Music Easel hacking for beginners

Part 1: First Principles

The program card slot on the Buchla Music Easel program card is a great platform for DIY, but like anything Buchla, it's not completely intuitive.

The program card slot has access to 45 different signals. They're not all strictly inputs or outputs - they're signals that you can connect to and either read or influence.

For example, F11 (SQLN) is the number of steps in the sequence. You can measure that voltage to understand which position the switch is in, or you can add to that voltage (through a resistor) to change the number of steps.

Disappointingly, you can only access control voltages - the audio path doesn't go near the program slot, so you can't, for example, make a drop-in delay card. You could, of course, use the power and CV to make a neat, controllable delay card with audio in and out.

However, there are several features in a 208 that could be CV controlled, but aren't, presumably because Don ran out of panel space. In some more recent designs, like the Easel Command, some of these are brought to the front panel.

For example, Duration, Attack & Decay of the Envelope can all be CV controlled (and are, on the Easel Command). The Complex Oscillator's waveshape pot—and both waveshape switches—can be CV controlled. The Sequencer length can be CV controlled all the way from from 1 step to 5.

Principle 1: You (almost) always need a resistor

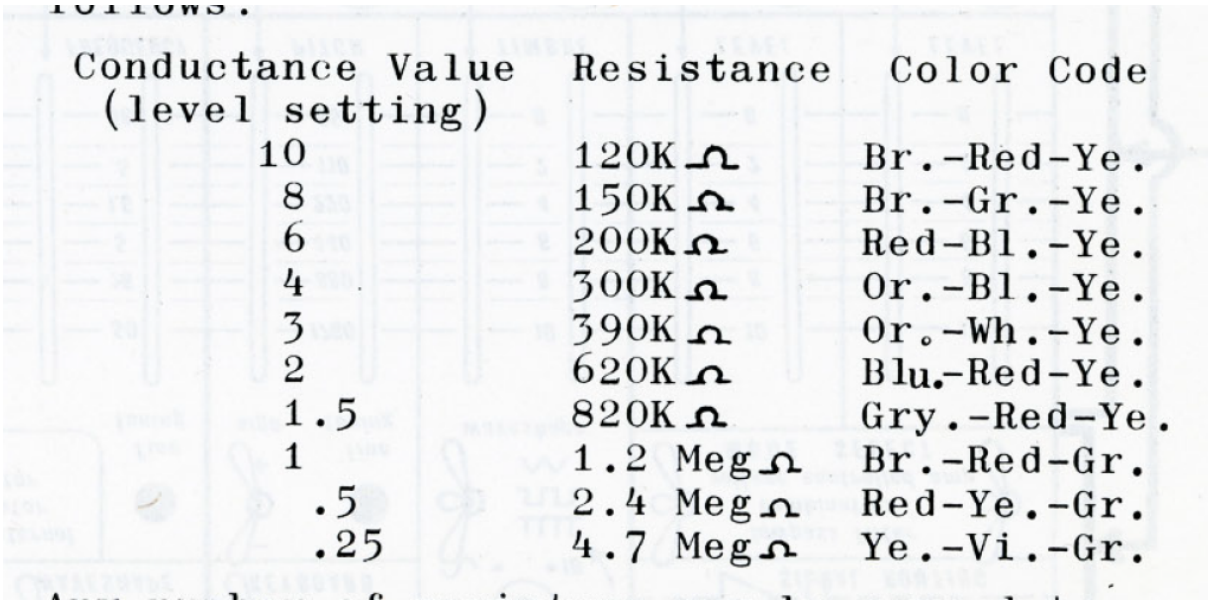
The original Easel Card - described in lots of detail in the Original Easel Manual by Allen Strange from p23 onwards - was designed to store patches. So, with a handful of resistors, you could preset sequences and fader or switch positions.

But you can do more than just save patches: build an LFO, and patch that wherever you like. Attach an Arduino and generate euclidean pulse streams. Randomise things that can't normally be randomised.

The program card is not a simple patchbay. You can't just run a wire from *F16 Random 2 out(RND2)* to *F21 Mod Osc Waveshape (MOWS)* and get random waveshapes from the Mod Osc. If you try, sometimes it won't work at all, most times it will override the front panel. It won't damage anything once the card is removed.

To make those connections you need a resistor. Think of the resistor as like a virtual fader: 120K is a fader that's fully up, 4.7M is a fader just a tiny way up from the bottom.

Pulse signals normally use a 390K resistor. All this is documented in the Easel Manual.



Conductance Value (level setting)	Resistance	Color Code
10	120KΩ	Br.-Red-Ye.
8	150KΩ	Br.-Gr.-Ye.
6	200KΩ	Red-Bl.-Ye.
4	300KΩ	Or.-Bl.-Ye.
3	390KΩ	Or.-Wh.-Ye.
2	620KΩ	Blu.-Red-Ye.
1.5	820KΩ	Gry.-Red-Ye.
1	1.2 MegΩ	Br.-Red-Gr.
.5	2.4 MegΩ	Red-Ye.-Gr.
.25	4.7 MegΩ	Ye.-Vi.-Gr.

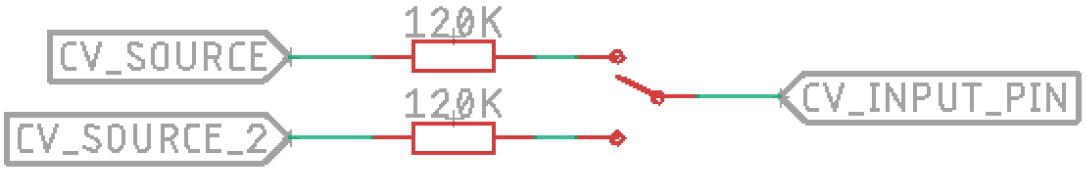
So: *Pin F16 → 120K resistor → Pin F21* = exactly what you expect: random waveshapes. With the control switch in 'Both' those random signals will be additive - so turn the Mod Osc Waveshape down to get the full effect.

Principle 2: Three ways to make a connection:

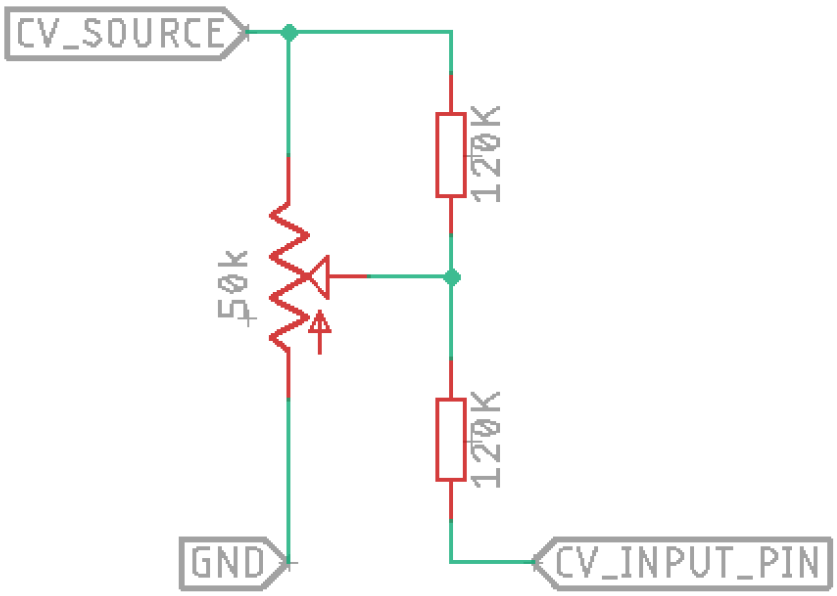
1. You can make a fixed connection—using a resistor to set the level of connection. So if you want to connect a banana socket to Envelope Decay, you can put a 120K resistor between the socket and pad 21 on the front edge connector. That's the equivalent of a CV input slider fully pushed up.

1. Permanent connection with resistor to set level

2. With switch



3. With fader or pot to control CV amount



2. Or, you can use a switch and a resistor. This is what happens, for example, in the Keyboard in/out switches. With SPDT On-Off-On switch, you can choose between two CV sources, or switch between input resistor values for a high/low/off input.

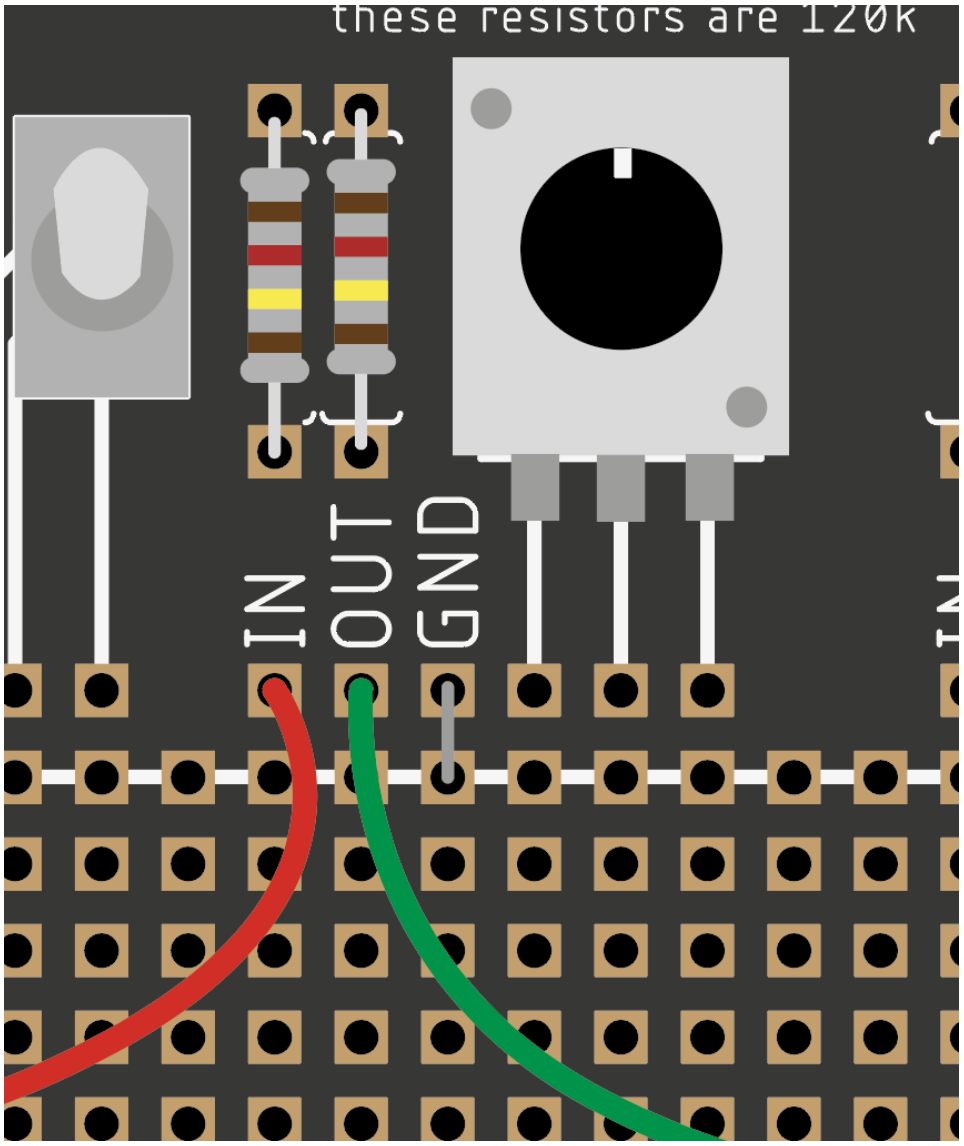
3. Finally, you can use a pot or fader to set the input level—this is the circuit used on the front panel CV inputs for Index, Frequency, Timbre etc.

You should use these schematics whenever you send voltage anywhere in the 208—for example, if you create a sequencer on a program card, and want to send the CV to the oscillators, these are the right circuits to make those connections.

However, if you create a voltage on the card, and output it from a banana jack on the card (or pad 28 ‘from prog’), you don’t need the input resistors or pots—they’re already there in the CV inputs you’ll connect to.

NB: The two pots on the card already have space for 120k resistors.

Principle 3: Setting up the on-board pots



The on-board pots have space for two 120K resistors so they’re ready to go.
1. Solder 120K resistors into the spaces on the front, or use 0603 SMD resistors on the back — not both!

2. Solder a wire or jumper between GND and the GND rail below it

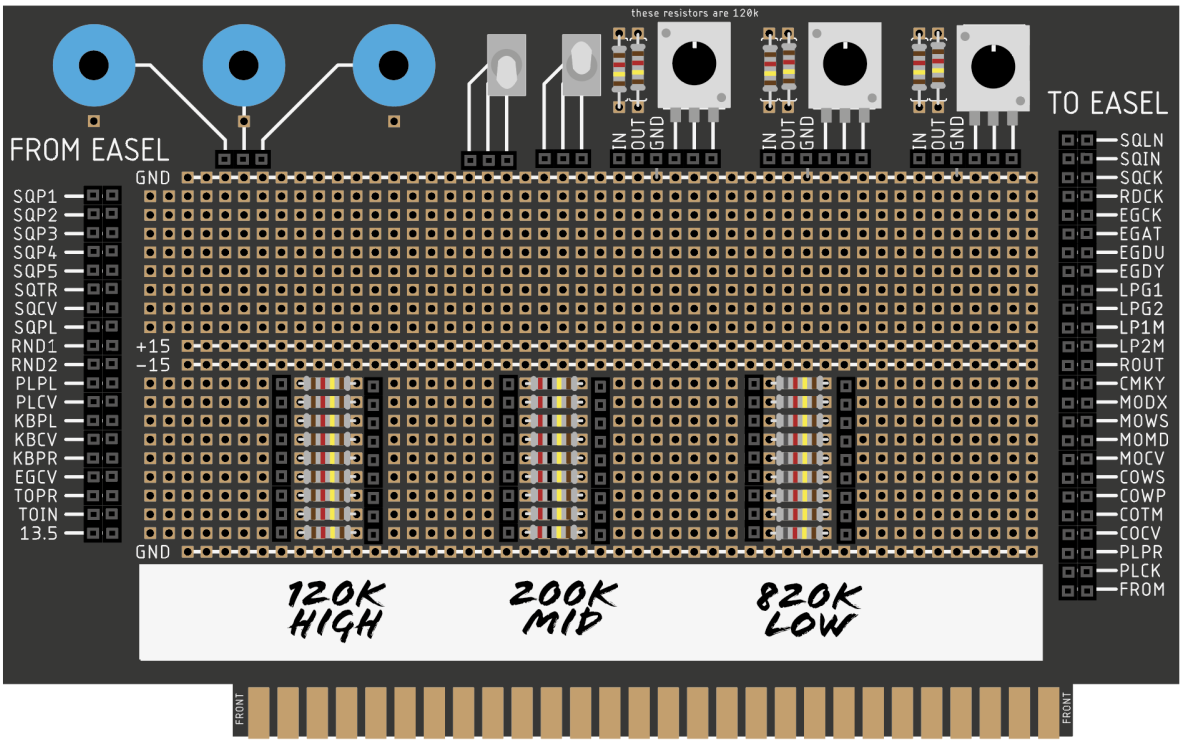
3. Now simply connect:
    A source like RND1 or EGCV to IN
    A destination like MOWS or LPG1 to OUT

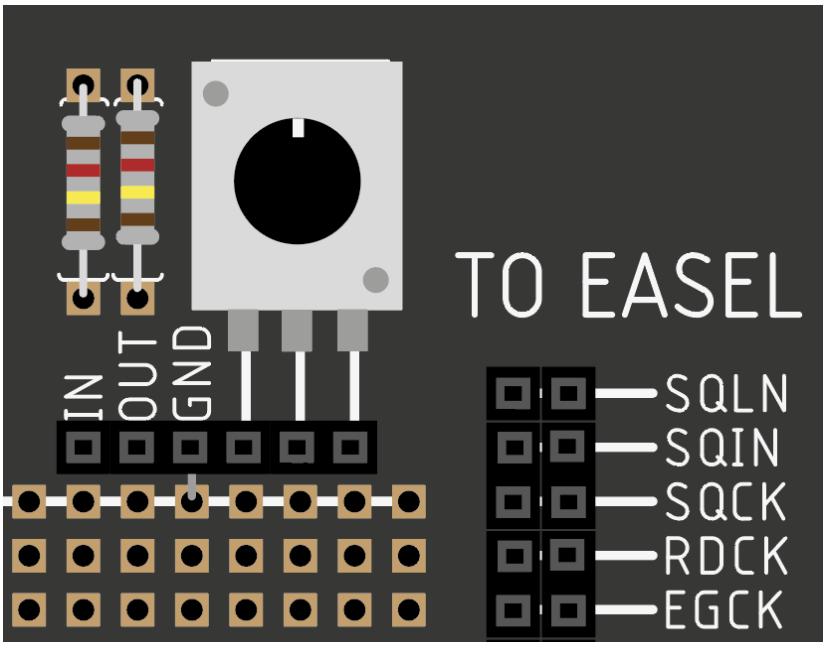
And you have a permanent connection through the attenuator. Often, you need to slide the front panel fader down when you add voltage in this way.

Principle 4: Setting up a board as a patchbay

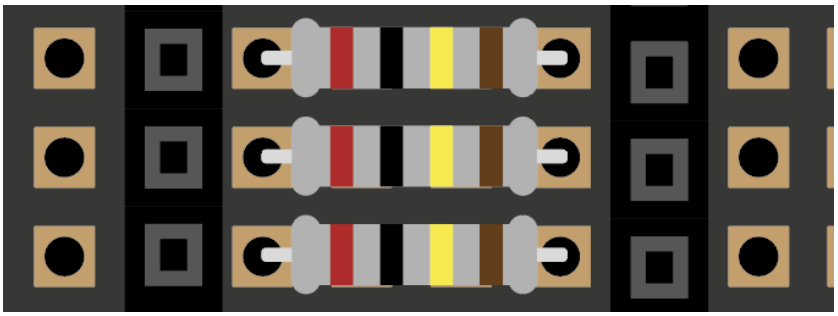
You can set up a proto card as a patchbay, allowing easy connections between all the available signals in the Easel.

1. Add female pin headers to the ‘From Easel’ and “To Easel’ columns, and the connections along the top for Bananas, switches and Pots. set up the resistors and ground connections for the pots as explained above.

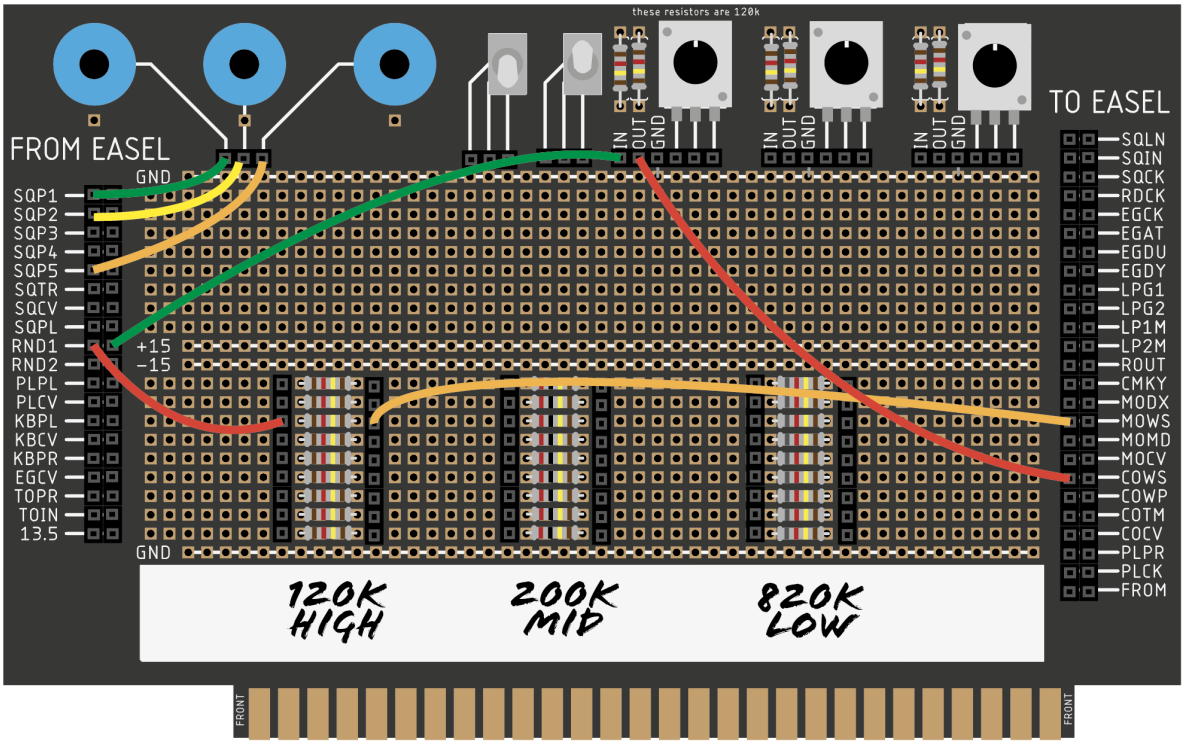




2. You then need a range of resistors to patch between signals: Add two vertical rows of female headers with four empty holes between them. Then solder resistors between the rows, connecting with the headers beneath the board



You can make multiple connections using jumper wires, either using switches, pots, or just resistors.

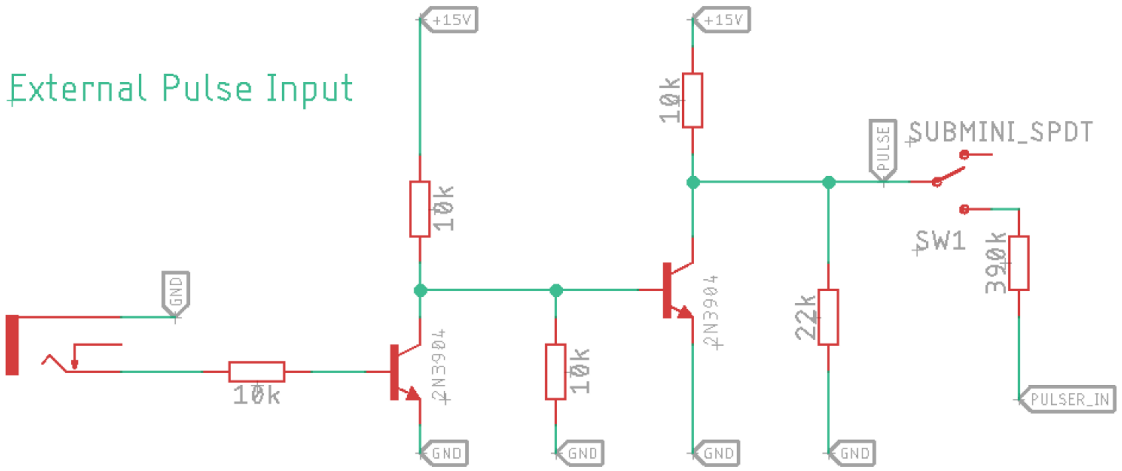

these resistors are 120k
FROM EASEL
TO EASEL
GND
SQP1
SQP2
SQP3
SQP4
SQP5
SQTR
SQCV
SQPL
RND1
RND2
PLPL
PLCV
KBPL
KBCV
KBPR
EGCV
TOPR
TOIN
13.5
+15
-15
GND
IN
OUT
GND
IN
OUT
GND
IN
OUT
GND
SQLN
SQIN
SQCK
RDCK
EGCK
EGAT
EGDU
EGDY
LPG1
LPG2
LP1M
LP2M
ROUT
CMKY
MODX
MOWS
MOMD
MOCV
COWS
COWP
COTM
COCV
PLPR
PLCK
FROM
120K HIGH
200K MID
820K LOW
FRONT
FRONT

Principle 4: Working with pulses

One of the first things I did on a proto board was building a pulse input, to sync the easel with things like a Korg Volca or a Eurorack module.

You can use these pulses to trigger the Pulser, the Envelope generator, or clock the sequencer or random voltage generator.

To do that, the 3–5v pulse from something like a Volca needs to be scaled up to 10v for Buchla.



I do this using two NPN transistors—I've used 2N3904 or 2N2222 plus six resistors.

You can then connect the PULSE output to, for example, Rear Pad 16 Pulser Pulse Input, via a switch and—importantly a 390K resistor. If you skip the resistor, it can stop the pulser working when no external clock is attached.

Appendix: All the available signals

FROM EASEL		
Code	Description	Edge Pin
SQP1	Sequencer step 1 Output (Pulses when step 1 is active)	F7
SQP2	Sequencer step 2 Output	B7
SQP3	Sequencer step 3 Output	F8
SQP4	Sequencer step 4 Output	F9
SQP5	Sequencer step 5 Output	F10
SQTR	Sequencer trigger pulse (Each time the sequence moves forward)	F12

SQCV	Sequence CV Output	F15
SQPL	Sequencer pulse Output (From the pulse sequencer switches)	B21
RND1	Random 1 Output (Each of the white jacks has a different random pattern, two are available here)	B8
RND2	Random 2 Output	F16
PLPL	Pulser pulse Output (A very short pulse at the start of each Pulser cycle)	F18
PLCV	Pulser Output (A decaying envelope on each pulse)	F20
KBPL	Keyboard Pulse	B14
KBCV	Keyboard CV	B15
KBPR	Keyboard Pressure CV (Violet Bananas)	B19
EGCV	Envelope Generator CV Output	B20
TOPR	Banana Jack "To Prog" in the Preamp section	F26
TOIN	Banana Jack "To Prog" in the Inverter section	B23
+13.5	Reference Voltage (+13.5V)	B27
TO EASEL		
Code	Description	Edge Pin
SQLN	Sequence Length 1-5 steps CV	F11
SQIN	Sequence CV Input	F13
SQCK	Sequencer Clock Pulse Input	B12
RDCK	Random Clock Pulse Input	F14
EGCK	Envelope Trigger Pulse Input	F17
EGAT	Envelope Attack CV Input	B18
EGDU	Envelope Duration CV Input	F19
EGDY	Envelope Decay CV Input	F21
LPG1	LPG1 level CV Input	F22
LPG2	LPG2 level CV Input	F25
LP1M	LPG1 mode switch CV Input	B26
LP2M	LPG2 mode switch CV Input	F27
ROUT	Lopass Gate Signal Routing Switch CV	B28
CMKY	Complex & Mod Osc Keyboard In/Out Switch	F24
MODX	Mod Osc Index CV Input	B10
MOWS	Mod Osc Waveshape CV Input	F23
MOMD	Mod Osc Modulation Mode Switch CV Input	B22
MOCV	Mod Osc Frequency CV Input	B11
COWS	Complex Osc Waveshape Switch CV Input	B25
COWP	Complex Osc Waveshape Pot CV Input	B24

COTM	Timbre Pot CV Input	B17
COCV	Complex Osc Pitch CV Input	B13
PLPR	Pulser Period CV Input	B9
PLCK	Pulser Trigger Pulse Input	B16
FROM	Banana Jack "From Prog" in the Inverter section	F28

Appendix: Suggested Parts

3	Banana Sockets	Cinch Connectivity White: 108-0901-001 Red: 108-0902-001 Black: 108-0903-001 Green: 108-0904-001 Orange: 108-0906-001 Yellow: 108-0907-001 Brown: 108-0908-001 Blue: 108-0910-001 Violet: 108-0912-001 Grey: 108-0913-001
2	Submini Switches	Thonk DW1 - SPDT ON-ON DW2 - SPDT ON-OFF-ON
3	Potentiometers	Thonk 50k Song Huei 9mm trimmer pots
Selection	Resistors	Standard ¼ watt resistors: 120K* 150K 200K 300K* 390K 620K* 820K 1.2M 2.4M 4.7M *Most common values, these are enough to get started. If you're a confident SMD solderer, 0805 or 0603 size SMD components also work well between the pads.
Selection	Pin Header Sockets	Standard or low-profile pin sockets. 1 x 19 x 2 rows 1 x 24 x 2 rows 8 x 8 x 1 row 3 x 6 x 1 row

		3 x 3 x 1 row It may be easiest to buy full-length strips and cut them to fit
Selection	**Pin patch cables**	In a range of lengths & colours