DC-ECHO

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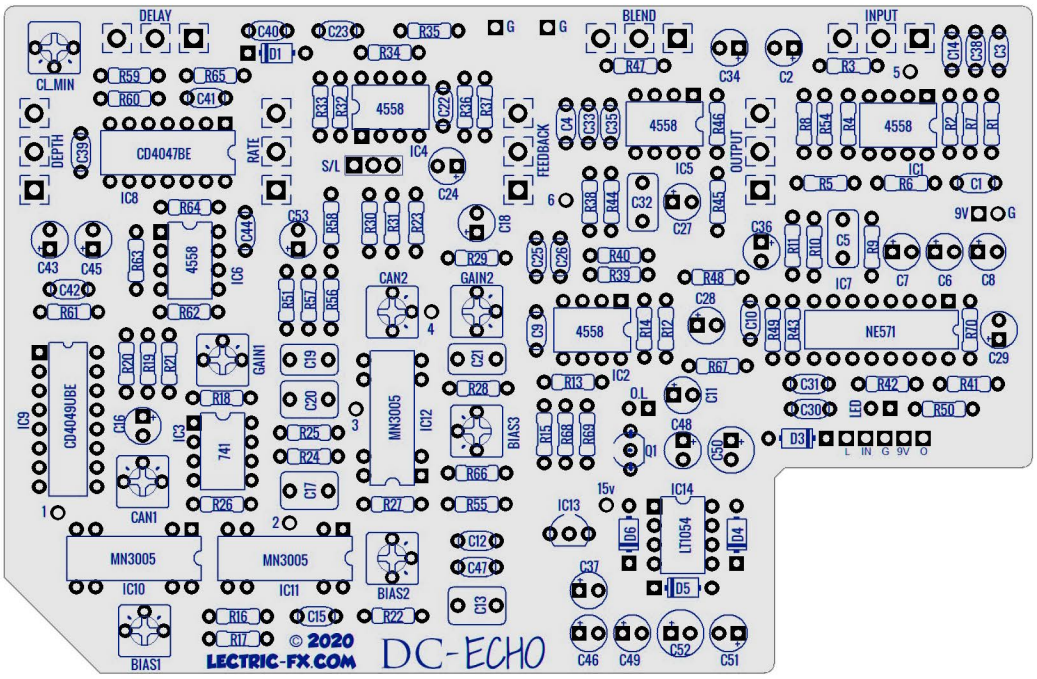


The Electro-Harmonix ™ Echo 600 was released in approximately 1981 at the beginning of EHX's financial, union, & MN3005 supply woes, followed by their eventual bankruptcy. As such, it had a very short life cycle and few original units seem to circulate today. It's original price tag ($339, nearly $1000 with inflation vs the Deluxe Memory Man's™ $219) may also be a reason behind this.

The circuit seems to have been designed from the standpoint of getting the absolute best performance from the MN3005 BBD chips in terms of functionality (offering control over every parameter compared to the Deluxe Memory Man's ™ limited feature set), fidelity and noise. Released just before the 2 & 16 second digital delay, it may have been an attempt to offer a budget alternative when digital delay was just starting to take off in the consumer market, but still carried a hefty price tag.

Thankfully, we were given the chance to study an original unit, and this leads us to the Lectric-FX DC-Echo, a faithful reproduction of this extremely rare unit.

So what does it sound like? In short, imagine a cleaner, brighter and quieter version of the Deluxe Memory Man ™ that retains its legendary BBD chip warmth , then adds some handy extra features and additional delay time.

WARNING: This is an extremely complex build, do not attempt this as a first analogue delay effect and be confident of your soldering skills, biasing game and debugging abilities before attempting it. Even veteran builders should be sure to read this document thoroughly and double check all errata before continuing.

Attention: If you purchased a 1st run DC-ECHO PCB (identified by the lack of a version number) this will require the Input, Output & Delay pots to be wired in reverse for normal operation.
*Additionally, test points 5 & 6 on this circuit board version should be ignored, when following the biasing procedure, this now refers to IC7 (NE571) pin 7 (test point 5) & 15 (test point 6).

This has been corrected on all version numbered circuit boards and can be ignored. Apologies for any inconvenience.

Controls:
Input- Controls guitar/instrument level. Best set to just before the point of clipping with normal playing.
Output- Controls the circuit output level. This is used to match the effect level to bypass.
Blend- Blends the output signal between no effect (100% dry) to delay only (100% wet).
Feedback- Controls the number of repeats.
Rate- Controls the speed of the modulation from slow chorus to fast vibrato.
Depth- Controls depth of the modulation.
Delay- Adjusts the delay time of the effect from approximately 20mS (short mode) to 600mS (long mode).
Short/Long Switch- Selects between 1 (slap back delays up to 200mS) or all 3 MN3005 being active in circuit.

Biasing Procedure (No Scope):

Before you begin, you will need a signal source to input to the pedal (guitar, looper, cd player etc.) an audio probe and a frequency counter (scope or multimeter).
You may find that using headphones instead of listening through a speaker cabinet will help with the procedure (although please be wary of levels in case of run away oscillation).

Control Settings:
Input - Insert your signal source to the effect and adjust this control until overload LED is dimly on. With a varying signal level such as a guitar there will be some flicker.
Output - 50%
Blend - CW
Feedback - CCW
Rate - CCW
Depth - CCW
Delay - CW
Short/Long - Short Position

You should begin by setting all trimmers to their halfway points.

Power on the unit and using your frequency counter, probe Test Point 1 and adjust the CL-Min trimmer until you read a frequency of 10kHz.
Set your multimeter aside.

Now, set Delay - CCW and with your input signal connected, audio probe Test Point 2 and adjust BIAS1 for the least amount of clipping/cleanest signal (You may need to reduce the input level if you cannot set this clean or increase it if you cannot hear the optimal bias point).

After adjusting BIAS1, move on to adjusting GAIN1 to achieve an equal signal level at Test Points 5 & 6. *

You should now switch the toggle to the Long setting and audio probe Test Point 3.

Adjust BIAS 2 for the least amount of clipping/cleanest signal and then move on to Test Point 4 and adjust BIAS3. Again, for the least amount of clipping/cleanest signal.

Once you have finished with BIAS 2 & 3, move on to GAIN 2 and once again adjust for equal signal level at Test Points 5 & 6*.

After completion of the BIAS & GAIN trimmer settings, you should now set the Delay Control CW and disconnect your input signal source.

Audio probe Test Point 2, you should hear a steady 10kHz tone. Adjust the CAN1 Trim until this tone is at its quietest point (there should be a small range of the trimmer where it is quieter and within this range you will have to very gently adjust for the optimal setting, preferably where it completely disappears although if complete silence is achievable will vary with set up).

Move your Audio Probe on to Test Point 4 and adjust the CAN2 Trim, repeating the same procedure as with CAN1.

Finally, it's time to test the pedal is functioning correctly. Set Delay CCW, plug in your guitar (or other instrument) and adjust the input level to the point before normal playing produces clipping and the output level to match your bypass signal. Check that you have equal signal level at both extremes (CW & CCW) of the blend pot in both short and long delay modes and that all other controls are working as expected.
You have now completed the biasing procedure.

* See 'Attention' Section.

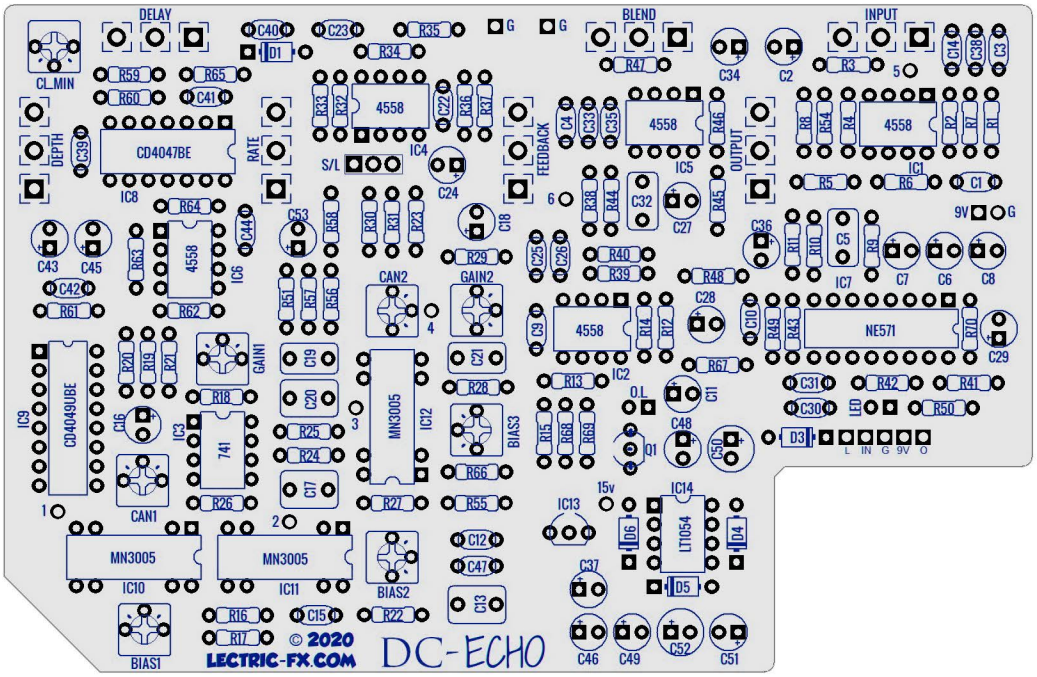
Be advised: For this one project we will not be providing a schematic, and ask that you please understand and respect this, as we have to respect our collaborator's wishes to continue bringing out the projects that no one else offers.

If you get stuck, please post over at the LECTRIC-FX subforum on madbeanpedals.com/forum and one of our team will get to you.

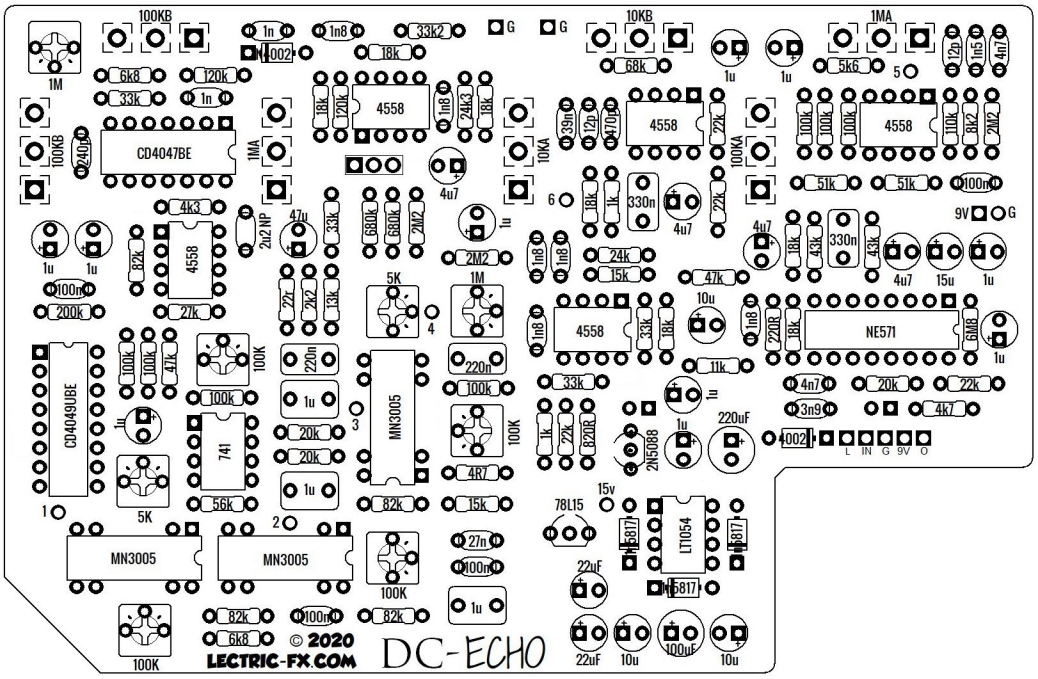
For troubleshooting purposes, this is your Wet Signal Audio Probing Flow (in Long Mode): IC1 Pin 1 - IC1 Pin 7 - IC7 Pin 7 - IC2 Pin 7 - TP2 (IC10) - IC3 Pin 6 - TP3 (IC11) - TP4 (IC12) - IC2 Pin 1 - IC4 Pin 7 - IC4 Pin 1 - IC7 Pin 10 - IC5 Pin 7

I had to go through this procedure a handful of times before I achieved satisfactory results, so be warned it's a tricky go. Remember that you are setting the bias and levels of 3 series MN3005 here so poor biasing, especially at the start of the procedure, will accumulate and magnify problems at the end in 'long' mode. Listen carefully, take your time and don't be afraid to step away.

Part Numbers



Values



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Complete BOM:

Resistors	Values
R1	2M2
R2	110k
R3	5k6
R4	100k
R5	51k
R6	51k
R7	8k2
R8	100k
R9	43k
R10	43k
R11	18k
R12	18k
R13	33k
R14	33k
R15	1k
R16	82k
R17	6k8
R18	100k
R19	100k
R20	100k
R21	47k
R22	82k
R23	2M2
R24	20k
R25	20k
R26	56k
R27	82k
R28	100k
R29	2M2
R30	680k
R31	680k
R32	120k
R33	18k
R34	18k
R35	33k2
R36	24k3
R37	18k
R38	18k
R39	15k
R40	24k
R41	22k
R42	20k
R43	18k
R44	1k
R45	22k
R46	22k
R47	68k
R48	47k
R49	220R
R50	4k7
R51	22r
R54	100k
R55	15k

Resistors	Values
R56	13k
R57	2k2
R58	33k
R59	6k8
R60	33k
R61	200k
R62	27k
R63	82k
R64	4k3
R65	120k
R66	4R7
R67	11k
R68	22k
R69	820R
R70	6M8

← CLR for LED

Caps	Values
C1	100n
C2	1u
C3	4n7
C4	39n
C5	330n
C6	15u
C7	4u7
C8	1u
C9	1n8
C10	1n8
C11	1u
C12	27n
C13	1u NP
C14	12p
C15	100n
C16	1u
C17	1u NP
C18	1u
C19	220n
C20	1u NP
C21	220n
C22	1n8
C23	1n8
C24	4u7
C25	1n8
C26	1n8
C27	4u7
C28	10u
C29	1u
C30	3n9
C31	4n7
C32	330n
C33	120n
C34	1u
C35	470p
C36	4u7
C37	22uF
C38	1n5
C39	240p
C40	1n
C41	1n
C42	100n
C43	1u
C44	2u2 NP
C45	1u
C46	22uF
C47	100n
C48	1u
C49	10u
C50	220uF
C51	10u
C52	100uF
C53	47u

Diodes	Values
D1	1n4001
D3	1n4002
D4	1n5817
D5	1n5817
D6	1n5817

O.L. LED	*
LED	Preference

ICs	Values
IC1	NJM4558
IC2	NJM4558
IC3	LM741
IC4	NJM4558
IC5	NJM4558
IC6	NJM4558
IC7	NE571
IC8	CD4047BE
IC9	CD4049UBE
IC10	MN3005
IC11	MN3005
IC12	MN3005
IC13	LM78L15
IC14	LT1054

Transistors	Values
Q1	2N5088

Switches	Values
SW1 Toggle	SPDT

Trimmers	3362 Type
GAIN1	100K
GAIN2	1M
BIAS1	100K
BIAS2	100K
BIAS3	100K
CAN1	5K
CAN2	5K
CL_MIN	1M

Pots	PC Mount
BLEND	10KB
DELAY	100KB
DEPTH	100KB
FEEDBACK	10KA
RATE	1MA
INPUT	1MA
OUTPUT	250KA

* This LED should preferably have fV between 1.8 - 2.1V

Quantity	Value	Quantity	Value	Quantity	Value
1	4R7	2	51k	1	12p
1	22R	1	56k	1	240p
1	220R	1	68k	1	470p
1	820R	4	82k	2	1n
2	1k	7	100k	1	1n5
1	2k2	1	110k	6	1n8
1	4k3	2	120k	1	3n9
1	4k7	1	200k	2	4n7
1	5k6	2	680k	1	27n
2	6k8	3	2M2	1	39n
1	8k2	1	6M8	4	100n
1	11k			1	120n
1	13k			2	220n
2	15k			2	330n
7	18k			3	1u NP
3	20k			10	1u
4	22k			1	2u2 NP
1	24k			4	4u7
1	24k3			3	10u
1	27k			1	15u
4	33k			2	22u
1	33k2			1	47u
2	43k			1	100u
2	47k			1	220u

Voltages:

PSU reading=9.25V, 15V test point=15.13V. All knobs at noon.

IC1

Pin #	V
1	7.58
2	7.6
3	7.58
4	0
5	7.58
6	7.58
7	7.58
8	15.13

IC2

Pin #	V
1	7.58
2	7.58
3	7.56
4	0
5	6.89
6	6.91
7	6.91
8	15.13

IC3

Pin #	V
1	0
2	5.6
3	5.6
4	0
5	0
6	5.6
7	15.13
8	.01

IC4

Pin #	V
1	7.58
2	7.59
3	7.58
4	0
5	7.58
6	7.58
7	7.58
8	15.13

IC5

Pin #	V
1	7.63
2	7.59
3	7.58
4	0
5	7.51
6	7.53
7	7.53
8	15.13

IC6

Pin #	V
1	flux
2	7.58
3	flux
4	0
5	7.58
6	7.59
7	flux
8	15.11

IC10

Pin #	V
1	15.13
2	7.52
3	5.5
4	5.5
5	0
6	7.57
7	7.82
8	1

IC11

Pin #	V
1	15.12
2	7.52
3	6.77
4	6.77
5	0
6	7.51
7	7.96
8	1

IC12

Pin #	V
1	15.12
2	7.52
3	4.6
4	4.6
5	0
6	7.51
7	6.8
8	1

IC7

Pin #	V
1	1.06
2	1.81
3	1.81
4	0
5	1.81
6	1.81
7	6.91
8	1.81
9	1.81
10	7.53
11	4.7
12	1.81
13	15.13
14	1.81
15	1.81
16	0.6

IC8

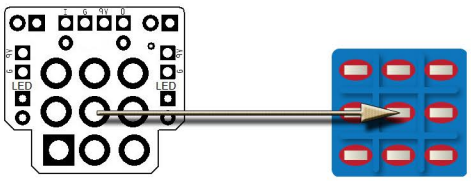
Pin #	V
1	8.0
2	7.1
3	7.1
4	15.12
5	15.11
6	15.11
7	0
8	0
9	0
10	7.55
11	7.55
12	0
13	8.0
14	15.12

IC9

Pin #	V
1	15.12
2	7.52
3	7.55
4	7.52
5	7.55
6	7.52
7	7.55
8	0
9	7.55
10	7.52
11	7.55
12	7.52
13	0
14	7.55
15	7.51
16	0

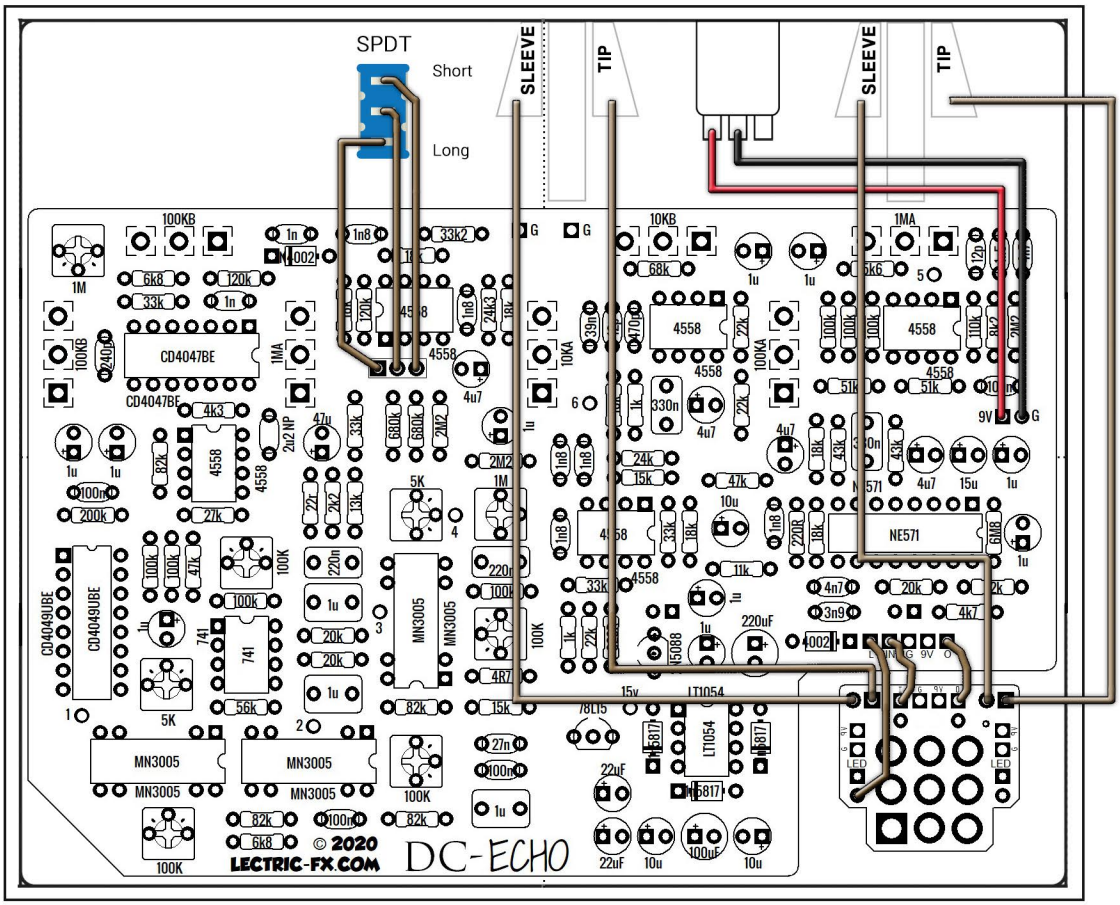
Q1: C = 13.6V, B = 0, E = 0

WIRING SUGGESTION

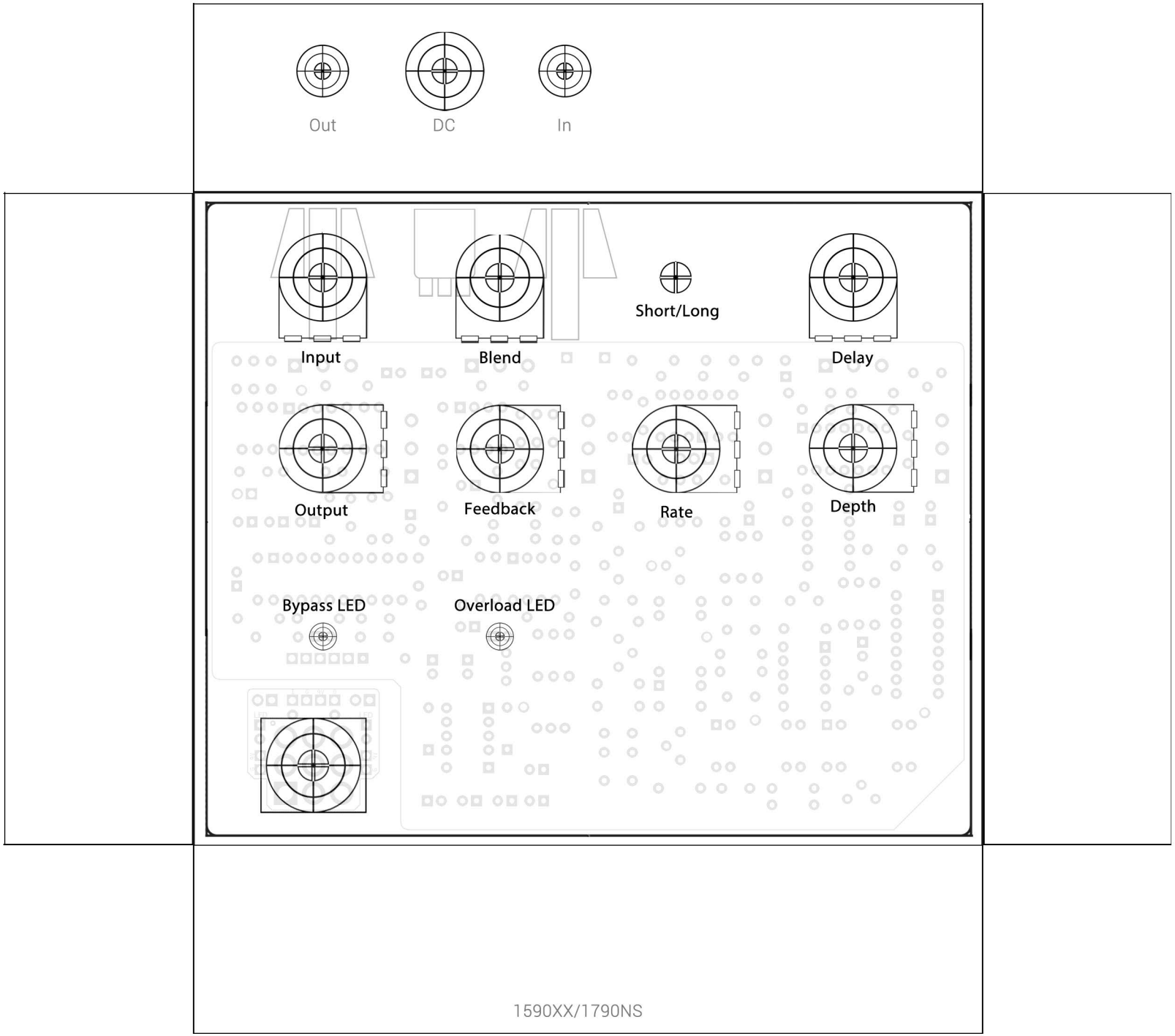


A miniature 3pdt footswitch pcb will be provided with each DC-Echo pcb sold, at no extra cost (provided it's in stock). You can use it to aid in wiring if you choose, or just use your favorite true-bypass wiring scheme instead.
The CLR (current-limiting resistor) and bypass LED are both on the pcb in this case, so all you have to do is wire the mini pcb to the larger pcb. Make sure the square pad is in the bottom left corner as shown (and the silkscreen of the resistor is facing away so you don't see it).

INNER VIEW OF BOX



You can twist each of the 2 pairs of wires coming off the mini 3pdt pcb together with a drill if you want, and run them under the pcb up to the tips and sleeves of the in/out jacks, for a very clean look.



1590XX/1790NS