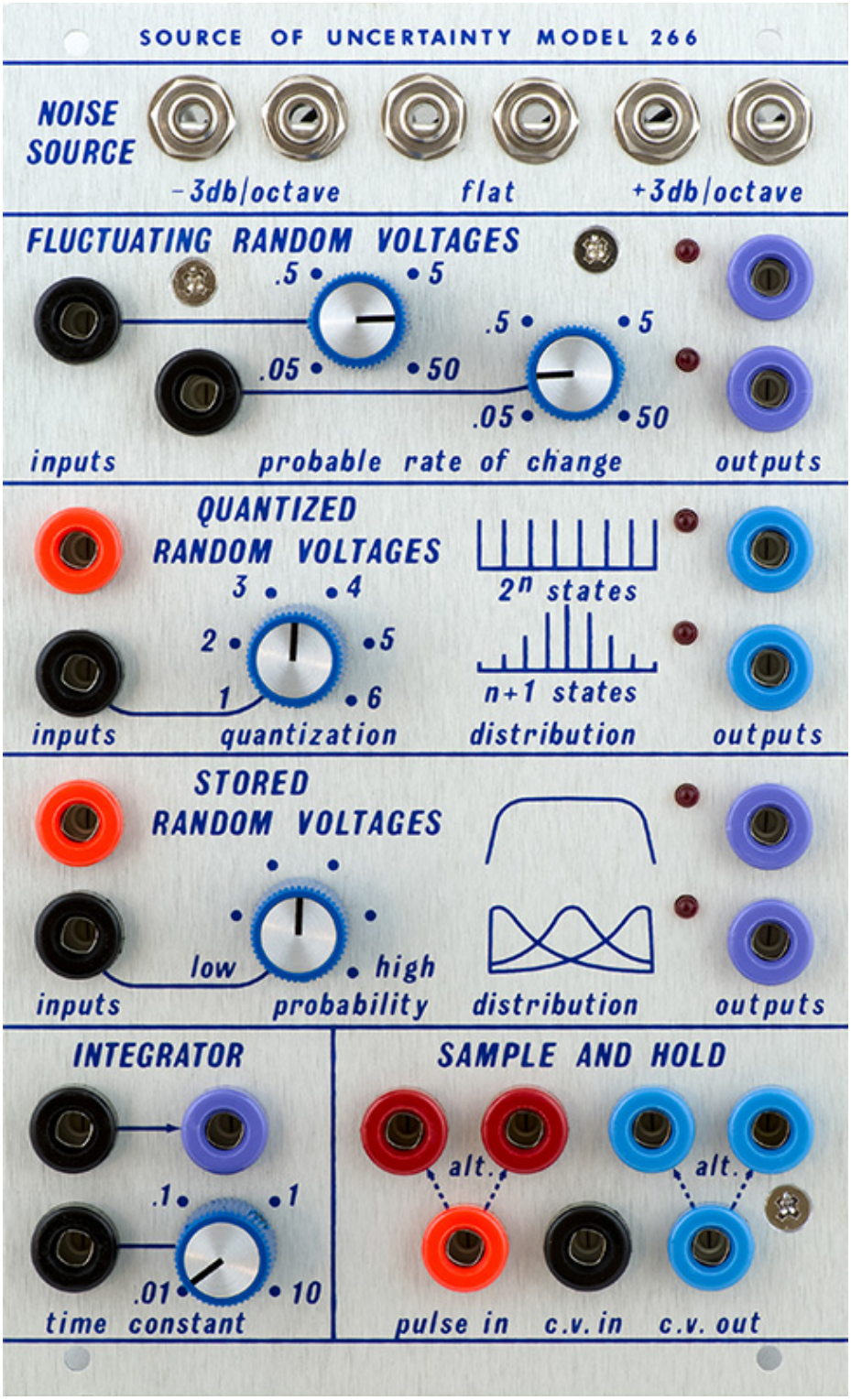
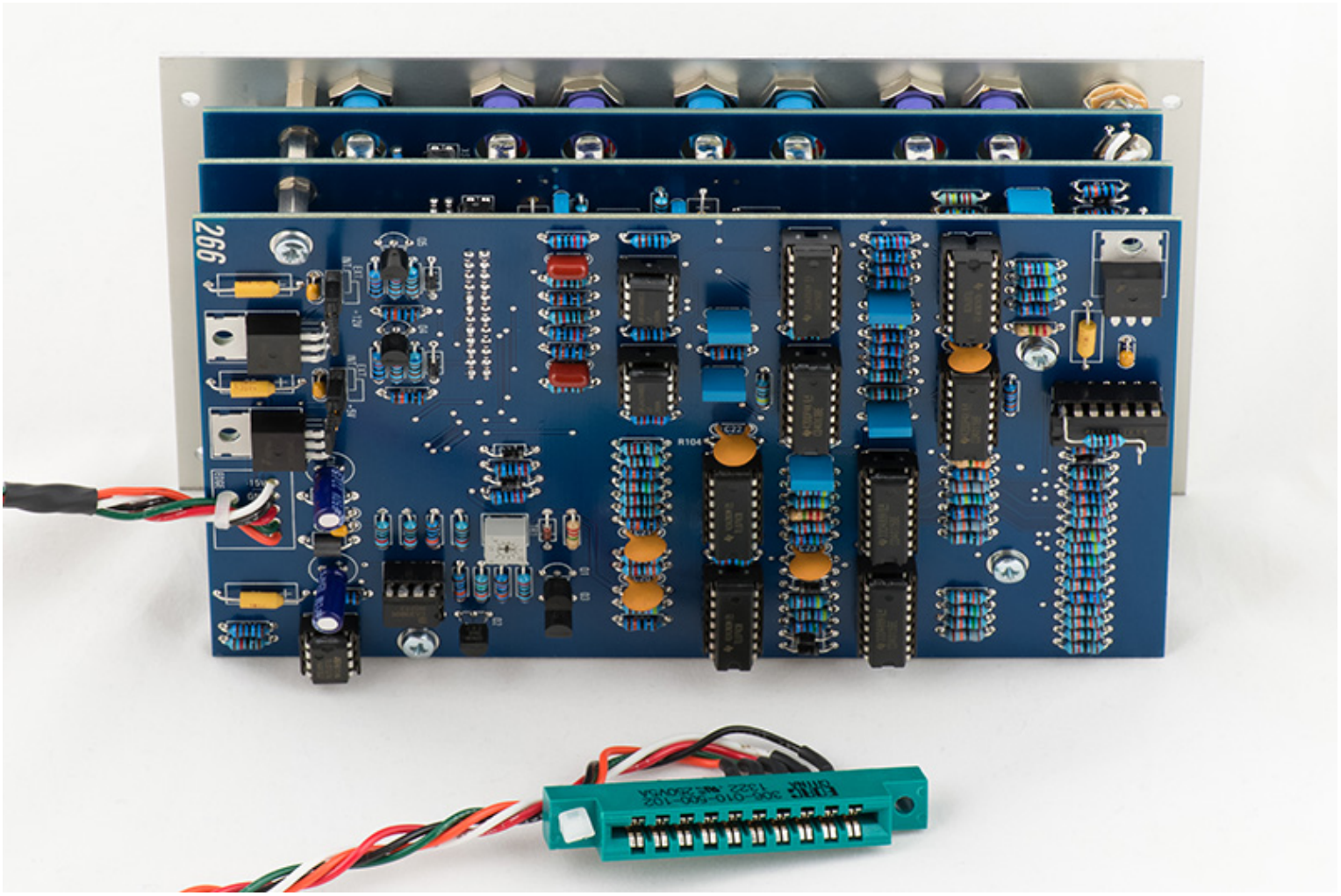
Buchla 266 Source Of Uncertainty Module

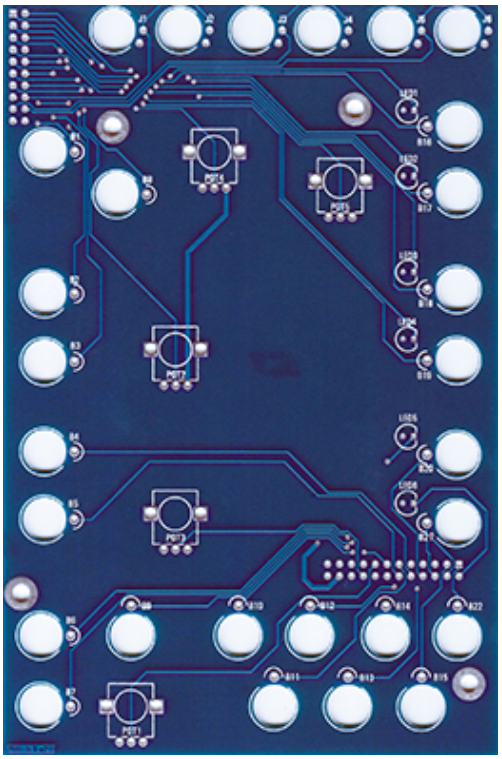
I built a Buchla 266 Source Of Uncertainty module for someone else. They sent me a complete kit of parts and I assembled and tested the module. Many of the components are sourced through Mouser but specialized parts, panel, knobs, and PCBs have specific sourcing and I do not know the details. This module is in the Buchla format with V2 PCBs and the circuitry will be kept mostly stock (the later V3 PCB requires a mod which is documented the bottom of this page). I documented all of the 266 functions on my 5U Source of Uncertainty page and extracted a single page description of the 266 from the Allan Strange Electronic Music Systems Techniques and Controls book.

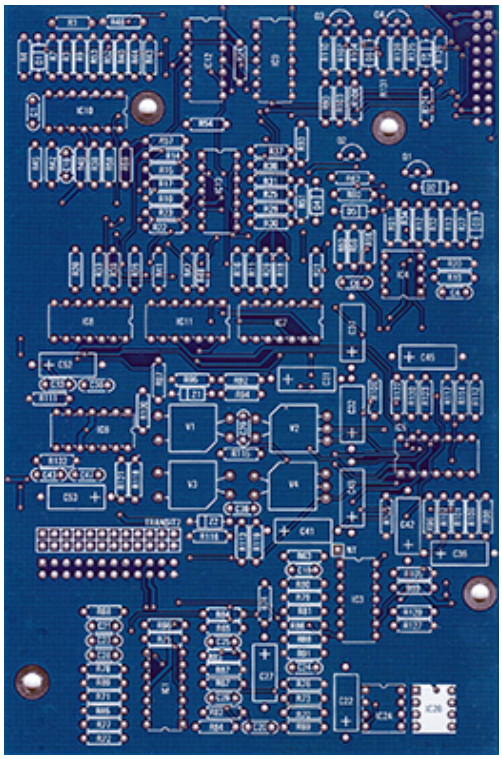
Buchla 266 description - Electronic Music Systems Techniques and Controls

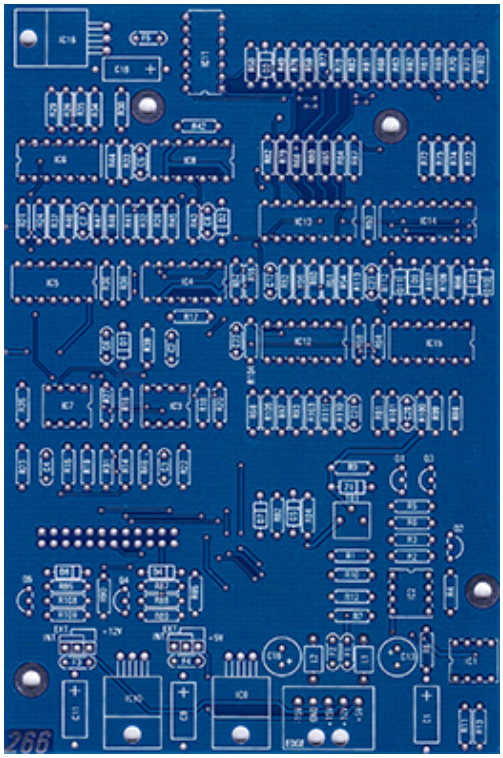

SOURCE OF UNCERTAINTY MODEL 266
NOISE SOURCE
-3db/octave
flat
+3db/octave
FLUCTUATING RANDOM VOLTAGES
.5
5
.05
50
.5
5
.05
50
inputs
probable rate of change
outputs
QUANTIZED RANDOM VOLTAGES
3
4
2
5
1
6
2n states
n+1 states
inputs
quantization
distribution
outputs
STORED RANDOM VOLTAGES
low
high
inputs
probability
distribution
outputs
INTEGRATOR
.1
1
.01
10
time constant
SAMPLE AND HOLD
alt.
alt.
pulse in
c.v. in
c.v. out



I made reference designators from the PCB images. The components cover the silk screen legends once populated which makes it hard to debug if anything is wrong. Of course the sandwich construction makes it nearly impossible to debug PCB2 anyways.







PCB 1 Reference Designators

PCB 2 Reference Designators

PCB 3 Reference Designators

Construction

There are two build threads and only one modification for the V2 PCB.

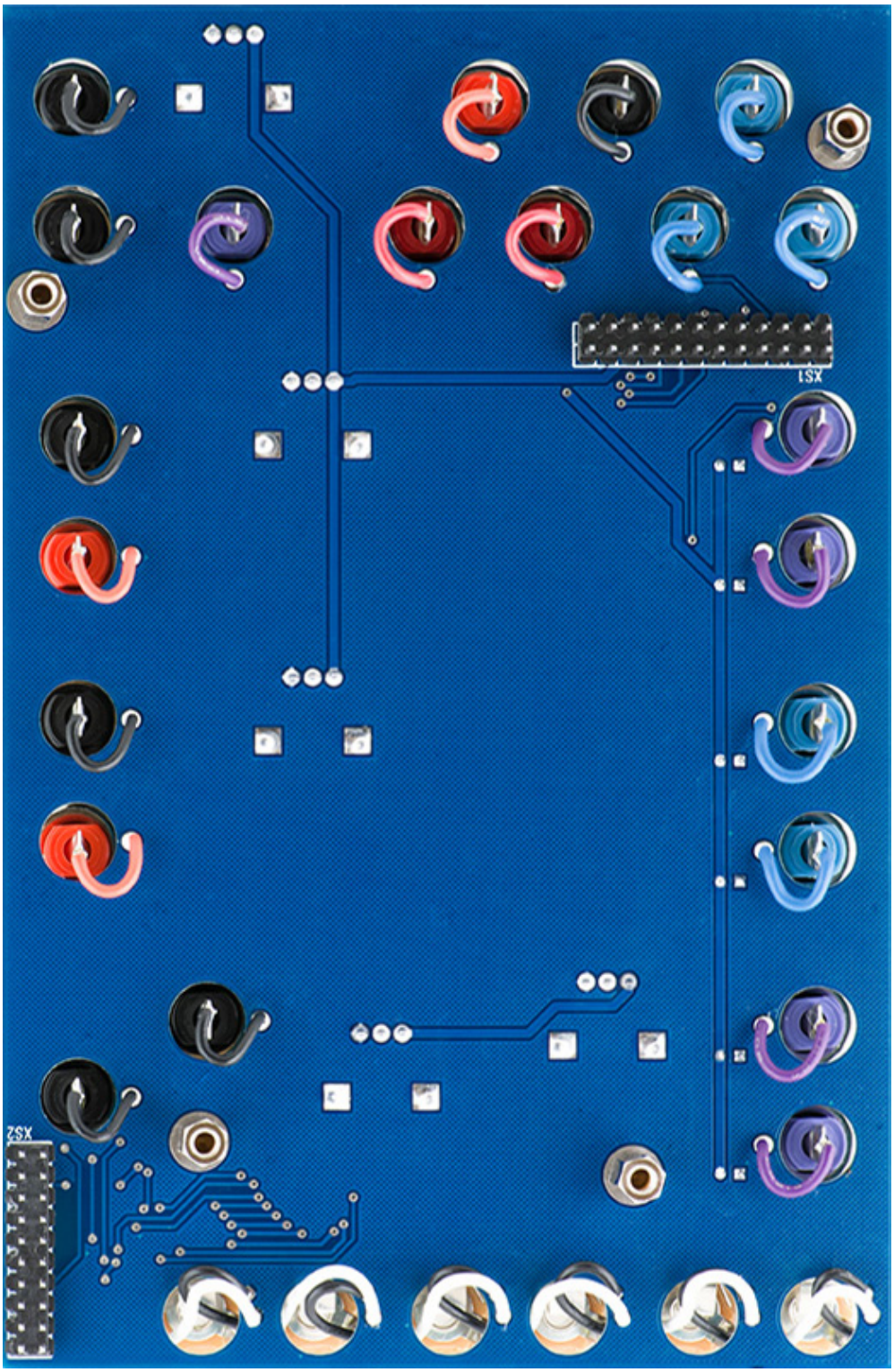
266 V2 Source Of Uncertainty modifications

1. This changes applies if using a programmed PIC for PCB2 IC2B: Change R69 from 39K to 6K8. Cut the trace from IC2A pin 3 to IC2B pin 2 and wire pin 3 of IC2A to pin 3 of IC2B.
2. The BOM lists PCB2 R59 as 60K1 but the standard value is 60K4.
3. The ferrite beads are not listed on the PCB3. I used Mouser 623-2743001112LF.
4. The 3 pin headers and shunts are not listed on the PCB3 BOM. I used Mouser 517-929647-01-03-EU pins and 571-8815452 shunts.

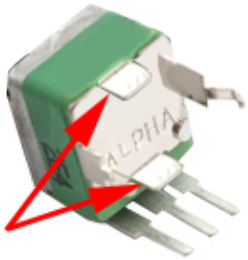
My Modifications

5. S&H and QRV clock on the rising edge but SRV clocks on the falling edge. Buchla pulses were narrow so it didn't make much difference but if you clock with a square wave SRV will be noticeably skewed. It is easy to change SRV to clock on the rising edge. On PCB3 cut (or lift) pin 6 of IC11 from ground and connect through a 10K resistor to pin 14 of IC11.

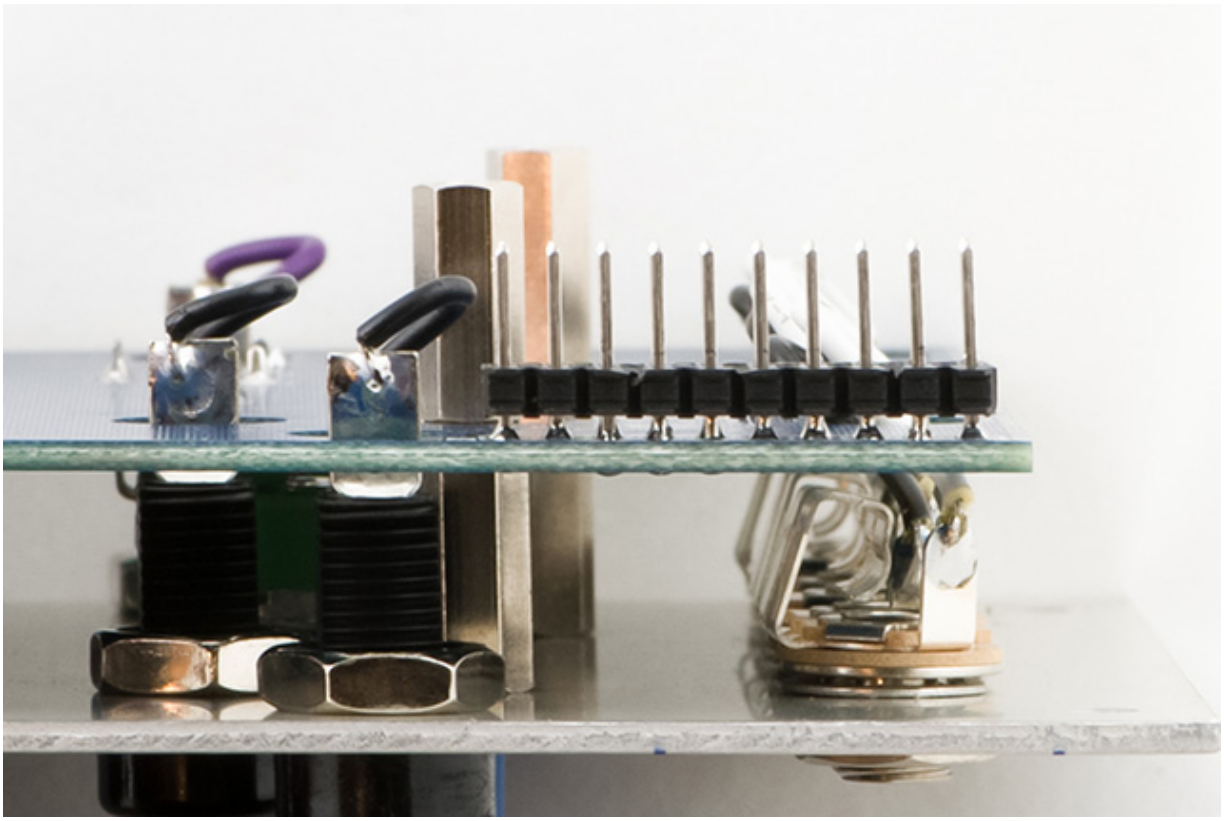
Build time for PCB1 and the panel was 2.25 hours. The LEDs do not have a flatted side so the long lead fits on the round side of the silk screen. I insert them fully into the PCB unsoldered. After the panel is mounted you can push them flush with the front panel and solder them in place. I also use color coordinated wire for the banana jacks.



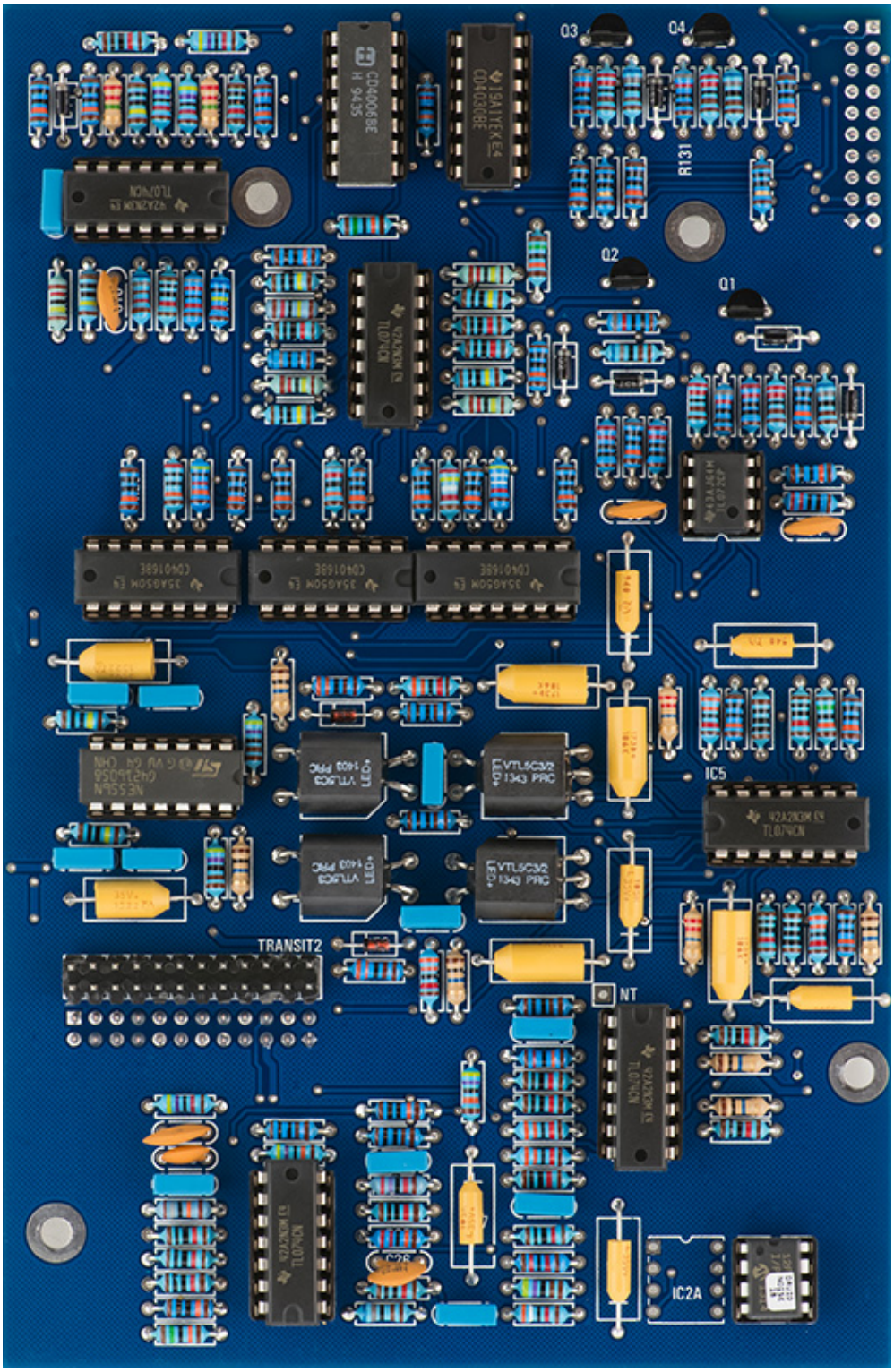
The tabs on the 9mm Alpha potentiometers contact the PCB so I cut the top and bottom tabs off since there are runs directly beneath the tabs. I do not like relying on solder mask for insulation.



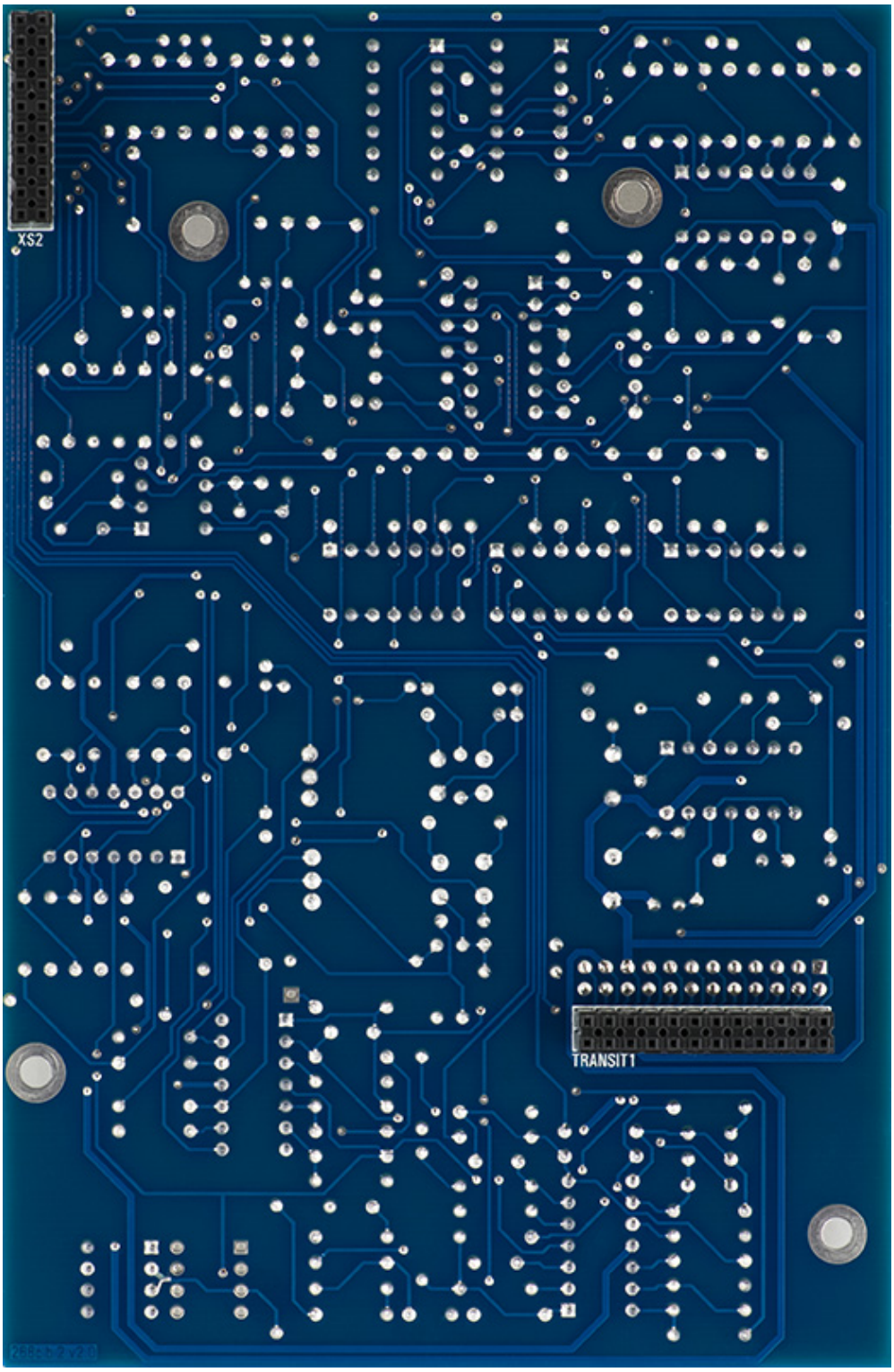
The square pins do not fully seat into the headers with the height of the standoffs. I insert the square pins fully into the female header and assemble the PCBs together. The pins are flush with the PCB and fully inserted into the header so the alignment is correct in all directions and then soldered in place.



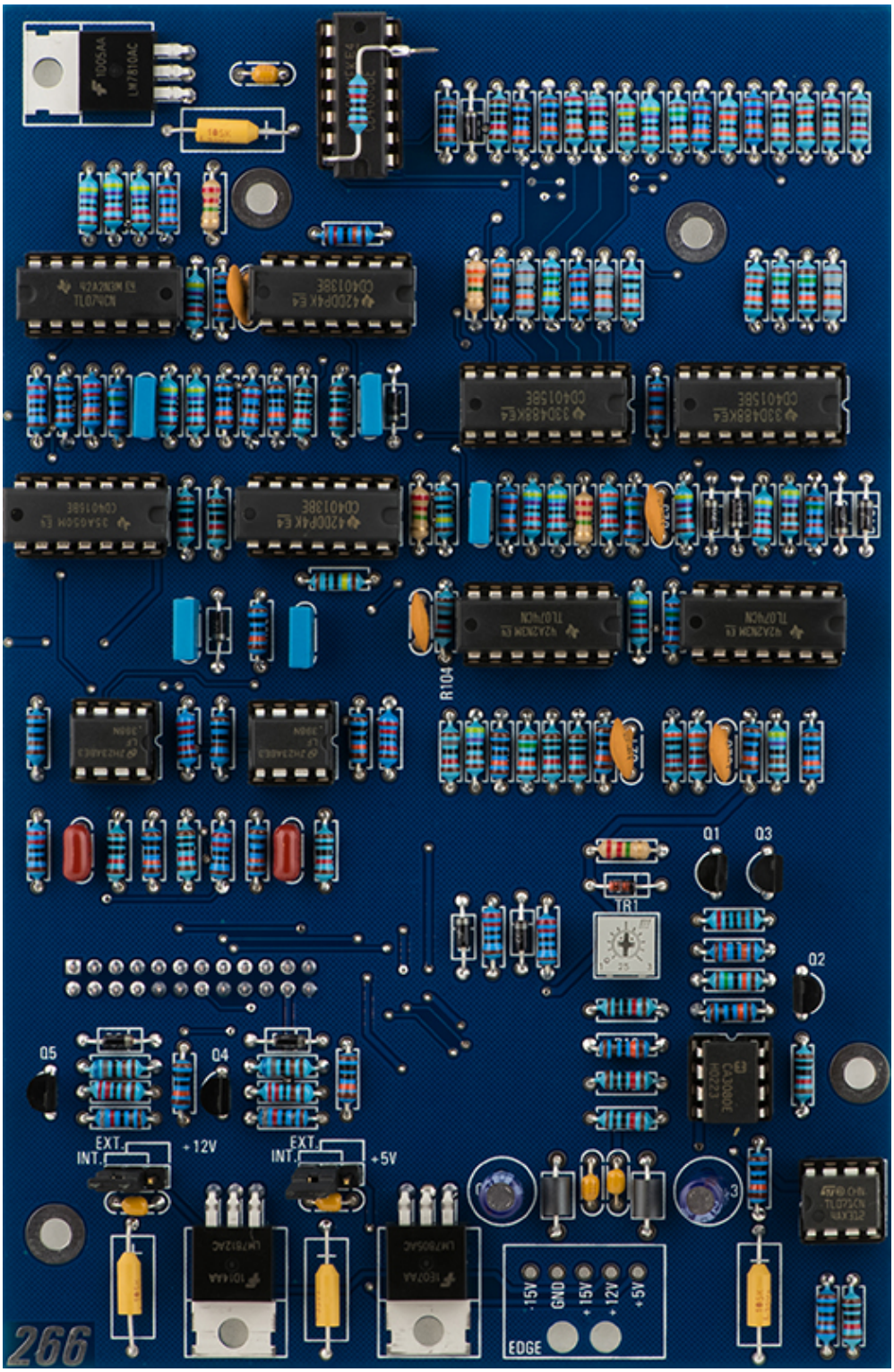
Build time for PCB2 was 4 hours. The resistors take a long time to install since there are so many of them and they are spread all over the PCB. I use Kester .020" diameter #24-6337-6401 331 water soluble core solder so take time every so often to wash the PCB. The potentiometers and vactrols are then added after washing and the wire connections are soldered.



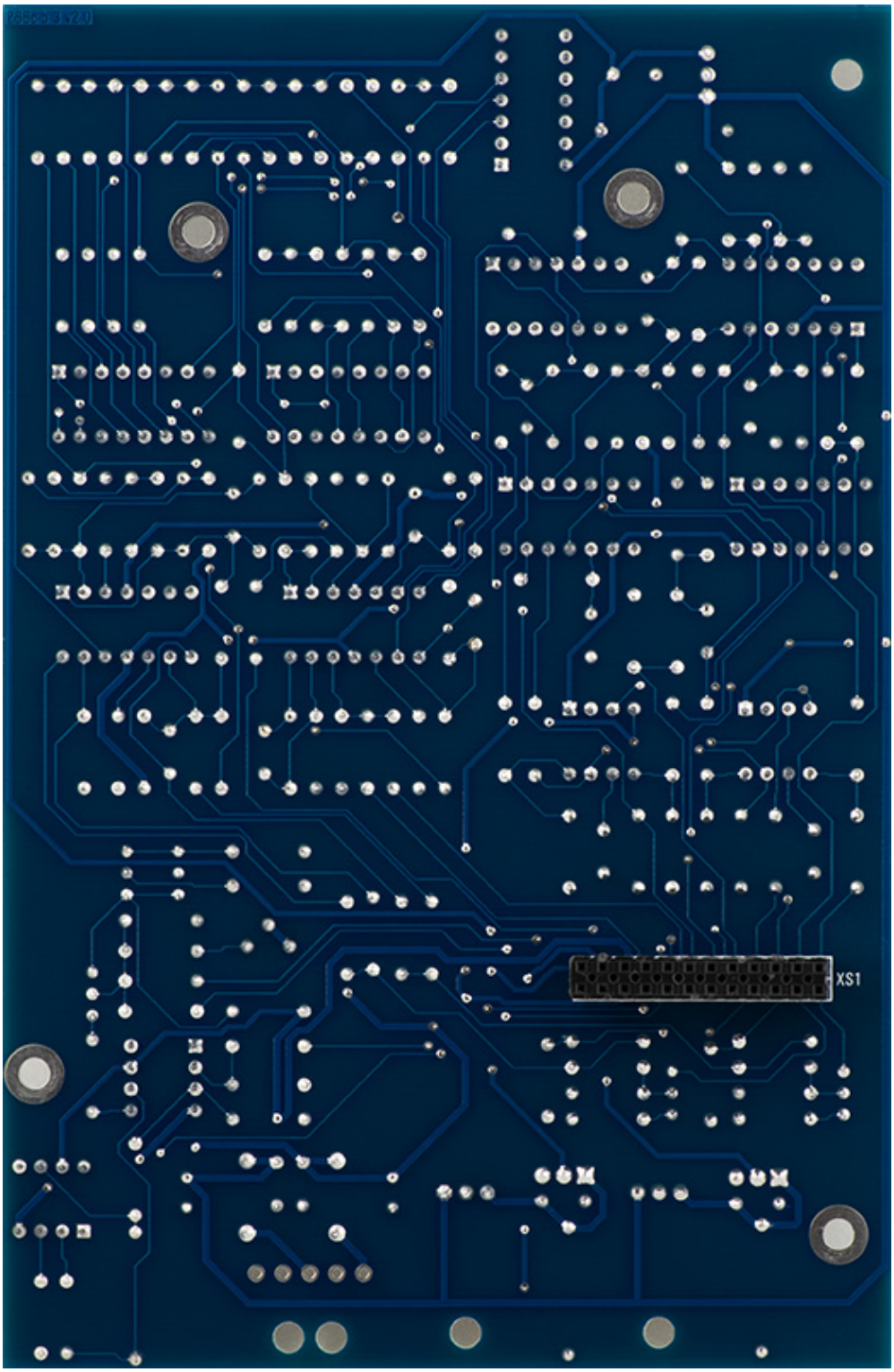
You can see the modification of the cut run and added wire at pin 3 of IC2B in the bottom left corner.



Build time for PCB3 and the power cable was 4 hours. Note that the ferrite beads and the 3 pin jumpers are not on the BOM. I also used 22 µF capacitors instead of 100 µF for C13 and C16. IC11 at the top has the SRV clock modification. I did not clip the IC pin so the modification could easily be reversed.



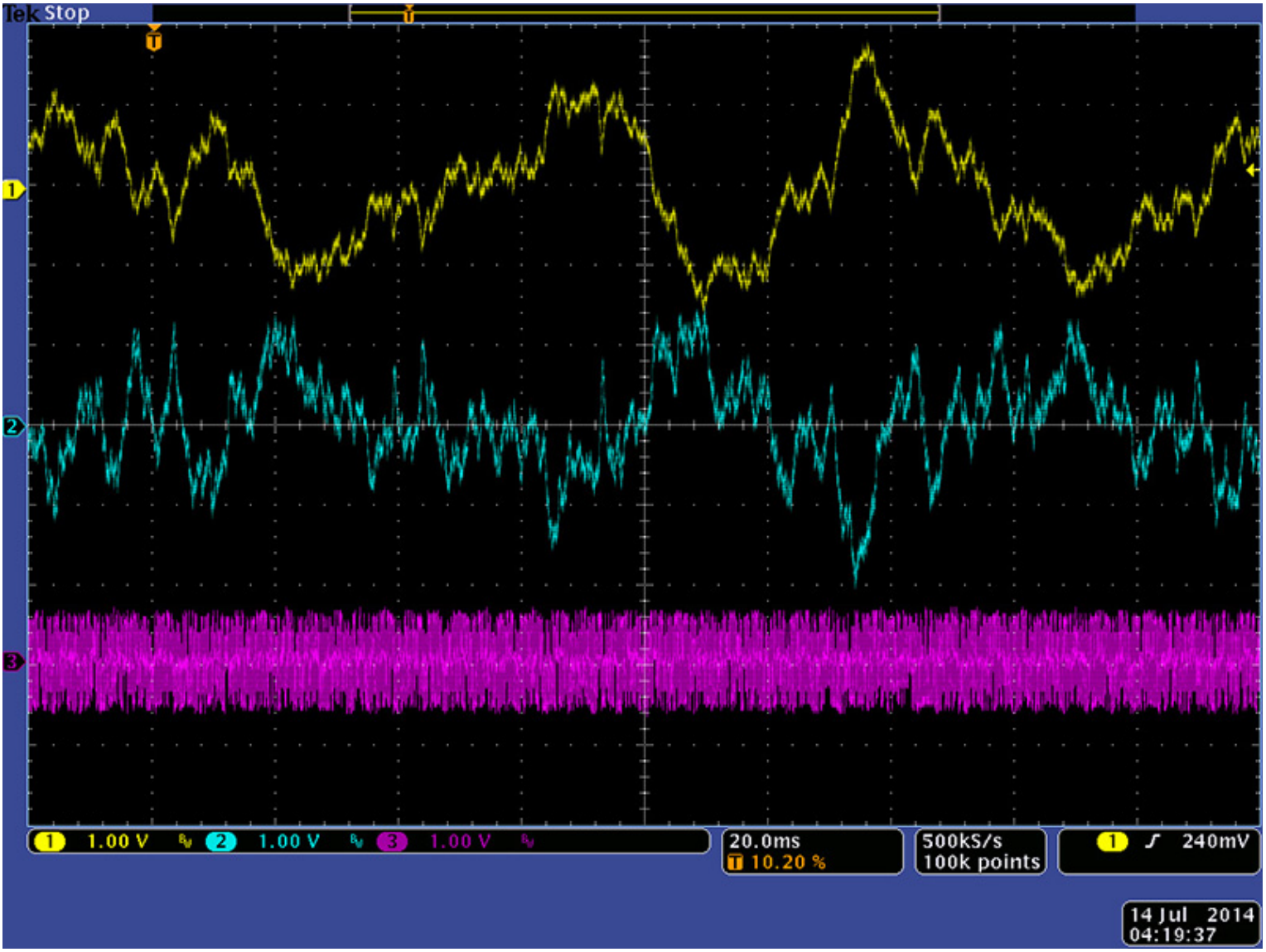
I chose to mount the female headers on the rear of the PCBs and the square pins on the front of PCB2. That provides better protection for the pins against handling damage.



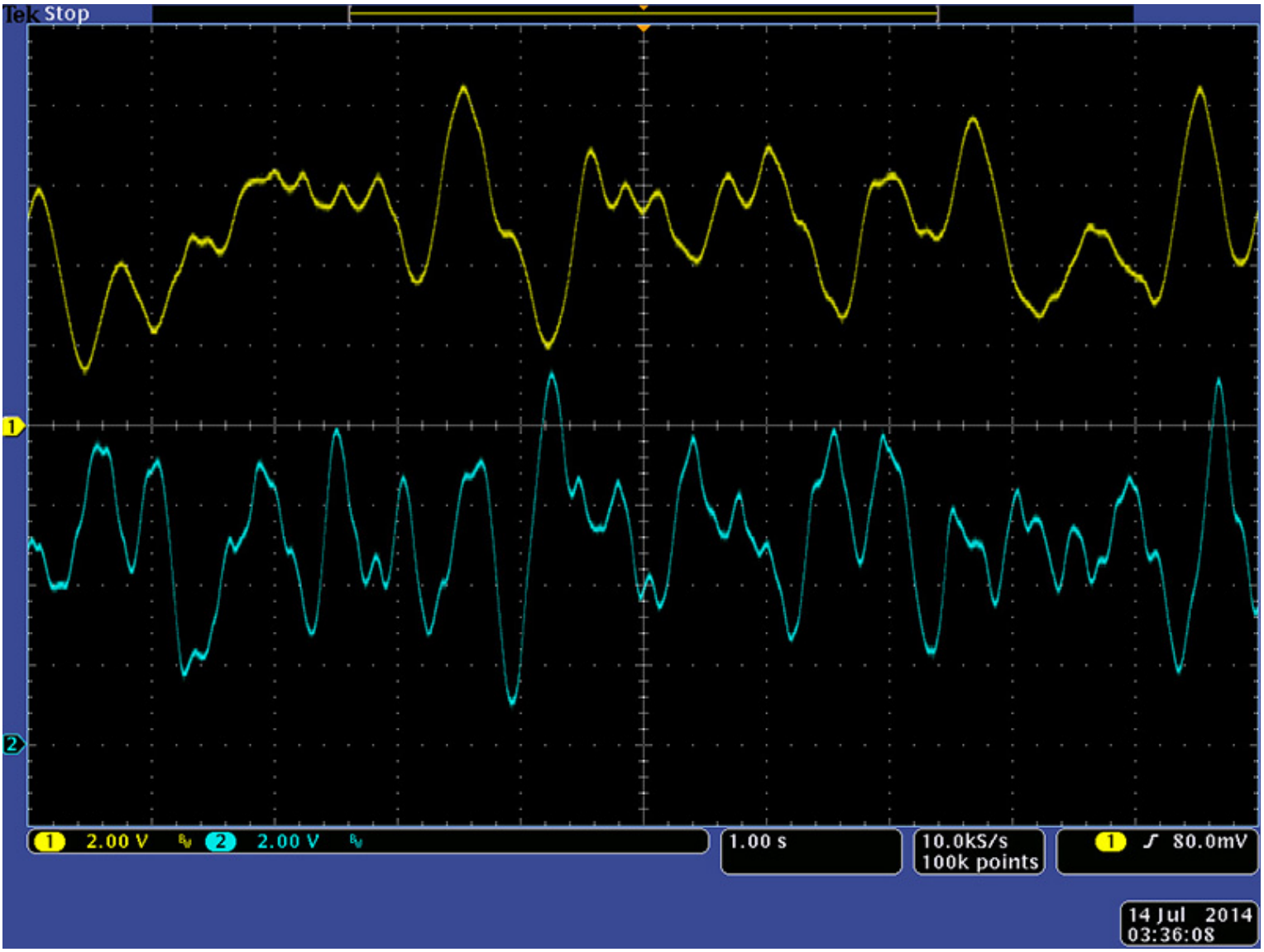
Operation

I have more and better scope images along with complete functional descriptions on my 5U 266 Source of

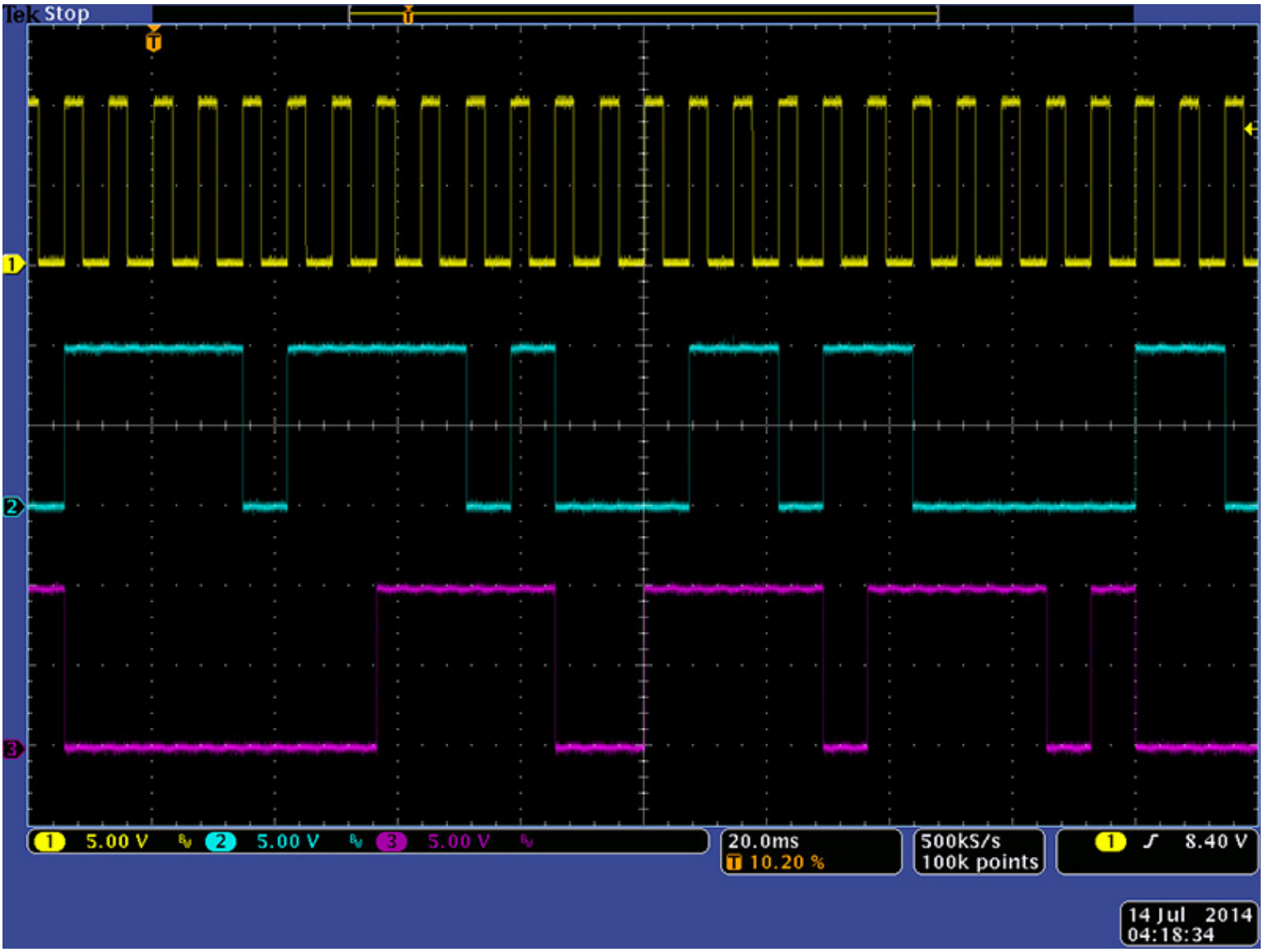
Uncertainty page. These scope images are from my verification of this module. These are the three noise outputs.



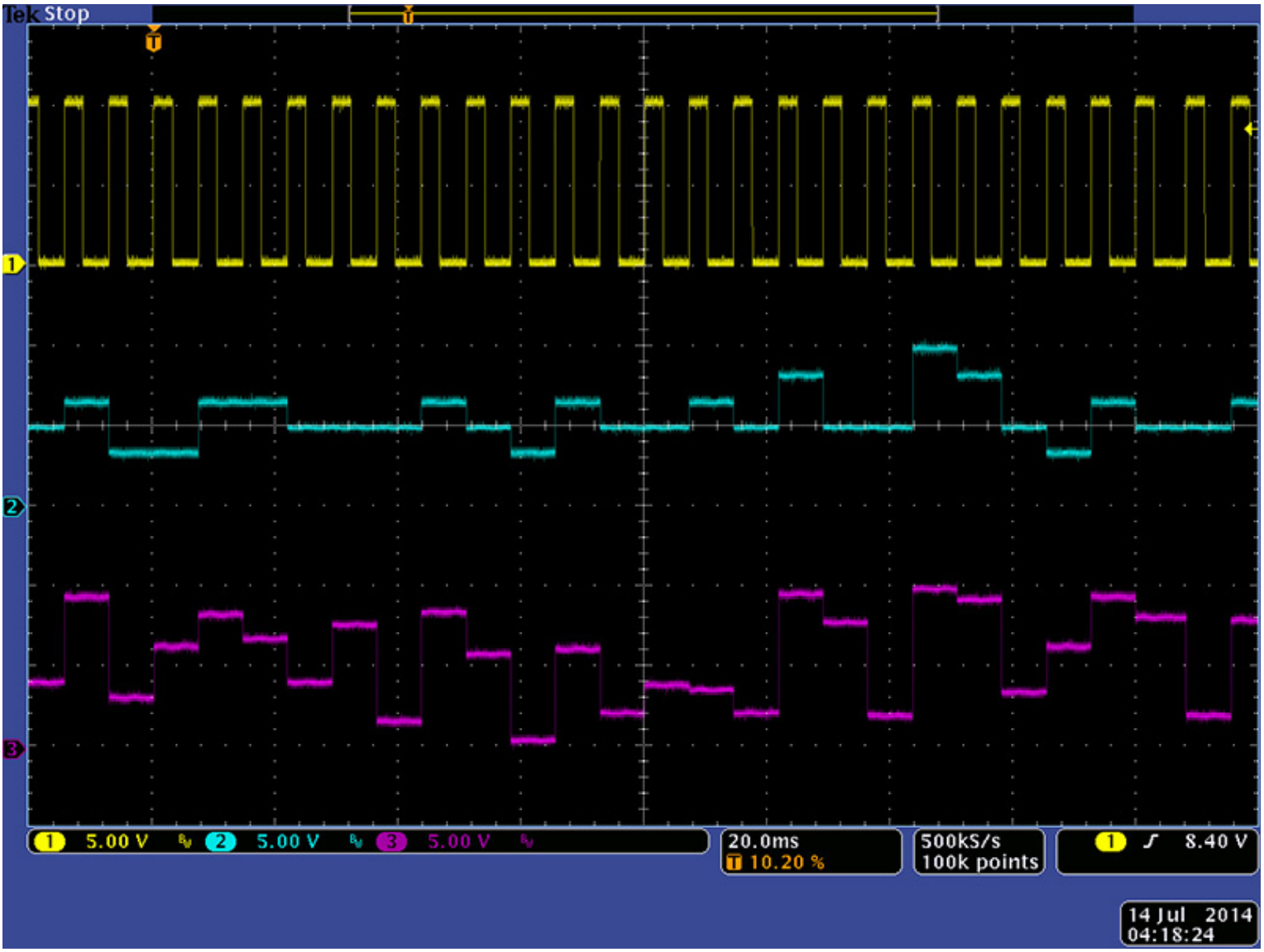
These are the Fluctuating Random Voltages outputs



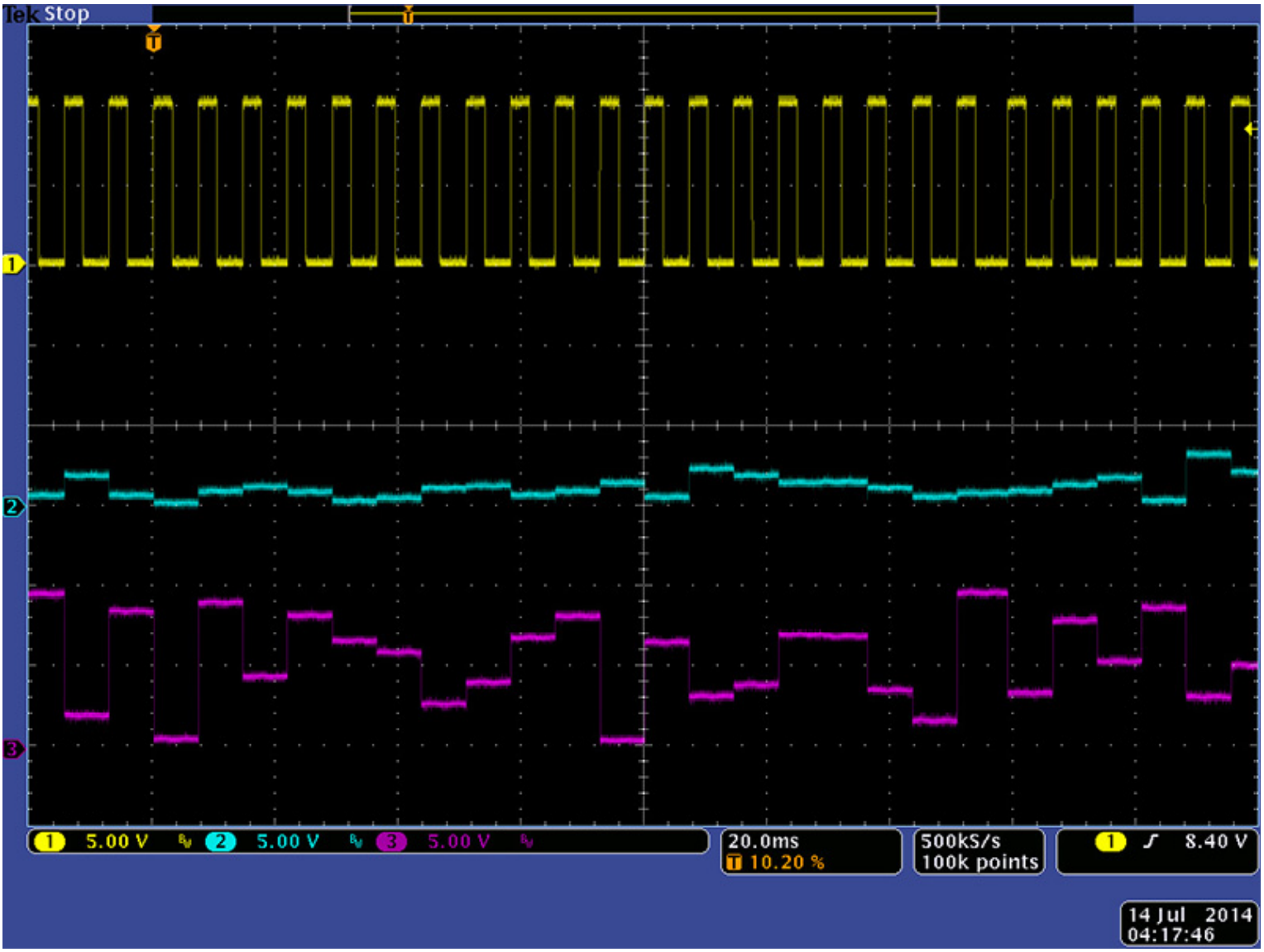
These are the Quantized Random Voltages outputs with low states.



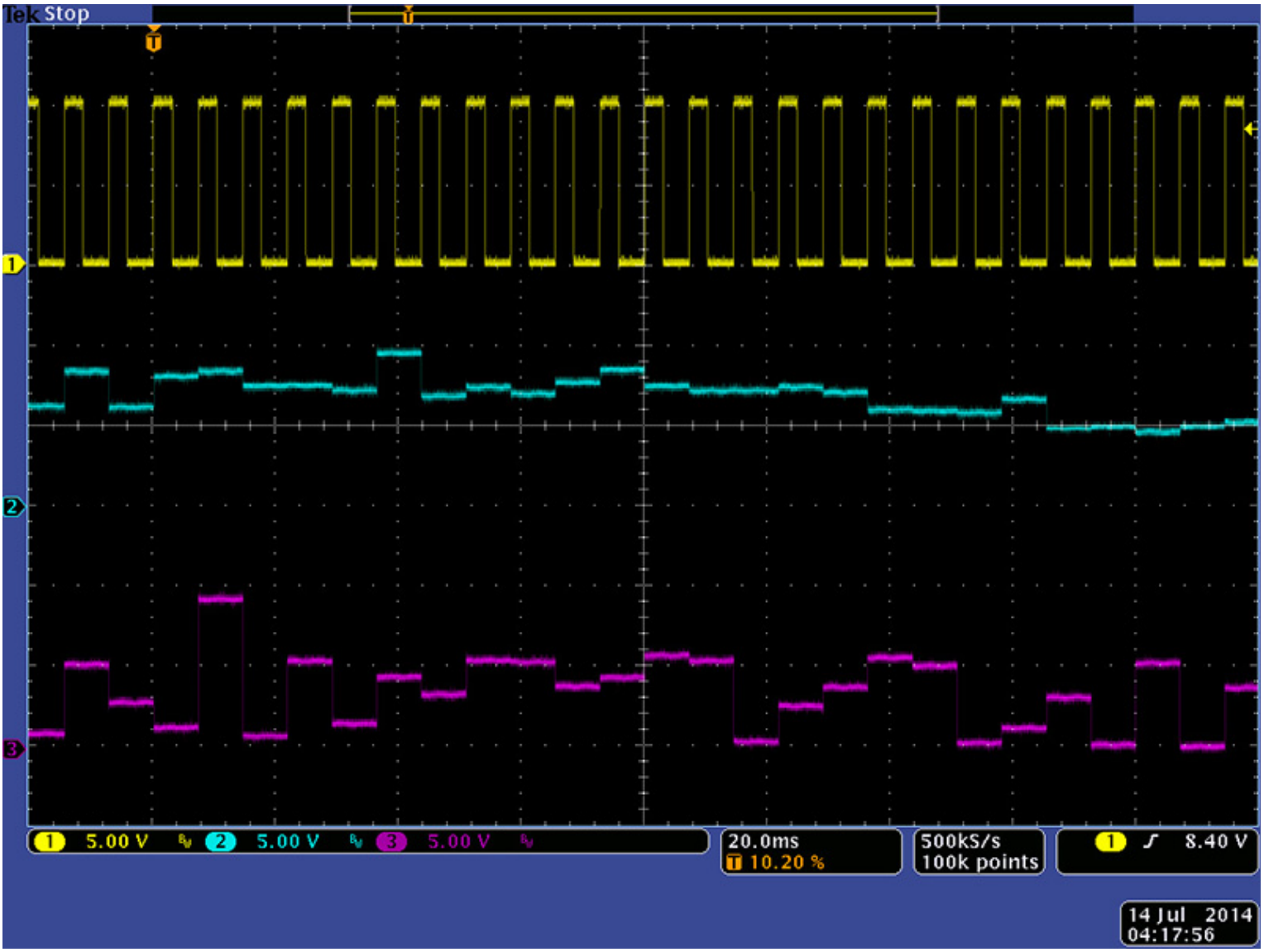
These are the Quantized Random Voltages outputs with high states.



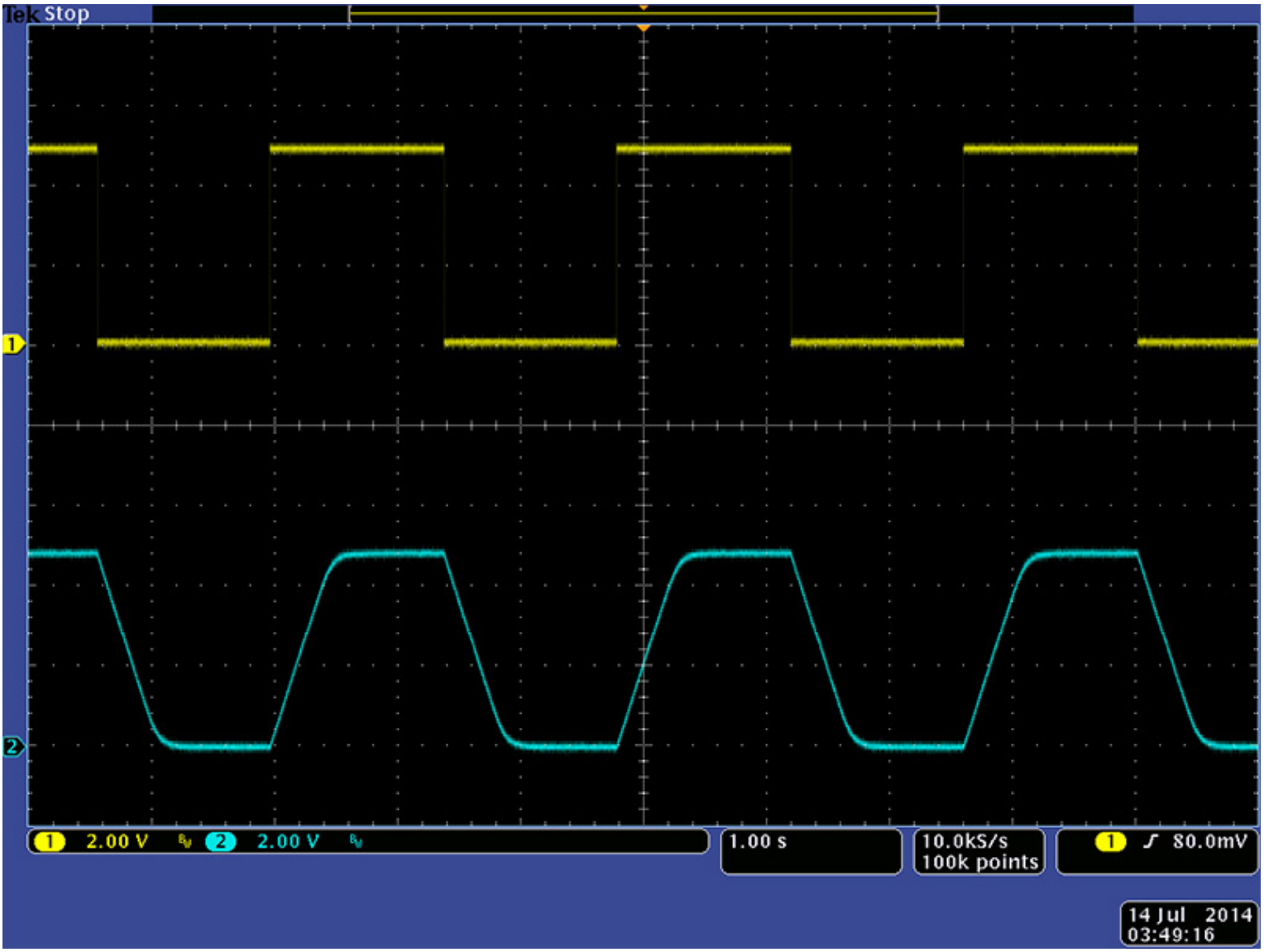
These are the Stored Random Voltages outputs with low probability. Note that they clock on the rising edge with the modification. With low probability the SRV2 output (cyan) stays closer to 0V.



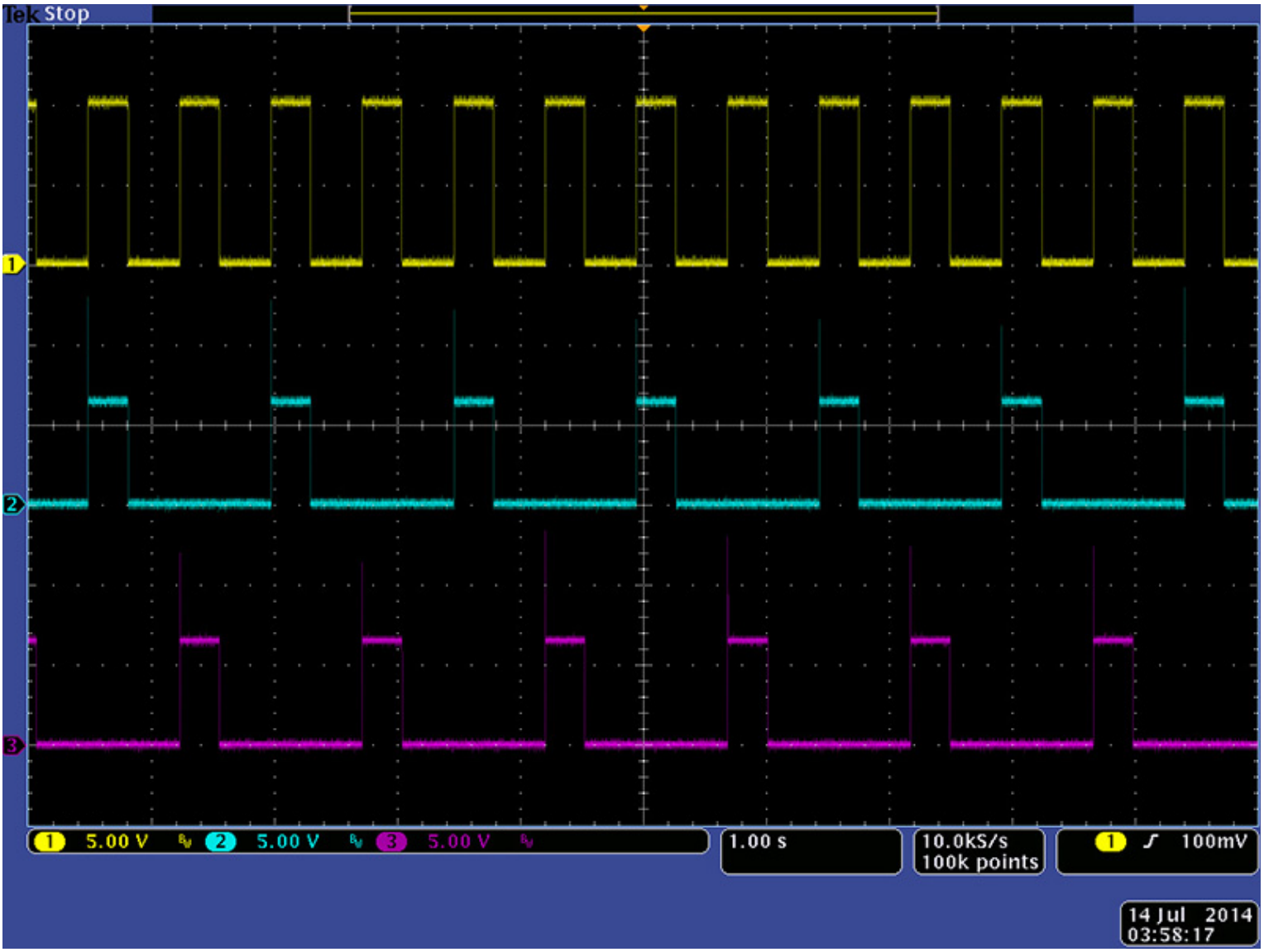
These are the Stored Random Voltages outputs with high probability. With high probability the SRV2 output (cyan) stays closer to 10V.



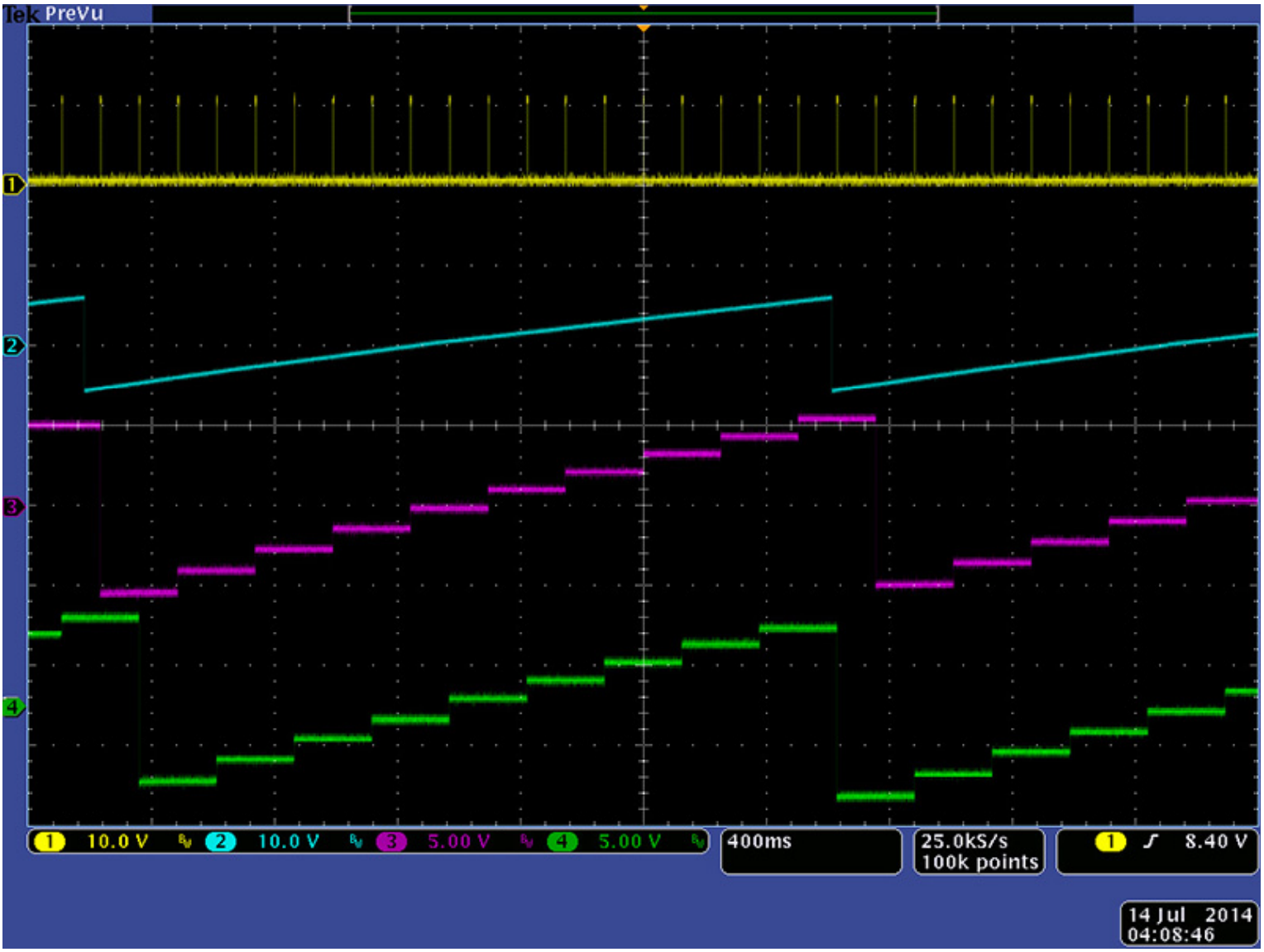
There is just one trimmer on PCB3. TR1 sets the integration limit of the front panel control and has quite a range. I adjusted TR1 so that the maximum integration time was 10 seconds (1 mV/mS, or 1V/S). This is the integrator output.



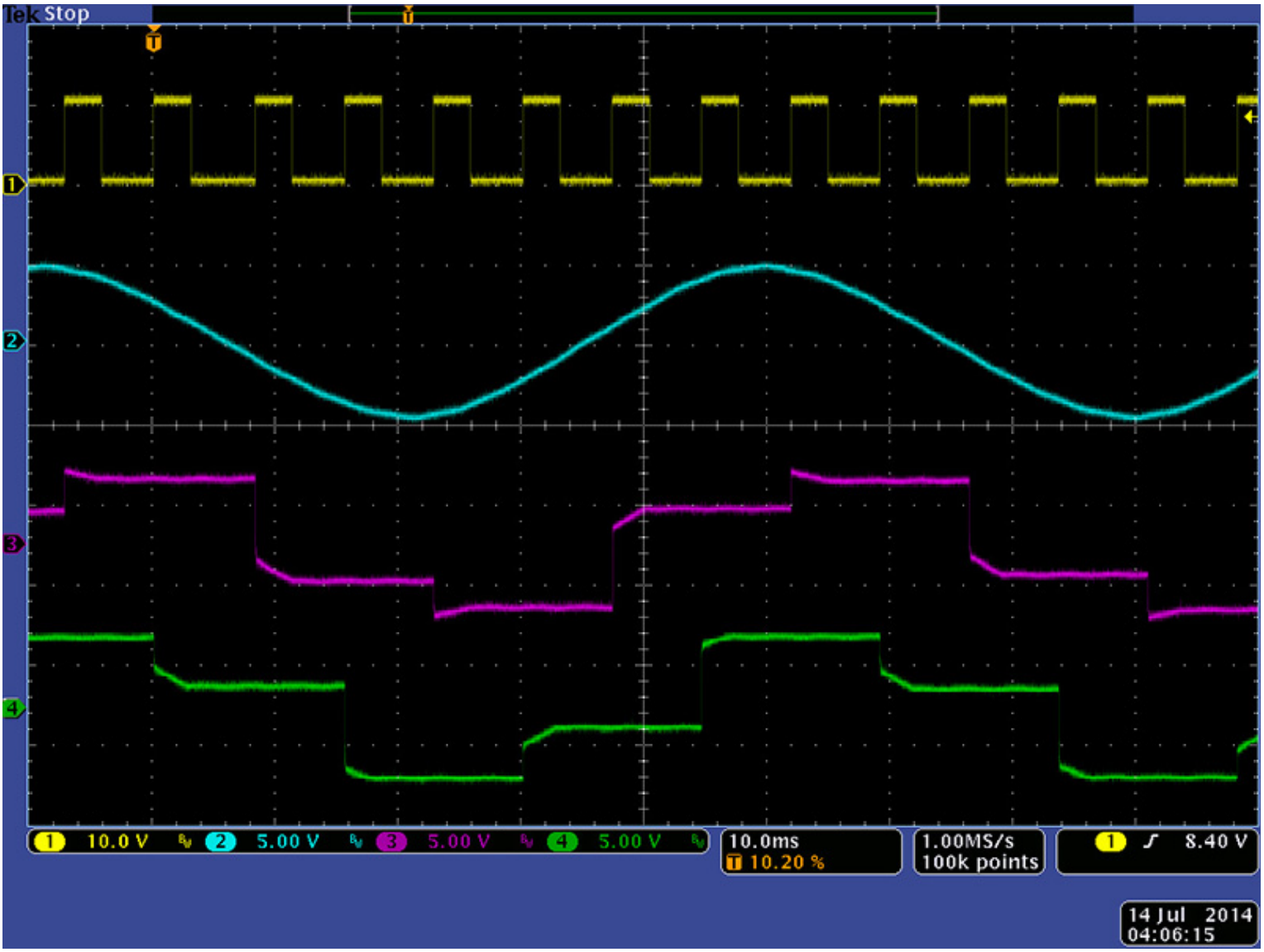
These are the S&H alternate clock outputs.



These are the two S&H outputs. You can see them sample on alternate clock edges.

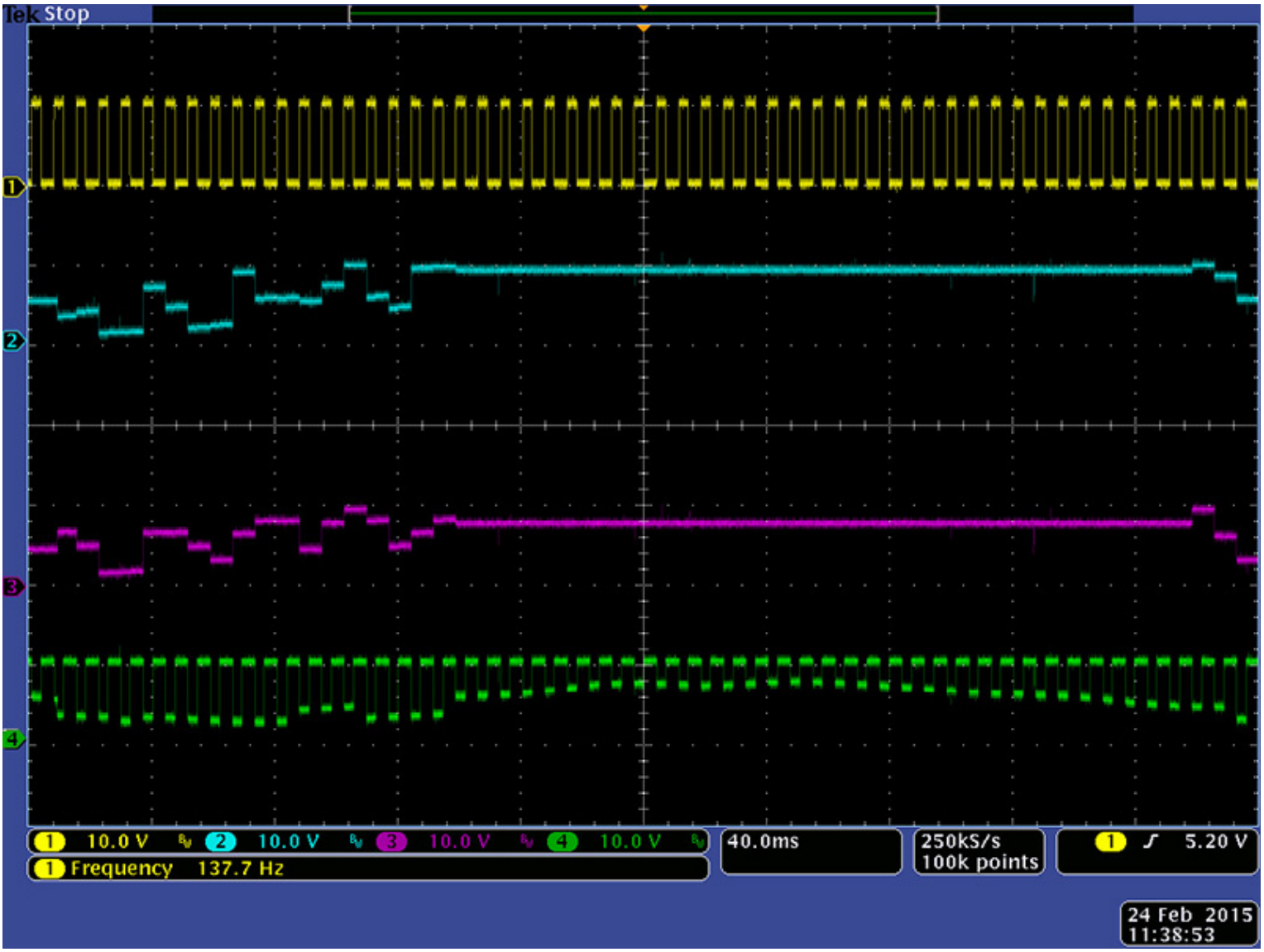


Note that the S&H is really a track and hold. With a higher duty cycle pulse you can see the outputs track the inputs when the pulse is high.

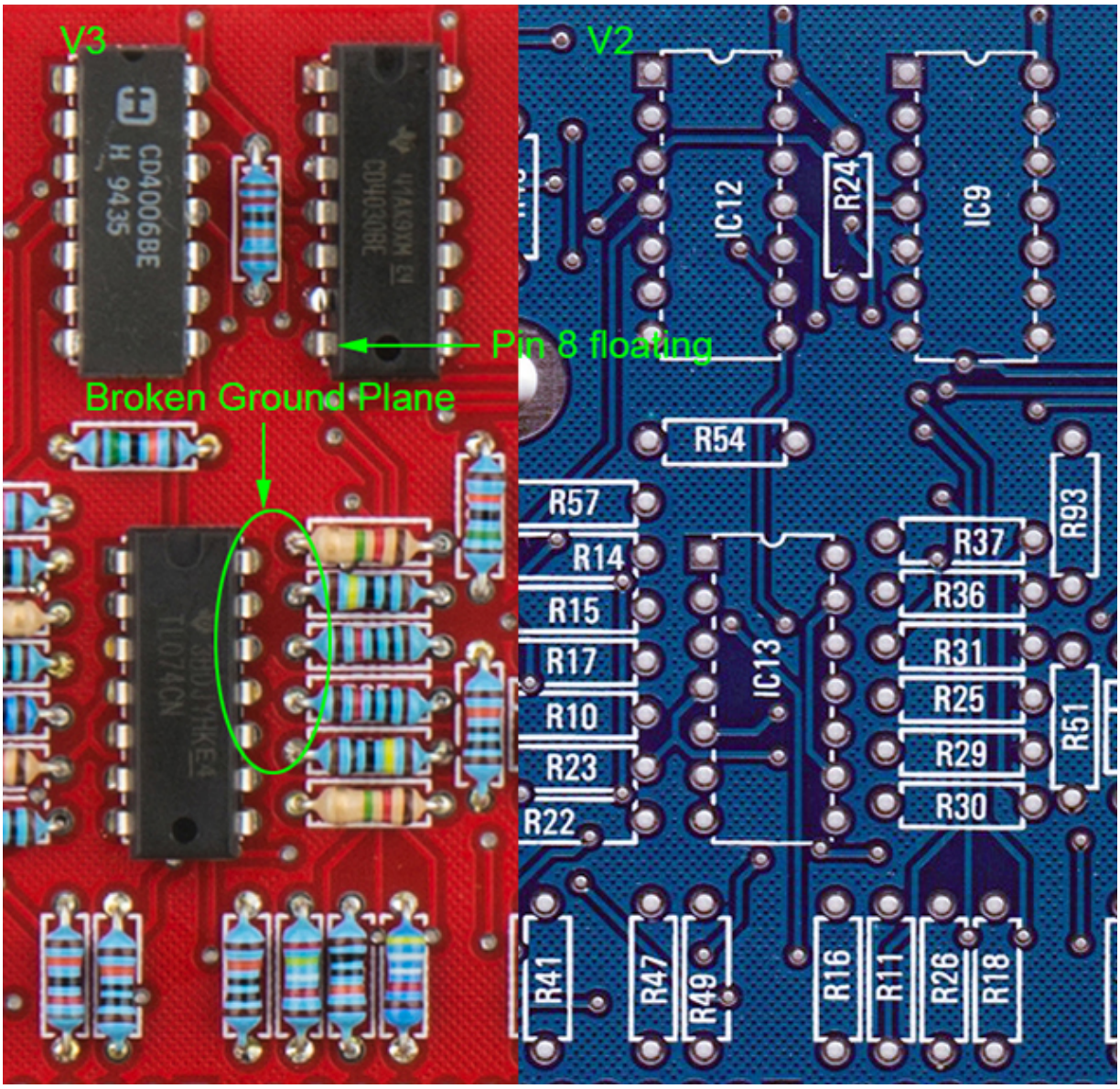


V3 PCB

There is a layout issue on V3 PCB2 which requires a wire mod. The plane that connects to IC9 pin 7 is isolated and needs to be connected to the ground plane. The CD4030 IC9 has no ground reference and the clock output references to the FRV voltages as can be seen in this scope image. Needless to say QRV stalls for long periods of time but does continue to operate.



The broken ground plane can be seen in this side by side comparison between a V3 PCB and the V2. Simply run a wire from pin 7 of IC9 to pin 7 of IC12.


V3
CD4006BE
H 9435
CD4030BE
Pin 8 floating
Broken Ground Plane
TL074CN
V2
IC12
R24
IC9
R54
R57
R14
R15
R17
R10
R23
R22
IC13
R37
R36
R31
R25
R29
R30
R93
R51
R41
R47
R49
R16
R11
R26
R18

back