to 4V.

In depth description

The logic function of the SW3 is not what you would find in every synth so it may need a deeper explanation.



Here is a simplified block schematic of what's going on inside the module. The dotted lines are normalling when nothing is connected to the jack. This is only showing the core of the evaluating circuit. Not the division, modes or reset functions. The ON signal controls the switch.

In the center of this there is a D-latch. You can see it as a one bit memory. It is a logic circuit.
If you put a high signal on D nothing happens, but if you feed it a rising edge on the Clock signal (internal signal) it will read what's on D and copy that to ON.
ON will then keep that high signal no matter what's going on at the D input until there is a Clock signal telling it to read a low signal from D.

The other part of the circuit is a comparator. Simply put, if the voltage on A is higher than B then A wins and the output from the comparator goes high. That's why there is a plus sign in the symbol.
If B is higher than A then B wins and the comparator output goes low.
The positive edges of the comparator output is what is clocking the D-latch.

The difference in this case compared to a normal comparator is that this one doesn't have any hysteresis. That means it will react more accurately when comparing A and B, which is key in fast accurate wave splicing.
The downside is that it will be more sensitive to noise on the signals on A and B. If it had been just a normal comparator without the D-latch you would have had ugly bursts going out, but as you have the D-latch here the ON can only change once to the high or low that you have put on the D input.
So the frequency in on D will be the maximum frequency on ON.
What you put on D can be anything from DC to a signal high above audio rate. You can run this circuit very fast if you like.

If you don't connect anything to D a time delay is normalled to the D input. This creates a time window when the D-latch isn't allowed to change the ON signal. It is a way to handle the fact that the comparator doesn't have the traditional hysteresis.
The ON will toggle from low to high or from high to low depending on what it was before at every clock event from the comparator.
In this mode the maximum frequency you can run from A or B to ON will be about 10 kHz.
That is enough for most use cases and will block most unwanted behavior in the comparator. If you find that it still reacts in a way you don't want you can add a signal to D to make it react less (or more) often.

Please check www.dpw.se for updates of the manual and demo videos.