



# HARBINGER1.5

**FX TYPE: Univibe**

Based on the Uni-Vibe™

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The **Harbinger 1.5** is a re-design of the Harbinger One project with emphasis on improved PCB layout. The circuit remains largely the same with a few minor circuit tweaks.

## What sets it apart from a traditional Uni-Vibe

- Runs off either a 9v supply (with a charge pump) or an 18v supply (without charge pump).
- Has an optional input buffer. This increases output and brightness.
- The regulated 15v supply line is only used on the LFO section (where it is needed most). The audio portion of the circuit runs on 18v for added headroom.
- The lamp action can be fine tuned with two trimmers. One tweaks the brightness of the lamp and the other the amount of shutoff between peaks (these mods were picked up from DIYSB).
- Film caps are used in the audio path instead of electrolytic caps.

## Tweaks to the new design

- Much better layout. Pots at the top and switches underneath instead of the other way around.
- Space to use top-mounted jacks!
- LFO section has better isolation from the audio components. It uses a little trick of having a separate ground plane connected by a thin trace. This can help reduce extra noise or ticking in modulation pedals.
- Ability to use a PCB mounted pot for the dual-gang 100kC pot. These are not available yet but I do have a request in to smallbear to carry them in the future.

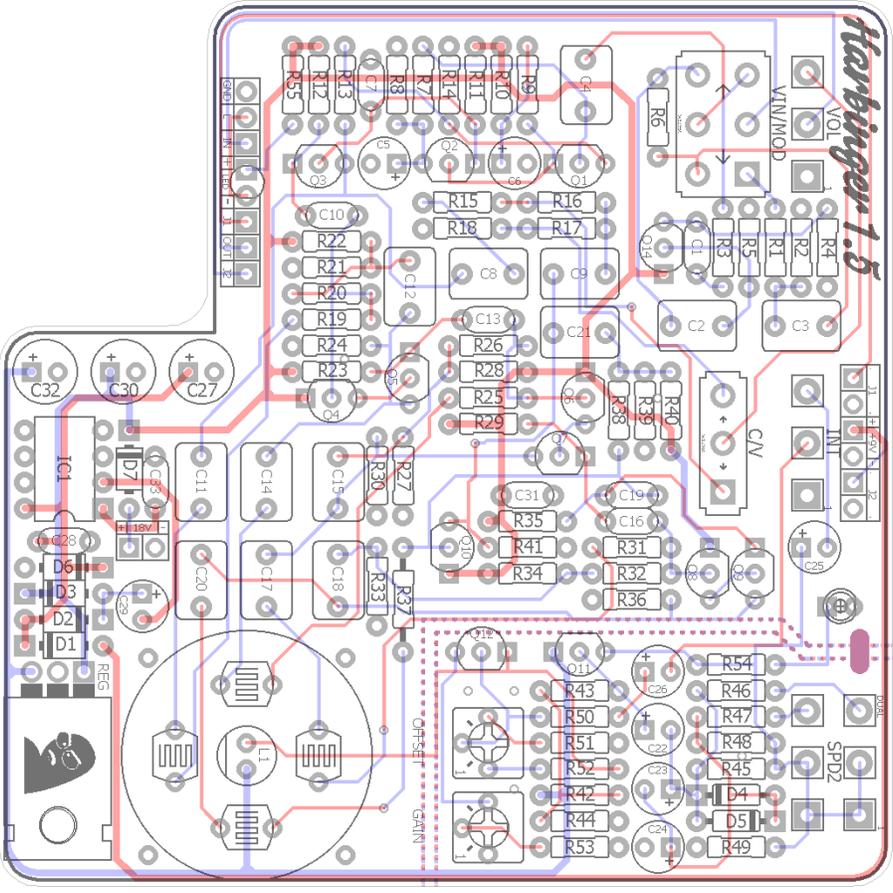
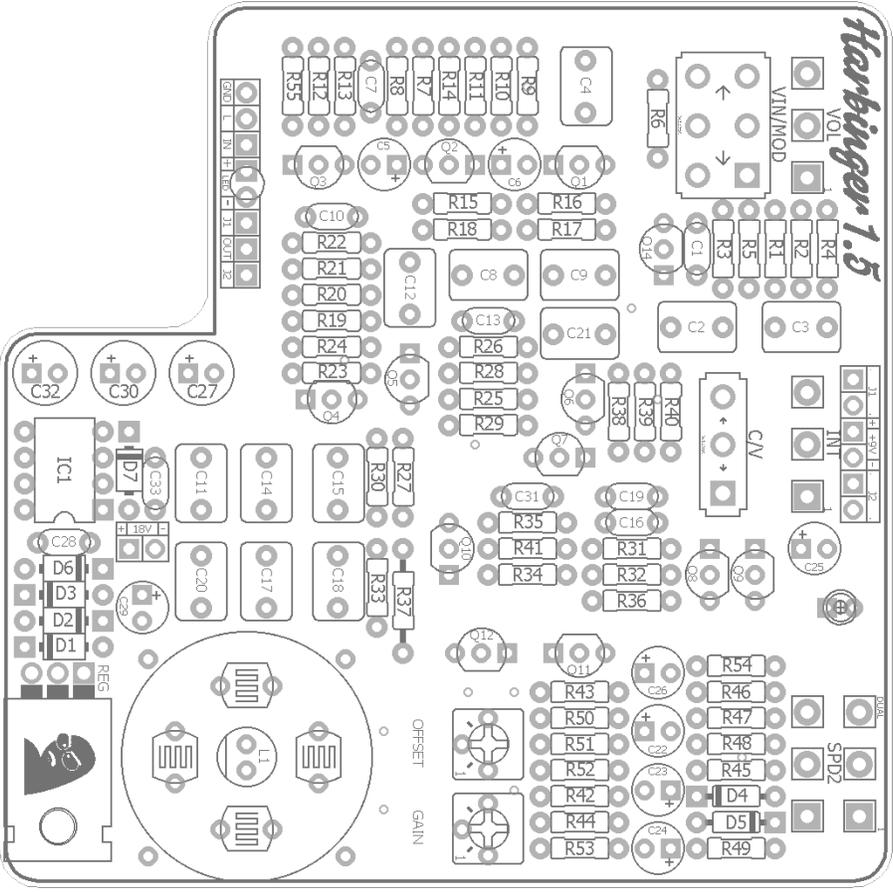
## **Controls**

- **SPD:** The rate of the modulation from slow to fast.
- **INT:** The intensity, or depth, of modulation.
- **VOL:** Output volume.
- **C/V:** This SPDT selects between a chorus effect (modulation mixed with dry signal) or vibrato effect (pitch modulation only).
- **MOD/VIN:** This DPDT switch selects between the traditional input and a JFET buffer input. The JFET buffer has more output volume and is brighter.
- **GAIN:** This trimmer sets the brightness of the LFO-driven bi-pin lamp.
- **OFFSET:** This trimmer lets you adjust the ramping of the lamp's brightness.

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**Terms of Use:** You are free to use purchased **Harbinger1.5** circuit boards for both DIY and small commercial operations. You may not offer **Harbinger1.5** PCBs for resale or as part of a "kit" in a commercial fashion. Peer to peer re-sale is fine, though.

Layout & Traces



## B.O.M.

Resistors		Resistors		Caps		Diodes	
R1	22K	R29	4k7	C1	100n	D1	1N5817
R2	47k	R30	4k7	C2	1uF	D2	1N5817
R3	1K	R31	4k7	C3	1uF	D3	1N5817
R4	1M	R32	100k	C4	1uF	D4	1n914
R5	10k	R33	47k	C5	1uF	D5	1n914
R6	1M	R34	100k	C6	1uF	D6	15v Zener
R7	1M	R35	4k7	C7	330pF	D7	1N5817
R8	5k6	R36	4k7	C8	1uF	LED1	3mm
R9	1M	R37	4k7	C9	1uF	<b>Transistors</b>	
R10	100k	R38	100k	C10	15n	Q1	2N5089
R11	47k	R39	47k	C11	1uF	Q2 - Q10	2N5088
R12	4k7	R40	68k	C12	1uF	Q11, Q12	MPSA13
R13	3k3	R41	22k	C13	220n	Q14	2N5457
R14	1k2	R42	3k3	C14	1uF	<b>Regulator</b>	
R15	100k	R43	2M2	C15	1uF	REG	LM7815
R16	100k	R44	4k7	C16	470pF	<b>IC</b>	
R17	47k	R45	220k	C17	1uF	IC1	LT1054
R18	220k	R46	4k7	C18	1uF	<b>Opto</b>	
R19	4k7	R47	4k7	C19	4n7	L1	Lamp
R20	100k	R48	220k	C20	1uF	LDR1 - 4	*see notes
R21	47k	R49	4k7	C21	1uF	<b>Switches</b>	
R22	100k	R50	4k7	C22	1uF	C/V	SPDT
R23	4k7	R51	47k	C23	1uF	VIN/MOD	DPDT
R24	4k7	R52	47k	C24	1uF	<b>Trimmers</b>	
R25	4k7	R53	22R	C25	10uF	OFFSET	250k
R26	100k	R54	10k	C26	10uF	GAIN	500R
R27	47k	R55	10k	C27	100uF	<b>Pots</b>	
R28	100k			C28	100n	INT	50kB
				C29	47uF	VOL	100kB
				C30	100uF	SPD2	100kC
				C31	100n		Dual Gang
				C32	100uF		
				C33	100n		

## Shopping List

Value	QTY	Type	Rating
22R	1	Metal / Carbon Film	1/4W
1K	1	Metal / Carbon Film	1/4W
1k2	1	Metal / Carbon Film	1/4W
3k3	2	Metal / Carbon Film	1/4W
4k7	16	Metal / Carbon Film	1/4W
5k6	1	Metal / Carbon Film	1/4W
10k	3	Metal / Carbon Film	1/4W
22K	2	Metal / Carbon Film	1/4W
47k	9	Metal / Carbon Film	1/4W
68k	1	Metal / Carbon Film	1/4W
100k	10	Metal / Carbon Film	1/4W
220k	3	Metal / Carbon Film	1/4W
1M	4	Metal / Carbon Film	1/4W
2M2	1	Metal / Carbon Film	1/4W
330pF	1	Ceramic / MLCC	25v min
470pF	1	Ceramic / MLCC	25v min
4n7	1	Film	25v min
15n	1	Film	25v min
100n	4	Film	25v min
220n	1	Film	25v min
1uF	13	Film	25v min
1uF	5	Electrolytic	25v min
10uF	2	Electrolytic	25v min
47uF	1	Electrolytic	25v min
100uF	3	Electrolytic	25v min

Value	QTY	Type	Rating
1N5817	4		
1n914	2		
15v Zener	1		
1N5817	1		
LED	1	Diffused, any color	3mm
2N5089	1		
2N5088	9		
MPSA13	2		
2N5457	1		
LT1054	1		
LM7815	1		
Lamp	1	*see Parts Guide	
LDR	4	*see Parts Guide	
SPDT	1	On/On, Pin Mount	
DPDT	1	On/On, Pin Mount	
250k	1	Bourns 3362p	
500R	1	Bourns 3362p	
50kB	1	Right Angle PC Mount	16mm
100kB	1	Right Angle PC Mount	16mm
100kC	1	Dual-Gang, Right Angle	16mm

## **Parts Guide**

**15v Zener:** <https://www.mouser.com/ProductDetail/ON-Semiconductor-Fairchild/1N4744A?qs=sGAEpiMZZMtQ8n-qTK-tFS%2fD313Kx94AdFdSPLy44WWjs%3d>

**2n5089:** <http://smallbear-electronics.mybigcommerce.com/transistor-2n5089/>

**2n5088:** <http://smallbear-electronics.mybigcommerce.com/transistor-2n5088/>

**MPSA13:** <http://smallbear-electronics.mybigcommerce.com/transistor-mpsa13/>

**2n5457:** <http://smallbear-electronics.mybigcommerce.com/transistor-fet-2n5457/>

or, **MPF102** (my personal choice): <http://smallbear-electronics.mybigcommerce.com/transistor-fet-mpf102/>

**LM7815:** <http://smallbear-electronics.mybigcommerce.com/ic-lm7815ct/>

**LT1054:** <http://smallbear-electronics.mybigcommerce.com/ic-lt1054cp/>

**SPDT:** <http://smallbear-electronics.mybigcommerce.com/spdt-on-on-short-lever-pc-mount/>

**DPDT:** <http://smallbear-electronics.mybigcommerce.com/dpdt-on-on-short-lever-pc-mount/>

**500R 3362p:** <https://www.mouser.com/ProductDetail/Bourns/3362P-1-501LF?qs=sGAEpiMZZMvygUB3GLcD7iDN-lz%2f-NDKOMPMEyhqEJhVo%3d>

or, <https://www.taydaelectronics.com/potentiometer-variable-resistors/cermet-potentiometers/3362p/500-ohm-trimmer-po-tentiometer-cermet-1-turn-3362p.html>

**250k 3362p:** <https://www.mouser.com/ProductDetail/Bourns/3362P-1-254LF?qs=sGAEpiMZZMvygUB3GLcD7p-0sIDtXd-CwsKR9Dy6lj2rI%3d>

or, (200k is okay): <https://www.taydaelectronics.com/potentiometer-variable-resistors/cermet-potentiometers/3362p/200k-ohm-trimmer-potentiometer-cermet-1-turn-3362-3362p.html>

**16mm PC Mount Pots (50k $\Omega$ , 100k $\Omega$ ):** <http://smallbear-electronics.mybigcommerce.com/alpha-single-gang-16mm-right-angle-pc-mount/>

**16mm Dual-Gang Pot (100k $\Omega$ ):** <http://smallbear-electronics.mybigcommerce.com/alpha-dual-gang-16mm-solder-terminals-100k-rev-audio/>

**Lamp:** <http://smallbear-electronics.mybigcommerce.com/lamp-18-volt-026-amp-bi-pin/>

**LDR:**

**NSL-7532** (expensive, but high quality): <http://smallbear-electronics.mybigcommerce.com/photo-cell-silonex-advanced-photonix-hi-dark-nsl-7532/>

**9203** (cheaper, not fine tuned for Univibes, but will work): <http://smallbear-electronics.mybigcommerce.com/photo-cells-cds-5mm-diameter/>

## Notes

Before you start you need to decide how you want to power the Harbinger 1.5. You can use either a 9v supply or an 18v one.

### Advantages/Disadvantages

9v - Works the same as using an 18v, more or less. It will require more parts and the use of a charge pump. The output of using 9v will be closer to 17.5v for the audio and 14.75 volts for the LFO (due to efficiency limitations of the charge pump). This is not a big deal, though.

18v - Requires fewer parts. If you do not have an 18v tap on your pedal board power supply, you'll need to use a wall-wart. For this I recommend the Dunlop 18v PS. It's a solid unit with 200mA of current on tap.

Whichever you decide, refer to the schematic so you know which parts to use where. When using 9v, exclude D7 and leave the 18v jack connection empty. When using 18v, exclude everything in the highlighted box on the schematic (D1-D3, D6, C27, C28, C33, C29).

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Each iteration of the Harbinger has included an optional LED that flashes with the rate of modulation. It has changed every iteration because it always ends up causing someone problems! For this version, I decided to simplify by adding a new resistor (R54) to power the LED. The only disadvantage with this method is at the slowest rate, the LED will flatten out so it is difficult to see the pulse. Once the rate is turned up a bit the flashing is more prominent (and the same goes with the overall intensity of the effect - at the slowest possible speed the modulation depth naturally decreases. This is normal). Anyway, you can fix the flashing issue by adding another 10k resistor between the two leads on LED1. I simply forgot to include it on the PCB.

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R46 and R47 set the fastest possible speed of the modulation. Stock, I find it a bit on the slow side. To increase the top speed lower the value of those two resistors. I suggest 2k7 or similar. You have to be careful, though. If you pick too low of a value the lamp could freeze up at the fastest rate. You can always socket these two resistors to get the best response for you.

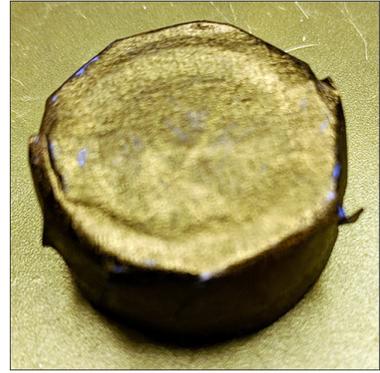
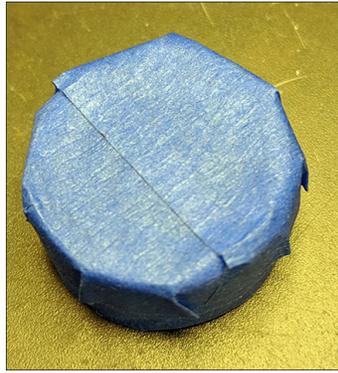
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I listed 2n5457 for Q14 since people tend to have these more often. I personally prefer an MPF102. It just sounds very slightly different to me. I don't know how to necessarily describe the difference but I hear it and like it. In any case, use what you have or can get!

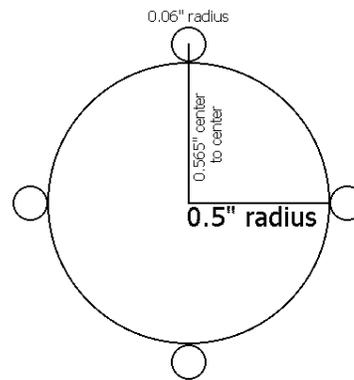
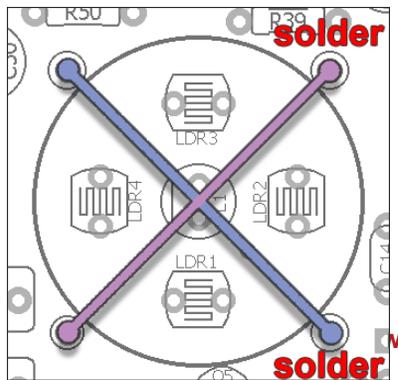
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## Light Shield

How to make one: 1) water bottle cap, 2) cover it in one layer of painter's tape, and 3) use a black Sharpie to mask out the tape.



To affix the light shield, I recommend the following: solder some buss wire the two the mounting holes on the PCB. Then just bend them over and insert in the opposite side to keep the shield in place. You don't need to solder all four positions. In fact, don't! You want to be able to remove the shield in case you need to visually inspect the lamp when making adjustments. Exact measurements of the light shield below. Alternatively, you could solder one wire in each spot and then twist them together over the top of the shield. Whatever works for you.



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## Lamp Calibration

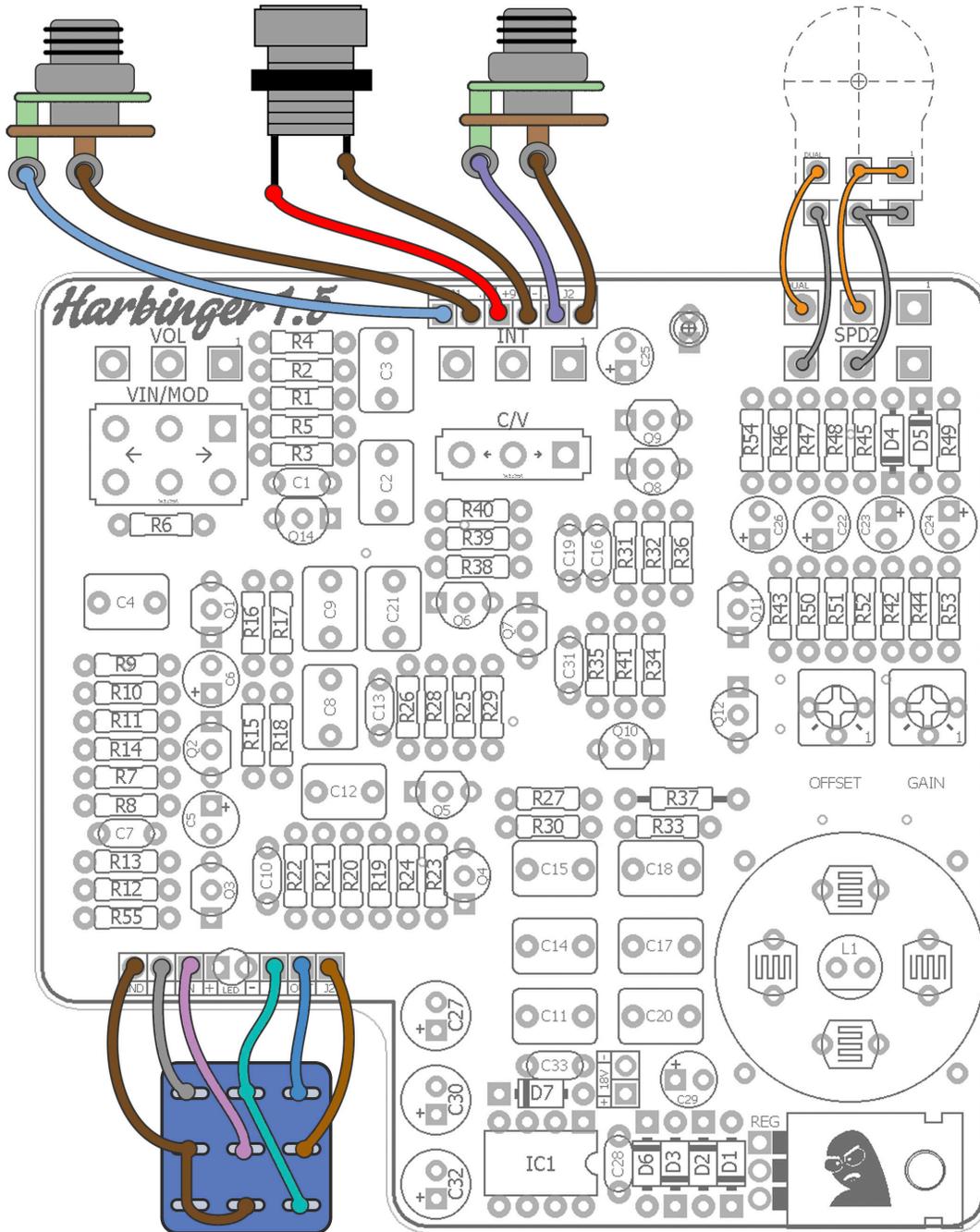
The GAIN and OFFSET controls are interactive. Use this procedure to calibrate the lamp

- Turn Intensity and Volume controls all the way up. Set the Speed control at about half-way.
- Turn the GAIN control up until you get moderate, but not overly bright lighting of the lamp.
- Now adjust the OFFSET control to find the sweet spot for the vibe where you get the most lush and swirly sounds.

The OFFSET will set the lower floor for the lamp brightness. High amounts of offset result in a lamp that goes fully off at the bottom of its sweep. Moderate and light offset means the lamp will pulse but never go fully dark. You will probably find yourself adjusting the GAIN and OFFSET a few times until you get the precise sound you want. I set my lamps to go fully dark to moderate brightness and get great results with that.

Be careful when adjusting the trimmers so that the lamp does not blow. I have yet to do this in any build no matter where I set the trimmers, but it is possible to do. Lastly, you should consider turning off your power supply or disconnecting the DC jack when not in use. This will preserve the life of the lamp considerably.

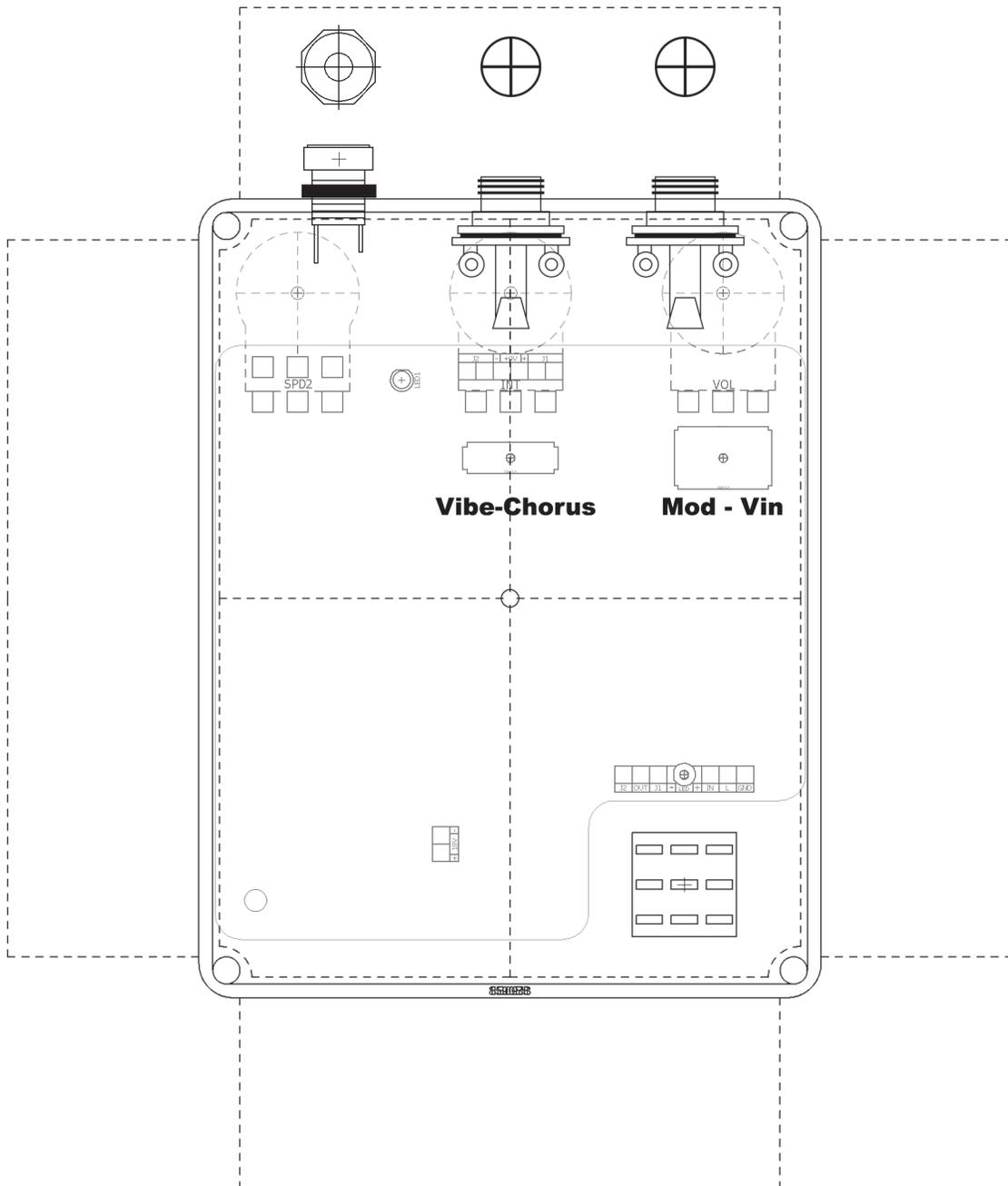
## Wiring



When wiring the 100kC dual-gang pot make sure you leave the wires long enough to turn the pot 90 degrees clockwise (this is needed for the solder lug pot to clear the PCB and still line up with the other two 16mm pots). Leave long enough wires for the jack connections, too. The DC jack will be located over the dual-gang pot rather than the middle of the enclosure wall. This is necessary to get the correct jack clearances in a 1590BB enclosure. You can also use a 125BB if you prefer more space to work with. Adjust your drilling accordingly if you do.

The PCB has the option for a PCB mounted Speed pot but they are not currently available. Smallbear may carry them in early 2020 if all goes well.

## 1590BB Drill Guide



When using a 1590BB you should use this style of jack:

<http://smallbear-electronics.mybigcommerce.com/lumberg-1-4-compact-shrouded-mono-jack/>

These jacks will ensure you have enough clearance over the pots. If you use a 125BB enclosure, you can move the drill locations for the jacks further up and allow you to use any style of jack you want.

## Voltages

Q1	2n5089	Q2	2n5088	Q3	2n5088	Q4	2n5088
C	2.13	C	4.42	C	13.5	C	17.5
B	1.45	B	2.13	B	4.4	B	5.53
E	1.03	E	1.57	E	3.8	E	5.17

Q5	2n5088	Q6	2n5088	Q7	2n5088	Q8	2n5088
C	13.02	C	17.5	C	13	C	17.5
B	5.25	B	5.5	B	5.16	B	5.5
E	4.51	E	5.18	E	4.54	E	5.2

Q9	2n5088	Q10	2n5088	Q11	MPSA13	Q12	MPSA13
C	13	C	17.5	C	14.73	C	9.2
B	5.2	B	6.94	B	varies	B	9.08
E	4.5	E	6.5	E	varies	E	8.13

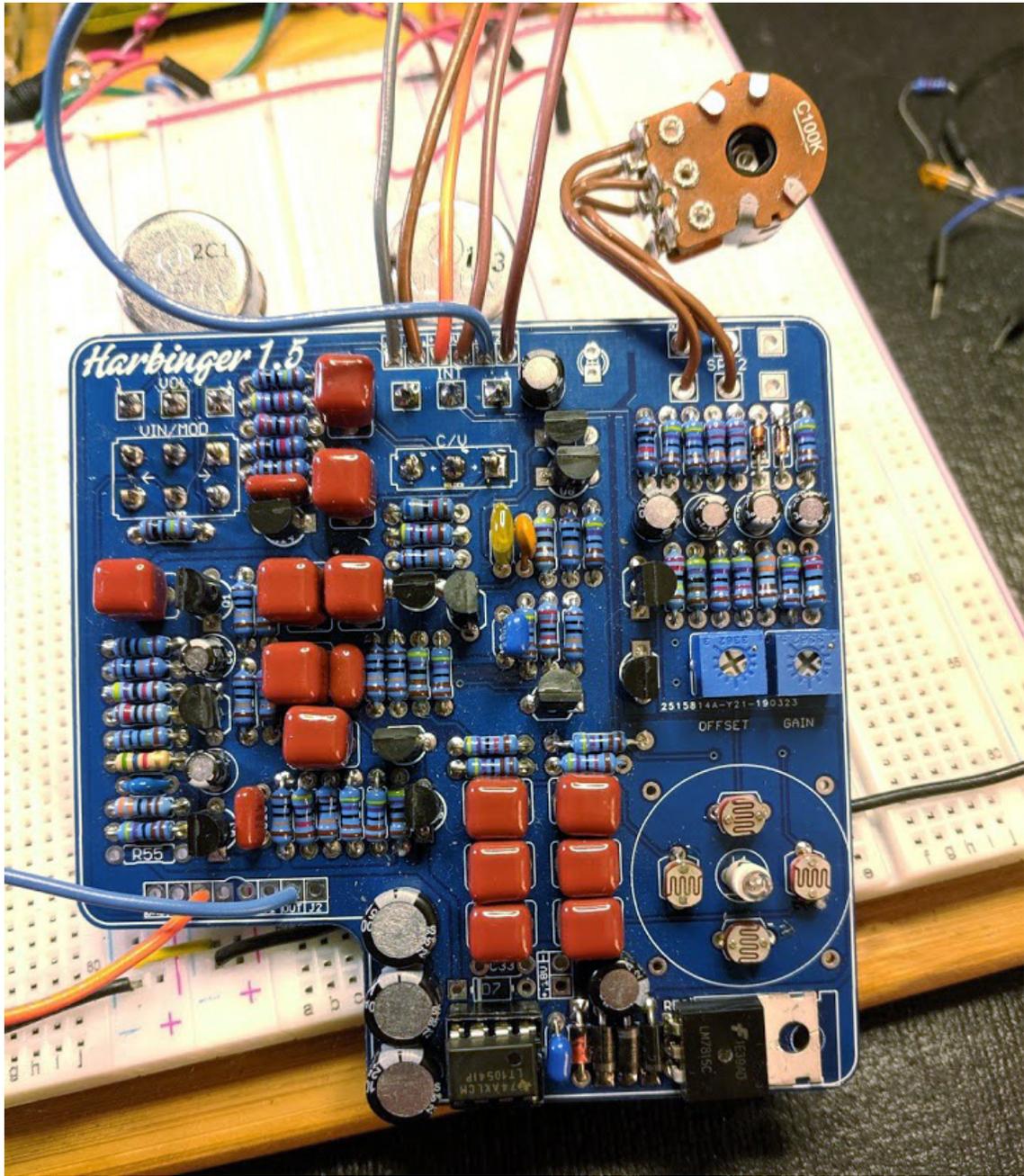
Q14	2n5457	REG	LM7815	IC1	LT1054
D	17.5	In	17.5	1	~2.1v
S	2.77	Gnd	0	2	4.94
G	0	Out	14.74	3	0
				4	0
				5	0
				6	2.56
				7	1.38
				8	9.26

These voltages are copied from the Harbinger Two project and should be more or less identical to the Harbinger 1.5.

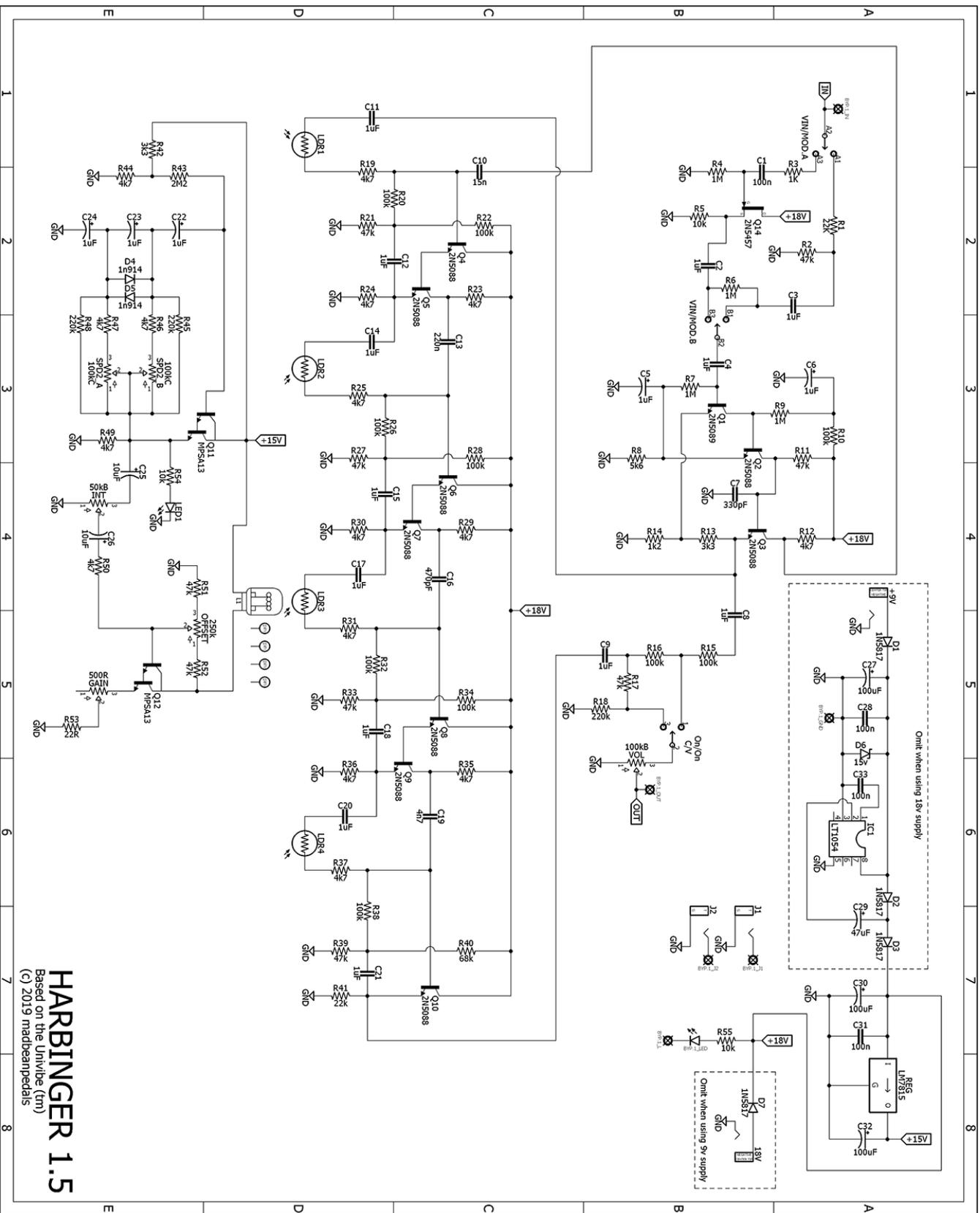
The audio portion of the Harbinger 1.5 is unregulated and you may see some small fluctuations on the ~18v rail. This is from the changing current demands of the LFO, as best I can tell (the total current draw does vary some with different speeds). Do not let it concern you. These small fluctuations will not negatively impact the overall result. What's shown on the list above is the top measurement for my 18v rail using a 9v power supply and charge pump.

Current Draw: Between 50-60mA

## Build Pic



# Schematic



**HARBINGER 1.5**  
 Based on the Univibe (tm)  
 (c) 2019 madbeanpedals