Prognosticator24

FX Type: **DELAY**
Build Level: Advanced
Based On: EHX® Stereo Memory Man™

Last Updated: November 22, 2024 6:04 PM

The *2024* version of the **Prognosticator** has no circuit changes and minor layout tweaks.

Overview

I worked on this project for most of 2022. It ended up being a total bear for me to get right. I had multiple issues with my prototypes (small and big errors), and even some bad luck with PCB manufacturing. So, I spent a lot of time getting it ready as an mbp DIY project. I finally got it perfect on rev.5, haha. And, boy, is it worth it!

The **Prognosticator** is based on the EHX Stereo Memory Man™. Not the more recent, DSP-based one, but the old school analog one. While there is some overlap, circuit-wise, with the traditional Deluxe Memory Man™, the Prognosticator is it's own thing. It utilizes a single MN3005 BBD, and the maximum usable delay is around 300ms. So, it's more in line with the DM-2 as far as delay time. Where this design shines is in its stereo implementation and how the delay and modulation behaves in a two amp setup.

Note that this is not a true stereo pedal. It does not have two independent pairs of inputs and outputs, each with their own BBD audio path. The Prognosticator is a mono input, single BBD output delay. It essentially "fakes" stereo by copying the delay output, inverting the signal then sending that inverted signal to a separate output. The outcome is two mono signals that, when combined, create a wider audio bed than mono. This was a popular method used in analog pedals back in the 80's with Boss, DOD and others. Don't let this shortcut fool you into thinking it's a gimmick. Here the "stereo" part acts a spatial enhancer across two amps. Not independent or as lush as true stereo, but still much wider and musical than a mono output. And, with the extended modulation control you can get some nice fast chorus effect at low delay settings. And, because of this implementation, you can still use it as a mono output if you are using a single amp. You can take the effect output from either output jack. They will sound exactly the same on their own.

I made a few changes to the Stereo Memory Man design. First, I set it up with a charge pump so it can be operated off a 9v supply. I also converted the bypass from a passive split to an active buffered output. I prefer this method of bypass for stereo. And, being that the delay is likely at the end of the signal chain, that's the right place to have a buffer in case you are using a lot of pedals before it. The last change was to swap the single, preset modulation to a fully featured modulation with rate and depth controls.

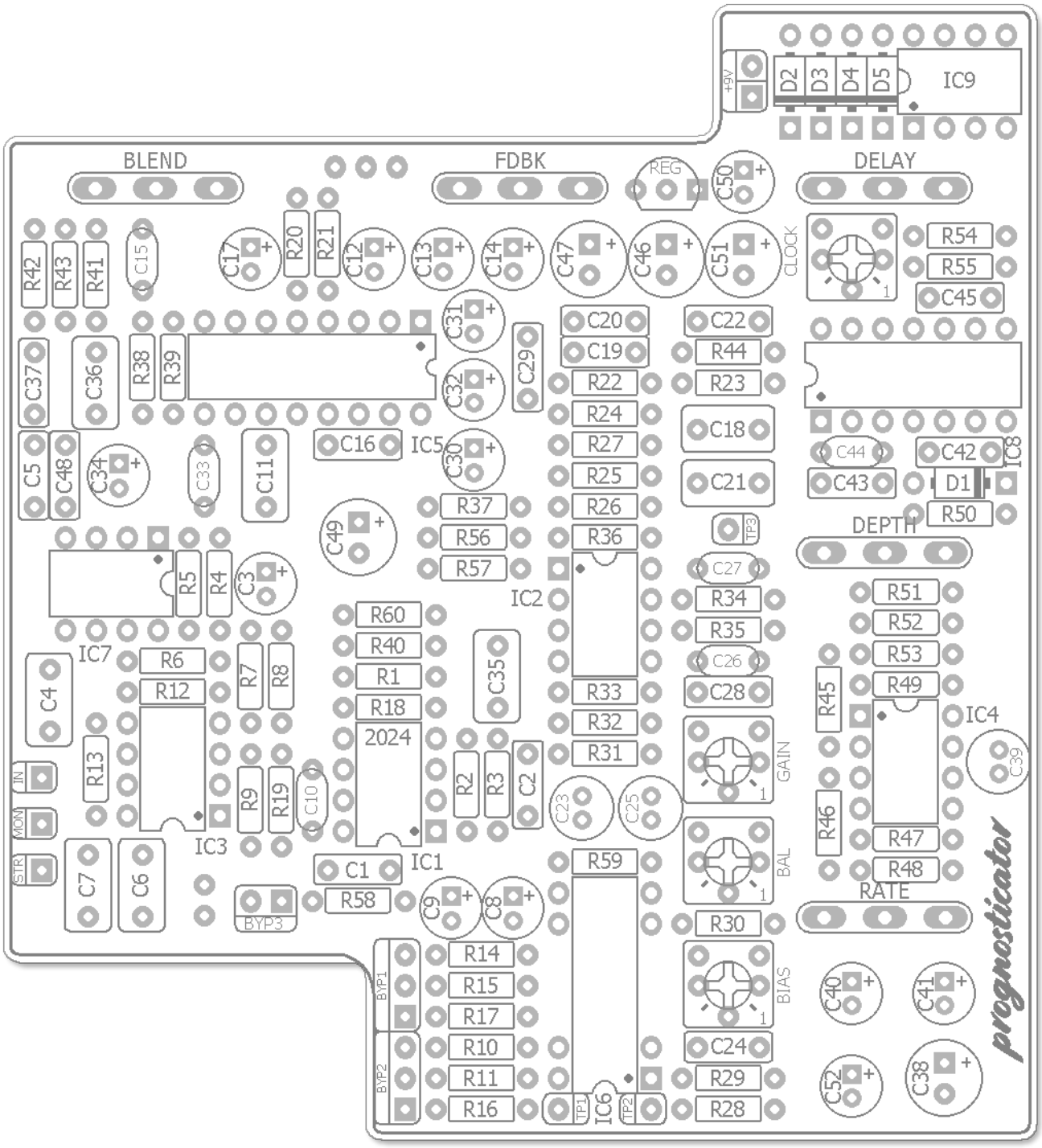
Audio Controls

- **DELAY**: Total delay time from slap-back to approximately 300ms.
- **FDBK**: The total number of repeats from one to many to self-oscillation.
- **BLEND**: Sets the volume of the delay output with the clean signal.
- **RATE/DEPTH:** Set the speed and amount of delay modulation.

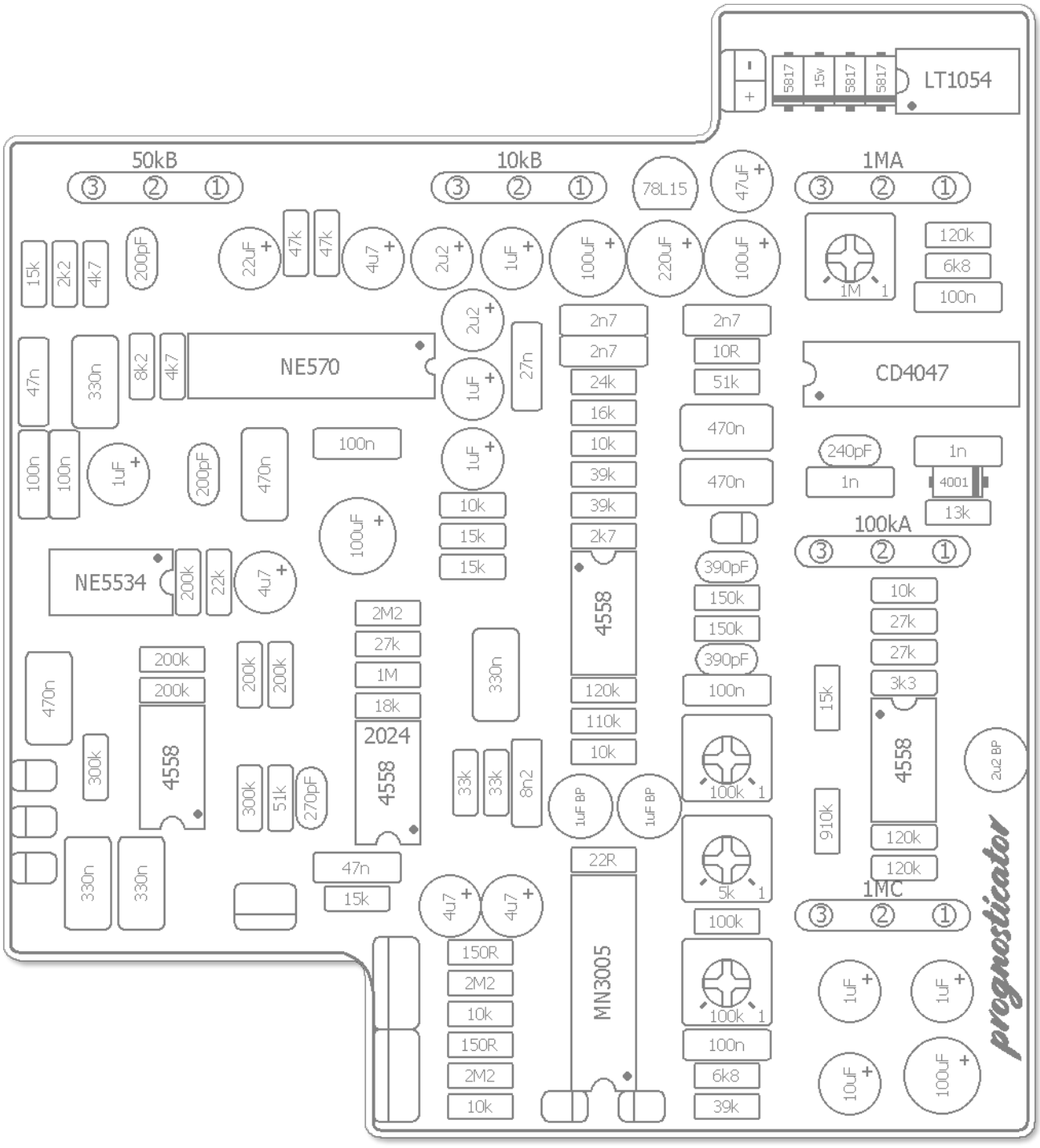
Biasing Controls

- **BIAS**: Sets the input bias voltage of the BBD.
- **BAL**: Balances the two outputs from the BBD.
- **GAIN**: Sets the amount of gain recovery from the BBD output.
- **CLOCK**: Sets the fine calibration for the maximum allowable delay time.

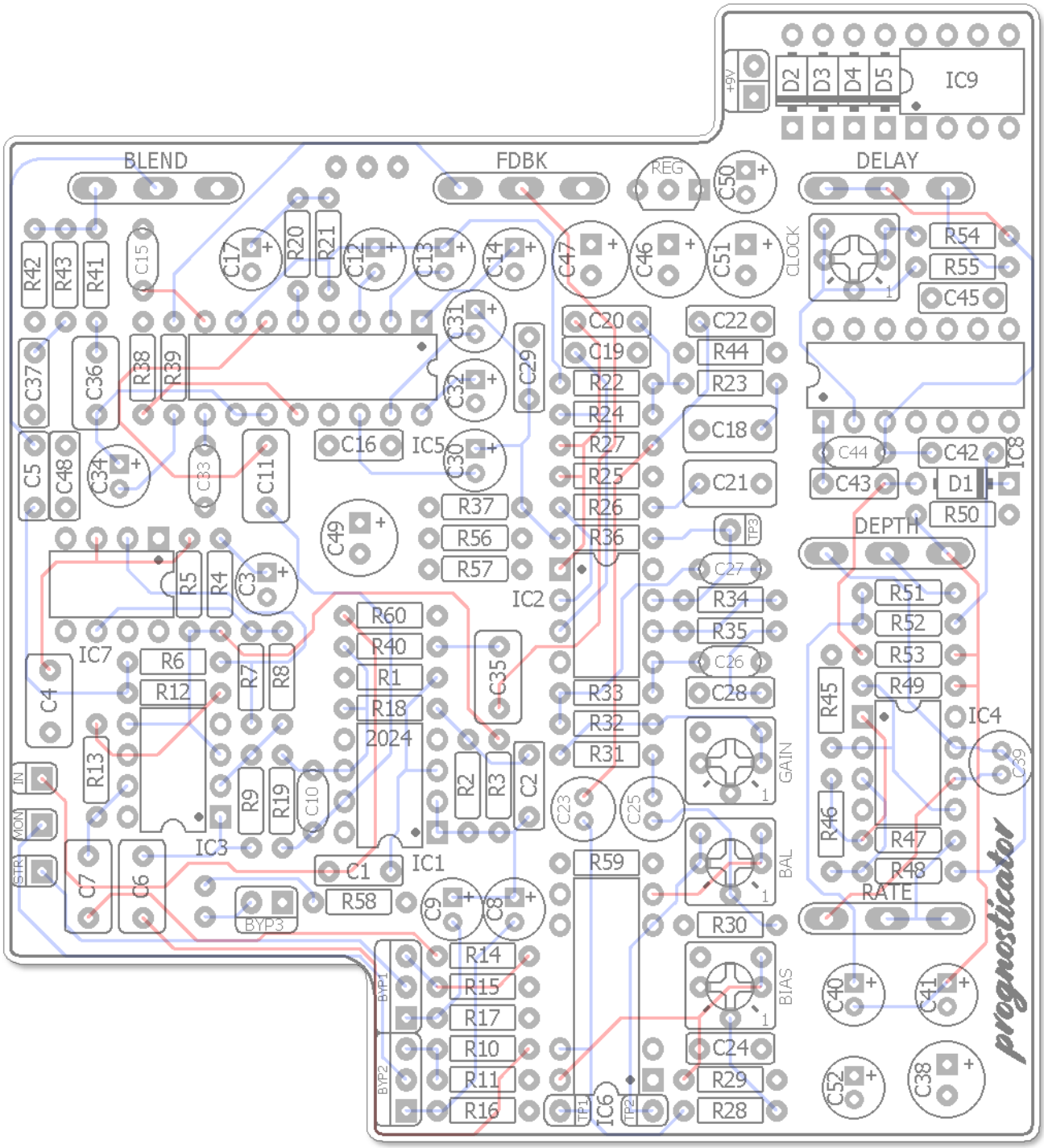
Parts Layout



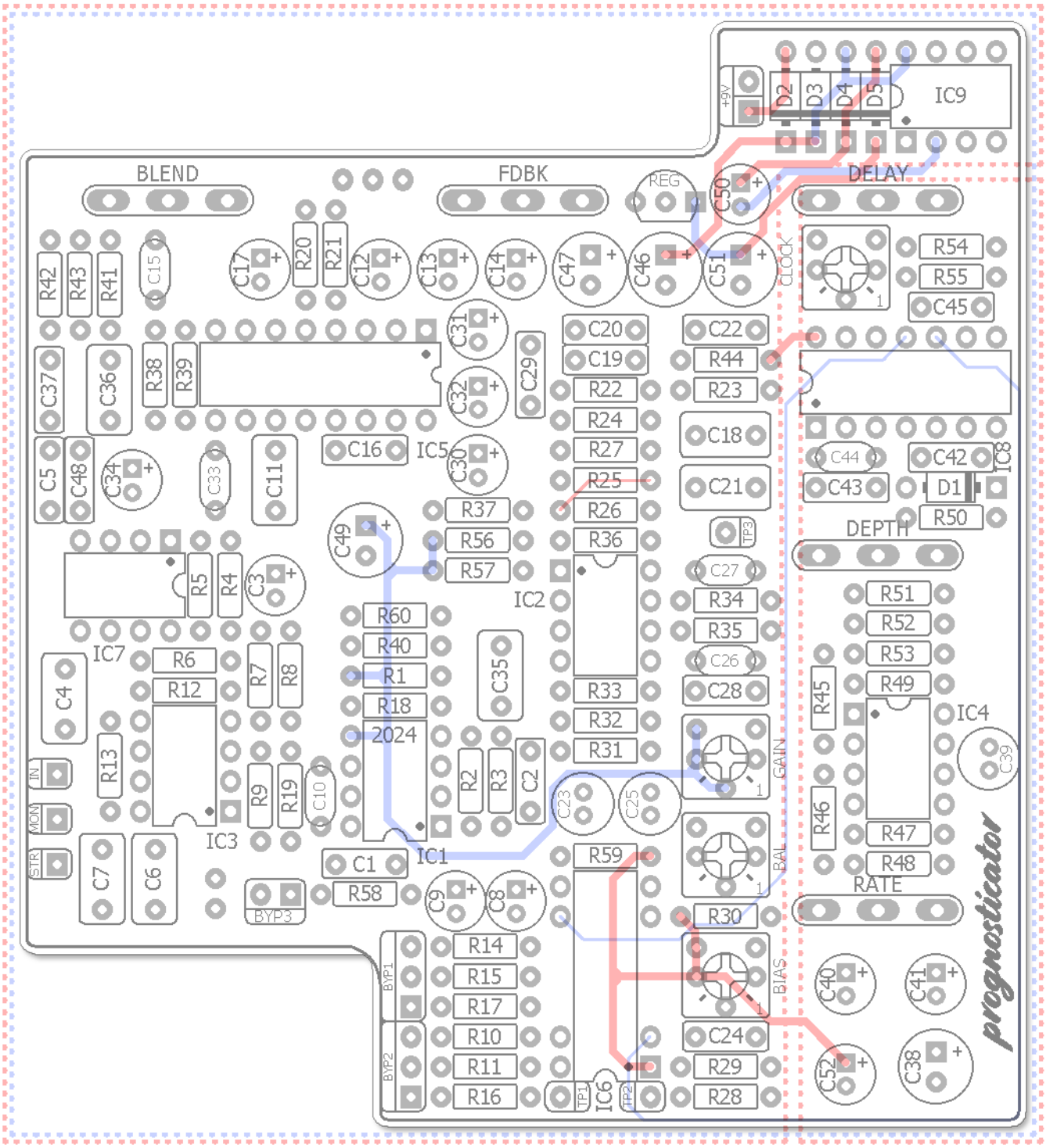
Component Values



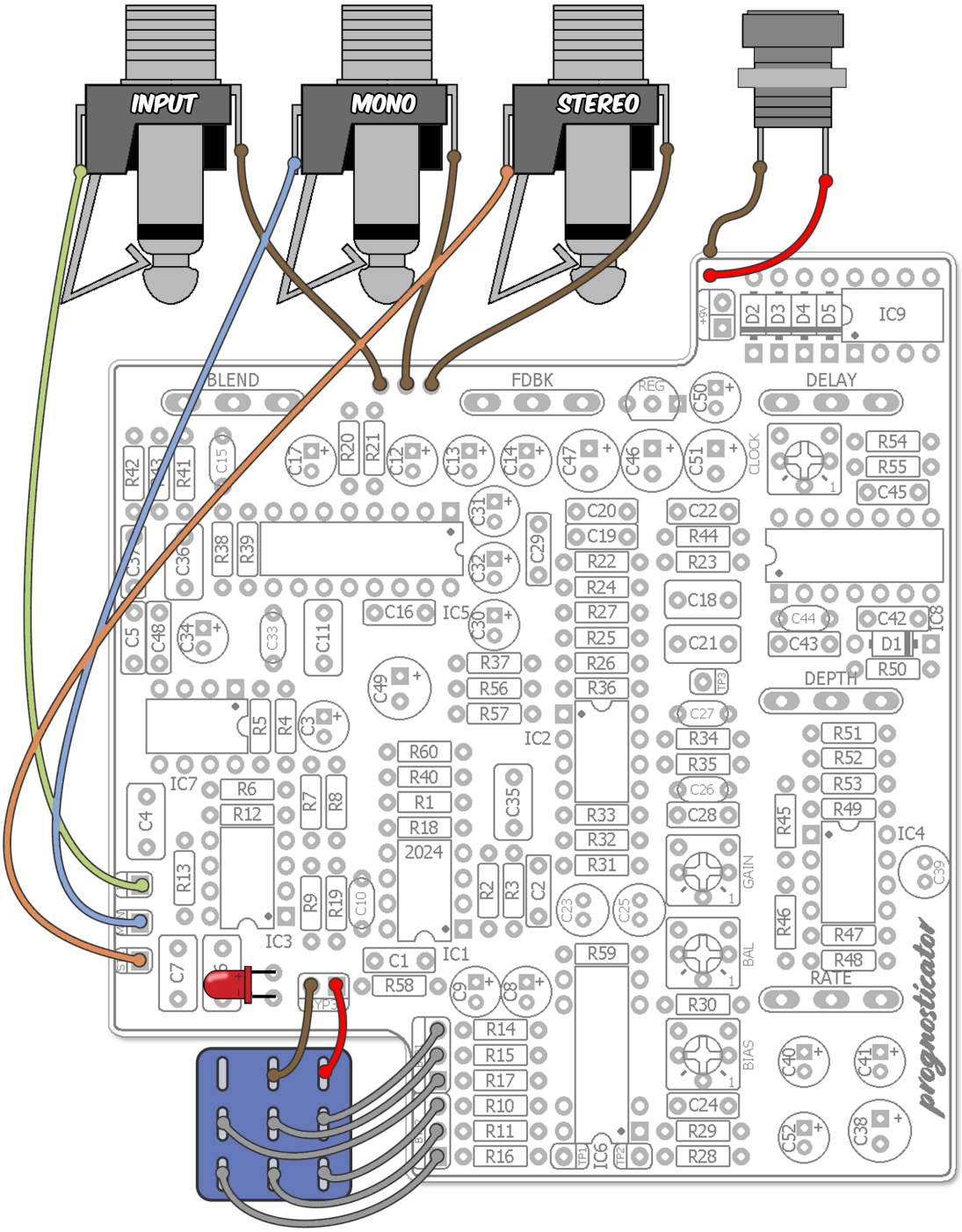
Traces - Outer



Traces - Inner



Wiring


INPUT
MONO
STEREO
BLEND
FDBK
REG
DELAY
CLOCK
DEPTH
RATE
GAIN
BAL
BIAS
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
2024
prognosticator

B.O.M.

Resistors		Resistors		Caps		ICs	
R1	1M	R41	4k7	C20	2n7	IC1	4558
R2	33k	R42	15k	C21	470n	IC2	4558
R3	33k	R43	2k2	C22	2n7	IC3	4558
R4	22k	R44	10R	C23	1uF BP	IC4	4558
R5	200k	R45	15k	C24	100n	IC5	NE570
R6	200k	R46	910k	C25	1uF BP	IC6	MN3005
R7	200k	R47	120k	C26	390pF	IC7	NE5534
R8	200k	R48	120k	C27	390pF	IC8	CD4047
R9	300k	R49	3k3	C28	100n	IC9	LT1054
R10	150R	R50	13k	C29	27n	Regulator	
R11	2M2	R51	10k	C30	1uF	REG	78L15
R12	200k	R52	27k	C31	2u2	Trimmers	
R13	300k	R53	27k	C32	1uF	BAL	5k
R14	150R	R54	120k	C33	200pF	GAIN	100k
R15	2M2	R55	6k8	C34	1uF	BIAS	100k
R16	10k	R56	15k	C35	330n	CLOCK	1M
R17	10k	R57	15k	C36	330n	Pots	
R18	18k	R58	15k	C37	47n	FDBK	10kB
R19	51k	R59	22R	C38	100uF	BLEND	50kB
R20	47k	R60	2M2	C39	2u2 BP	DEPTH	100kA
R21	47k	Caps		C40	1uF	DELAY	1MA
R22	24k	C1	47n	C41	1uF	RATE	1MC
R23	51k	C2	8n2	C42	1n		
R24	16k	C3	4u7	C43	1n		
R25	39k	C4	470n	C44	240pF		
R26	39k	C5	100n	C45	100n		
R27	10k	C6	330n	C46	220uF		
R28	39k	C7	330n	C47	100uF		
R29	6k8	C8	4u7	C48	100n		
R30	100k	C9	4u7	C49	100uF		
R31	10k	C10	270pF	C50	47uF		
R32	110k	C11	470n	C51	100uF		
R33	120k	C12	4u7	C52	10uF		
R34	150k	C13	2u2	Diodes			
R35	150k	C14	1uF	D1	1n4001		
R36	2k7	C15	200pF	D2	1n5817		
R37	10k	C16	100n	D3	15v Zener		
R38	8k2	C17	22uF	D4	1n5817		
R39	4k7	C18	470n	D5	1n5817		
R40	27k	C19	2n7				

Shopping List

Values	Qty	Type	Rating	Values	Qty	Type	Rating
10R	1	Metal / Carbon Film	1/4W	330n	4	Film	25v min.
22R	1	Metal / Carbon Film	1/4W	470n	4	Film	25v min.
150R	2	Metal / Carbon Film	1/4W	1uF BP	2	BiPolar	25v min.
2k2	1	Metal / Carbon Film	1/4W	2u2 BP	1	BiPolar	25v min.
2k7	1	Metal / Carbon Film	1/4W	1uF	6	Electrolytic	25v min.
3k3	1	Metal / Carbon Film	1/4W	2u2	2	Electrolytic	25v min.
4k7	2	Metal / Carbon Film	1/4W	4u7	4	Electrolytic	25v min.
6k8	2	Metal / Carbon Film	1/4W	10uF	1	Electrolytic	25v min.
8k2	1	Metal / Carbon Film	1/4W	22uF	1	Electrolytic	25v min.
10k	6	Metal / Carbon Film	1/4W	47uF	1	Electrolytic	25v min.
13k	1	Metal / Carbon Film	1/4W	100uF	4	Electrolytic	25v min.
15k	5	Metal / Carbon Film	1/4W	220uF	1	Electrolytic	16v min.
16k	1	Metal / Carbon Film	1/4W	1n4001	1		
18k	1	Metal / Carbon Film	1/4W	1n5817	3		
22k	1	Metal / Carbon Film	1/4W	Zener	1	15v	1W
24k	1	Metal / Carbon Film	1/4W	4558	4		
27k	3	Metal / Carbon Film	1/4W	CD4047	1		
33k	2	Metal / Carbon Film	1/4W	LT1054	1		
39k	3	Metal / Carbon Film	1/4W	MN3005	1		
47k	2	Metal / Carbon Film	1/4W	NE5534	1		
51k	2	Metal / Carbon Film	1/4W	NE570	1		
100k	1	Metal / Carbon Film	1/4W	78L15	1		
110k	1	Metal / Carbon Film	1/4W	5k	1	Bourns 3362p or 6mm	
120k	4	Metal / Carbon Film	1/4W	100k	2	Bourns 3362p or 6mm	
150k	2	Metal / Carbon Film	1/4W	1M	1	Bourns 3362p or 6mm	
200k	5	Metal / Carbon Film	1/4W	10kB	1	PCB Right Angle	16mm
300k	2	Metal / Carbon Film	1/4W	50kB	1	PCB Right Angle	16mm
910k	1	Metal / Carbon Film	1/4W	100kA	1	PCB Right Angle	16mm
1M	1	Metal / Carbon Film	1/4W	1MA	1	PCB Right Angle	16mm
2M2	3	Metal / Carbon Film	1/4W	1MC	1	PCB Right Angle	16mm
200pF	2	Ceramic / MLCC	25v min.	1590BB	1		
240pF	1	Ceramic / MLCC	25v min.	1/4” Jacks	3		
270pF	1	Ceramic / MLCC	25v min.	DC Jack	1		
390pF	2	Ceramic / MLCC	25v min.	LED	1		
1n	2	Film	25v min.	3PDT	1		
2n7	3	Film	25v min.				
8n2	1	Film	25v min.				
27n	1	Film	25v min.				
47n	2	Film	25v min.				
100n	6	Film	25v min.				

Build Notes

This is a lengthy, but relatively easy build as far as analog delay goes. It should not pose too much of a challenge to an experienced builder. Just take your time!

Delay pot

The audio taper for the delay pot is unusual. A linear taper in these setups is generally preferred. It may be that with the shortened delay time, the audio taper was chosen for more fine control over very tight delays.

Clock trimmer

While I listed the Bourns 3362p as the trimmer to use, the clock trimmer is extremely sensitive to adjustment. Even a little drift can push the delay control into noise territory and that may be why noise in the delay was a common complaint for this pedal. Set properly, the delay is plenty clean without artifact. So, it might be better to use a multi-turn trimmer instead of single turn trimmer for the clock. That would produce very fine calibration that is not likely to drift. You can use any of these:

1. https://www.mouser.com/ProductDetail/652-3296Y-1-105
2. https://www.mouser.com/ProductDetail/652-3296Z-1-105LF
3. https://www.taydaelectronics.com/potentiometer-variable-resistors/cermet-potentiometers/3296w/1m-ohm-trimmer-potentiometer-cermet-25-turns-3296w.html

Testing

It's tempting, but don't jump right to loading all the ICs in and firing it up yet. Being a little bit methodical at the beginning of testing can potentially save a lot of guess work later on. And, obviously, do not box this build up until you are sure everything is working properly. Use whatever testing apparatus you have available. I used my Protoyping/Testing rig.

Follow this procedure (reminder - never load an IC when the PCB is powered. Always unplug power first!)

1. Load in IC9, the LT1054 charge pump. Now connect 9v power.

2. Using your multimeter, verify you have about 9v on pin8 of IC9. Now check pin8 of the IC1 socket. You should be seeing about 15v. If so, go to step 3. If not, you will need to check over the charge pump circuitry and 15v regulator to see if you've made a mistake somewhere.

3. Disconnect power. Load the remaining ICs except for the MN3005. Power back on. Now check for about 15v on pin8 of each 4558 and pin13 on the NE570. If you have a sudden drop in voltage supply, you'll need to determine which IC is causing it (simply remove them in sequence until full power returns). Replace any bad ones as needed or determine if you have some other fault causing strange voltage readings (bad soldering, etc).

4. Finally, load the MN3005. You should read about 15v on pin1 and about 1v on pin8 and 0v on pin5. If so, you are ready to move on to the next procedure, the calibration.

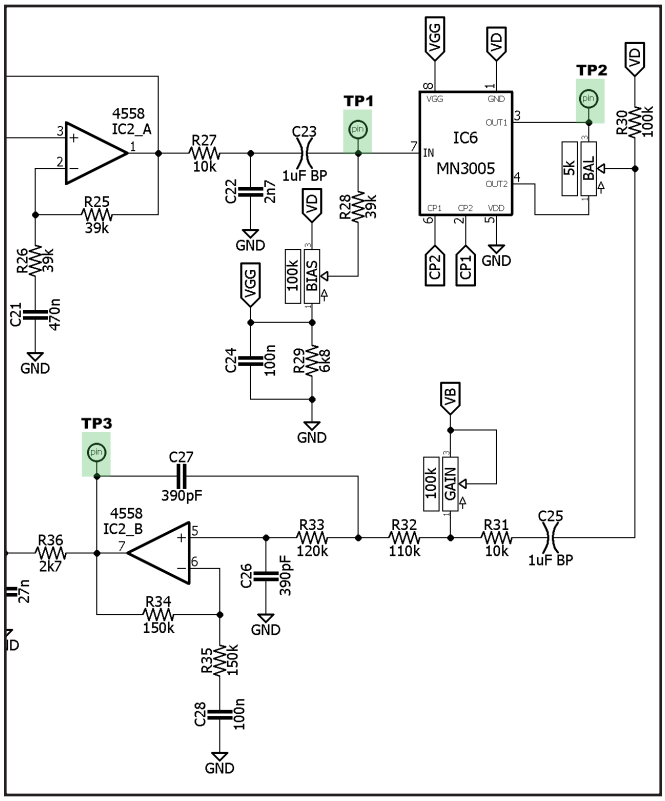
Build Notes

This part requires an audio probe

This procedure is for “ear” calibration. Fortunately, it’s fairly easy (as compared to the Tourbus or Skoolie projects). If you want to calibrate by scope, please refer to the “Scope” pdf in the Skoolie project zip file. You’’ll need to adapt the procedure somewhat to the Prognosticator, but all the essential info on how do scope calibration is in there.

Start with these settings

Delay at 1/2, all other pots full CCW.
Clock trimmer at about 1/4 up, all remaining trimmers: 1/2 up.



There are three test points used for calibration, labeled TP1-3. We’ll go through each with an audio probe to calibrate.

TP1 - Using your guitar or signal source, check the audio at TP1. This is input pin to the BBD. If you have no audio signal, check pin1 of IC2 and then pin7 and pin6 of the NE570 to find where the audio signal is getting lost. Debug as necessary.

TP2 - Once you’ve determined signal is getting to the BBD, set your audio probe at TP2. Now adjust the BIAS trim until you get the cleanest delay output possible at TP2. It’s usually right around the middle setting. Leave the BAL trimmer at its midpoint.

TP3 - This is the gain recovery output. Audio probe TP3 and adjust the GAIN trim until the audio is about the same volume or just above the audio input at TP1.

Build Notes

We're done with the audio probe so let's get to the final tweaking.

1. You don't need your bypass switch fully wired, but you will need wires attached to the BYP1 and BYP2 pads for the remainder. Connect pads 2 and 1 of each BYP switch. Now check both the MON and STR outputs for clean signal. This is the buffered bypass signal for each output jack.

2. Connect pads 2 and 3 of BYP1 and BYP2. Now, the effect signal (dry plus delay) is active. Turn the BLEND and FDBK pots up to about 1/3. You should hear some delay with repeats. If not, you're going to need to spend some time determining where your delay audio is getting lost (compander, BLEND pot, etc).

3. Turn the RATE and DEPTH pots up about 1/3rd. You should now hear some modulation on the delay.

4. Turn the DELAY pot to max. If your DMM has a frequency measurement setting, check the frequency on pin 10 or 11 of the CD4047. Adjust the CLOCK trim for the maximum clean delay possible without any artifact or noise. For me, this ended up being about 13.5kHz. If you don't have a frequency measurement, just set it by ear.

5. Last step: when need to do a finer calibration on the GAIN trimmer. You need to adjust this setting to balance the feedback level and feedback quality of the delay. Set it high enough that you get nice clean tails on the delay repeats but low enough so that the FDBK pot doesn't go into self-oscillation before its midpoint. Once you find a setting you're happy with, you are done! You can always go back to this after the project is boxed if you need to tweak it.

Clock Range for Delay control (my build): 96kHz - 13.5kHz

Circuit Voltages

IC1	4558
1	6.74
2	6.78
3	6.14
4	0
5	7.48
6	7.48
7	8.09
8	14.99

IC2	4558
1	7.8
2	7.79
3	7.76
4	0
5	7.14
6	7.31
7	7.32
8	14.99

IC3	4558
1	7.32
2	6.74
3	6.71
4	0
5	6.71
6	6.78
7	9.92
8	14.99

IC4	4558
1	varies
2	7.84
3	7.79
4	0
5	7.84
6	7.89
7	varies
8	14.9

IC5	NE570
1	2.1
2	1.83
3	1.84
4	0
5	1.83
6	1.84
7	7.81
8	1.83
9	1.83
10	7.39
11	7.39
12	1.83
13	14.99
14	1.84
15	1.83
16	0.94

IC6	MN3005
1	14.98
2	7.3
3	4.9
4	4.88
5	0
6	7.31
7	7.76
8	0.89

IC7	NE5534
1	12.85
2	6.55
3	6.39
4	0
5	5.8
6	6.46
7	14.99
8	12.85

IC8	CD4047
1	8.1
2	6.68
3	6.73
4	14.89
5	14.89
6	14.89
7	0
8	0
9	0
10	7.28
11	7.28
12	0
13	8.15
14	14.89

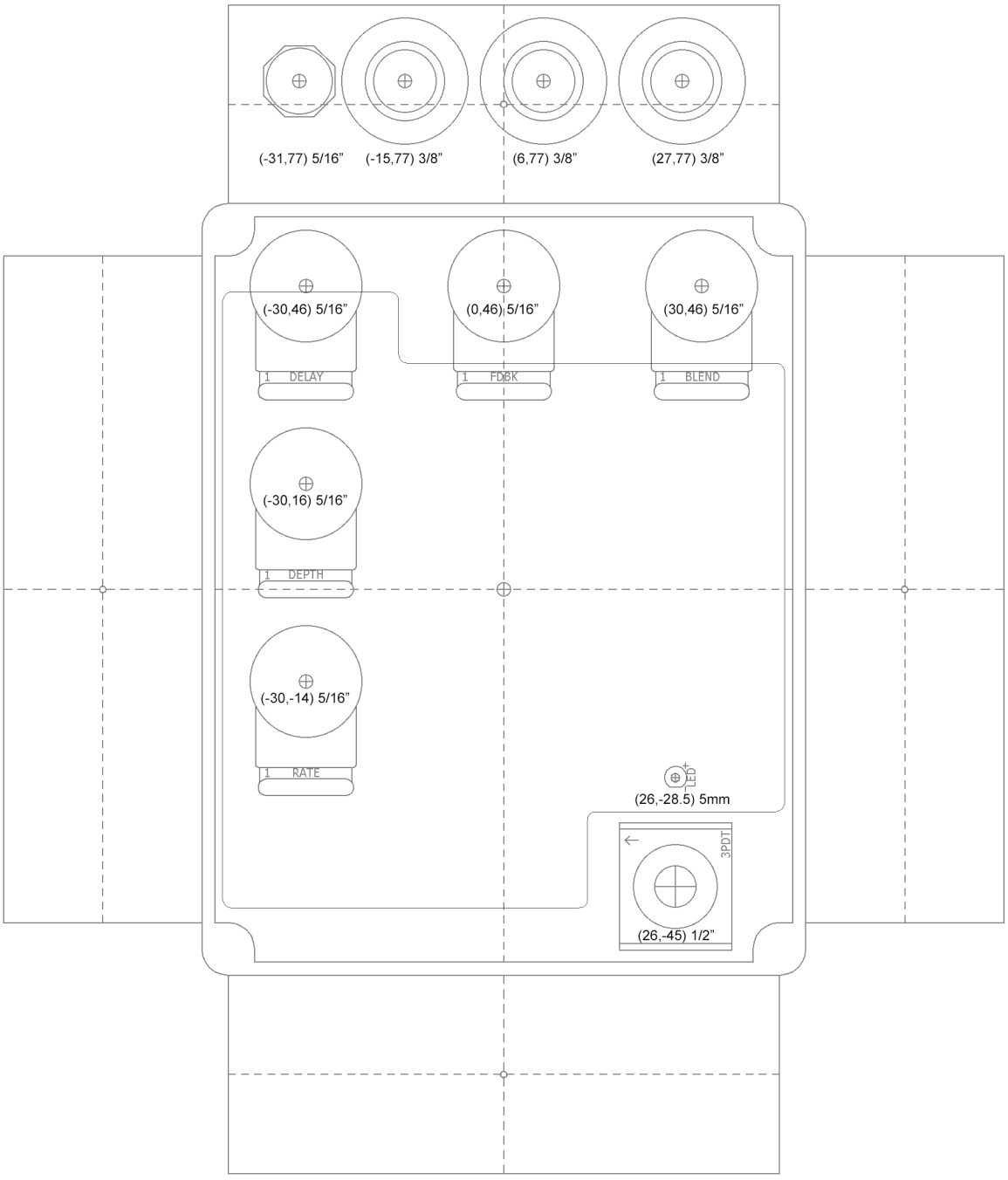
IC9	LT1054
1	~3.7
2	4.89
3	0
4	0
5	0
6	7.56
7	1.36
8	9.17

- 9.5vDC One Spot
- Current Draw: ~56mA
- Testing Conditions: All knobs @ 0
- Some results will vary depending on trimmer settings.

Drill Template

Coordinates are denoted in (X,Y), drill size format starting from the center (0,0) location of the enclosure.

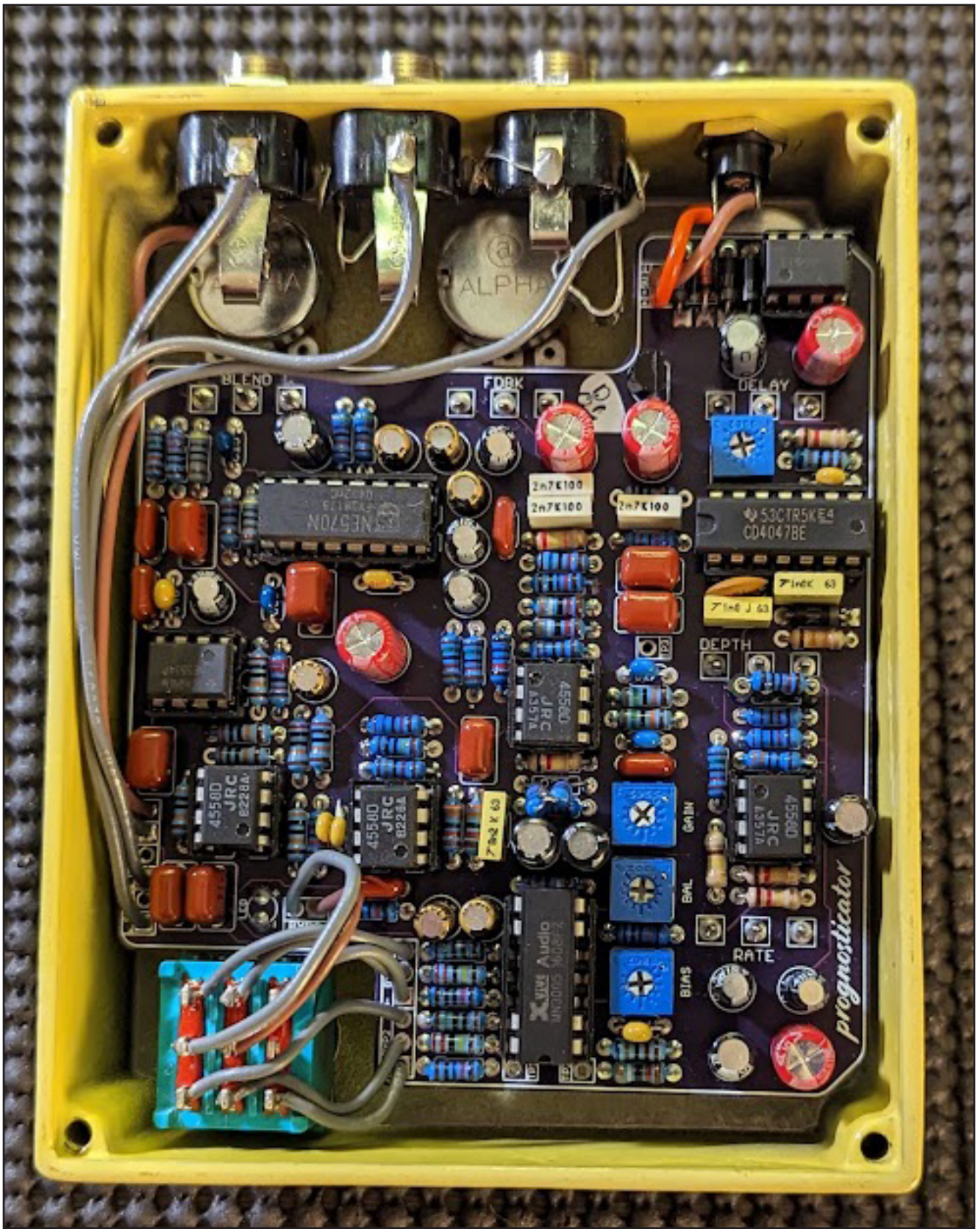
Tayda drill template: https://drill.taydakits.com/box-designs/new?public_key=SDRrY3c3MG9CRmtzZGF2R3dqWVZKdz09Cg==



Hardware

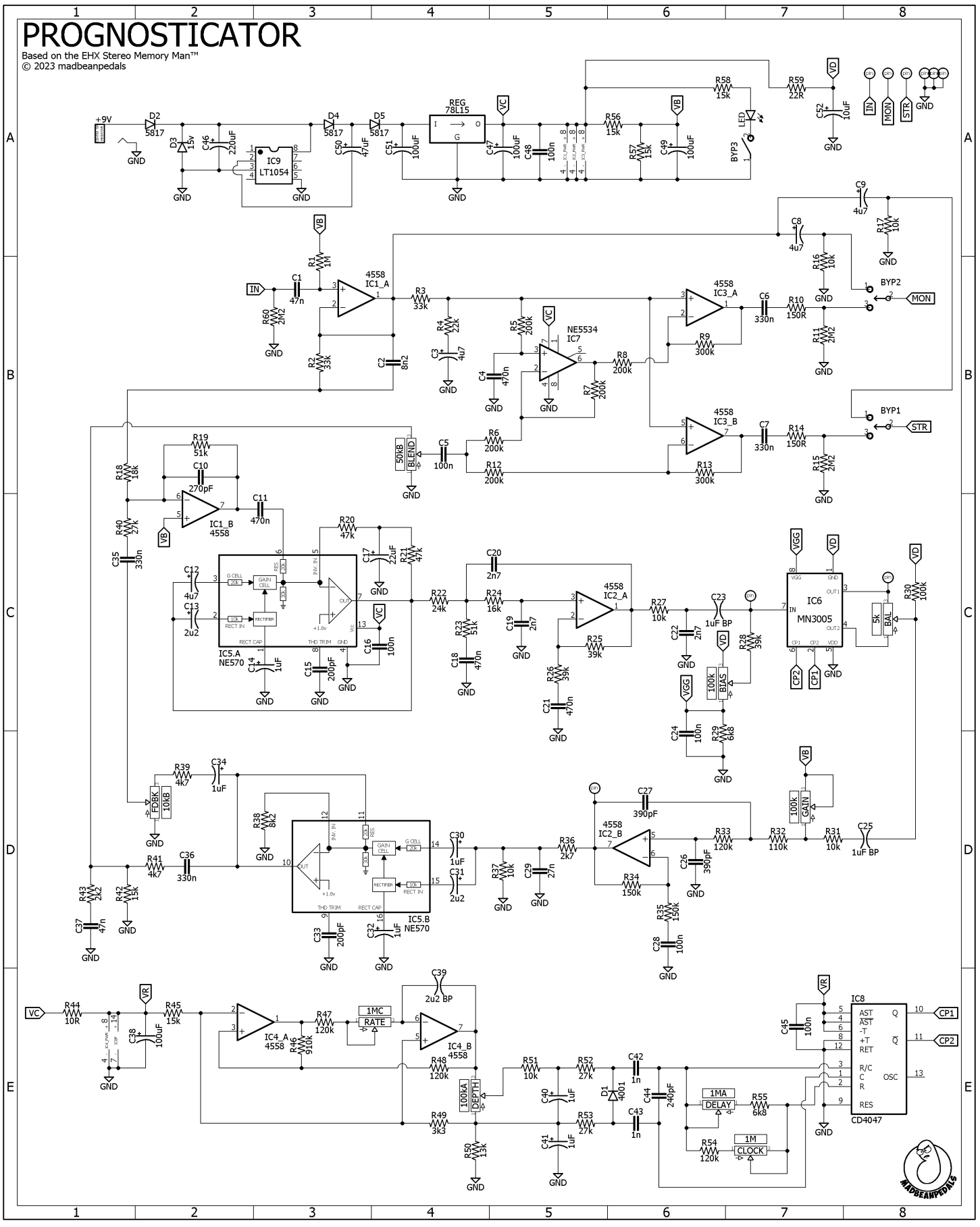
1590BB enclosure
Mono jacks
Slim 2.1mm DC jack
Standard 3PDT footswitch
5mm LED
NOTE: Different 1/4" and DC jack styles may require different sized drill holes.

Build Pic



Previous version build.

Schematic


PROGNOSTICATOR
Based on the EHX Stereo Memory Man™
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+9V
GND
D2
5817
D3
15v
C46
220uF
IC9
LT1054
D4
5817
D5
5817
C50
47uF
C51
100uF
REG
78L15
VC
C47
100uF
C48
100n
R56
15k
VB
R57
15k
C49
100uF
R58
15k
LED
BYP3
R59
22R
VD
C52
10uF
IN
MON
STR
C9
4u7
C8
4u7
R17
10k
R16
10k
BYP2
R1
1M
C1
47n
4558
IC1_A
R3
33k
R60
2M2
R4
22k
R5
200k
NE5534
IC7
R2
33k
C2
8n2
C3
4u7
C4
470n
R8
200k
R7
200k
4558
IC3_A
C6
330n
R10
150R
R9
300k
R11
2M2
BYP1
4558
IC3_B
C7
330n
R14
150R
R13
300k
R15
2M2
R19
51k
C10
270pF
C11
470n
IC1_B
4558
R18
18k
R40
27k
C35
330n
50kB
BLEND
C5
100n
R6
200k
R12
200k
R20
47k
C17
22uF
R21
47k
C12
4u7
C13
2u2
IC5.A
NE570
C14
1uF
C15
200pF
C16
100n
C20
2n7
R22
24k
R24
16k
C19
2n7
R23
51k
C18
470n
4558
IC2_A
R25
39k
R26
39k
C21
470n
R27
10k
C23
1uF BP
C22
2n7
R28
39k
IC6
MN3005
R30
100k
5k
BAL
CP2
CP1
100k
BIAS
C24
100n
R29
6k8
VGG
R39
4k7
C34
1uF
FD8K
10kB
R38
8k2
C30
1uF
C31
2u2
R37
10k
C29
27n
R36
2k7
4558
IC2_B
C27
390pF
R33
120k
R32
110k
R31
10k
C25
1uF BP
100k
GAIN
C26
390pF
R34
150k
R35
150k
C28
100n
R41
4k7
C36
330n
R43
2k2
R42
15k
C37
47n
IC5.B
NE570
C33
200pF
C32
1uF
VC
R44
10R
VR
R45
15k
C38
100uF
IC4_A
4558
R47
120k
R46
910k
1MC
RATE
C39
2u2 BP
IC4_B
4558
R48
120k
R49
3k3
100kA
DEPTH
R50
13k
R51
10k
R52
27k
C42
1n
C40
1uF
D1
4001
C44
240pF
R53
27k
C43
1n
C41
1uF
1MA
DELAY
R55
6k8
1M
CLOCK
R54
120k
C45
100n
IC8
CD4047
AST
-T
+T
RET
R/C
C
R
RES
Q
OSC
CP1
CP2
MADBEANPEDALS