Schu-Tone
DELAY-MACHINE 3

Overview:
The Schu-Tone Delay-Machine 3 is an analog delay based on the Boss DM-3 that fits in a 125B enclosure. While similar to the DM-2, the DM-3 has a few differences that makes for a quieter, easier to build and cheaper delay than the DM-2. The DM-3 uses the cheaper and easier to acquire V3205 chips as opposed to the MN3005's used on the DM-2. Unlike the Boss DM-3 which tops out at 300ms, the Delay-Machine 3 utilizes 2 V3205 chips to deliver 600ms of analog delay tone.

Controls:
Delay – Sets the amount of delay time
Mix – Adjusts the level of the repeats
Feedback – Sets the amount of repeats. This can go into self-oscillation if set high enough.

Pedal runs on +9v power. Do not run at 18v, the V3205's cannot handle the power

Trim Pots:
Trim pots on the inside are meant for initial calibration of pedal. Take your time with these, they will ensure you have a good sounding and working delay. See Calibration section at the end for setup instructions. (Thanks to Clinton aka. Blackhatboojum for the awesome calibration instructions)
BBD_Bias1 – Sets the Bias voltage on IC3 to create cleanest delay
BBD_Bias2 – Sets the Bias voltage on IC4 to create cleanest delay
Cancel_1 – Sets the mix of the delay outputs on IC3
Cancel_2 – Sets the mix of the delay outputs on IC4
BBD_Gain – Sets level of BBD-1 cascading into BBD-2
Clock – Sets the frequency range to drive the BBD's

Notes on parts:
-All parts can be sourced from basic parts sources (Tayda Electronics, Stompbox Parts, Small Bear, etc.)
-All Resistors are 1/8w resistors. If you do not have those, 1/4w resistors can be used if you stand them up.
- I recommend low-profile Electrolytic Capacitors on board 1 due to the height left by the stacked boards (approx. 8 mm). If you cannot get low-profile electo's, Tantalum capacitors will work, or there should be enough room to lay down regular height electrolytics (this has not been tested though).
-Film capacitors are laid out for MLCC film caps, but box film caps will also work.
-The JFET J201 on board 1 can be either SMD or thru-hole. Use one or the other, not both.

Special Parts:
4-Pin Header (You will need 2 of these)
https://www.taydaelectronics.com/4-pin-2-54-mm-single-row-female-pin-header.html

Header Strip (Don't forget this one!)
https://www.taydaelectronics.com/40-pin-2-54-mm-single-row-pin-header-strip.html

J201 JFET
https://stompboxparts.com/transistors/j201-smt-to-to92/

V3205 BBD
https://stompboxparts.com/semiconductors/v3205sd-bbd-ic/

V3102 Clock
https://stompboxparts.com/integrated-circuits-ics-/v3102d---bbd-clock-ic/

V571 Compander
https://stompboxparts.com/semiconductors/v571d-dual-compander-ic/

Delay Machine_1

Resistors	
R1	1M
R2	10k
R3	1M
R4	10k
R5	10k
R6	47k
R7	10k
R8	47k
R9	10k
R10	10k
R28	2.2k
R36	47k
R37	47k
R38	20k
R39	10k
R40	470R
R41	100k
R42	10k
R43	10k
R44	1k
R45	62k
R46	4.7k

Capacitors	
C2	47nF
C3	1uF
C4	6.8nF
C5	100pF
C6	10uF
C7	220nF
C8	10uF
C9	100pF
C10	10uF
C21	10uF
C27	10uF
C28	220nF
C29	100pF
C30	1uF
C31	1uF
C32	100nF
C33	100pF
C34	6.8nF
C35	1uF
C36	47uF
C37	100nF
C38	100uF
C39	10uF
C40	10uF

Diodes, IC's & Transistors	
D5	1N5817
Z1	5.1v Zener
Z2	8.2v Zener
IC1	NJM4558
IC2	V571
Q1	J201
Q6	2N3904

Pots & Switches	
Delay	50k B
Feed	50k B
Mix	50k B

Resistors (1/8w)	
1	470R
1	1k
1	2.2k
1	4.7k
9	10k
1	20k
4	47k
1	62k
1	100k
2	1M

Capacitors (Film)	
2	6.8nF
1	47nF
2	100nF
2	220nF
4	1uF

Capacitors (Electro)	
7	10uF
1	47uF
1	100uF

Capacitors (Ceramic)	
4	100pF

Diodes, IC's & Transistors	
1	1N5817
1	5.1v Zener
1	8.2v Zener
1	NJM4558
1	V571
1	J201
1	2N3904
2	4 pin Header

Pots & Switches	
3	50k B (BM)

Delay Machine 3_2

Resistors	
R11	7.5k
R12	7.5k
R13	7.5k
R14	10k
R15	100k
R16	100k
R17	100k
R20	100k
R21	100k
R22	100k
R23	33k
R24	2.7k
R25	470k
R26	10k
R27	2.2k
R29	7.5k
R30	7.5k
R31	7.5k
R32	10k
R33	7.5k
R34	10k
R35	7.5k

Capacitors	
C2	1uF
C3	1uF
C11	10nF
C12	10nF
C13	330pF
C14	1uF
C15	1uF
C16	1uF
C17	1uF
C19	220pF
C20	470nF
C22	2.2nF
C23	33nF
C24	1nF
C25	47nF
C26	330pF

Diodes, IC's & Transistors	
D2	1N4148
D3	1N4148
D4	1N4148
IC3	V3205
IC4	V3205
IC5	V3102
Q2	2N3904
Q3	2N3904
Q4	2N3904
Q5	2N3904

Pots & Switches	
BBD_Bias1	20k Trim
BBD_Bias2	20k Trim
BBD_Gain	100k Trim
Cancel_1	10k Trim
Cancel_2	10k Trim
Clock	100k Trim

Resistors (1/8w)	
1	2.2k
1	2.7k
8	7.5k
4	10k
1	33k
6	100k
1	470k

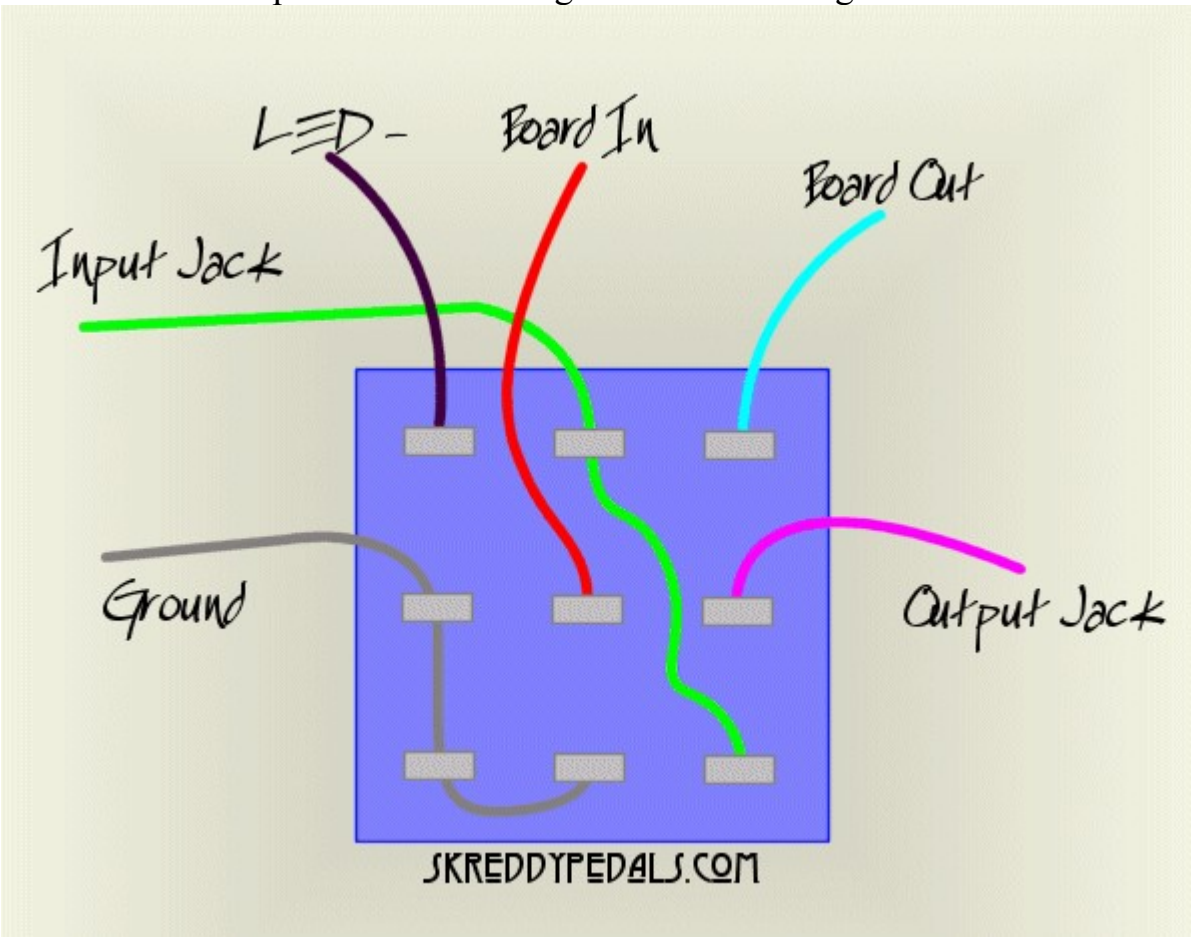
Capacitors (Film)	
1	1nF
1	2.2nF
2	10nF
1	33nF
1	47nF
1	470nF
6	1uF

Capacitors (Ceramic)	
1	220pF
2	330pF

Diodes, IC's & Transistors	
3	1N4148
4	2N3904
1	V3102
2	V3205

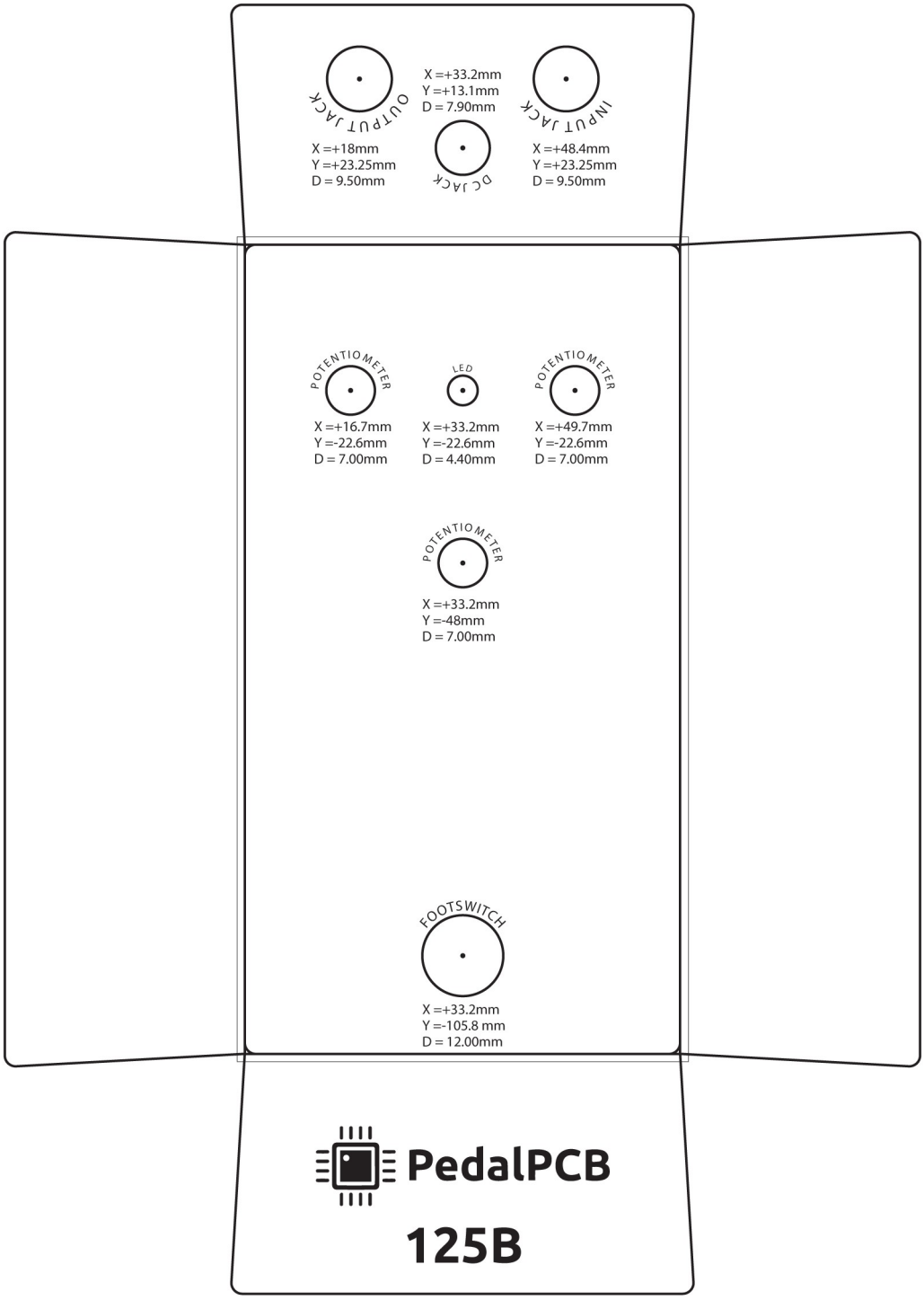
Pots & Switches	
2	10k Trim
2	20k Trim
2	100k Trim

Use standard Madbeanpedals 3PDT wiring scheme for wiring

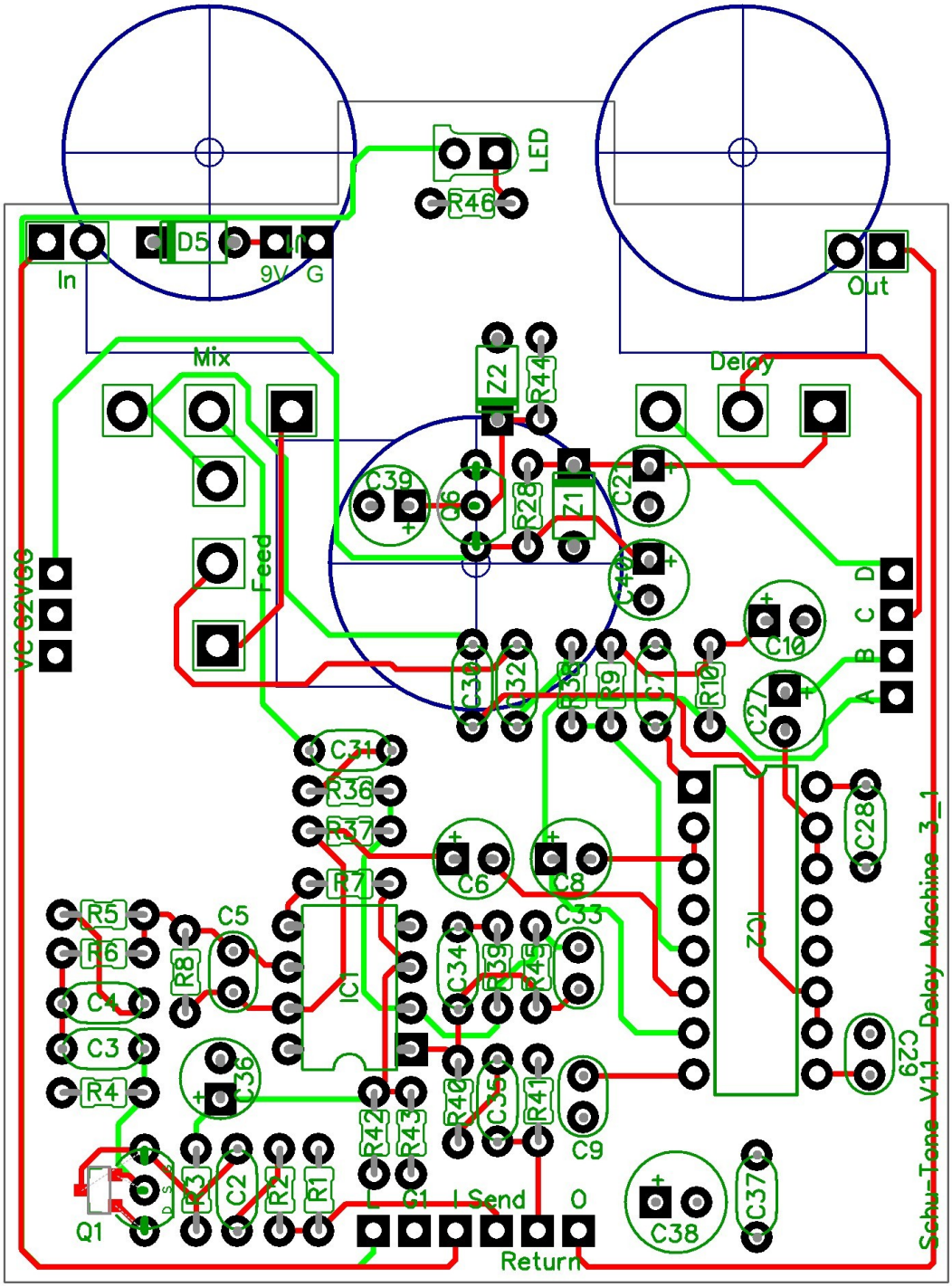


L – LED
G- Ground
I – Input Jack
Send – Board In
Return – Board Out
O – Output Jack

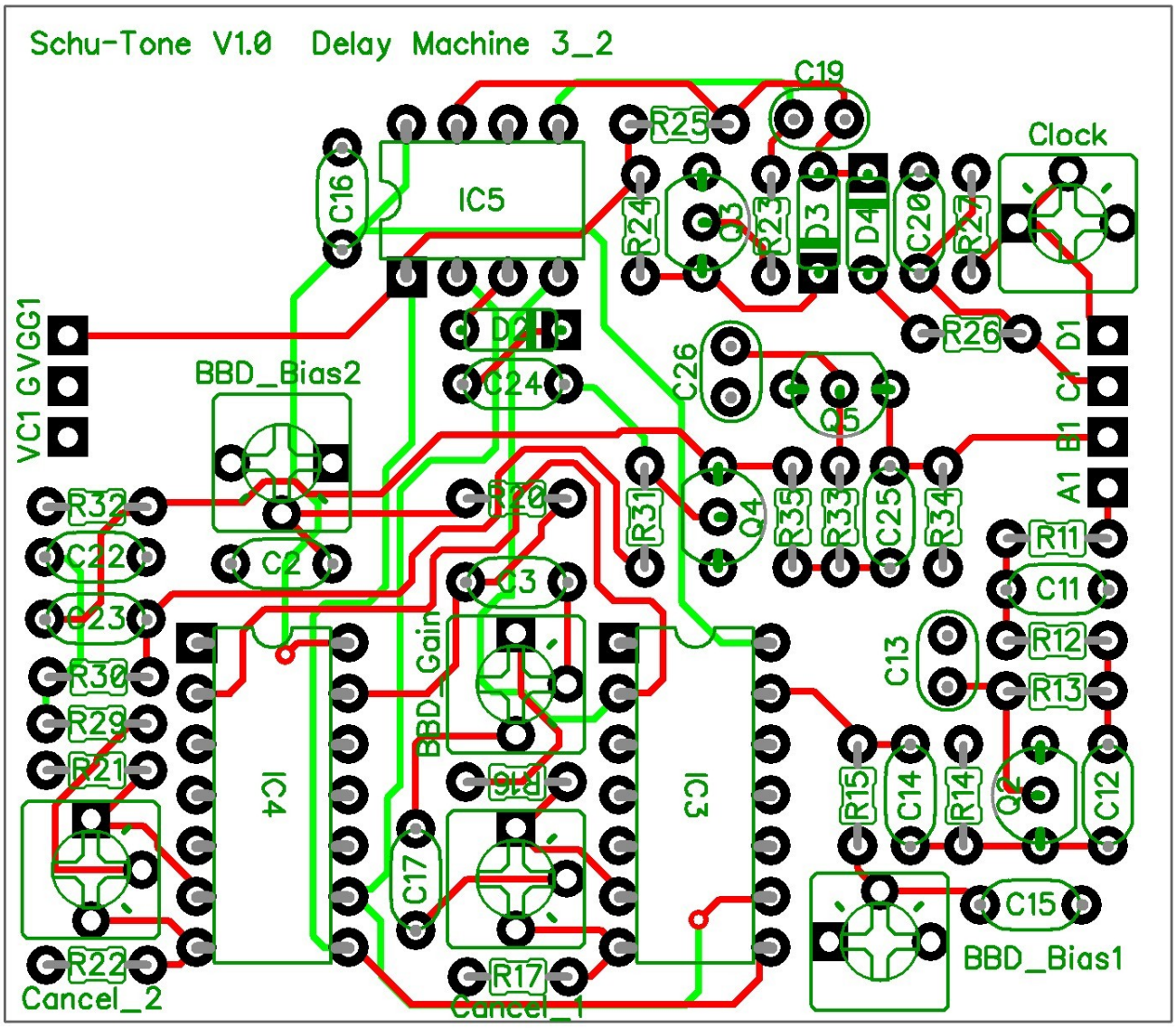
Drill Template:
The Delay Machine 3 uses the standard PedalPCB 3-knob template.
https://www.taydaelectronics.com/datasheets/files/125B-DrillTemplate_3Knob-2.pdf



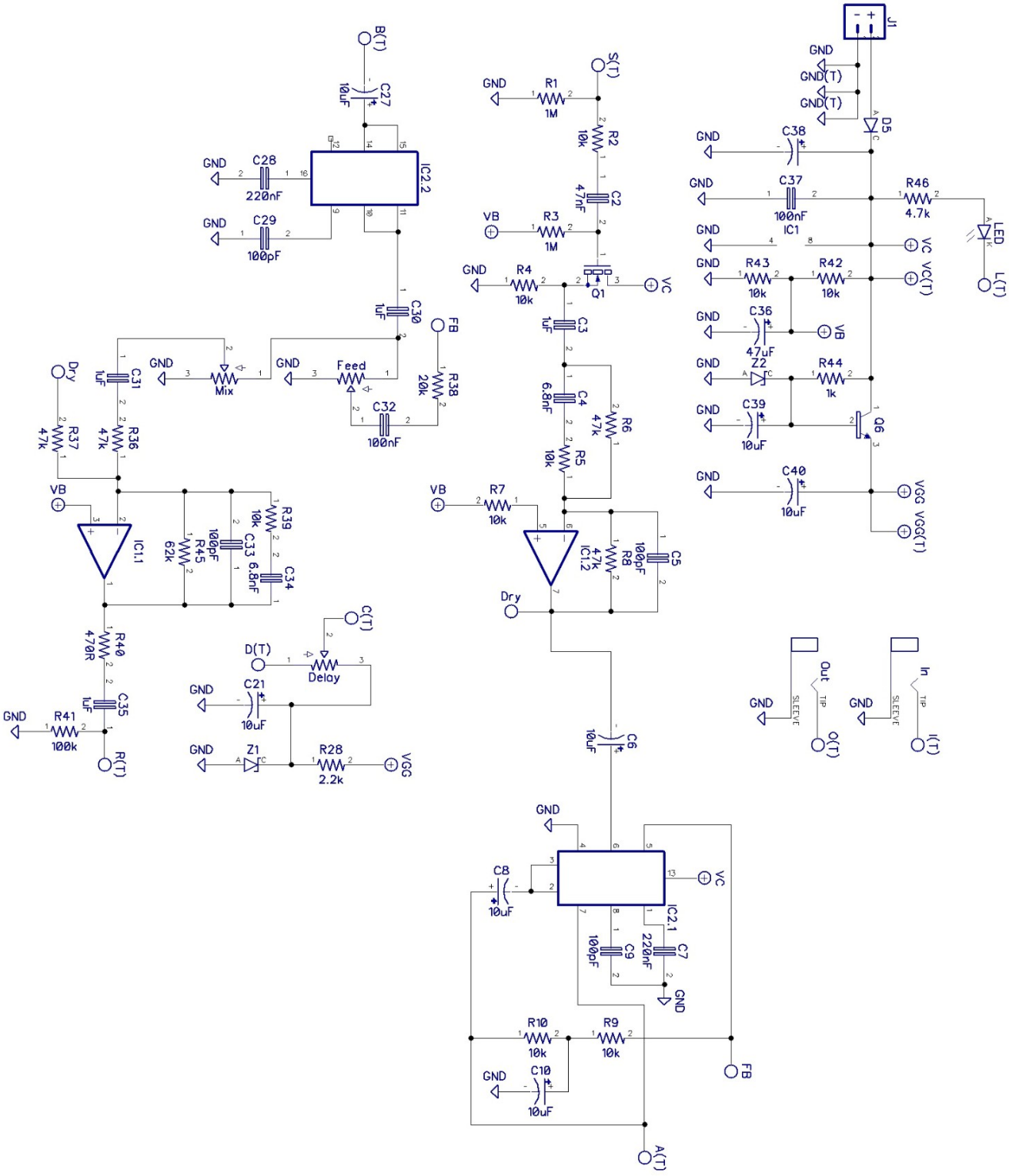
PedalPCB 3-Knob Type 1



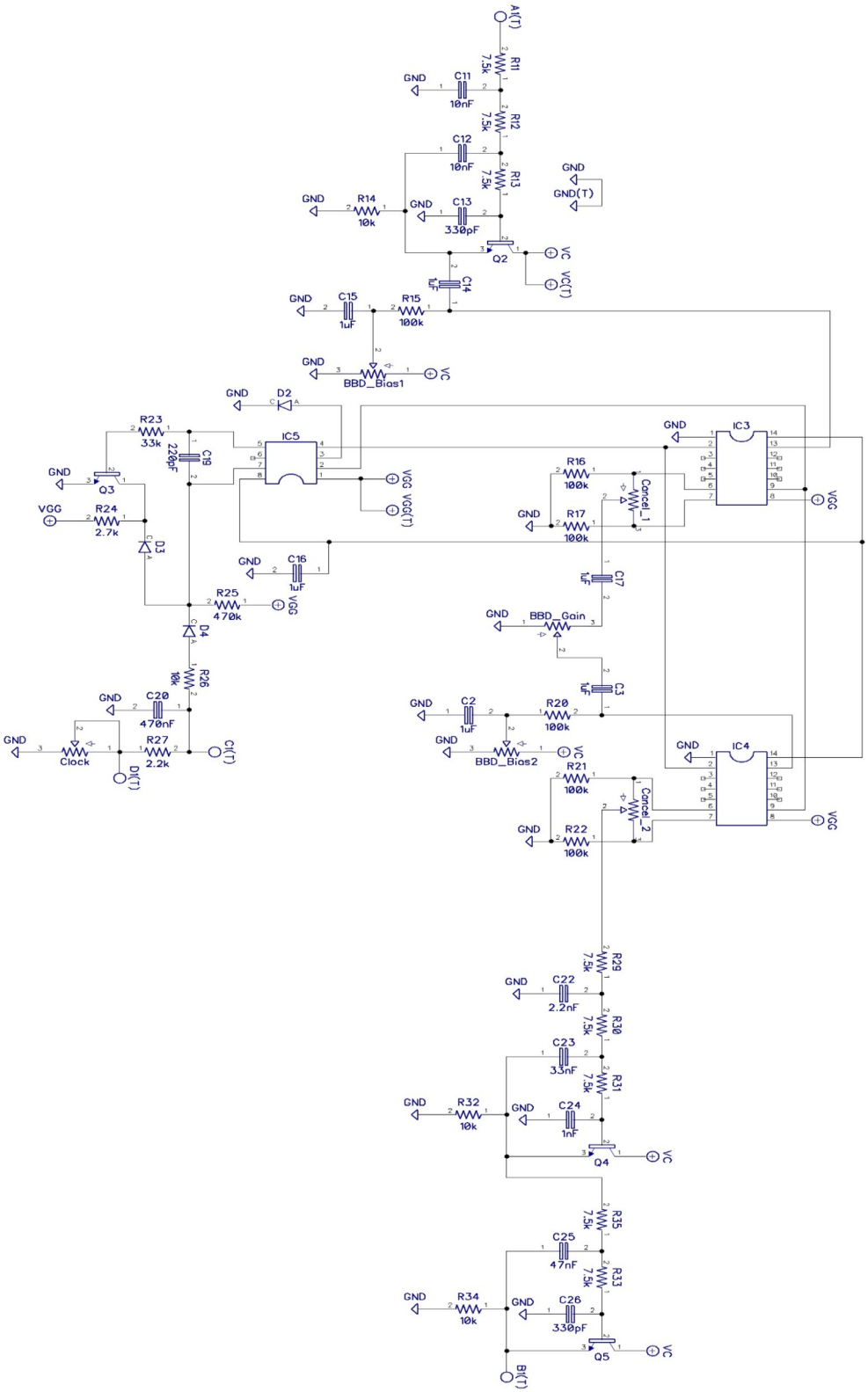
Delay Machine 3_1 Lower Board



Delay Machine 3-2 Upper Board



Delay Machine 3_1 Schematic



Delay Machine 3_2 Schematic

Schu-Tone Delay Machine 3 calibration

For best results, an oscilloscope and signal generator is recommended but, the Delay Machine 3 can be easily calibrated by ear although an audio probe is needed at the very least. A digital multimeter that can read frequency can also be used to adjust clock setting.

Set delay control full clockwise. Set mix and feedback controls to full counterclockwise. Set all trimpots to noon except for BBD Gain. Set BBD Gain trimpot to about 2/3 of the way up.

Clock frequency:

Probe pin 2 of IC5 (V3102) with oscilloscope or DMM. Adjust clock trimmer to 6.8kHz - 7.0kHz. If calibrating by ear, set clock trimmer between 2/3 and 3/4 of the way up to start with. After bias, gain, and cancel adjustments, revisit the clock trimmer and see if you can squeeze more delay time out of it. Too low of a clock frequency will result in clock noise entering your signal. If you start getting high pitched whine, back the clock trimmer off a little bit. 3/4 of the way up with the clock trimmer is about the max before clock noise becomes an issue.

BBD bias:

Feed a 200hz 0dbm (.78 AC volt) sine wave through the input jack. Probe pin 3 or 4 of IC3 (V3205) with scope. Adjust BBD bias 1 trimpot to smoothest waveform. If calibrating by ear, adjust BBD bias 1 to cleanest and loudest sound as you play your guitar or feed a sine wave signal. Repeat the same procedure for IC4 and BBD bias 2 trimpot.

BBD gain:

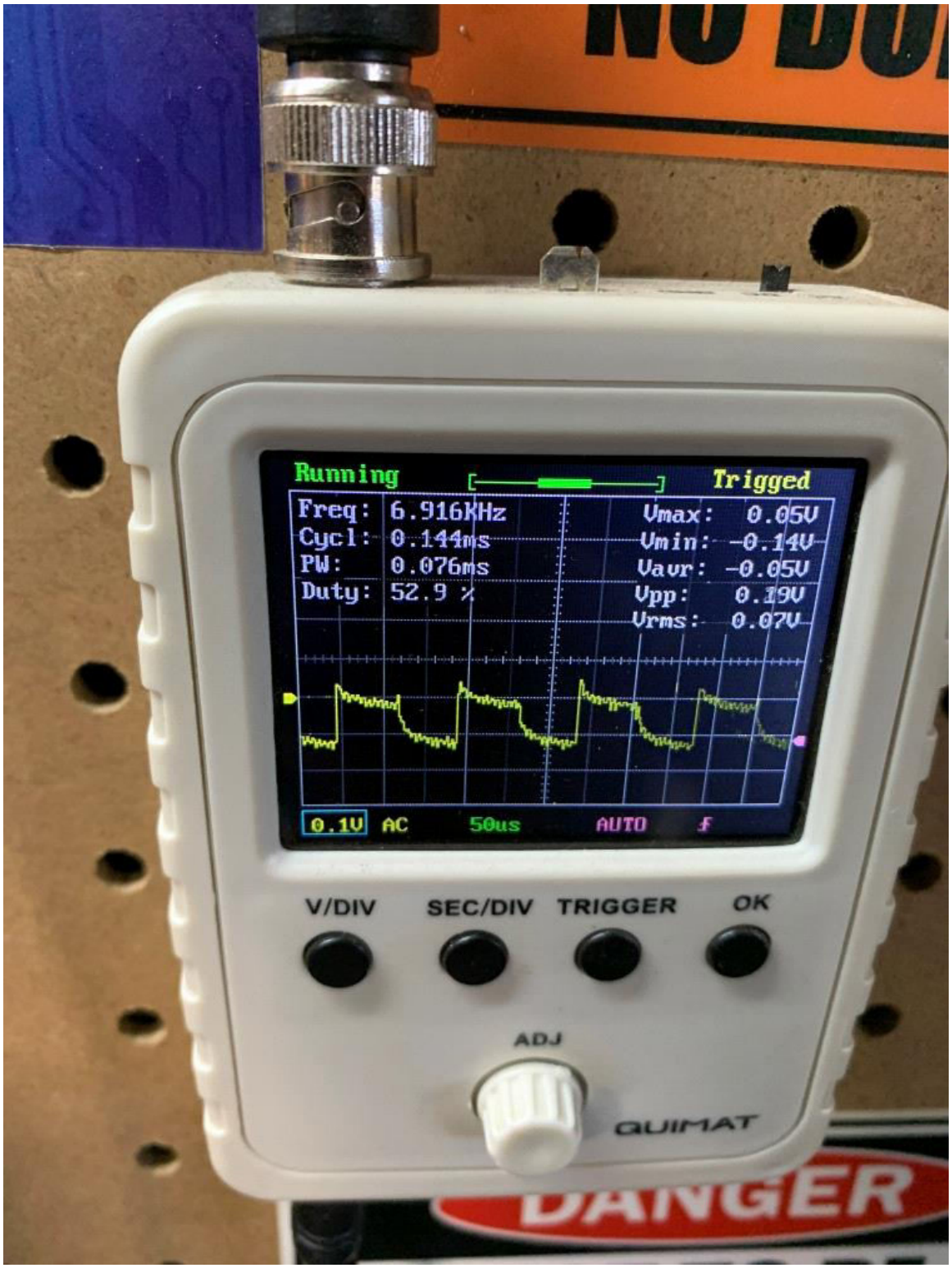
While feeding 200hz sine wave or playing guitar, probe pins 3 or 4 of IC3 and note the amplitude of the sound. Continue playing and probe the same pins of IC4. Adjust BBD gain trimpot so that the amplitude coming out of IC3 is the same as IC4. This can be seen using an oscilloscope. If calibrating by ear you want the overall output volumes from both V3205s to match.

Cancel trimpots:

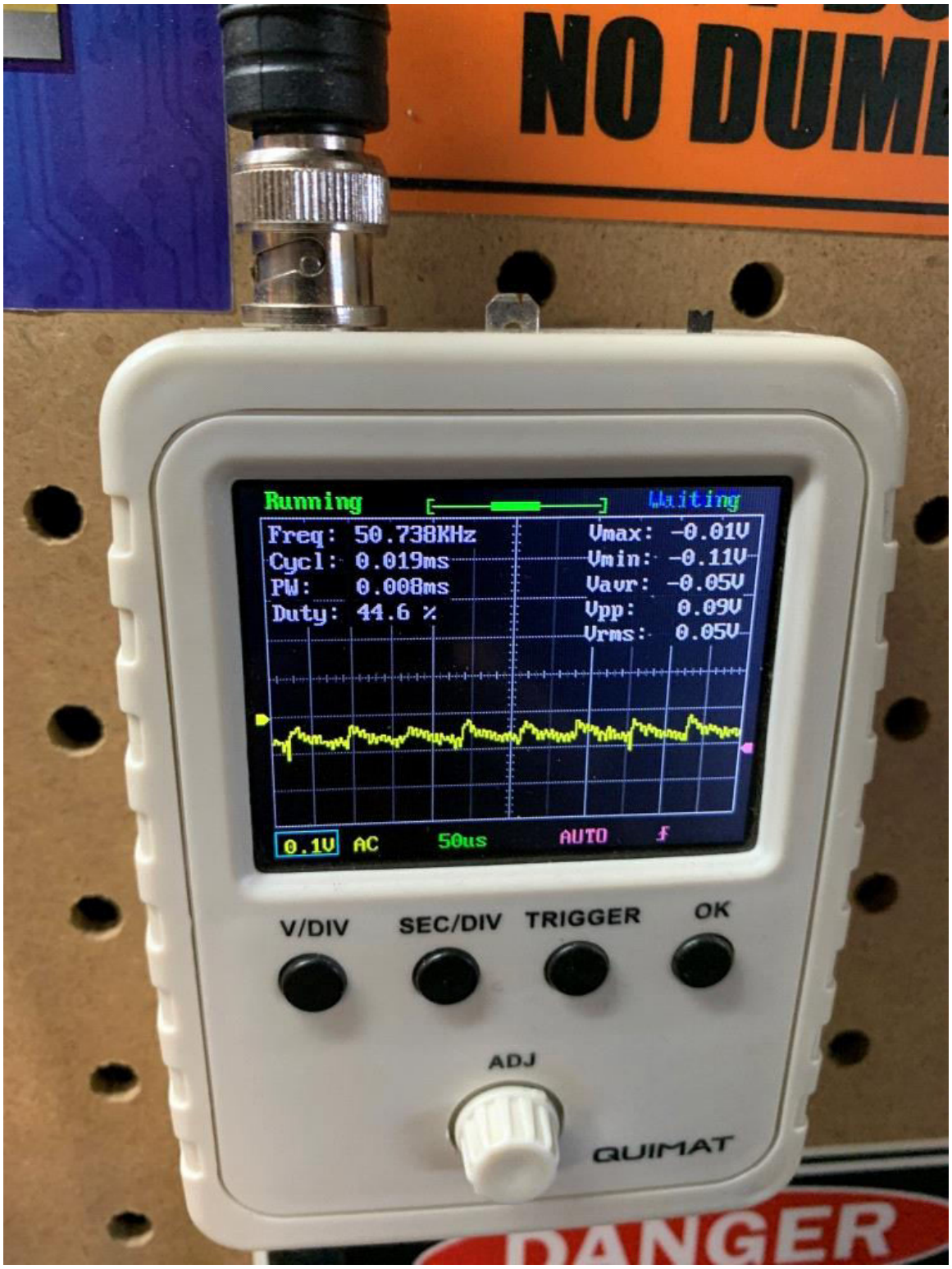
Place a jumper wire from input jack tip to the input jack sleeve. Probe pin 7 of IC4 with your audio probe and listen for clock noise (high pitched whine). Adjust Cancel 1 trimmer back and forth until you find a spot where the clock noise is the quietest. Repeat the same process for the Cancel 2 trimmer but, this time probe R29. More specifically, the side of R29 closest to IC4. For oscilloscope calibration, follow by ear process but, adjust the trimmers to achieve

pictured results.

Waveform with lots of clock noise and needs the cancel trimpot adjusted.



Adjust cancel trimpots to achieve a waveform that is flat as possible.


NO DUM
Running
Waiting
Freq: 50.738KHz
Cycl: 0.019ms
PW: 0.008ms
Duty: 44.6 %
Vmax: -0.01V
Vmin: -0.11V
Vavr: -0.05V
Vpp: 0.09V
Vrms: 0.05V
0.1V AC 50us AUTO
V/DIV
SEC/DIV
TRIGGER
OK
ADJ
QUIMAT
DANGER