The Engineer's Thumb – Compressor/Limiter

ValveWizard PCB User Guide (Issue 4 PCB)

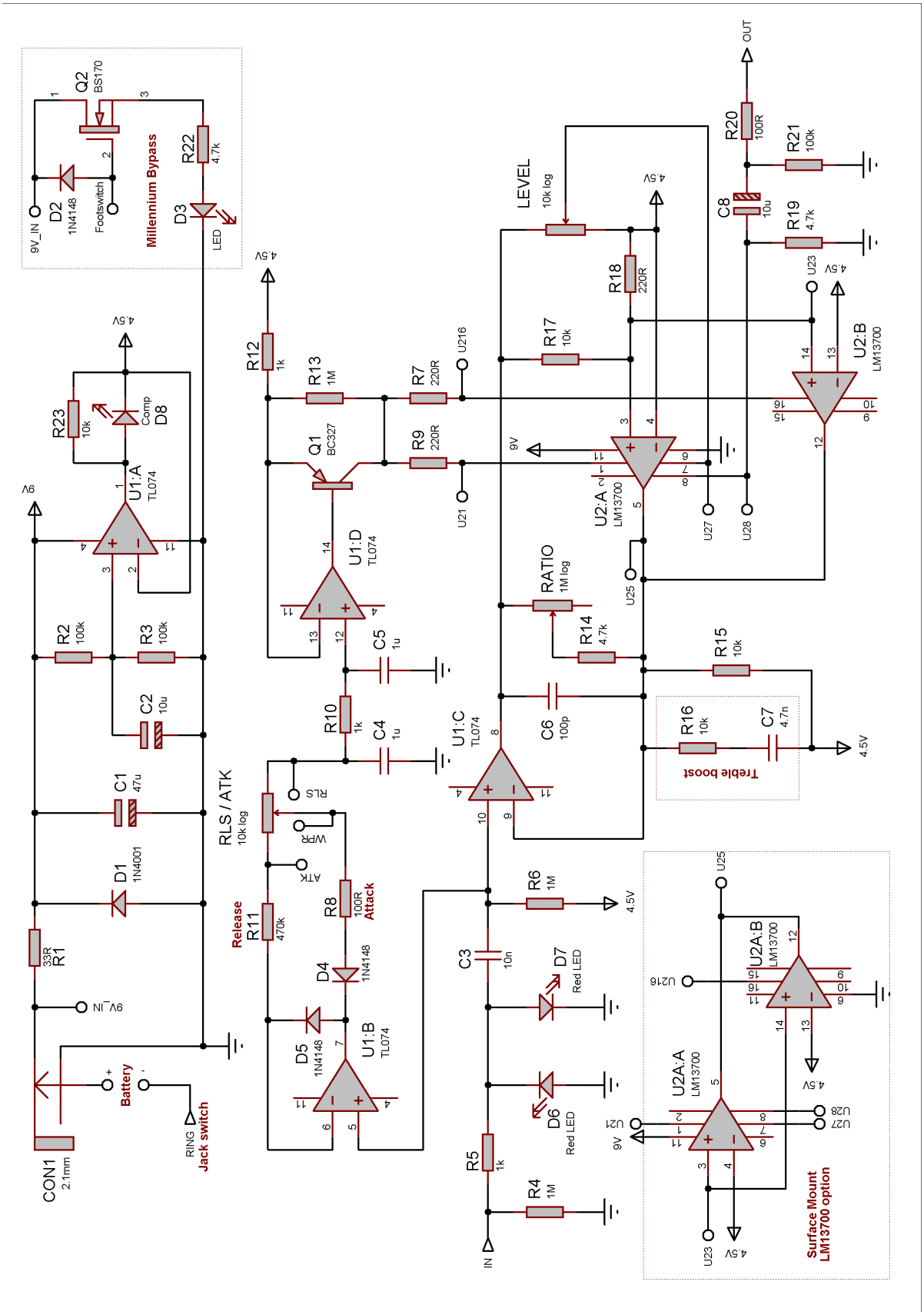

Fig. 1: Circuit schematic

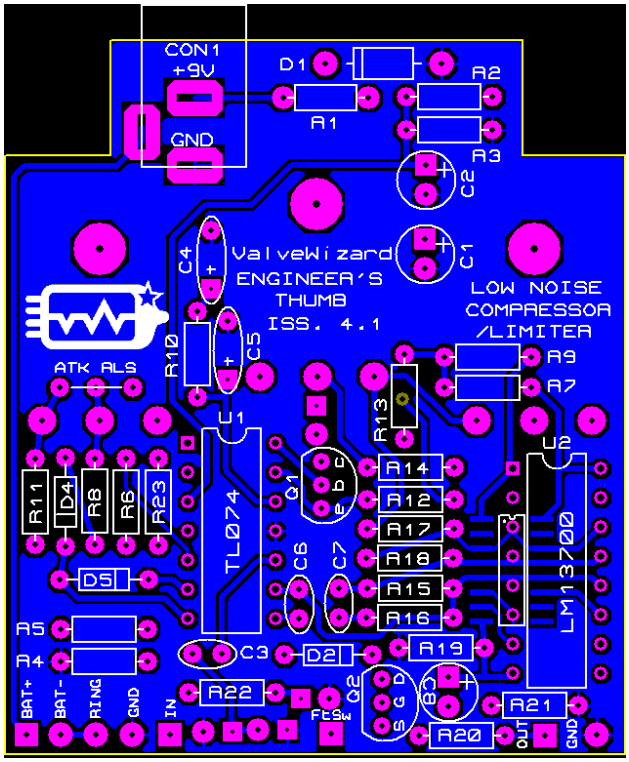

Fig. 2: Component layout

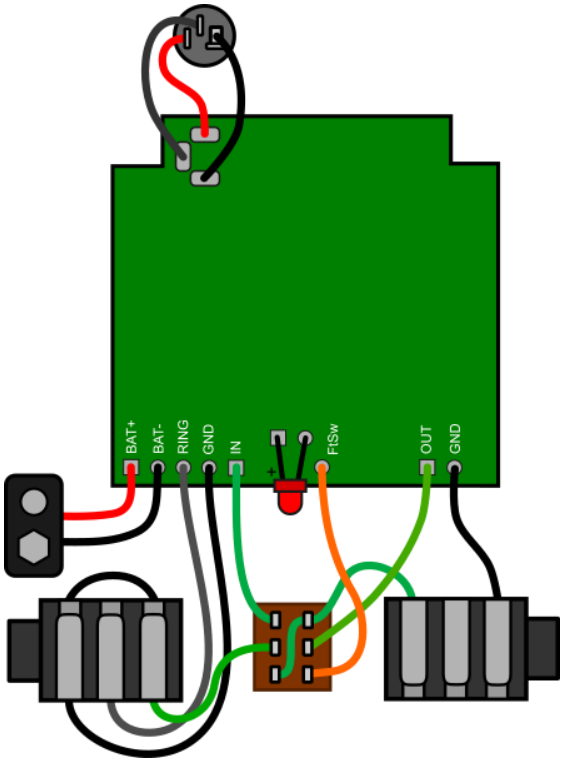

Fig. 3: Wiring diagram (with millennium bypass)

Before populating the PCB you can use it as a drill template by poking a pen through the holes where the pots are.

Populate the smallest components first, e.g. diodes and resistors. Best soldering practice is to tack-solder the component in place so it does not fall out, then snip off the excess leads. Then re-solder the joints properly. This ensures the cut ends will be fully coated in solder. Failure to do this will leave exposed copper that will oxidise over time.

It is recommended that you use IC sockets for the chips.

The square solder pads for the LEDs are the *anodes* (e.g. positive, long lead). Note: D6 and D7 *do not* visibly light up, they just provide graceful clipping if the input is overloaded.

SMD LM13700 Option

This PCB provides the option of using either a through-hole (DIP) package or a surface-mount (SMD package for the LM13700. Use whichever you like.

Attack or Release Option

This PCB provides the option of having either an attack or release control. Link the pads labelled ATK if you want to use an attack control (10k log pot). Note that you will get longer attack time as the pot rotates anticlockwise.
Link the pads labelled RLS if you want to use a release control (1M lin pot). Note that you will get longer release as the pot rotates anticlockwise.

Parts list:

	Engineer's Thumb Iss.4	
	Value	**Notes**
R1	33R	Any value 22R to 47R will do
R2	100k	
R3	100k	
R4	1M	Any value 1M to 10M will do
R5	1k	Any value 1k to 4.7k will do
R6	1M	
R7	220R	
R8	100R	Sets minimum attack time
R9	220R	
R10	1k	
R11	470k	Use 100k if using a release pot
R12	1k	
R13	1M	
R14	4.7k	
R15	10k	
R16	10k	Optional treble boost
R17	10k	
R18	220R	
R19	4.7k	
R20	100R	
R21	100k	
R22	4.7k	Adjusts status LED brightness
R23	10k	

C1	47u	Up to 100u will do
C2	10u	Up to 100u will do
C3	10n	Reduce for bass cut, e.g. 1n
C4	1u	
C5	1u	Use 2.2u for bass guitar
C6	100p	
C7	4.7n	Optional treble boost
C8	10u	Up to 100u will do

D1	1N4001	Any power diode will do
D2	1N4148	
D3	LED	Any indicator LED
D4	1N4148	
D5	1N4148	
D6	Red LED	Use only cheap red GaAs 3mm LED
D7	Red LED	Use only cheap red GaAs 3mm LED
D8	LED	Comp indicator; use high efficiency LED, e.g. white

RATIO	1M log	
RLS / ATK	10k log	Use 10k log for attack or 1M lin for release.
LEVEL	10k log	

Q1	BC327	Or any general purpose PNP e.g. BC558
Q2	BS170	Or VN2222 if turned 180 degrees

U1	TL074	Or TL064/TL084/TLE2074
U2	LM13700	SMD or DIP can be used.

CON1	2.1mm DC jack	

Labelled solder pads:

BAT+	Battery '+' terminal
BAT-	Battery '–' terminal
Ring	Input jack 'ring' terminal (switches the circuit on when a jack is plugged in)
GND	Ground
IN	Signal input
FtSw	Footswitch connection for Millennium bypass
OUT	Signal output
GND	Ground
ATK / RLS	Link according to you choice of attack or release control

Idle voltages (with 9V supply):

Pin No.	U1: TL074	U2: LM13700
1	4.4V	1.1V
2	4.4V	0V
3	<4.4V (depends on meter impedance)	4.4V
4	8.8V	4.4V
5	<4.4V (depends on meter impedance)	4.4V
6	4.4V	0V
7	4.4V	4.4V
8	4.4V	3.2V
9	4.4V	0V
10	<4.4V (depends on meter impedance)	0V
11	0V	8.8V
12	<4.4V (depends on meter impedance)	4.4V
13	4.4V	4.4V
14	3.9V	4.4V
15		0V
16		1.1V

If you use insulated jack sockets like I do then you will need to connect the metal enclosure to circuit ground, such a solder tag connected to a mounting screw.

Dynamic Performance:

The following images were captured by feeding the compressor with a 15mV$_{pp}$ 800Hz signal (below threshold) which is interrupted by a 150mV$_{pp}$ burst (well above threshold). Ratio and Level were set to maximum.

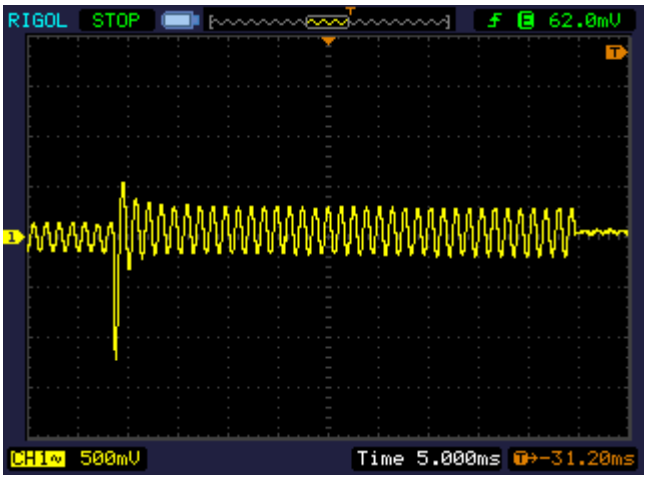

Fig. 6: Fast attack

With the Attack control set to minimum you can see the compressor clamping down on the signal within 3 milliseconds. For guitar this is almost instant, making notes sound more uniform and fluid.

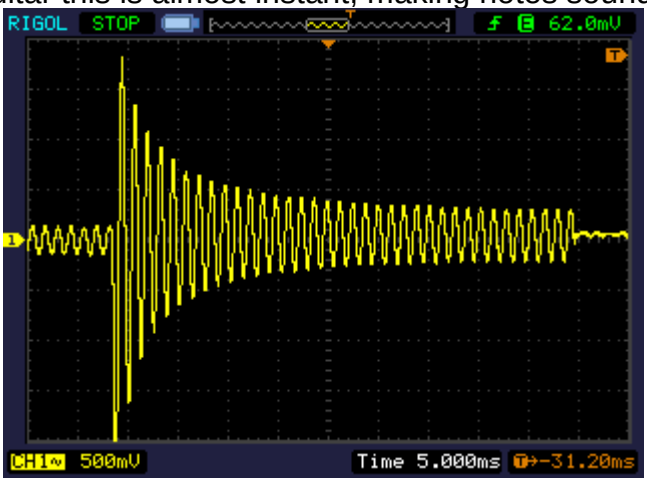

Fig. 7: Slow attack

With the attack control set to maximum the attack time is about 20 milliseconds. This allows note runs to retain their normal dynamics; only with sustained chords will compression kick in.

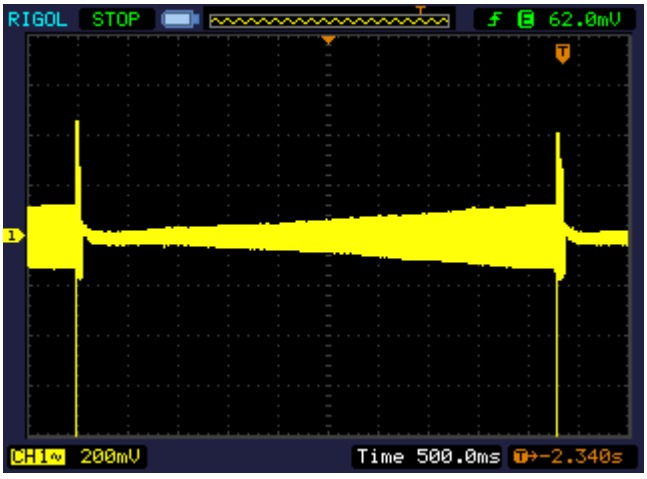

Fig. 8: Release

The stock values give a release time of about four seconds, for maximum sustain on ringing notes. However, you or your guitar may prefer a shorter release by reducing R11 to as little as 100kΩ.