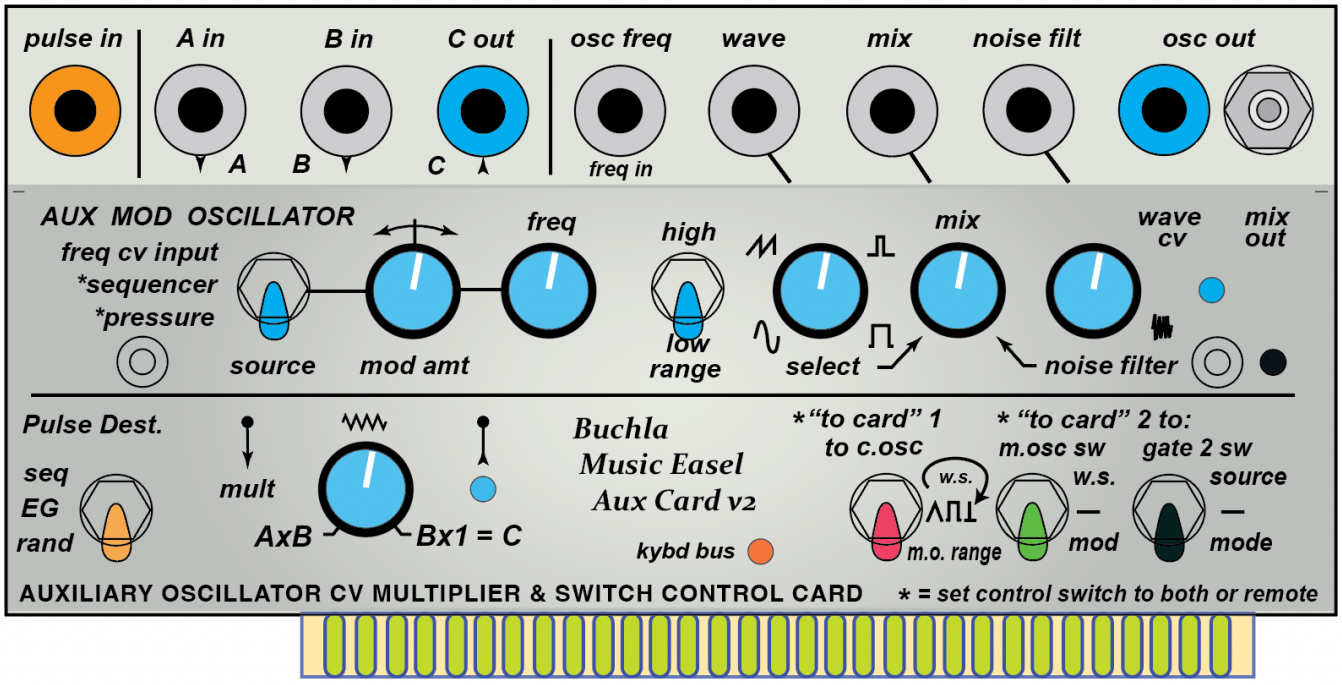
Buchla Music Easel AuxCard v2

The Auxiliary Oscillator, CV Multiplier, and Switch Control Card
for the Buchla 208

User's Guide v2.3

by Joel Davel updated 3/27/24 for v2 (software 3.2+)



The Music Easel Auxilary Oscillator CV Multiplier and Switch Control Card: how and why

What controls have been missing from the Easel in the past and how do we make them available? By using the Program Card connections, of course. We can use these Program Card connections to not just offer preset patch possibilities, but as a way to expand your resources.

What's the difference between the AuxCard v1 and the AuxCard v2?
The main difference is that the Attack, Sustain, and Decay CV inputs have been replaced with a CV multiplier. There were updates with the 208C and 218e that made those inputs redundant. Those EG CV inputs are now available on the front panel of a 208C, and with the 218e-V3's added velocity output or using the velocity control out of the 208C's buffer out, the use of a multiplier makes that velocity CV more useful when multiplied with the 208 EG output. Or you can use the multiplier as a general CV utility.

Also, the oscillator now morphs between a sine wave to sawtooth to square instead of just selecting sine and sawtooth and pulse width modulating the pulse/square wave.

LET GET STARTED:

Plug it in! First a word of CAUTION:
1) **Always plug in** the Aux Card (or any other Easel Program Card) **with the panel**–the switches and knobs–**facing the performer.** (It is not reversible!)
2) **Always plug in the Aux Card** (or any other Easel Program Card) **with the power off.** (A good habit is to carefully line up the pins first and push straight down or up without rocking the card. If you do that, then PERHAPS you will avoid damaging the unit even if you forget to power off.) Plugging it in with the power on is to be avoided.

Failure to properly insert the unit could result in damage.

Set the *CONTROL* switch on the 208 to both

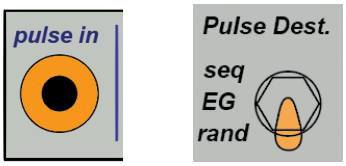
The best position for the 208's CONTROL switch (just to the right of the card slot) is to its middle "both" position.
Most functions will be fine in just "local" mode, but CV signals from the 208C's "to card" inputs or to the sequencer or pressure inputs to the AuxCard oscillator will not be passed to the card unless it is in the switch is in the "both" or "remote" setting.

CONTROL Modes if you have a Program Manager (inserted or embedded in a 208C)

If you have a Program Manager, remember that it responds to the 3 position switch with 4 modes: (Observe its display)
1) Remote mode; all control is from the card (except EG self mode) is from the card
2) Both mode; local settings are liternally added in, but the card gives up control of the switches
3) Local mode; no card control.
4) Local+ mode; local mode with "to card" connections engaged but without engaging the Program Manager program.
Local+ mode is especially useful for an AuxCard or a Retro Program Card or third-party card when you want all the card connections but don't want to engage the Program Manager set up.

An Aux Pulse input: The Orange banana and it's associated switch:

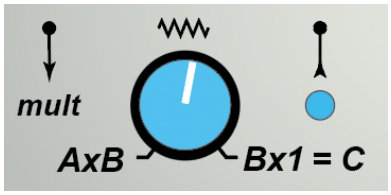
Let us start from the left corner. The first thing you see is a pulse input. The 208 has 4 possible destinations for pulses, but the sources for pulses are limited to pulses from the keyboard pulse input or the pulser. (And with the 208C you can use the CV input as a pulse input.) We've simply added one more pulse input and give you a choice of destinations. Plug your pulse into the orange banana and select its destination with the switch: Sequencer, Envelope Generator or Random. *(A minor update to the new AuxCard is that the pulser input is replaced with the random pulse input.)*

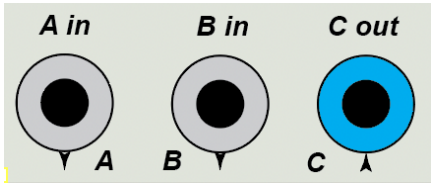


*Note about **pulse ins** use while also using a Program Manager: they don't work as expected.*
The EG pulse will only work in local mode when paired with a Program Manager. The other pulse ins will trigger in both mode, but will not work as expected with a Program Manager even when the LEDs fire. This is because the sequencer and the random only work inside the Program Manager's virtual connections using its internally stored data.

Multiplier CV inputs:

A few inputs on the 208C can sum, such as for pitch or frequency and keyboard pitch. But others simply merge together in an imperfect way if you put two 0-10v outputs into one input. One solution to combine two 0-10v signals so that the output will also be 0-10v, is a simple CV crossfader; the other is a multiplier. With this multiplier you can crossfade the influence of the A input on the B input: with the pot turned fully clockwise, you only get the B input out C output; with the knob fully counter clockwise, you get the full multiplication of the two CVs. An obvious use is to take the velocity output from the buffer out (if you use MIDI input in the 208C) or the velocity output of an Easel's 218e-V3 to the A input, and the Envelope Generator output into the B input, then dial in the amount of velocity control you want to control from C output to the gate. But it has other uses such as messing with a pitch CV and maybe a random multiplier or perhaps taking the AuxCard's own oscillator CV output as an LFO and modulating another CV. And if you want to simply dial back a CV, put nothing in the A input and turn it down.





“to card” routing switches:

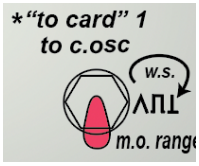
The ‘“to card” 1’ and ‘“to card” 2’ switches provide switchable routing of CV inputs to control switch settings on the 208.

Most users are unaware that switch settings on the Easel can be CV controlled. Traditionally this was done by plugging into one of the “to card” banana inputs on the 208 and then routing that signal with the appropriate resistor value to the switch’s signal using the old Program Card. But it was seldom done and took knowledge and experimentation to get it right. We’ve made it much simpler to do this and more fun to experiment with by providing switches that route the signals for you and with resistor values that give the user typical break points in the 0-10 volt range.

To use the ‘“to card” 1’ input:

1) Plug a 0-10v CV in the “to card1” banana input on the 208C
(or into the black banana in the INVERTER section of an older 208. *Fun fact: This signal was called INV. on the old Program Card though it was not inverted. Calling it “to card 1” is less confusing.)*

2) Select the destination:



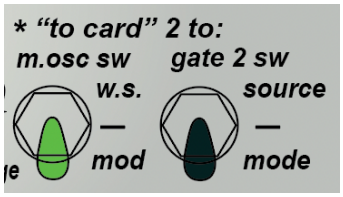
- In the top position the CV will control the 208’s complex oscillator’s waveshape knob **(full control only if the waveshape knob is turned down.) ;** (the 208C already has a CV input with this ability but older 208’s do not.)
- in the middle position the CV will select the complex oscillator waveshape
- in the bottom position the CV selects the 208’s modulation oscillator low or high range

To use the ‘“to card” 2’ input:

1) Plug a 0-10v CV in the “to card2” input of a 208C
(or into the black banana in the ENVELOPE DETECTOR section of an older 208. *Fun fact: This signal was called ENV DET on the older Program Cards though it was not related the Envelop Detector circuit.)*

2) Select the destination for the first switch:

- In the top position the CV will control the modulation oscillator’s waveshape selection
- the middle position disconnects the control
- in the bottom position the CV will control the modulation oscillator’s modulation type/variation (bal ext./a.m. osc./f.m. osc.)



3) Select the destination for the second switch:

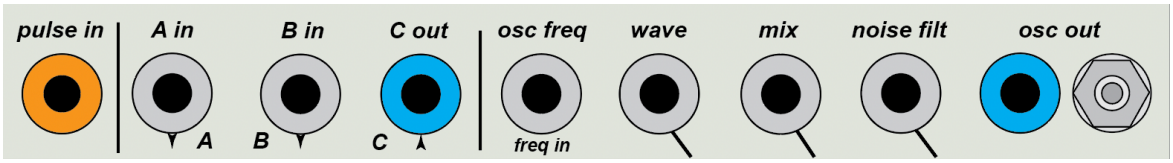
- the top position the CV will control the gate2 source selection;
- the middle position disconnects the control;
- in the bottom position the CV will control the gate(s) mode selection.

These routings give the user a lot of variety. Whether a CV control of a switch will have much perceptible effect will be based on your patch. This switchable routing allows you to experiment. Have fun.

IMPORTANT NOTE1: For full remote control of switches, the controllable switches on the 208 or 208C should be in the bottom position. CV’s can only remotely/virtually move the switch “up”. If you want to switch between the two top positions, switch the middle setting. If the switch is in the top position, CV will have no effect.

****IMPORTANT NOTE2**:** *The signals from the “to card” bananas are only sent to the card if the setting for the 208’s CONTROL switch (just to the right of the card slot) is set to its middle “both” position or the upper “remote” setting. This is what the asterisk on the card text signifies.*

Unlike switch control inputs, inputs on the top of the Aux Card and the Aux Mod Oscillator will always work regardless of the 208's CONTROL switch setting.

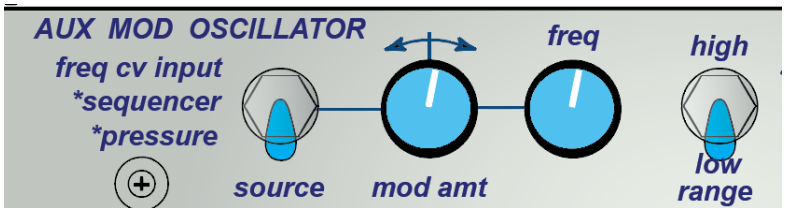


Auxiliary Modulation Oscillator:

You see several bananas and the upper portion of the Aux Card dedicated to oscillator and noise controls. Not to be confused with the modulation oscillator on the 208, the intent of this auxiliary oscillator was to provide an additional modulation oscillator and a white noise audio source. But we've expanded the white noise audio output to include the ability to mix in the auxiliary oscillator and included a filter to the noise. It is not just an LFO, but a bonus audio source to take advantage the "aux in" on your Easel.

The Oscillator pitch controls:





The "source" switch selects the pitch control course for the oscillator. The top selection "freq cv input" selects the black banana input labeled "osc freq." The other 2 selections use the inputs from the 208.
**Note: the inputs *sequencer or *pressure are only sent to the card if the setting for the 208's CONTROL switch (just to the right of the card slot) is set the "both" or "remote" setting.*

The "mod amt" pot controls how much of that CV input influences the pitch of the oscillator. In it's middle position, the source input has no influence.
Fully clockwise, the influence on the pitch is 1.2 volts per octave (the Buchla standard is 1.2v per octave or .1v per half step). To play standard scales from the 218e main output, turn the knob fully clockwise. To use it for the sequencer or pressure, turn it less to get the range you want.
To make the frequency go down as the voltage goes up, turn the knob to the left of the middle position. Fully counter-clockwise the influence is also 1.2 volts/octave but in the negative direction.

The "freq" pot controls the frequency of the oscillator. This frequency is added to or subtracted from by the incoming control voltage as determined by the "mod amount".

The "range" switch selects the range for the frequency pot. Low range is .12 Hertz (sub-audible) to 64 Hertz. The high range is 16.35 Hertz to 5274 Hertz.
Low range is used for the CV output to work as an LFO; the LFO waveshape will not mix to audio with the noise.
High range also sends CV output to the blue banana output, but **high range sends the oscillator wave to audio output and can be mixed with the noise.**

The **“range” switch has a middle setting too.** Its function is indicated with the **keyboard bus LED.** In this setting the oscillator frequency will be a “C” that can be used for tuning your Easel to a 440Hz standard. (Or use it as a drone pitch.)

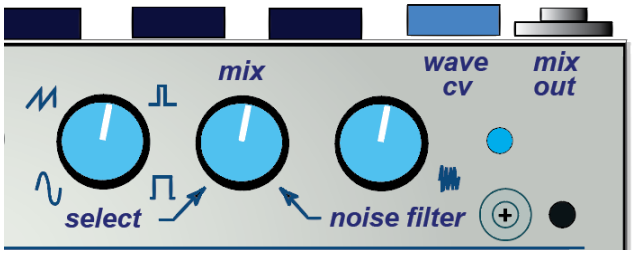


This **kybd bus** setting has an additional function for 218e’s that can send internal pitch messages:
In this setting the pitch of the oscillator is exclusively controlled by **internal bus** messages sent from the 218e or any other device that can send internal bus messages (such as the 226h, 225e). The **Keyboard bus LED** will flicker when it is receiving messages.

By using the internal bus, the user does not require a patch cable to control the oscillator pitch from the keyboard. But more important than that, it will immediately play the associated pitches tuned to a standard equal-tempered scale with A=440 Hz. This means that not only can this oscillator be a convenient pitch reference for tuning up the 208’s analog oscillators, it can also be used when you want to immediately start jamming with others without having to worry about tuning an analog oscillator or relying on imperfect control voltage ranges.

*See **Appendix A: More about the “keyboard bus”: Internal Busses** at the end of this manual.*

The Oscillator waveshape/noise and audio mix controls:



The “select” pot crossfades between 3 oscillator waveshapes: Sine, sawtooth, and square wave. (*Pre-2025 versions of the AuxCard could only select the waveshapes with no crossfading. You still see 4 selections based on the original graphics for selection only.)*
Now the pot position in the center (at 12 o’clock) is a sawtooth wave while fully clockwise it is a square wave. All positions in between are some combination of the waveshapes.
The waveshapes track independently so the combined shapes sometimes change in subtle ways when pitches are changed resulting in a more varied sound or LFO during repeated pitch patterns.

The “noise filter” pot opens up a simple low pass filter on the white noise generator.

The audio “mix” pot crossfades between the oscillator output and the (post filter) noise generator

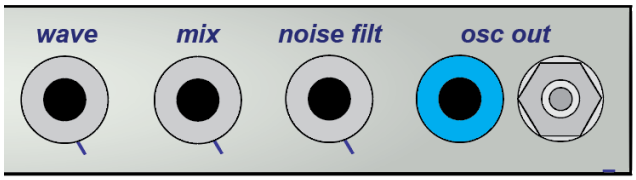
The black bananas: Each banana jack is directly associated with a knob below it. The input CV can have the same control over the sound as if the user was twisting the knob.

But unlike the frequency input, which has a “mod amt” pot, there is no additional pot to limit the influence of the CV. Instead, **the control voltage that is applied will be ADDED proportionally to the pot position.** For instance, for full 0-10 volt CV control, the knob position should be set fully counter-clockwise to get the full range of values. **But if it is set in the middle, the CV input will start at that knob position and be proportional for 0-10v from that position to the top of the knob**.

Examples using the waveshape "select" CV input :
Turn the wave select pot to the middle and the CV will only crossfade between the sawtooth and the square wave. But if you if you turn the knob fully to the left to allow the full range of wave shape selection.

Using the CV inputs can result in interesting effects, while also turning the knob by hand will control the CV's influence in real time.

The Oscillator outputs:



To the right of the banana inputs are **the two "osc out" outputs. The blue banana is a CV output** of ONLY THE WAVESHAPE. **The blue LED** on the panel is directly connected to the CV output and so will indicate 10v at it's brightest.

The Tini-jax output is **the audio output** set by the "mix" pot. With these outputs the Aux Card provides an alternate LFO and white noise generator with exclusive outputs, but also give the audio output some interesting variations.

In the low range, only "noise" will come out the audio output; LFO CV from 0-10v will come out the blue banana jack.

*(**Fun fact: Black bananas are always inputs on Buchla instruments. And the Buchla standard for CV outputs is blue or purple**. But the 208 is unique: The white, orange, and yellow bananas on the 208 indicate their output function with a color association. The orange banana (for the EG output) in particular breaks the Buchla rule for 200 series modules that orange signifies a pulse input. But Don was known as rule breaker—even his own. Also pre-1975 200's pulse inputs were still red.)*

Typical "osc out" connections:
1) Plug an audio cable from this jack to the "aux in" audio input on the top of the 208.
Use gain setting on "low" for the cleanest sound (though higher gain settings can have interesting saturation effects on the noise.)
2) To function as a modulation oscillator, plug the (blue) banana output into any (black) banana input on the 208.

More Tips for using the audio:
1) The oscillator sounds best when it goes through the 208's VCAs.
2) Make sure to switch the Gate 2 source switch to the top position when using the "aux in" (unless you have switched control the source switch position with AuxCard "to card" CV.)
3) The Modulation Oscillator modulates the "aux in" input if the Modulation switch is in the "bal. ext" setting.
-Explore this option for additional timbres.
-If you hear unexpected modulation, double check this setting when troubleshooting.

Aside: Analog vs Digital oscillator

For analog purists there will be a certain amount of disdain for a digital oscillator. After all, if you own an Easel, you are getting the 1973 exclusively analog oscillator circuitry that the 208 is known for. Yet analog purists can use just the CV expanding capabilities of the AuxCard and get quite a lot out of it. For its reference to tune your 208's analog oscillators to a reliable generated pitch, the ability to use the 218e's internal bus messages for perfectly tuned pitches, and other features, the digital model was a more complementary choice. And since using the "aux in" will put the audio through the signature Buchla LPG gates, even purist's will be tempted to use its audio. For more omnivorous noise or rhythmically focused artists, using the intense aliasing and especially with filtered noise can created a variety of percussive sounds through a 208's gates. Give it a go and use the AuxCard in whatever fashion you choose.

Appendix A: More about the "keyboard bus": Internal Busses

The busses designated A,B,C, and D are dedicated internal busses sent by the 225e or 226e or 218e. All modules within a system share internal communication and some of these modules will respond to note messages. The Buchla modules that respond to pitch messages include the 259e, 261e and the Aux Card. (Other messages can include clock and note on and velocity messages that the Aux Card ignores.)

Internal bus Assignment.

Up to four 259e or 261e Complex Oscillators can be assigned to the four internal MIDI busses A – D.

The Aux Card listens only on internal bus C by default. (C for "Card")

This way a system can include a 259e and 261e that listen on Bus A and B and that use the 281h and 292h on those same busses.

See the 218e manual or read below for how to enable and assign the 218's internal bus output.

How to enable and assign the 218e-V3 internal bus output:

Hold down the first 2 Preset Voltage Source pads (above "20" and "23") simultaneously (about 2 seconds) until both LEDs flicker. The LEDs in pad 1 and 2 blink. Then while holding pad 4 use Preset Voltage Source Pot 4 to move the steady LED to select the internal bus combination of A,B,C,D that correspond to the steady LEDs in the pads 1,2,3,4. For the AuxCard, move the LED to blink above the third "pad" (bus C) or turn the pot all the way to the right select all of the busses (all four LEDs lit up.) You can play the internal bus now and experiment with it on the keys 13-24 while in edit mode. Exit this mode as you entered this mode: Hold down the first 2 Preset Voltage Source pads simultaneously until both LEDs flicker and go out.

How to enable and assign the legacy 218e (V2) internal bus output:

Hold down the first 2 Preset Voltage Source pads (above "20" and "23") simultaneously until both LEDs flicker. (about 2 seconds). The LED in pad 4 blinks. Then use Preset Voltage Source Pot 1 to move the steady LED to select the internal bus. For the AuxCard, move the LED to blink above the third "pad" (bus C) or turn the pot all the way to the right select all of the busses (all four LEDs lit up.) You can play the internal bus now. Exit this mode as you entered this mode: Hold down the first 2 Preset Voltage Source pads simultaneously until both LEDs flicker. (Unfortunately this mode is not saved on the older V2 218e and you will need to repeat the procedure whenever you boot up the 218e.)

If your 218 does not have this feature, contact your Buchla representative to see you if can upgrade yours. It is possible a standard Firmware upgrade procedure will work.

Appendix B: Using the 2-pin jumpers for more options:

Adding jumpers is a hidden feature of the Aux Card reserved for advanced users. But it merely requires unscrewing the back panel and popping on 2-pin jumpers to easily accessible pins. These jumpers are accessible from the side of the unit. Install or remove the back cover unit only with the panhead screws on the back. Do not attempt to remove the flathead screws on the front.

On the upper left: JUMP1 will add control of the number of sequencer stages via the CV plugged into the "A in" banana. (It will remain connected to the multiplier too). But this CV control is also now available on a 208C per a switch setting.

On the lower right: JUMP3 will connect both gates1 and gate2 mode controls together from the "to card" input. (This would come standard on your card.) To control only the gate 2 mode, remove this jumper.

At this time JUMP2 (on the middle left) should not be used. It will send the sequencer pulse output to the "from card" banana of the 208. That pulse that can be used for a unique short gate. But it can interfere with the ability of the sequencer to trigger the envelope.

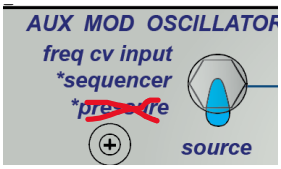
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Appendix C: Hacks: *(Note: This could void your warranty)*

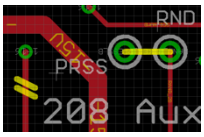
For those who are good at cutting traces and OK at soldering: The important thing is that you cut the traces in the examples below fully so you don't mess up the operation of your control voltages by connecting shorting two of the CV's together

To do these you have to disassemble the AuxCard by
1. Removing the 2 screws on the back.
2. Then remove the knobs by pulling those off, then remove the nuts on the switches.
3. Then take the back off, and if you did the first two steps, pry the two circuit boards apart. (They are only held together by the connectors at this point.)

Now you have access to the card connector board where all the fun below is.
OPTION1: switched random source



One option is to replace the switched "pressure" source to the oscillator frequency input with the random1 CV input. You can always use a cable directly but this is an interesting option for a quick switch control for random instead of pressure. (It's something I meant to change, but the graphics were already printed, so . . . it wasn't)

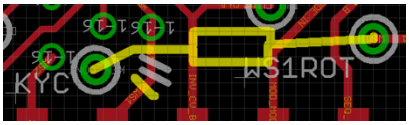


Cut here where the 2 lines are and jump between labeled PRSS and RND pads.

OPTION2: Key On control instead w.s. pot

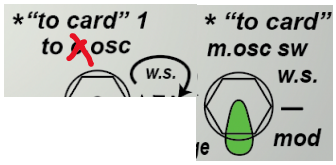


If you have a 208C and you don't need a redundant way to control the waveshape knob on the complex oscillator, then this other setting could be altered.
My own personal hack is to instead control the "keyboard on" switches. Only one CV controls the keyboard on switch for both oscillators. It's an unusual thing to control, but I enjoy it especially when there a nice modulation between the two oscillators that changes radically as the "keyboard on" switches are turned on and off.

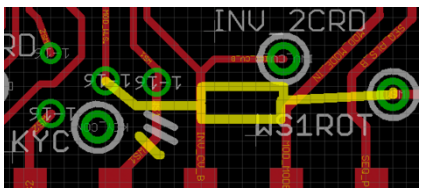


Cut where two white silkscreen lines and jump from WS1ROT to KYC with a 47k resistor.

OPTION3: Modulation Waveshape "card1" control instead w.s. pot



You could instead do a hack to make the w.s. position do what the next switch to the right does but with the card1 input; connect the waveshape of the mod oscillator to the card1 control instead card2. Why? This would allow the user to control the waveshape with the card1 input and the modulation type with the card2 input. Otherwise you have to choose only one or the other on that switch for card2 control. (See left)



Cut where two white silkscreen lines and jump from WS1ROT the pad just about the KYC pad with a 47k resistor.