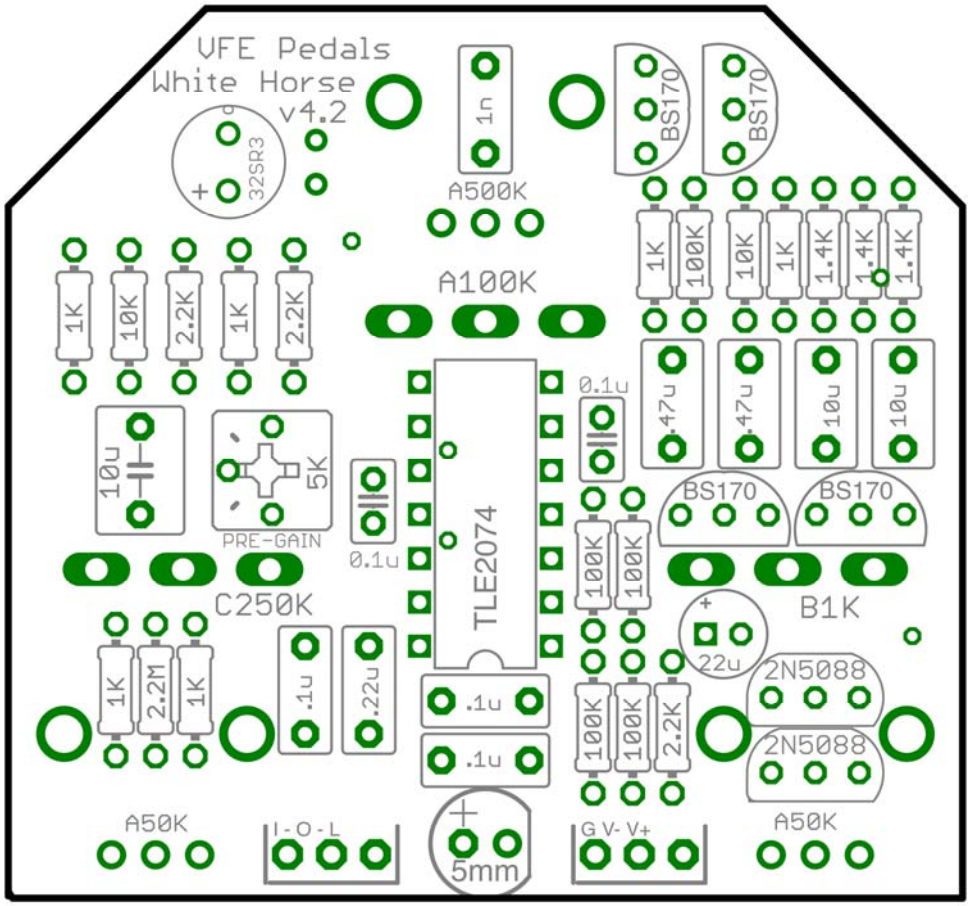
WHITE HORSE™

FX TYPE: Compressor

2.17” W x 2.025” H

This circuit uses the voltage at the anode of the LED to turn the optocoupler on when the effect is off. This is done to turn on the compression gradually, so that the signal doesn't "pop" when the effect is engaged. This means that LEDs with a voltage dropoff above 2.5V will trigger one BS170 transistor to turn off this feature when the effect is on. However, LEDs will lower thresholds may not work, as there won't be sufficient voltage to trigger the circuit off.

In short, green, blue, UV, and white LEDs have no problems. Red, orange, & yellow LEDs may require modification to the LED to increase its voltage dropoff.



Axial parts
6 x 1K
3 x 1.43K
3 x 2.2K
2 x 10K
5 x 100K
1 x 2.2M

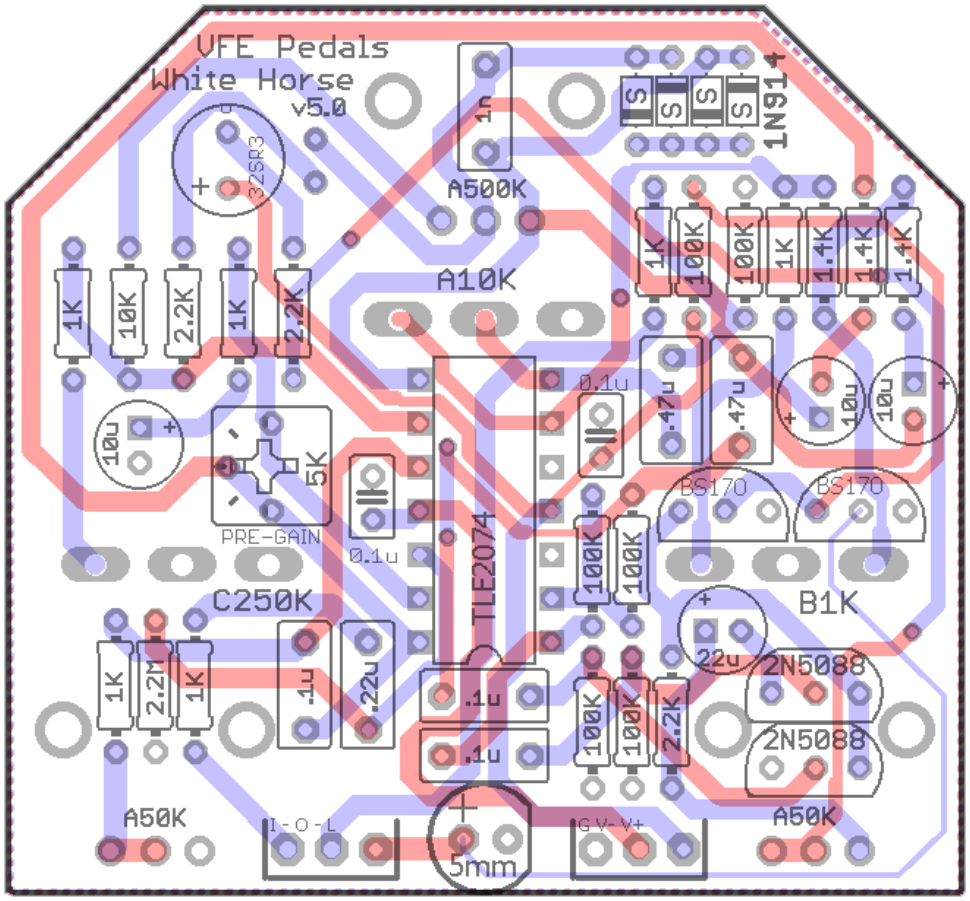
2.5mm caps
2 x 0.1u

5mm caps
3 x .1u
1 x 1n
2 x .22u
2 x .47u

Other
1 x TLE2074
1 x 5K trim
4 x BS170
2 x 2N5088
3 x 10u bipolar
1 x 22u
1 x NSL-32SR3

Note: Use the values listed on the image above – not the values indicated on the silk-screen of the PCB. Some values changed over time in the VFE product cycles.

REMINDER: PETER RUTTER / VFE DOES NOT PROVIDE SUPPORT FOR THESE PROJECTS. PLEASE DO NOT CONTACT HIM FOR QUESTIONS OR TECHNICAL SUPPORT. VISIT THE VFE SECTION OF THE MADBEANPEDALS FORUM FOR QUESTIONS AND ANSWERS!



This image shows ver.5 instead of ver. 4.2 (the one I have). There are two differences: the three 10uF BiPlolar caps are show as electrolytic instead of film caps and the two BS170 transistors used for clipping were changed to four 1n914. If you want to use the clipping from ver.5 in your build, see the last page of this document.

Shopping List

Value	QTY	Type	Rating	Spacing
1k	6	Metal / Carbon Film	1/4W	
1k43	3	Metal / Carbon Film	1/4W	
2k2	3	Metal / Carbon Film	1/4W	
10k	2	Metal / Carbon Film	1/4W	
100k	5	Metal / Carbon Film	1/4W	
2M2	1	Metal / Carbon Film	1/4W	
100n	2	MLCC	25v min	2.5mm
1n	1	Film	25v min	5mm
100n	3	Film	25v min	5mm
220n	2	Film	25v min	5mm
470n	2	Film	25v min	5mm
10uF	3	Electrolytic, Non-Polar	25v min	
22uF	1	Electrolytic	25v min	
BS170	4			
2N5088	2			
TLE2074	1			
Optocoupler	1	NSL-32SR3		
LED	1	>2.5 voltage drop	3 or 5mm	
5k	1	Bourns 3362p		
1kB	1	PC Mount, Right Angle	16mm	
100kA	1	PC Mount, Right Angle	16mm	
250kC	1	PC Mount, Right Angle	16mm	
50kA	2	PC Mount, Right Angle, Plastic Shaft	9mm	
500kA	1	PC Mount, Right Angle, Plastic Shaft	9mm	

This list is for the audio board only. See the **Switching Board** doc for the parts needed for the switching system. This effect does use a split-rail power supply so you will need to build the Switching Board with the charge pump.

Note: Use 1k4 or 1k5 if you do not have 1k43 resistors.

2.5mm caps, MLCC:
100n:
http://www.mouser.com/Search/ProductDetail.aspx?R=C320C104K5R5TAvirtualkey64600000virtualkey80-C320C104K5R

5mm caps, FILM:
470n:
https://www.mouser.com/ProductDetail/KEMET/R82DC3470Z360J/?qs=sGAEpiMZZMv1cc3ydrPrF0%2fKYujtVgoK1HnXG0zURSM%3d

10uF (Non-Polar/Bi-Polar):
https://www.mouser.com/Search/ProductDetail.aspx?R=ECE-A1EN100Uvirtualkey66720000virtualkey667-ECE-A1EN100U

1.43k resistors:
https://www.mouser.com/ProductDetail/Xicon/271-143K-RC/?qs=sGAEpiMZZMu61qfTUdNhG7t5%252bQWVpuiAZtkRWbO3cks%3d

TLE2074:
https://www.mouser.com/ProductDetail/Texas-Instruments/TLE2074CN/?qs=sGAEpiMZZMtCHixnSjNA6CumnoLUElGjtkQTPuP%252bT7A%3d

Bourns 5k (3362p):
https://www.mouser.com/ProductDetail/Bourns/3362P-1-502LF/?qs=sGAEpiMZZMvygUB3GLcD7pXz6c6XAR3tLU32B218z4E%3d

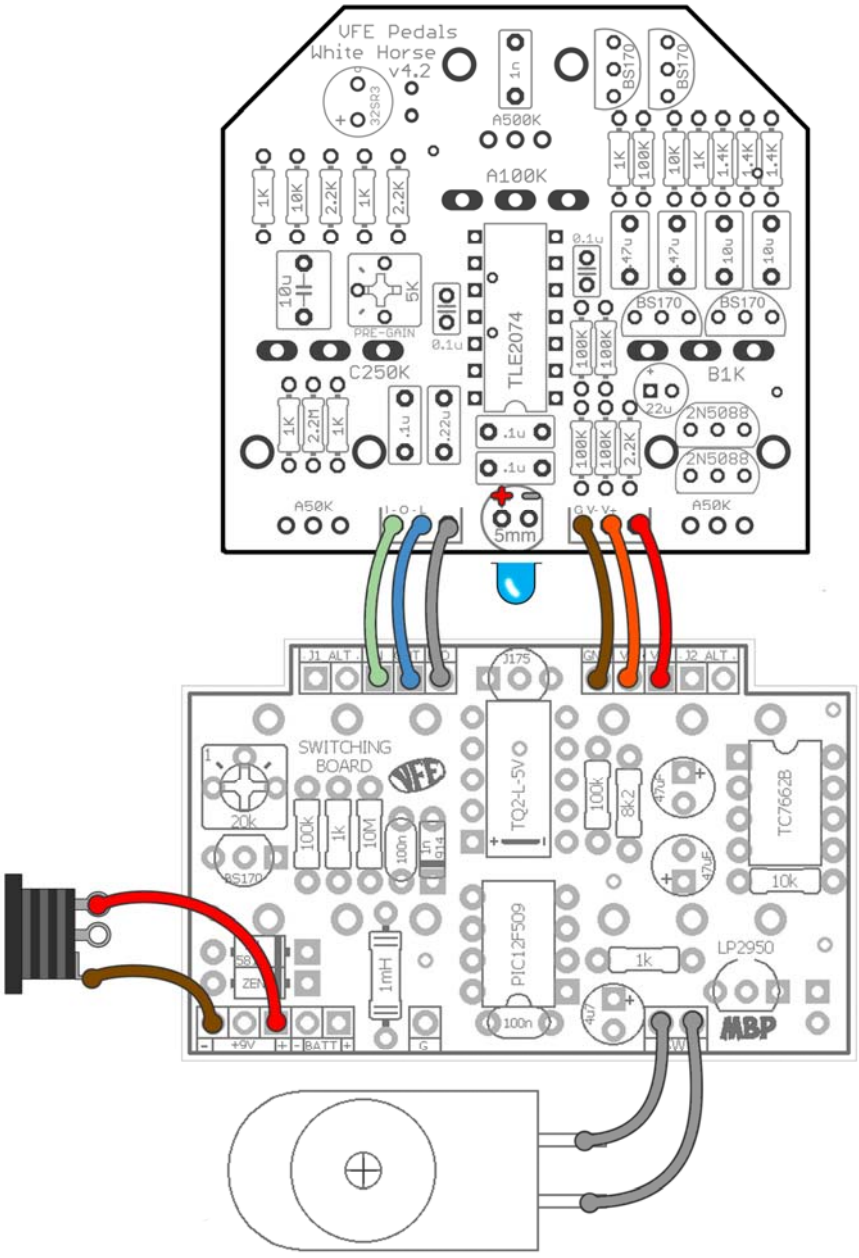
NSL32SR3:
http://www.smallbear-electronics.mybigcommerce.com/photocoupler-silonex-nsl-32sr3/

9mm Plastic Shaft, PC Mount (50kA, 500kA):
http://smallbear-electronics.mybigcommerce.com/alpha-single-gang-9mm-right-angle-pc-mount-w-knurled-plastic-shaft/

16mm Right Angle, PC Mount (1kB, 100kA, 250kC):
http://smallbear-electronics.mybigcommerce.com/alpha-single-gang-16mm-right-angle-pc-mount/

LED (bypass): This LED is only a suggestion since it is similar to the one I used.
https://www.mouser.com/ProductDetail/Kingbright/WP7113LVBC-D/?qs=sGAEpiMZZMtmwHDZQCdlqZc0cNJrjkniW1Md49zqWQKln5okyRAtHw%3d%3d

Wiring



For more detailed wiring information and options, please refer to the “v2” Switching Board document.
http://www.madbeanpedals.com/projects/VFE/VFE_SwitchingBoard_v2.pdf

Overview

From the VFE Website: The WHITE HORSE is an optical compressor pedal and a whole lot more. The blend control allows for longer, sustained notes that aren't squashed to oblivion. Our unique drive threshold technology allows for touch-sensitive effects, responding to the intensity of your picking and adding grit as you play harder. We've included additional controls to fine tune the punch and feel of the compressor to accommodate a wide array of instruments and playing styles.

Controls

Descriptions from the VFE website: http://vfepedals.com/white-horse.html

BLEND: Blends between the dry (uncompressed) and compressed signals. Blend in some clean signal to take advantage of added sustain without overly squashy your dynamics.

SUSTAIN: Adds gain/sustain to the compression stage. There's a ton of gain on tap, so you won't need to crank this to the max like all other compressors (though you can if you want).

LEVEL: Sets the output volume of the White Horse. Be careful the White Horse can get LOUD!

PRE-GAIN: Turn it up for more squish & sustain, or pull it back for high input sources (like active bass guitars).

DRIVE: Balances the gain section between the clean compression and a saturated mosfet drive section. Set the SUSTAIN between 2:00-3:00 and DRIVE between 11:00-12:00 for a drive tone that cleans up nicely with playing dynamics. Don't forget to cut some of the bass to tighten up your drive tones!

BASS: Sets the speed at which the compressor reacts to your playing dynamics. Pull it all the way back for a snappier attack, or pull it back to smooth out the sustain at high compression settings.

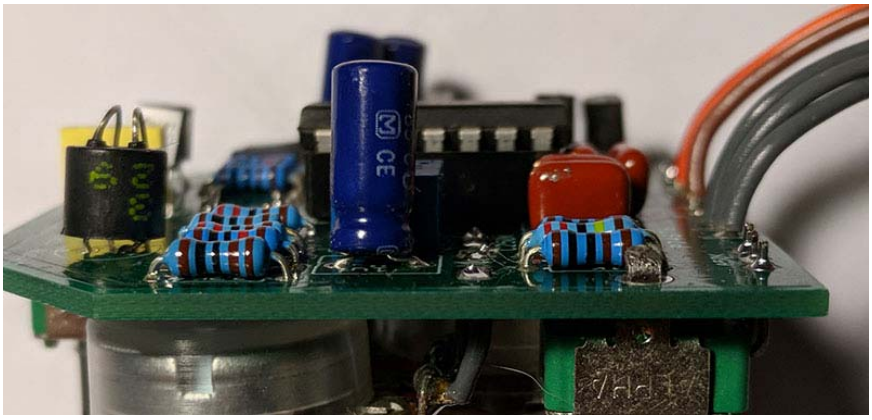
SPEED ("Response" on schematic): Sets the pre-gain bass cut. Due to the way the human brain hears different frequencies, it is often helpful to cut a touch of bass in compression. Crank it to the max for a flat bass response.

Notes

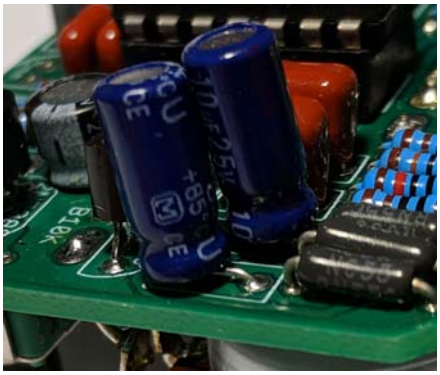
The bypass LED type is critical in this build. As explained on pg.1 the bypass LED is designed so that the compressor turns on gradually when the effect is activated (in this case gradually means a few ms rather than instantaneous). This requires that the bypass LED has a high voltage drop otherwise it will reduce (or even remove) the available compression in the circuit. I used a water-clear blue LED on mine and it worked perfectly. See the link on pg.4 for a similar one, or just follow the guide on pg.1.

Tip: in the build process you can test your LED pretty easily. Leave the bypass LED off, verify your build works (rock it before you box it) then slip your LED into the holes – don't solder the leads just make sure they have contact with the pads. You'll be able to tell right away whether or not your LED passes the test. If you want to try an experiment, use a red diffused instead and listen as your compression magically disappear.

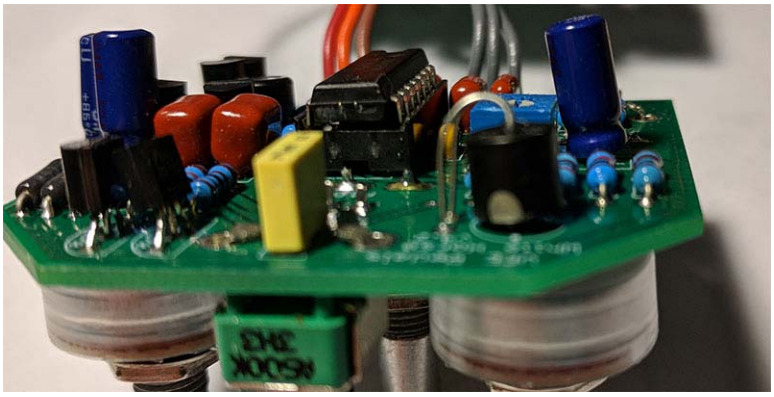
The White Horse seems to have gone through several revisions. On the 4.2 board there are three 10uF caps on the silk screen, but they are drawn as film caps. These were originally 470n but changed to 10uF Bi-Polar at some point. So, we will need to fit the 2.5mm leads in the 5mm spacing of the original film caps. No problem!



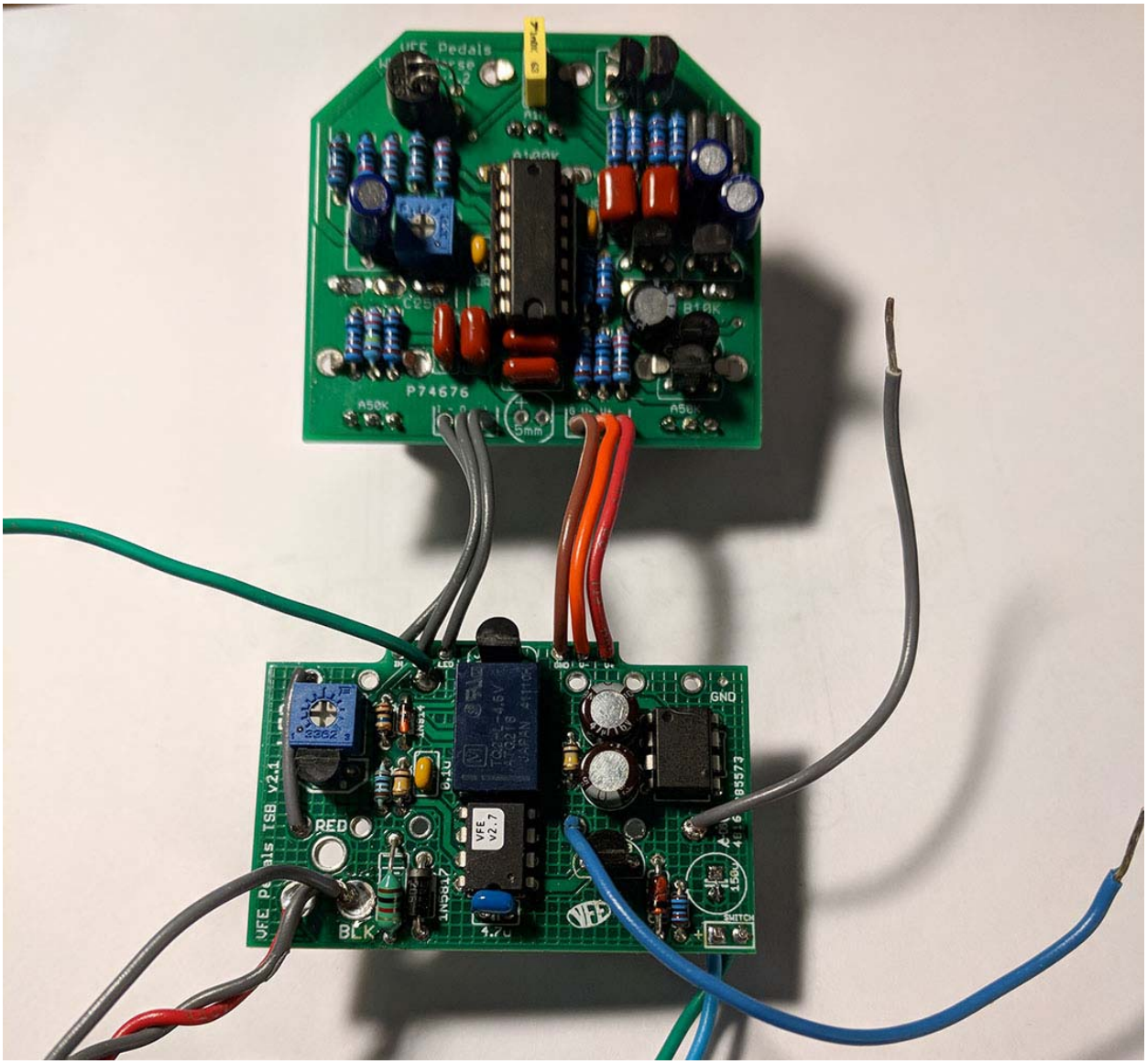
Cap on the left side of the PCB



Here I staggered the two caps next to each other so they would fit in the space a little more easily.



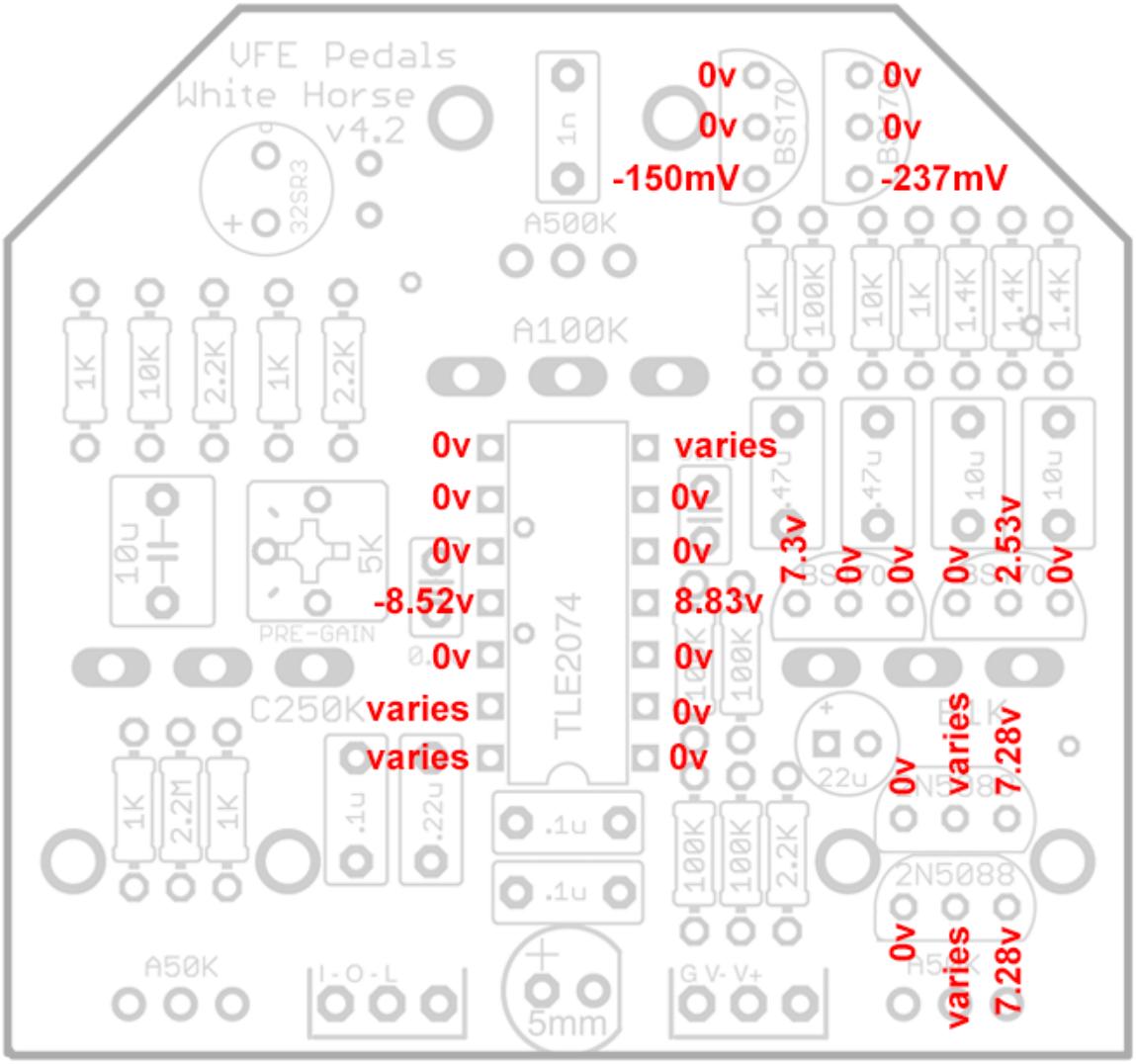
Install the NSL-32SR3 optocoupler as shown here. The dot indicates the cathode of the internal LED. The lead spacing is a little small so you will have to bend the pins inward slightly (you can just make that out in the pic at the top of this page). I do not recommend trying to roll your own optocoupler. Stick with the NSL.



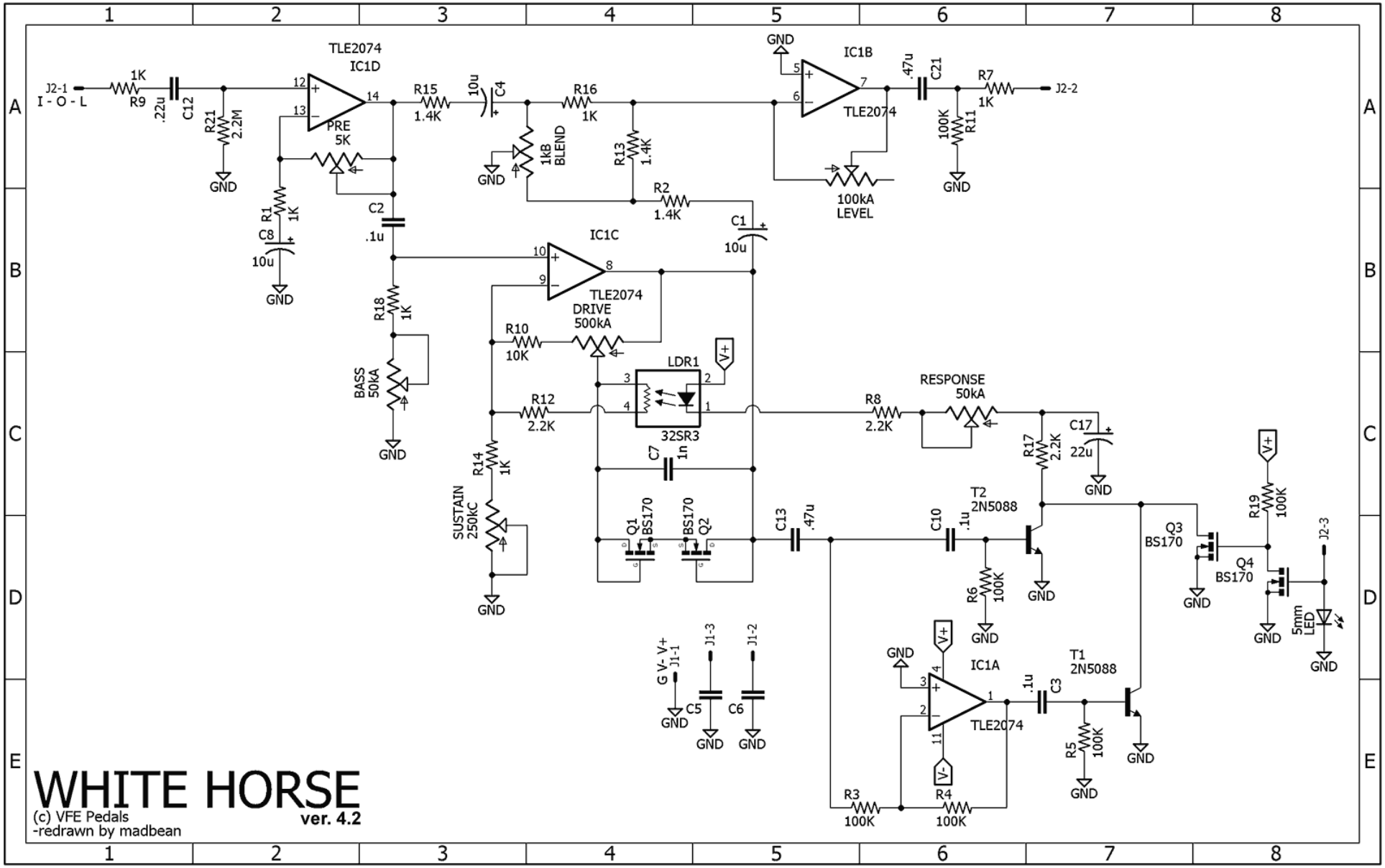
Don’t forget this project uses split-rail power!

Voltages

9.42vDC One-Spot Power Supply

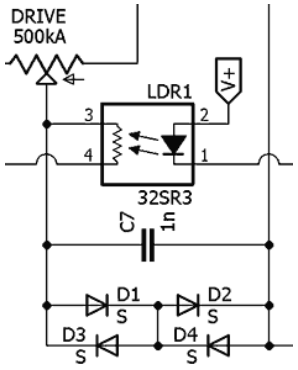


These voltages were taken with the pedal <u>on</u> (changes some readings)

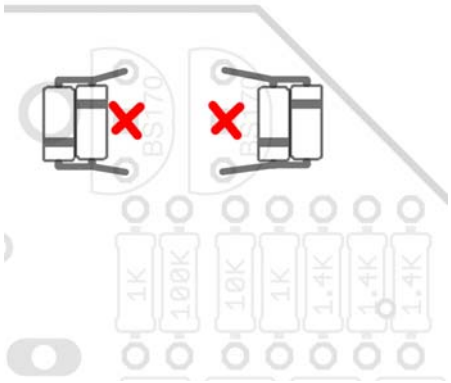

WHITE HORSE
ver. 4.2
(c) VFE Pedals
-redrawn by madbean
TLE2074
IC1D
IC1B
IC1C
IC1A
PRE
5K
DRIVE
500kA
BASS
50kA
SUSTAIN
250kC
RESPONSE
50kA
100kA
LEVEL
1kB
BLEND
LDR1
32SR3
T1
2N5088
T2
2N5088
Q1
BS170
Q2
BS170
Q3
BS170
Q4
BS170
5mm
LED
J2-1
I - O - L
J2-2
J2-3
J1-1
G V- V+
J1-2
J1-3
R1 1K
R2 1.4K
R3 100K
R4 100K
R5 100K
R6 100K
R7 1K
R8 2.2K
R9 1K
R10 10K
R11 100K
R12 2.2K
R13 1.4K
R14 1K
R15 1.4K
R16 1K
R17 2.2K
R18 1K
R19 100K
R21 2.2M
C1 10u
C2 .1u
C3 .1u
C4 10u
C5
C6
C7 1n
C8 10u
C10 .1u
C12 .22u
C13 .47u
C17 22u
C21 .47u
GND
V+
V-

Bonus!

Besides changing those 470n caps to 10uF BiPolar, ver.5 also changed the clipping on the Drive section. In place of two BS170s set up for body-mode clipping, four 1n914 are used. Those of you familiar with the Timmy will recognize how these diodes are set up.



If you want to implement the ver.5 clipping on the ver. 4.2 board do the following: solder two pairs of 1n914 together and back to back. Solder each pair in like this:



Obviously, omit the two BS170.

I did not build this version so I can't say how different it sounds. But, if you like the Timmy I imagine you will like this, as well.