

# **! No Name Flange (Lovetone ?™ Flange With No Name V1 Clone)**

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This is what the creators of the ?™ had to say about it:

“?™

Ladies and Gentlemen of tone, please empty your minds of all thoughts and preconceptions and prepare for a journey in spaced out time as you encounter the ?™ (or “Flange With No Name”)! As can easily happen with the Man With No Name, you may see fleeting images which will disappear as you turn your head. You may hear strange and distant calls. Is it just an illusion, or are they filtering through the parallax of your mind? You are aware of movement, but time seems to be standing still (ironic or what!).

The ?™ is packed with innovative concepts producing truly stunning spatial time-based effects. Take the best flanger you can imagine, add a decimal point, an extra dimension, and you might just begin to imagine the pristine burnished sounds that are delivered. The ?™ is the most highly evolved Lovetone pedal yet and spans the whole range from hypnotic chilled out subtlety to horrifying yet strangely comforting extremes. The unmistakable vintage fatness and smoothness of tone means that when the unit is going ape it sounds like crazed modular synthesis, and not like having your nails removed as is usual with this type of effect. And yes, we have designed it very much with ape-going in mind!”

Effects: Stereo Flanger/Phaser/Chorus, Tape Echo Simulator (using external delay), Vibrato/Tremolo, Spatial FX, Pseudo Ring Mod, Tuned Reverb FX, Rotary FX, Special Whirling Dervish Sound, Lo-Fi FX, Sub Aqua FX, Farmyard Sounds, Vocal Sounds, Unique Modular Synth-Type Sounds, Spaceships and Assorted Single-Engine Air Transport

Features:

- ❖ Stereo Outputs
- ❖ Wide Range Triangle/Square LFO
- ❖ CV/Pedal Input for Delay Time
- ❖ Gain Control
- ❖ FX Loop (make your digital delay sound like an echoplex!)
- ❖ Twin Mode Delay Mix
- ❖ Twin Mode Regen Control
- ❖ Gate/Sync Input
- ❖ Loop On/Off Footswitch
- ❖ 2 Bypass Footswitches
- ❖ Light Jack (can also be used on other Lovetone pedals instead of passive volume pedal!)

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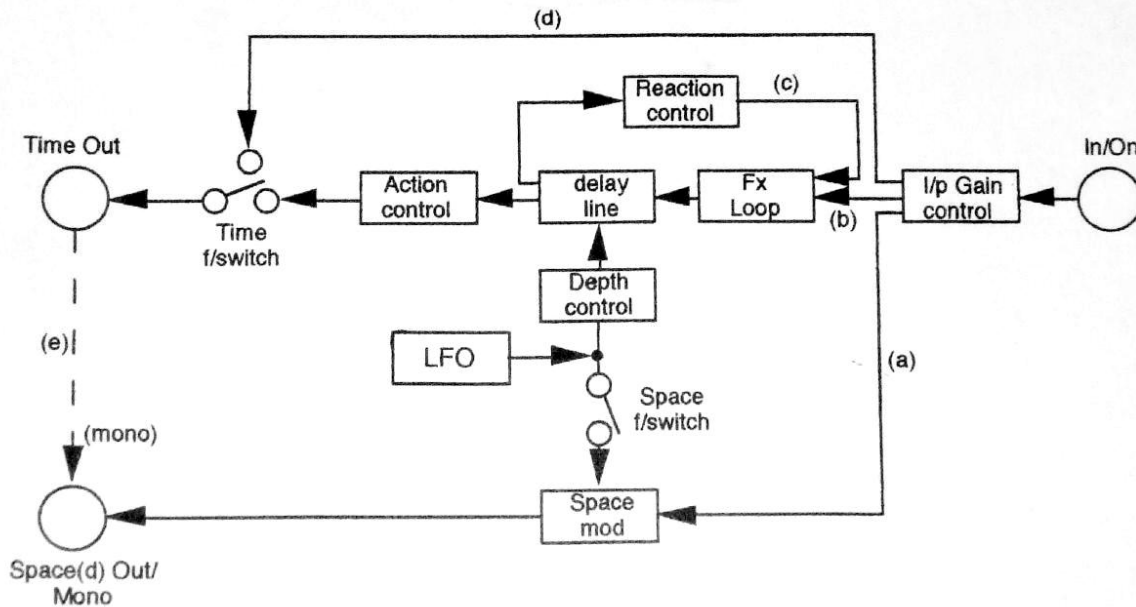
This is a clone of the famous Lovetone ?™ Flange. Every attempt has been made to reproduce the unique sounds of the original flanger. However, depending on parts selection ymmv.

I would like to thank the following individuals for their help with this project. Without their help, this project would not have been possible:

LaceSensor, buck007, Haberdasher, Shed\_FX, Govmnt\_Lucky, Toneman, digi2t, playon, alanp, and stephengiles.

The ?™ Flange With No Name® V1 Clone is a verified working unit using the parts listed in the BOM. 1% MF resistors may be used or 5% MF or CF are acceptable except where 1% MF are specifically noted in the BOM. Epcos and/or WIMA box caps were used except where electrolytics were specified. Box caps or tantalums may be used for the electrolytics, but may not fit the board due to the small lead spacing (1.5mm). Rotary switches are the enclosed plastic type and may be obtained through Smallbear or Mouser. Alpha or Lorlin enclosed plastic type rotary switches may also be used. DO NOT USE the open metal type switches. These switches will not work due to the pins being connected in a different sequence. The original circuit uses a TL074CN for the LFO. Socket this IC so that you can experiment with other quad op-amps if you like.

You should understand how the pedal operates prior to using the flanger clone.



## THEORY OF OPERATION

This is a very simplified (and not necessarily theoretically correct) description of the main functions in the pedal (please refer to block diagram above). **All** these points are covered in greater detail later in the manual but will be much easier to follow if you understand the diagram. The input signal level is adjusted by the I/p Gain control (which also affects the bypass level). It is then split into two main paths: (a) straight path which comes out at Space(d) Out/Mono (via Space mod - see below) and (b) delay path which goes via the FX Loop (normalized if nothing is connected) into the delay line. The (center-zero) Reaction control sets the level of Regen (or “regeneration/feedback”) which is fed back in before the FX loop. The FX loop is therefore included in the Regen path (c). The delay path then goes via the Time footswitch and out at Time Out at a level which is determined by the (center-zero) Action control. When the Time footswitch is “off” the delay path is bypassed completely and the output of the I/p Gain section goes straight to Time Out as shown by (d). The **LFO** can be used to modulate the delay time (at an amount set by the Depth control and/or the straight path) to create Space mod (at a fixed amount if selected by the Space footswitch). If nothing is connected to Time Out its output will automatically be routed to Space(d) Out/Mono as shown by (e) and summed with Space mod to create a mono output.

# Controls:

## Manual

Determines the off-set value of the delay time. Counter-clockwise settings produce phasing. Turning the control clockwise will produce flanging with regen (short to medium delay times), chorusing (medium to long delay times), and “cardboard tube” reverb and slap back echo are possible (at longer delay times). As expected, longer delay times will produce more hiss/noise.

## Depth

Determines the intensity of the LFO modulation for the delay time (the off-set value is set by the Manual control and/or the incoming CV/Pedal control)

## Rate

Adjusts the speed or rate of the LFO. The green and/or red LED will give a visual indication of the rate when used with the Time and/or Space function.

## I/P Gain

Provides the best headroom/noise compromise. For instruments (guitars, bass, etc.) control settings about half-way are ideal. Line level and high o/p instruments (synths, etc.) should be less than half-way settings. Turn control up toward max for microphones. Due to the delay path having less headroom than the dry signal (especially with regen), this control should be set so there will be no discrepancy between the delay and straight signal levels at the outputs. When this control is turned completely down there will be no signal from In/On to the outputs but signals from the FX loop will not be affected. **This control also affects the bypass level.**

## Reaction

Adds Regen to the delay path (via the FX loop). This is a Center-Zero control. When set at 12 o’clock, Regen is at zero. Clockwise settings produce even harmonics and counter-clockwise settings produce odd harmonics in increasing amounts of Regen. Settings past approximately 10 o’clock and 2 o’clock will produce self oscillation. The amount of Regen available is dependent on the operating voltage (9v or 12v. See calibration section), the setting of the Regen Bias trim pot and the length of delay time.

## **Action**

Sets the mix level of the delay path. This is **not** a blend control and has no effect on the dry signal. This is also a Center-Zero control. When set at 12 o'clock there will be minimum signal at Time Out (if you have no effect or little or no signal at Time Out, check the position of this control first). Moving the control in either direction will increase the level of the delay signal. Clockwise will produce an "in phase" or normal signal and counter-clockwise will produce an "out of phase" signal. A 1:1 balance of delay level with the "un-modulated" dry signal occurs just before the control reaches either extreme provided it has not gone into self oscillation. Note: When in stereo (listening to Time Out individually), the delay effect level is equivalent to the delay bypass level when the Action control is set to 9 o'clock or 3 o'clock. When set to the extremes there will be a drop in level when the delay path is bypassed. In stereo operation you can set the preferred balance and adjust amp/monitor volume accordingly.

## **LFO Selector Switch**

Sets the triangle/square waveform options for "Time" and "Space". Modulation depth is only adjustable for Time. Space is always at maximum. **WARNING:** Set the Depth control to less than the 12 o'clock position and turn the volume down on your amp/monitor **before** making other selections with this switch until you have determined the maximum levels of thumping from the square wave modulation of the Time delay. Changing this switch without turning your equipment levels down and decreasing the amount of Depth can cause a large and sudden increase in volume with substantial bass content which can cause permanent damage to your speakers.

## **Footswitches**

### **Loopage**

Turns the FX loop on/off for external effects. FX loop is engaged when the yellow LED is on.

### **Time**

Selects the delay path for time-based FX. The delay is active when the green LED is on. LED brightness shows length of delay time (bright = max delay, dim = min delay). If modulation is used, the LED will flash at the specified rate but never goes out completely (to indicate status during slow LFO rates). In bypass, Regen is not available (LED is off).

### **Space**

Selects "Space Mod" (which acts on the dry signal). Effect is active when the red LED is on (LED works similar to the Time LED, it does not go completely out). Tremolo and vibrato effects can be obtained as well as pseudo ring mod effects being possible with high LFO rates.

## **Mono/Stereo Switch**

Selects the phase of the Time Output (in bypass only) in order to obtain the strongest “bypass” signal (when Time and Space are both off). This switch has no effect when the delay path is on and works independently of the Action and Reaction controls (which do not work in bypass).

## **Mono Set-Ups**

When Space(d) out only is connected, switch should be set to mono for proper ‘in phase’ bypass sound.

## **Stereo Set-Ups**

When Space(d) out and Time out are both used, switch should normally be set to Stereo for proper “in phase” bypass. This is dependent on the phase relationship of whatever the pedal is connected to. If the two pieces of equipment are 180 degrees out of phase, select the mono setting for the best bypass signal. If you are not sure, try both mono and stereo and select the preferred/best setting.

## **Circuit Boards**

The main board measures 175mm x 90mm (approx. 6-29/32“ x 3-35/64”).

The daughter board measures 32mm x 82mm (approx. 3-1/4” x 1-1/4”).

# **! No Name Flange (Lovetone ?™ Flange With No Name V1 Clone) BOM**

## **Main Board:**

### **1%, 1/4w Resistors:**

<b>Value</b>	<b>Location</b>	<b>Qty.</b>
100R	R51, 72	2
3K9	R33	1
10K	R2, 6, 41, 55, 59, 62, 68, 77, 81	9
22K	R87	1
68K	R84, 86	2
100K	R13, 29, 36, 40, 56, 57, 60, 64, 65, 67	10
120K	R83	1
150K	R11	1

### **5%, 1/4w Resistors:**

<b>Value</b>	<b>Location</b>	<b>Qty.</b>
47R	R1, 78, 79	3
330R	R5, 10, 26, 32, 46, 80	6
1K	R9, 21, 25, 50, 52, 74, 75	7
2K2	R14, 15, 22, 37, 38, 49, 76	7
4K7	R4, 7, 31, 39, 43, 47, 54, 63	8
22K	R45, 70	2
39K	R24, 27, 28, 34, 42, 58, 66, 69, 71, 73, 82, 85	12
470K	R12, 16, 19, 30, 35, 53	6
1M2	R3, R23, 48, 61	4
2M2	R8, 17, 18, 44	4
Jumper	R20	1

### **Electrolytic, 35v Capacitors:**

<b>Value</b>	<b>Location</b>	<b>Qty.</b>
10uF	C4, 14, 15, 24, 26, 29	6
220uF	C1, 2	2

### Tantalum, 35v Capacitors:

Value	Location	Qty.
10uF	C6	1

### Box/Film, 63v Capacitors:

Value	Location	Qty.
1nF	C19	1
3n3	C18	1
10nF	C5, 25	2
47nF	C13, 23	2
100nF	C3, 7, 8, 9, 10, 11, 12, 16, 17, 20, 21, 22, 28*	13
470nF	C27	1

### Diodes:

Value	Location	Qty.
1N4002	D1	1
1N4148	D2, 3, 4	3

### Transistors:

Value	Location	Qty.
BC549C	Q1, 2, 4, 6, 8, 9, 11, 12, 13, 16, 17	11
BC307B	Q14	1
J113	Q3, 5, 7, 10, 15	5

### LED's, 5mm (Diffuse Color):

Value	Location	Qty.
Green	LED1, 2, 5, 6	4
Red	LED3	1
Yellow	LED4	1



### Pots, Trimmers:

Value	Location	Qty.
B100K*	VR1, 4, 5, 6 (Linear)	4
A100K*	VR2, VR3 (Log)	2
22K*	VR7 (Regen Bias)	1

### Op-Amp:

Value	Location	Qty.
TL074CN	IC1	1

### LDR's:

Value	Location	Qty.
10K/20M*	LDR1, 2, 3	3

### Transformer:

Value	Location	Qty.
OEP1200*	XFMR1	1

### Zero OHM Jumpers:

Value	Location	Qty.
Jumper	J1, 2, 3, 4 (wire jumpers may be used)	4

### Switches:

Value	Location	Qty.
3P4T Rotary	SW1	1
2PDT	SW2, 3, 5	3
SPDT Slide	SW4 (On/On Toggle may be used)	1

## Jacks:

Value	Location	Qty.	
Mono	FX Loop Send, Return, Space(d) Out/Mono	3	(Neutrik Switching)
Stereo	In/On, Trig/Gate, CV In/Pedal, Time Out	4	(Neutrik Switching)
9vdc	Power Jack	1	

## Ferrite Bead:

Value	Location	Qty.
Ferrite Bead*	Input Side of R2	1

## Daughter Board:

### 1%, 1/4w Resistors:

Value	Location	Qty.
330R	R2	1
4K7	R4	1
10K	R1, 7, 8	3
100K	R3, 5, 6	3
120K	R9	1

### Electrolytic, 35v Capacitors:

Value	Location	Qty.
10uF	C2, 5	2

### Box/Film, 63v Capacitors:

Value	Location	Qty.
2n2	C1, 6	2
100nF	C3, 4, 7	3

### Polystyrene, 160v, 2.5% Capacitors:

Value	Location	Qty.
100pF	C8	1

### Diodes:

Value	Location	Qty.
1N4148	D1, 2	2

### BBDs:

Value	Location	Qty.
MN3207*	IC1	1
MN3102*	IC2	1

### Trimmer Pot:

Value	Location	Qty.
22K*	VR1 (Bias Trim)	1

### LED's 5MM (Clear or Diffuse Color):

Value	Location	Qty.
Green	D1 (Fv 2.2v @ 20mA, 45mcd)	1

### LDR:

Value	Location	Qty.
10K/20M	LDR1	1

### Jumpers:

Value	Location	Qty.
Jumper	J1	1

**\* Notes:**

**C28**

Mouser.com 100n (0.1uF) WIMA Red cap. Part # 505-MKS02.1/63/10 Price \$0.45

**100K Pots**

AvnetExpress.Avnet.com	Bourns Linear Part# 91A1A-B24-B20L	Price \$2.82
MasterElectronics.com	Bourns Log Part# 91A1A-B24-D20L	Price \$3.30

**22K Trimmers (Main and Daughter Boards)**

Mouser.com	Piher	Part # 531-PT10V-22K	Price \$0.46
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**Alternate Trimmer**

Newark.com	TE Connectivity	Part # 16R3926	Price \$0.22
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**OEP1200 transformer**

HamRadioExpress.com	OEP1200	Part # 6K6CXFMR	Price \$3.95
Newark.com	OEP1200	Part # 86K9492	Price \$4.81 (plus \$20 freight charge once per order)
Farnell.com	OEP1200	Part # 1172348	Price £4.21

**BBDs**

Smallbear.com	Cool Audio V3102D	Part # 1914A	Price \$2.75
	Cool Audio V3207D	Part # 1915C	Price \$4.25
	Shanghai Beling BL3102	Part # 1900	Price \$2.75
	Shanghai Beling BL3207	Part # 1901	Price \$4.25

**Ferrite Bead**

DoctorTweek.com	Ferrite Bead	Part # 382	Price £0.11
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**LED1, 2, 3 (Main Board), LED1 (Daughter Board)**

Smallbear.com	Diffuse Green	Part # 2300	Price \$0.25
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**Note: Pricing is subject to change and may be different from prices listed above.**

## LDR Substitution Notes:

If you wish to substitute the LDR/LED combos, a VTL5C3 Vactrol works well. If using vactrols, omit LDR1, LDR2, LDR3, LED1, LED2 and LED5, Daughter Board – LDR1 and LED1.

## Jacks:

Instead of using Neutrik insulated jacks, standard\* 1/4 “ jacks may be used. Use these types of jacks:

Type	Qty.	Notes
Mono (non-switching)	2	Send, Space(d) Out/Mono
Stereo (non-switching)	1	CV In/Pedal
Mono (switching)	2	In/Out, Return
Stereo (switching)	1	Trig/Gate
Stereo (switching)	1	Time Out (*jack is isolated from enclosure GND)

## Mods:

If you do not want the FX loop, leave these jacks off. Omit SW2, LED4 (yellow LED), and make a connection from “1” or “1” “ to “6” on the daughter board.

If the Trig/Gate function is not needed, omit the jack and ground “M” on the main board or you might try omitting the jack, R55, R56, R57, R58, C25, D2, and Q13. I have not tried this, ymmv!

If CV In/Pedal is not needed, omit the jack, R81, and R82.

It is highly recommended that you use shielded cable for the connections from the input to the board, output from the daughter board to the main board, and from “C” and “U” on main board to the Time switch (SW5) to reduce noise and hum.

## Note on slide switch:

If using an on/on toggle switch for the Mono/Stereo switch, you may want to use a “short lever” type of switch (Smallbear SKU: 0220N (DPDT) or SKU: 0218B (SPDT)). Also, switch the two outer connections on the slide switch for use with the toggle so that the Mono/Stereo functions correctly.

## Other Info:

The ferrite bead is not necessary unless you are concerned about RFI interference.

## Bias Trim Calibration (Daughter Board)

**WARNING:** Set the Depth control to less than the 12 o'clock position and turn the volume down on your amp/monitor **before** making adjustments until you have determined the maximum levels of thumping from the Time delay. Making adjustments without turning your equipment levels down and decreasing the amount of Depth can cause a large and sudden increase in volume with substantial bass content which can cause permanent damage to your speakers.

A well regulated bench power supply is recommended for calibrating the Bias Trim and Regen Bias. Turn these trimmers **slowly** while making adjustments. Small adjustments can make a huge difference in sound/ticking. Adjustments **must** be made in a dimly lit room.

Initial settings:

- 1) Set voltage on power supply to 12vdc
- 2) Set Bias Trim on Daughter Board and Regen Bias on Main Board to their mid-way points
- 3) Set controls and switches as follows:
  - a) Manual, Depth, Rate, I/P Gain, and Action fully Clockwise
  - b) Reaction at 12 O'clock
  - c) LFO Mode fully Counter-Clockwise (pointing to the upper most triangle wave)
  - d) Loopage may be either off or on, doesn't matter (nothing connected to FX loop)
  - e) "Time" footswitch on (Green LED on)
  - f) "Stereo/Mono" switch set to Mono
  - g) "Space" footswitch off (Red LED off)
  - h) Connect a varying 1kHz signal or guitar to input of pedal (guitar works best)
  - i) Connect pedal output to amp
- 4) Turn amp on and adjust volume so you can hear the signal while making adjustments

You should hear a 60Hz hum and possibly static type sounds. From the top of the Daughter Board, turn Bias Trim clockwise (slowly) until you have the least amount of static sound/distortion. If the 60Hz hum sound turns into a clock ticking sound, turn the Bias Trim counter-clockwise (slowly) just until the ticking stops and you hear the 60Hz hum sound again.

Slowly turn the Rate pot counter-clockwise and listen for clock ticking. Now, set the Manual pot to 12 O'clock and slowly adjust the Rate pot from one extreme to the other. If ticking is heard, slowly adjust Bias Trim counter-clockwise just until it stops and check for ticking again by repeating the steps above.

Finally, set the power supply to between 9.5vdc and 9.6vdc. Check range of Rate and Manual pots for ticking. There should be no ticking, if there is adjust Bias Trim counter-clockwise until ticking just stops. No further adjustment should be needed.

If you have a scope and/or audio probe, follow the same procedure as outlined above except do not connect the pedal to your amp. Use the audio probe on pin 7 of IC1 on the Daughter Board if calibrating by ear or use a scope on pin 7 of IC1 and apply a 200Hz sine wave signal at about 1vpp and adjust the Bias Trim for the least amount of distortion. After calibration, connect to your amp and check for clock ticking.

## Regen Bias Calibration (Main Board)

**Warning:** Turn volume levels down on you amp to reduce the chances of damage to your speakers. Adjust volume for a comfortable listening level while making Regen Bias adjustments as the oscillation can get quite loud.

A well regulated bench power supply is recommended for calibrating the Bias Trim and Regen Bias. Turn these trimmers **slowly** while making adjustments. Small adjustments can make a huge difference in sound/oscillation. Adjustments **must** be made in a dimly lit room.

Self oscillation changes depending on operating voltage of the pedal. For this reason, you need to select an operating voltage, either 9vdc or 12vdc on your power supply. For this example, 9.6vdc (approximate 9v battery voltage) will be used.

Initial settings:

- 1) Select your operating voltage, 9vdc or 12vdc (this example will use 9.6vdc)
- 2) Regen Bias should be at the midway point from the Bias Trim Cal. step, if not, set it now
- 3) Set all controls as they were set for Bias Trim calibration except Depth and Reaction pots
- 4) Set Depth pot fully counter-clockwise and Reaction pot fully clockwise
- 5) Adjust volume of amp till you hear the guitar when strummed (comfortable listening level with no distortion)

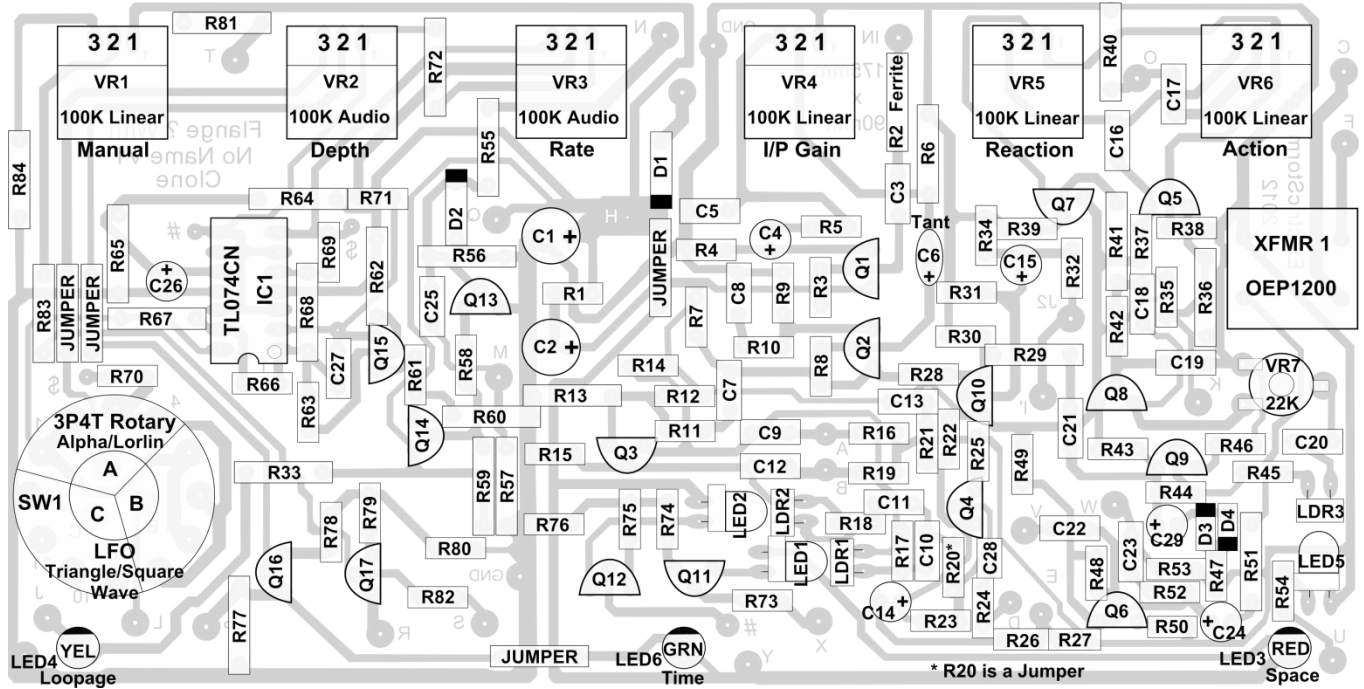
From the top of main board, slowly turn Regen Bias while strumming the “high E” string on your guitar. Stop turning the Regen Bias when you can hear a sort of quick echo (it may reverberate a little). Without strumming the guitar (no signal), you should hear a faint reverberating buzzing or whine type of sound. Turn the Reaction pot to 9 O’clock, then slowly toward 8’Oclock. As you approach 8:30, you should start to hear self-oscillation.

Set Reaction pot to 12 O’clock. Now turn the Action pot fully counter-clockwise. Turn the Reaction pot to 9 O’clock, then slowly toward 8 O’clock and then turn to 3 O’clock, then slowly proceed to 4 O’clock. Self-oscillation should begin between the 9 O’clock & 8:30 and 3 O’clock & 3:30 positions.

To go from 9vdc to 12vdc or 12vdc to 9vdc operation, follow the same procedure as outlined above except the board will now be mounted and (assuming you drilled the hole for the trimmer adjustment) you will make the adjustments in the opposite direction of those given above (clockwise is now counter-clockwise and vice-versa). **Do not adjust Bias Trim on Daughter Board.** Bias Trim does not need to be adjusted again when changing operating voltages, only the Regen Bias needs to be re-calibrated. **DO NOT EXCEED 12vdc supply voltage or you will permanently damage the pedal.**

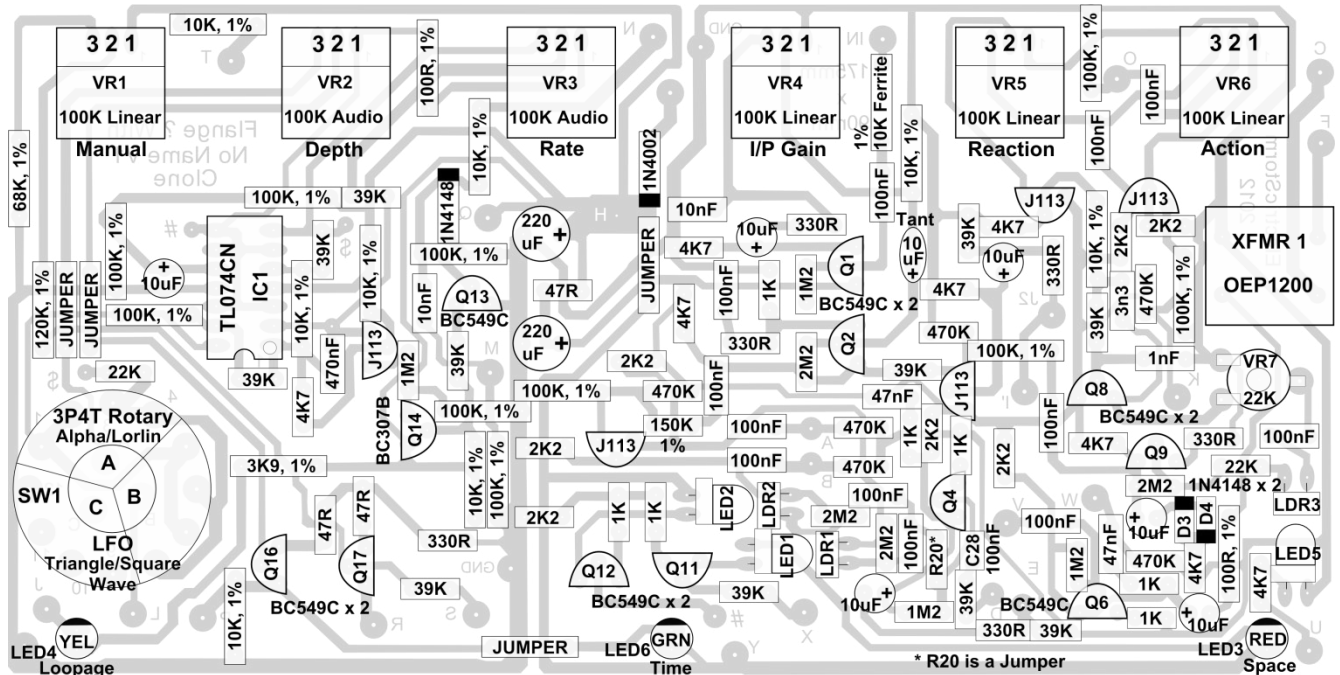


## Main Board Parts Placement



Ferrite bead on input side of R2 (10K) between VR4 and VR5.

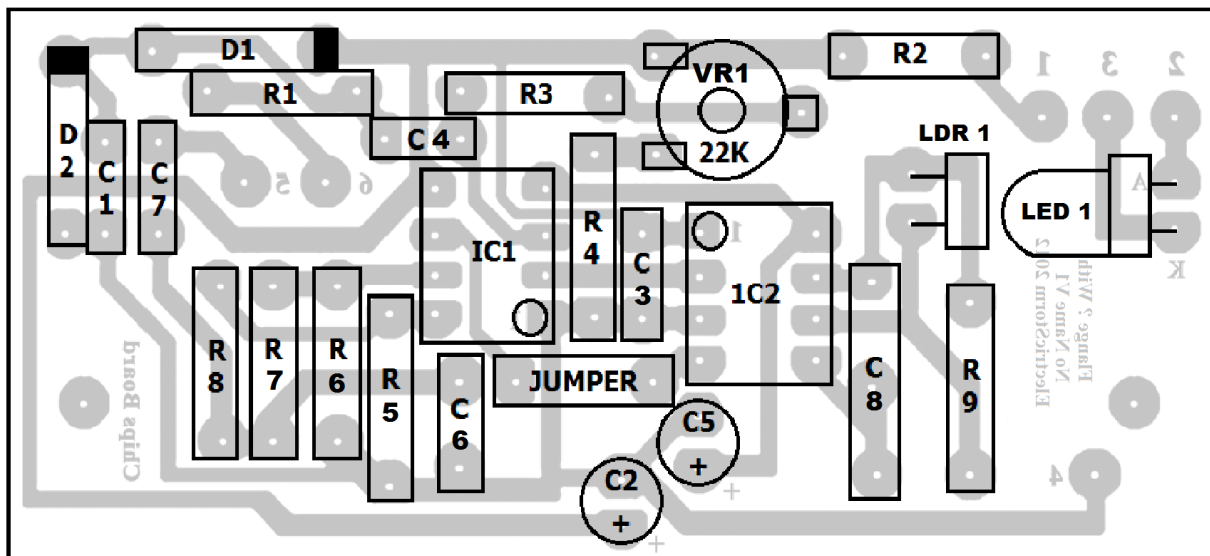
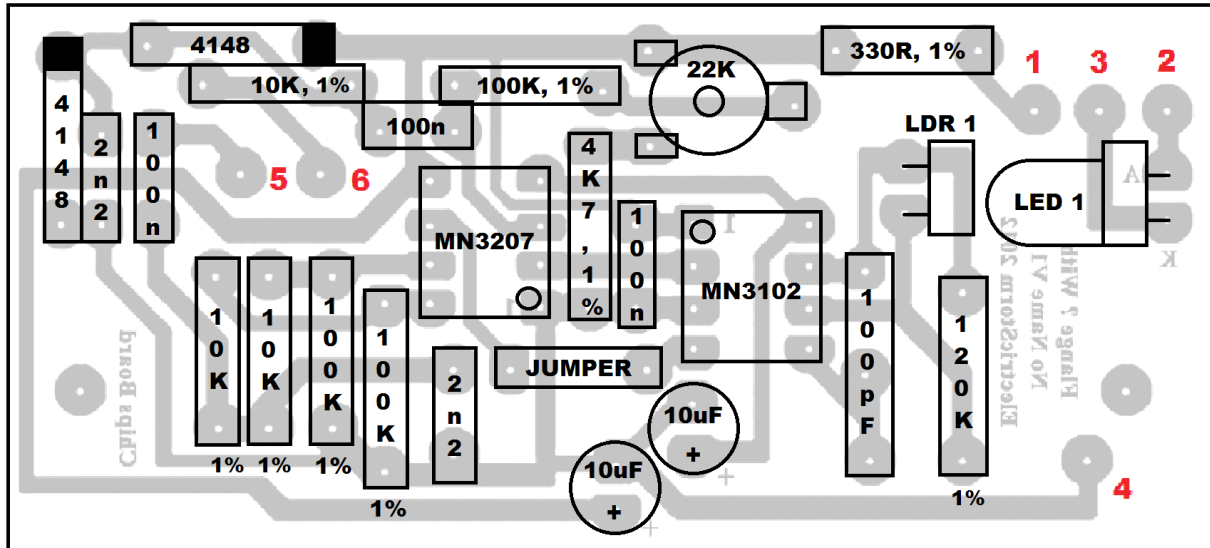
## Main Board Parts Values



Ferrite bead on input side of R2 (10K) between VR4 and VR5.

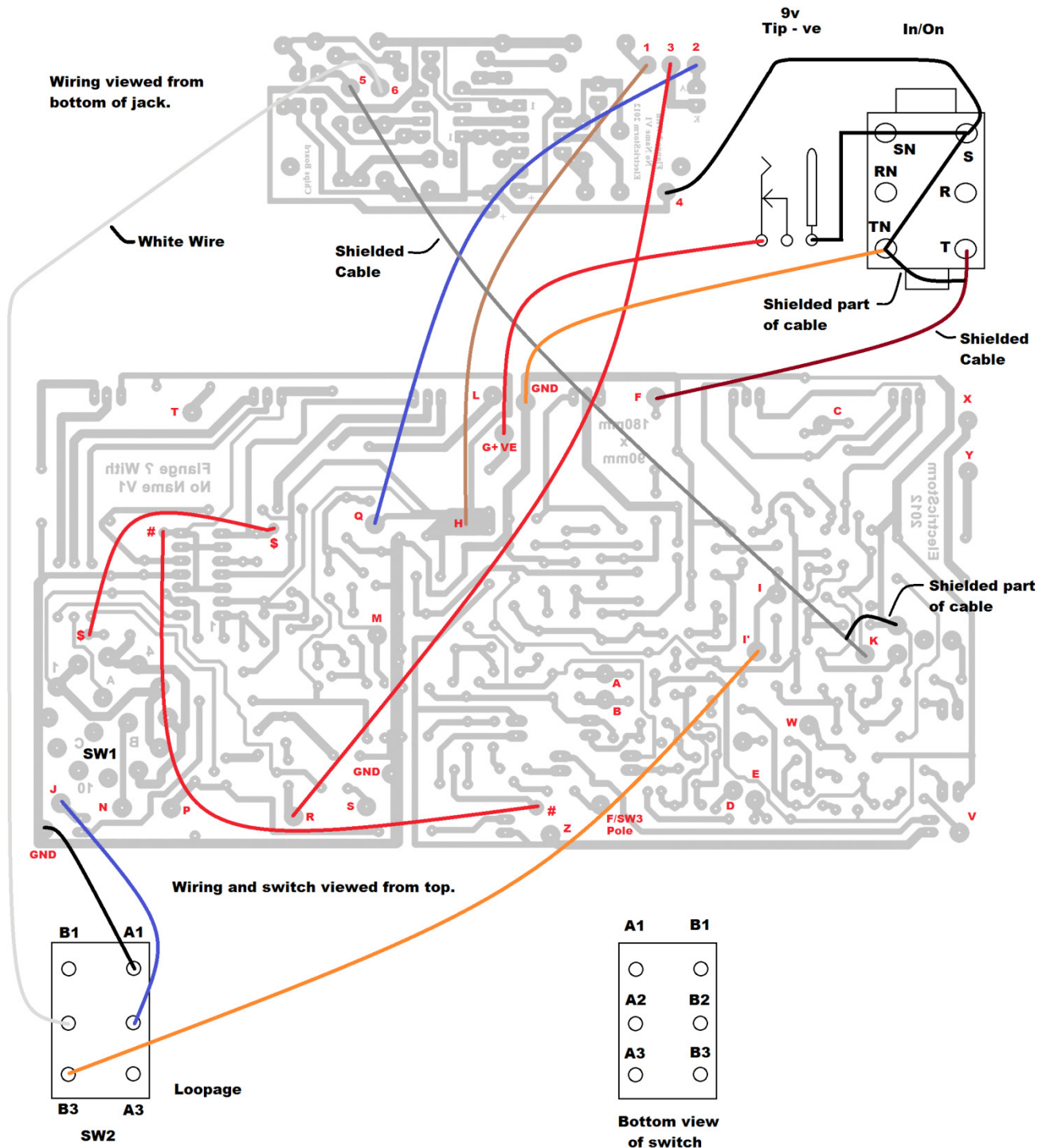


## Daughter Board Parts Values and Placement

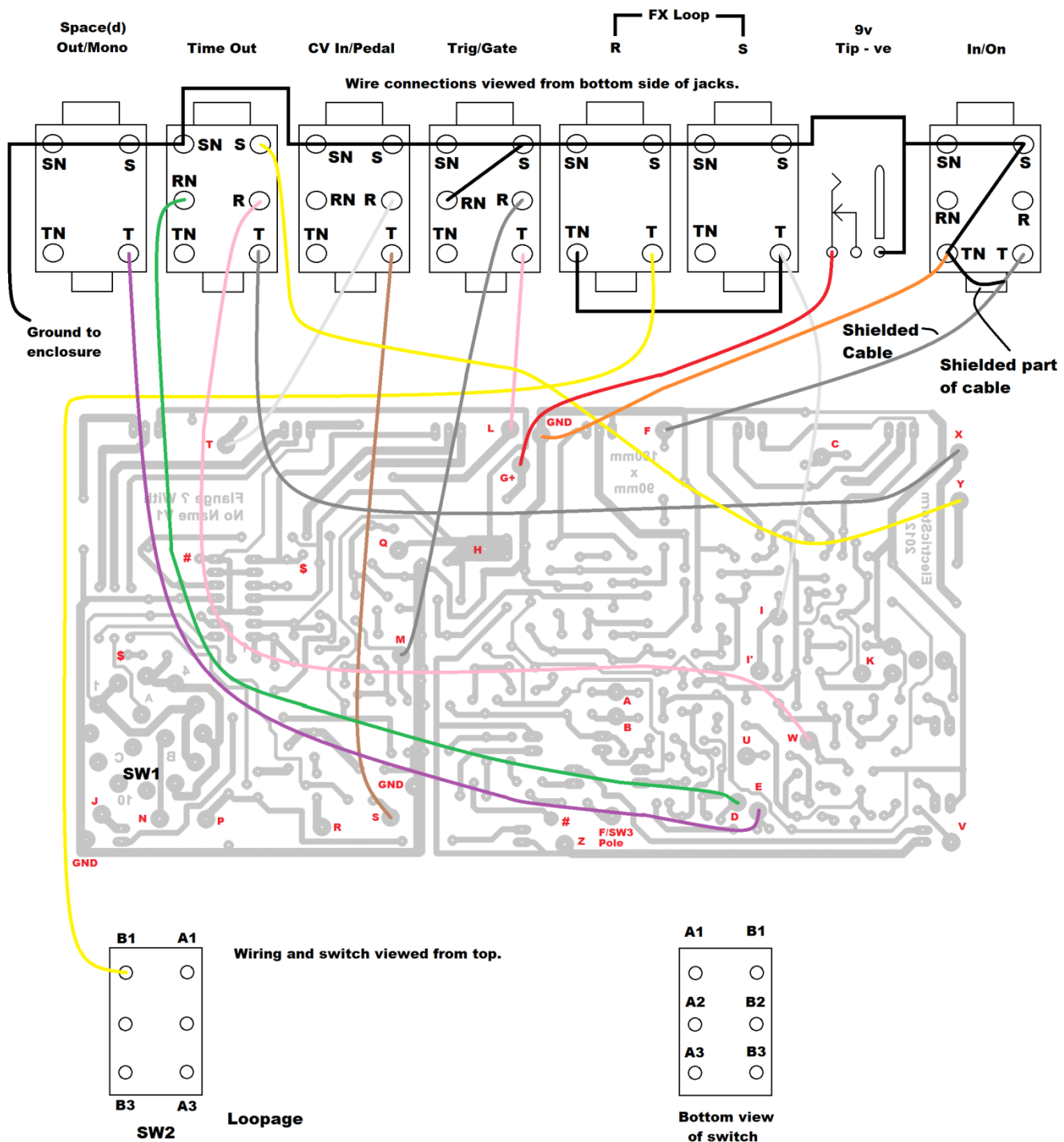


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# Main/Daughter Board Wiring

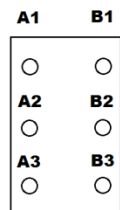
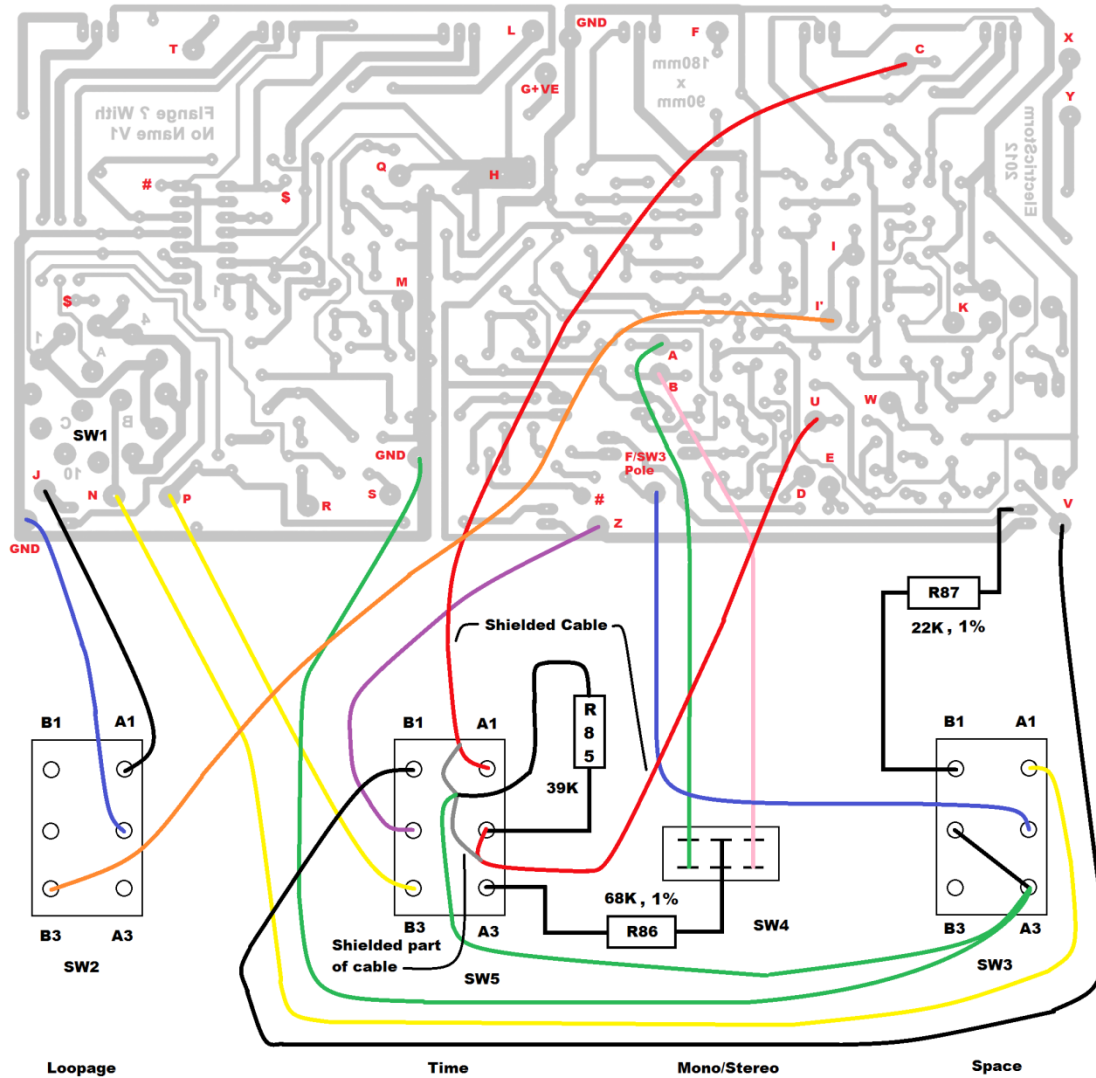


# Main Board/Jack Wiring



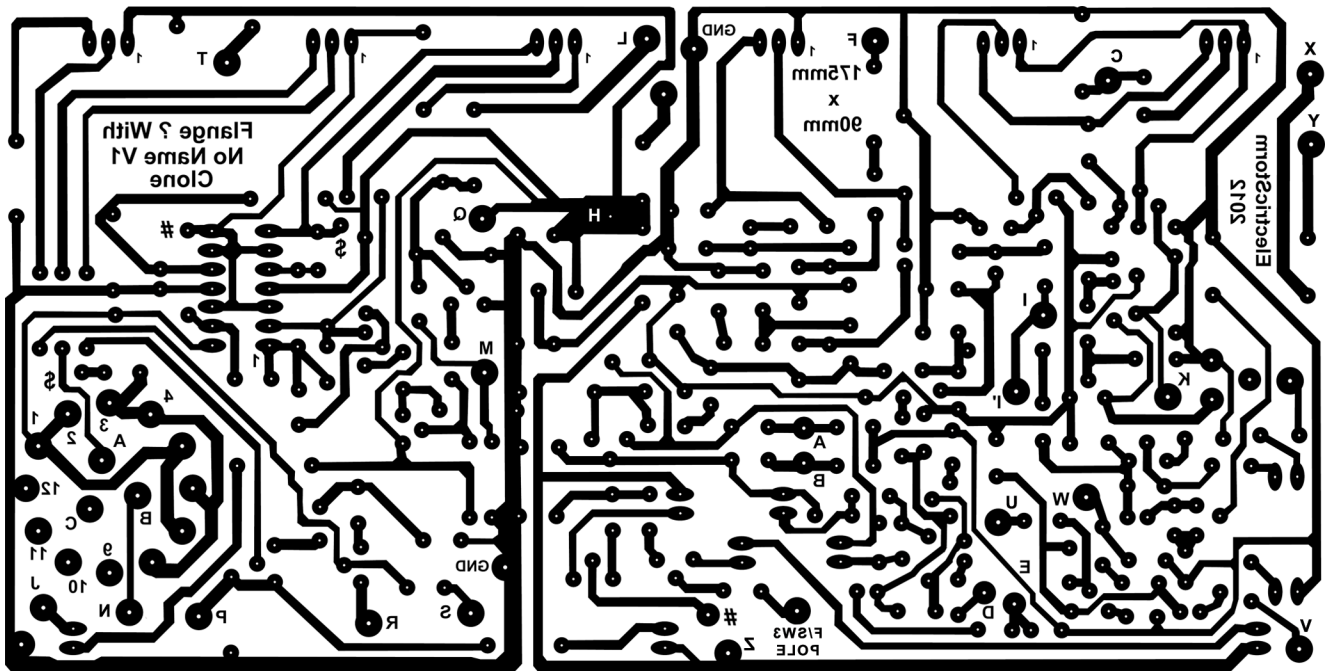
# Main Board/Switch Wiring

Wiring and switches viewed from top.

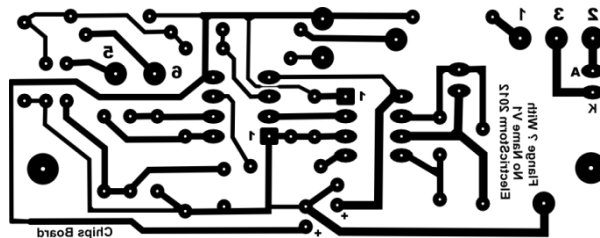


Bottom view of switch

# Etching Templates



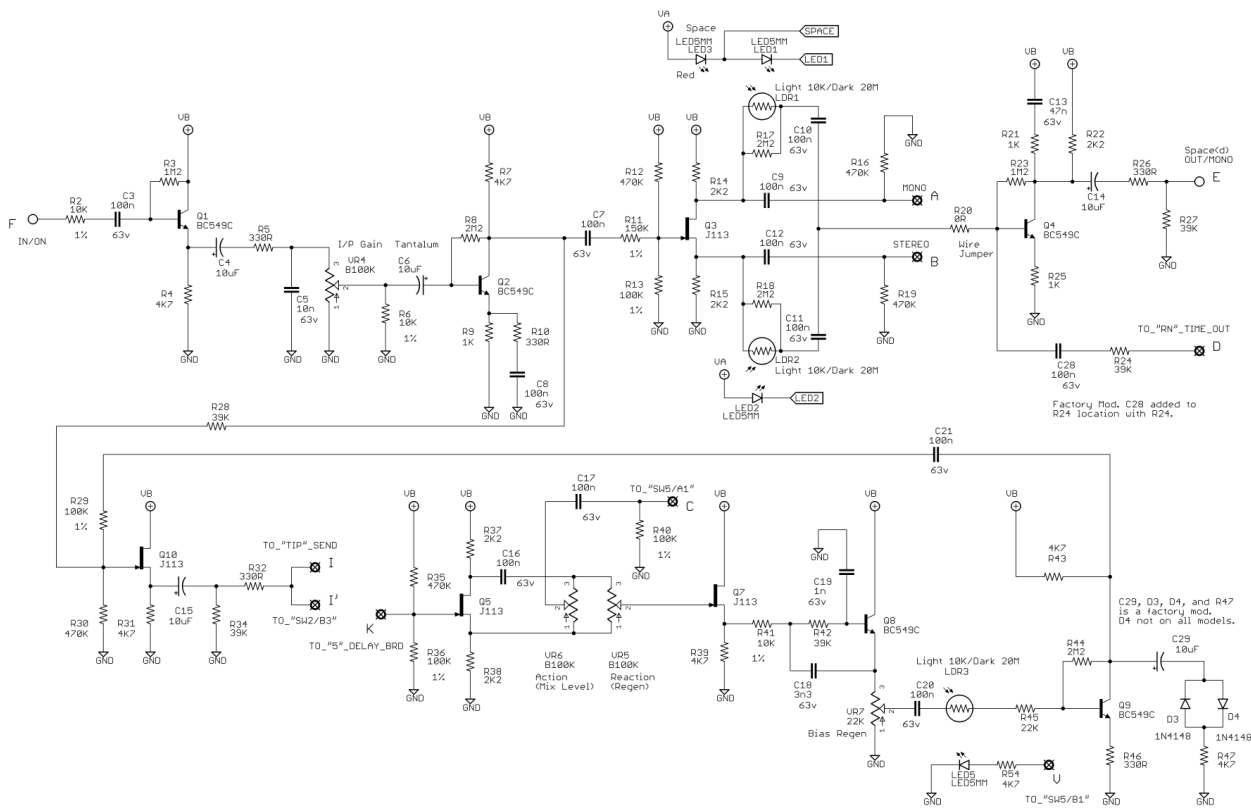
Main Board



Daughter Board

Do not resize or use print scaling when printing these PNP templates. If you resize them, they will not be the correct size for etching.

## Main Board Schematic (1)



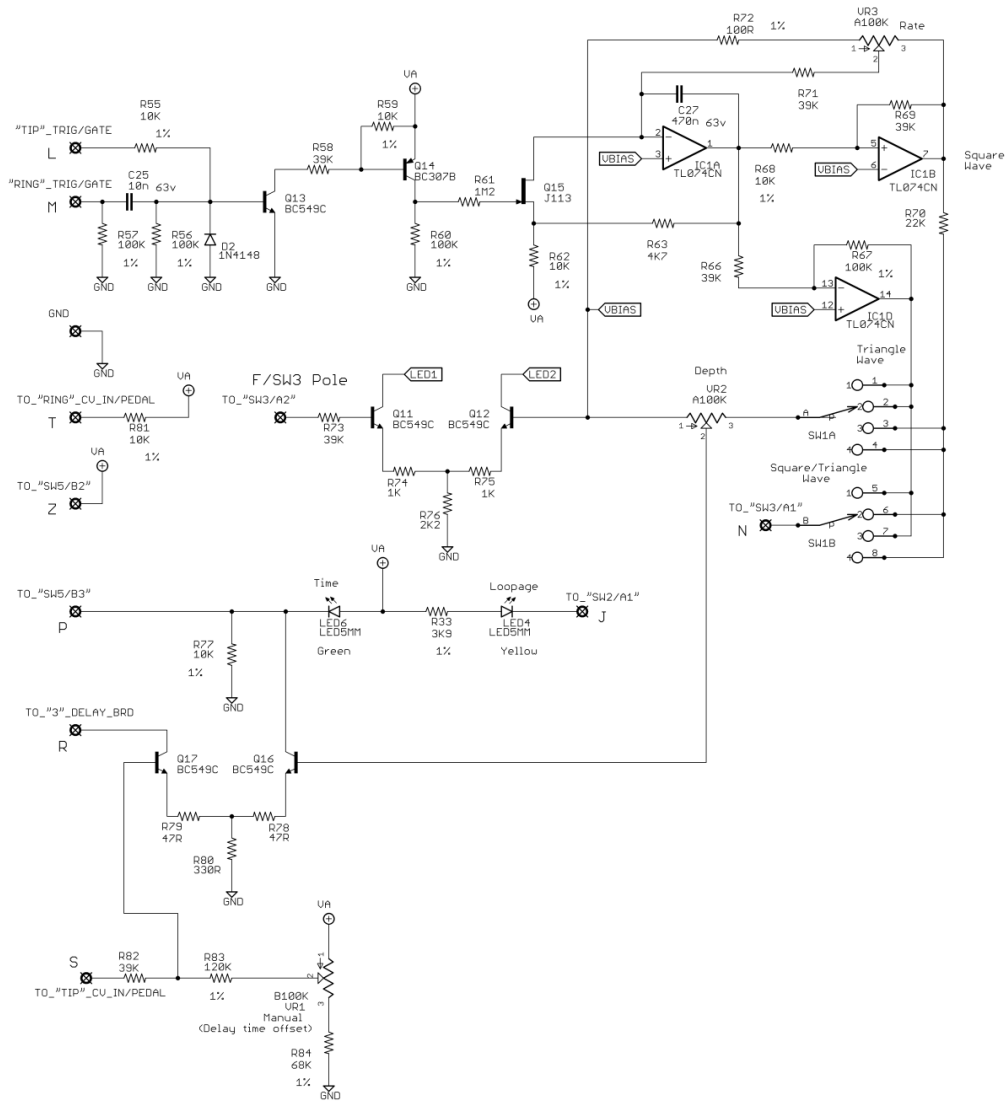
Notes:

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All resistors 1/4 watt, 5% unless otherwise noted  
 All capacitors are +/-10%, 35V unless otherwise noted  
 LDR's are Light 10K +/- 20K/DAI 20M  
 U1, U5, C3 Vactrols also work well  
 U2 is a uPC 4017  
 D4 is not on all versions  
 Voltages given with power supply set @ 3.6vdc

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# Main Board Schematic (2)



## Notes:

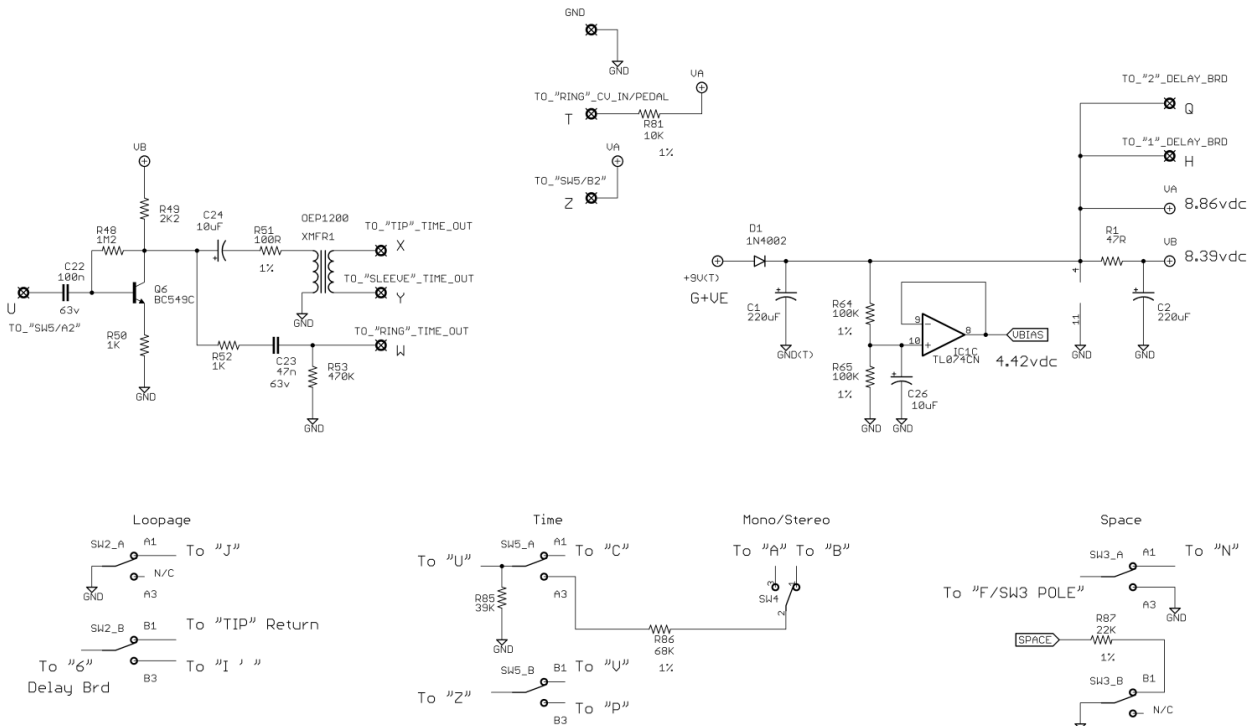
All resistors 1/4 watt, 5% unless otherwise noted  
 All capacitors are +/-10%, 35v unless otherwise noted  
 LDR's are Light 10K ~ 20K/Dark 20M  
 UTLS5C3 Vactrols also work well  
 R29 is a wire jumper  
 D4 is not on all versions  
 Voltages given with power supply set @ 9.6vdc

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# Main Board Schematic (3)



## Notes:

All resistors 1/4 watt, 5% unless otherwise noted  
 All capacitors are +/-10%, 35v unless otherwise noted  
 LDR's are Light 10K ~ 20K/Dark 20M  
 UT15C3 Vactrols also work well  
 R20 is a wire jumper  
 D1 is not on all versions  
 Voltages given with power supply set @ 9.6vdc

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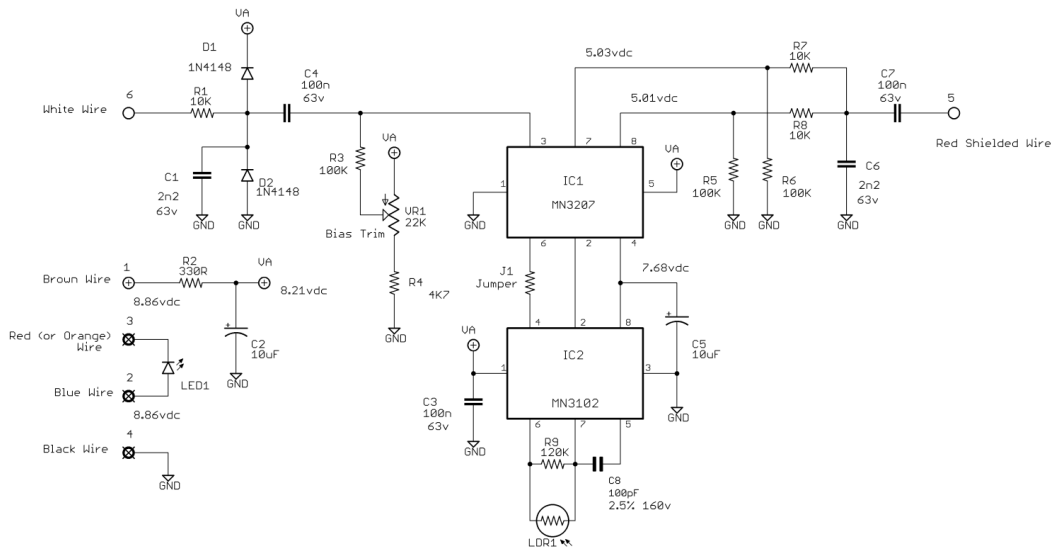
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## Daughter Board (Delay Board)











Notes:

All resistors are 1/4 watt, 1% unless otherwise noted.  
All capacitors are +/-10%, 35v unless otherwise noted.  
Any voltages given are with power supply @ 9.6vdc

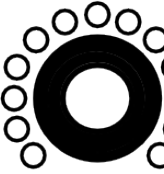
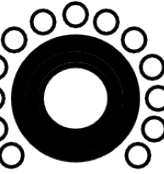
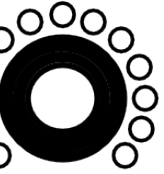
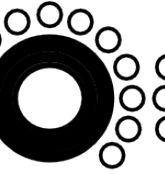
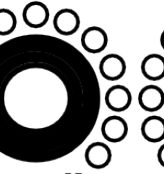
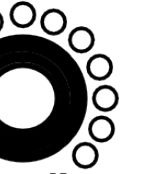
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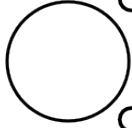


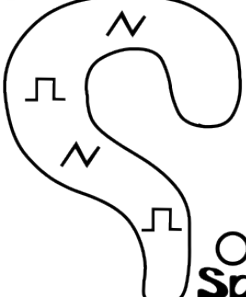
# Settings Sheet

							
Space(d) Out/Mono	Time Out	CV In/ Pedal	Trig/ Gate	R- FX Loop	S -S	9v tip - ve	In/On

					
Manual	Depth	Rate	I/P Gain	Yin Reaction	Yang Action

LFO

Loopage

with

NO NAME™

Time

Space

Mono ■ Stereo

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Make copies of the settings sheet and enlarge/reduce as needed to keep track of your settings.

# 1550G

## Drill Template

Template is approximate.  
Double check before  
drilling enclosure.

