

# The Blue Guitar

## FrankenStrat Wiring Harness

(for 2 Humbuckers & 1 Single Coil Pickup)

Designed by Steve Ahola 1997

**Click Below for Schematic:**

[franken2.gif](#)

(30KB)

Graphics file is sized to print out on a single sheet in portrait mode.  
To save file to disk, right-click on the link and choose the appropriate menu command.

**Higher Resolution Schematic:**

[franken1.gif](#)

(191KB)

The FrankenStrat wiring harness was designed to maximize the tonal possibilities available for a strat-style guitar using a pair of small SD humbuckers in the neck and bridge positions, and a single coil pickup in the middle position. A few years back, I had replaced the stock single coil pickups in a strat with a set of SD humbuckers (Hot Rails neck, Cool Rails lead, DuckBucker middle) hooked up to a traditional 5-way selector switch and was not very impressed with the results. I got two decent humbucker sounds: the neck pickup alone and the bridge pickups alone. After designing a strat wiring harness using a 4 pole 5 position MegaSwitch that duplicated the linkages of a modern PRS rotary switch guitar, I decided to see if I could come up with something that would recreate as many killer guitar sounds as possible: Les Paul sounds, PRS sounds, Strat and Tele sounds, and other guitars like Guilds and Gretschs. Since I was of the belief that it is an "abomination" to add humbuckers to a Strat, I decided to call my project... ***FrankenStrat!***

Along with their other improvements to the basic design of a Les Paul, PRS revolutionized the whole concept of linking guitar pickups to a wiring harness. While a coil-cut switch could be added to an LP, it always seemed like an add-on rather than being an integral part of the design. With PRS, they looked at how the pickups would work together by splitting the coils and linking them together in series and parallel configurations that sounded great and were hum-cancelling. While tricks like this had probably been done by guitar techs for many years, the PRS was one of the first to come with them stock from the factory. Fender has gotten away from the traditional switch and harness on many of their guitars in recent years.

To keep things simple, I decided to design the main switching circuitry around the two humbuckers, with the middle pickup optionally added to the mix with the push-pull switch on the volume pot. I had originally planned to use the DuckBucker for the middle pickup but I wasn't pleased with the results at all. I used a single coil pickup instead, which added several hum-cancelling linkages in split-coil mode.

With the FrankenStrat wiring harness, the MegaSwitch determines the basic "algorithm" of the linkage: bridge or neck pickup alone, both of them linked in parallel or in series (in-phase or out-of-phase). The 4PDT mini-toggle Mode switch determines whether both pickups are in full-humbucker mode or split-coil mode. The DPDT switch on the push-pull bottom tone pot serves 2 functions. In Full Humbucker mode, it will put the bridge pickup out of phase with the neck pickup. In Single Coil mode, the push-pull switch will select the inner coil of the bridge pickup instead of the outer coil without reversing its phasing. For the middle tone pot, I used a customized version of the Dan Torres passive midrange controls built on a 500K push-pull pot. With the knob down, the pot is a mid-cut control, which is essentially removed from the circuit when set to 10. With the knob pulled out, the pot is a mid-boost/mid-cut control which attenuates the signal a bit when set to the middle neutral position (which is between 5 and 7).

The following charts spell out the 5 basic algorithms selected by the MegaSwitch and the effects of the Mode and Reverse switches:

# FrankenStrat Linkages

## MegaSwitch Positions (Humbucking Mode)

]	Configuration:	Notes:
Position # 1	Both pickups in Series (in-phase)	Very loud and crunchy rhythm sound
Position #2	Neck pickup alone	Les Paul / PRS position #6
Position #3	Both pickups in Parallel (in-phase)*	Les Paul
Position #4	Bridge pickup alone	Les Paul / PRS position #10
Position #5	Both pickups in Series (out-of-phase)	Old PRS position #9

\* Reverse Switch on push-pull tone control produces out-of-phase parallel linkage in Full Humbucker mode.

## Mode Switch (4PDT) (Humbucking or Split Coil)

	Configuration:	Notes:
Pos # 1 (Up)	Full Humbucker mode (all coils active)	Traditional humbucker sounds
Pos #2 (Down)	Split Coil mode (outer coils selected)*	Can be hum-cancelling in some linkages

\* Reverse Switch on push-pull tone control selects Bridge pickup inner coil in Split Coil mode.

## Reverse Switch (on Tone pot)

Mode	Switch position	Bridge pickup configuration
Full Humbucker mode:	Down	Normal Phasing
	Up	Reverse Phasing
Split Coil mode:	Down	Outer Coil selected
	Up	Inner Coil selected

## Construction Notes:

The trickiest part of this project is determining the magnetic polarity and winding direction of your pickups and deciding how to link them together to achieve a humcancelling effect. The color codes for the humbuckers as printed on the wiring diagram correspond to the SD Hot Rails and Cool Rails pickups I used, but may need to be translated for other pickups.

According to electronics theory, for 2 coils to have a hum-cancelling effect when linked together, they need to be of a reversed polarity and winding with respect to each other. A traditional PAF-style humbucker achieves this effect using a few tricks. The way the magnet is oriented causes each coil to be of an opposite polarity to the other. If you carefully trace the path of the signal through the pickup from the hot output to ground, you will notice that it travels clockwise in one coil and counterclockwise in the other.

A traditional coil-cut switch for humbuckers will ground out the junction between the two coils; when both pickups are used together in this split coil configuration, there is generally no hum-cancelling effect. To achieve a hum-cancelling effect with 2 pickups of similar design you would want to use the first coil from one pickup and the second coil from the other pickup.

To determine the polarity of each coil of your humbucker and of your single coil pickup, you can use a bar magnet with one end marked and write down your findings. The coils you will be connecting together in hum-cancelling linkages will need to be of opposite polarities. For a traditional PAF-style humbucker, you can reverse the polarity by taking it apart carefully and rotating the magnet 180 degrees with respect to the long axis. Double-check it with your bar magnet and notes to make sure that you did reverse the polarity. When you reverse the magnet, you will need to reverse the 4 pickup leads so that the 2 humbuckers will be in phase with each other. Rather than resoldering the leads at the pickup, I will mark the cable with a short piece of colored heat shrink tubing so that I know I have to invert the color codes when I connect them to the wiring harness.

In selecting a single coil pickup to use in conjunction with the 2 humbuckers, it is strongly recommended that you check out the polarity and phasing before you solder it in. An initial test you can make is to see if the top of the single coil pickup is attracted to the outer coil of the neck pickup; if it is attracted to the outer coil, then it is probably the correct pickup to use. To confirm that it is of the correct polarity and phasing, you can try hooking it up temporarily first to the outer neck coil and then to the inner bridge coil and connecting it to a guitar amp. If the humbuckers are not in the guitar, orient the pickups as they will be mounted on the pickguard and use a test cord with jumper clips to plug into your guitar amp. If the humbuckers are already mounted in your guitar, I unscrewed the barrel from the plug on a guitar cord and made the connections to the hot and ground terminals there after setting the single coil pickup face up on the pickguard between and parallel to the neck and bridge pickups.

When you turn on your guitar amp, note any changes in the 60hz hum when you add the single coil pickup to the outer neck or inner bridge coil. If the hum gets about twice as loud, they are definitely not humbucking. If the hum essentially disappears, they are probably humbucking in which case you need to make the next test: try inputting a signal to see if there is a drastic drop in the signal level when the single coil is added. If the humbuckers are already mounted in your guitar, you can try playing a few notes. If the pickups aren't mounted, you can use a tuning fork to generate a signal. It is normal for there to be a slight reduction in signal level when you add a second pickup in parallel to the first, but if there is a drastic reduction in volume the phasing or polarity isn't right.

I mention all of this because if you choose the wrong pickup for the middle position, you won't get the full humbucking effect and proper phasing. Because of that potential problem, if you are buying the single coil pickup new, make sure that the store will let you return it if it doesn't work properly with your other pickups. While many of the modern aftermarket pickup manufacturers seem to have standardized pickup polarities and coil winding directions, there can be compatibility problems between the different companies that might not be noticed unless you are splitting the coils of a humbucker and trying to create linkages

with other split humbuckers or single coil pickups to eliminate hum.

Once you have decided on which pickups you will be using, the best way to confirm all of the linkages for proper polarity and phasing is to label the pickup leads and pull them through a pot mounting hole on the pickguard. Screw the pickguard down and tune up your guitar. Make up some sort of test cord with a 1/4" phone plug and use test clips to connect the various pickup leads to each other and to the test cord. Radio Shack has a pack of 4 color-coded micro test clips (#270-355) which work great on fine pickup leads. Try out some of the basic linkages to verify color codes, and basic polarity and phasing (like full humbuckers in parallel). After that try linking the inner and outer coils together, in series and an parallel, and write down the results you note.

Once you have the humbuckers set up properly, try adding in the single coil pickup in parallel to see which (if any) of the combinations are hum-cancelling. If the results you note are quite different from the charts published here, you may need to reverse the hot signal and ground lead from the single coil pickup. (I had to do that to get a Lindy Fralin neck pickup to work properly with my SD humbuckers.)

## Full Humbucking vs Near Humbucking vs Partial Humbucking:

In wiring up my FrankenStrat with SD Hot Rails and Cool Rails pickups, I made a discovery that doesn't quite jibe with the electronics theory that for 2 coils to be humbucking they must be of reverse winding and polarity with respect to each other. Once I got the winding and polarity of the single coil pickup straightened out with respect to the humbuckers, the hum-cancelling linkages worked as designed. However, I discovered several other linkages which were not supposed to be hum-cancelling, yet drastically reduced the hum. To test out the hum-cancelling properties of the various configurations, I turned on my computer monitor about 18 inches away and rotated the guitar to generate the maximum amount of hum. For lack of a better term, if I felt that hum was reduced at least 90%, I'd rate the linkage as being Near Humbucking (NHB on the chart). If I felt that the hum was reduced at least 80%, I'd consider the configuration to be Partially Humbucking (PHB).

The chart of my findings follows:

### FrankenStrat in Split Coil Mode Effects of Reverse Switch and Adding Middle Pickup

	Middle Pickup		Reverse Switch		<b>FHB</b> : Full Humbucker <b>NHB</b> : Near Humbucker <b>PHB</b> : Partial Humbucker [not hb]
	Not Engaged ↓	Engaged ↑	Normal ↓	Alternate ↑	
<b>Position #1</b>	X		X		<b>FHB</b> (PRS #8 alt)
Series linkage (normal phase)	X			X	[not hb]
		X	X		[not hb]
		X		X	<b>NHB</b> (Notched Strat alt)
<b>Position #2</b>	X		X (no effect)		[not hb] (Strat Neck)
Neck Outer Coil	X			X (no effect)	[not hb] (ditto)
		X	X (no effect)		<b>FHB</b> (Notched Strat)
		X		X (no effect)	<b>FHB</b> (ditto)
<b>Position #3</b>	X		X		<b>FHB</b> (PRS #9)
Parallel linkage	X			X	[not hb]
		X	X		<b>PHB</b>
		X		X	<b>NHB</b> (Notched Strat)
<b>Position #4</b>	X		X		[not hb](Strat Bridge)
Treble Single Coil	X			X	[not hb](Strat Bridge alt)
		X	X		[not hb]
		X		X	<b>FHB</b> (Notched Strat)
<b>Position #5</b>	X		X		[not hb]
Series linkage	X			X	<b>PHB</b> (out-of-phase)
(reverse phase)		X	X		<b>NHB</b> (Guild or Gretsch)
		X		X	[not hb]

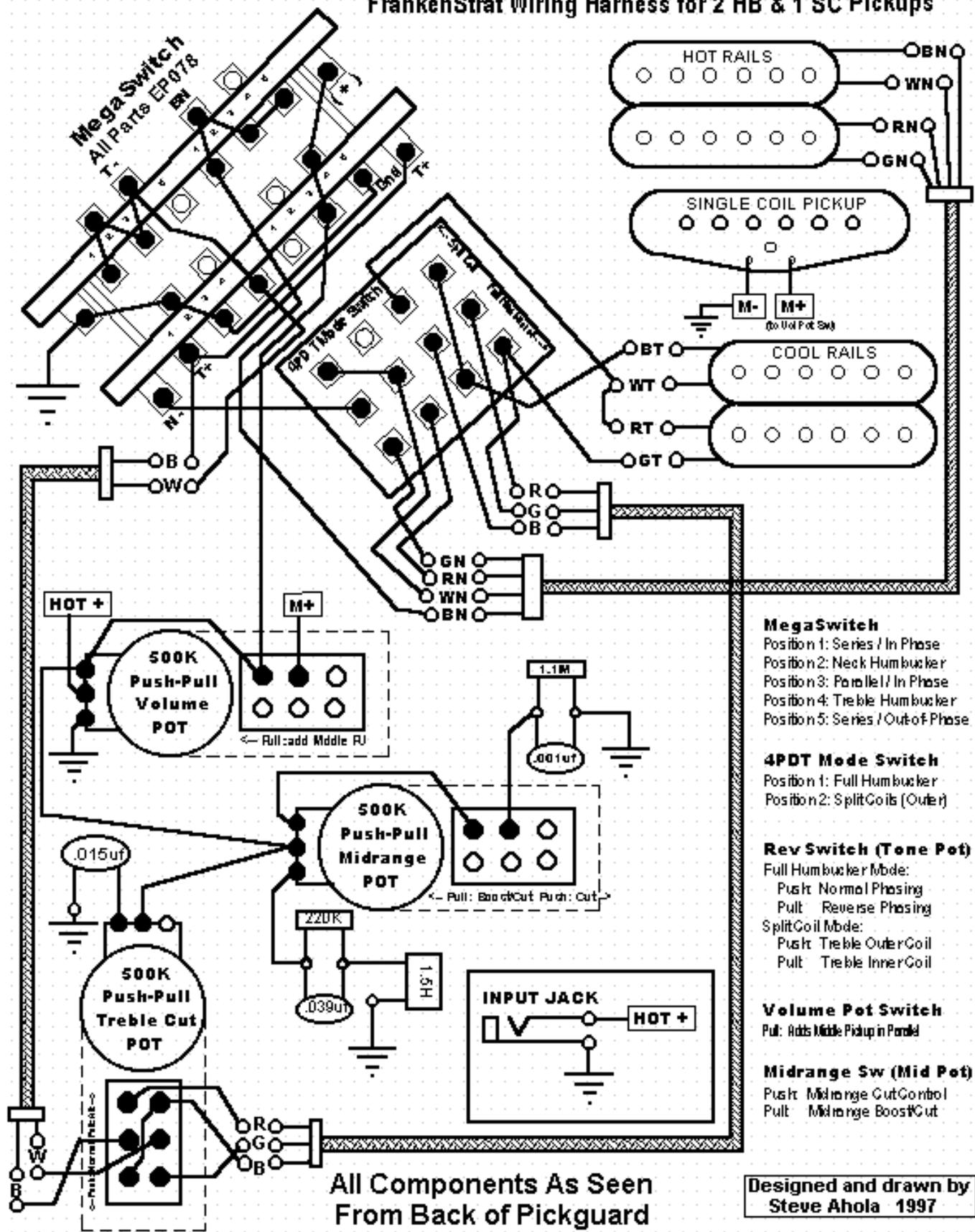
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# FrankenStrat Wiring Harness for 2 HB & 1 SC Pickups

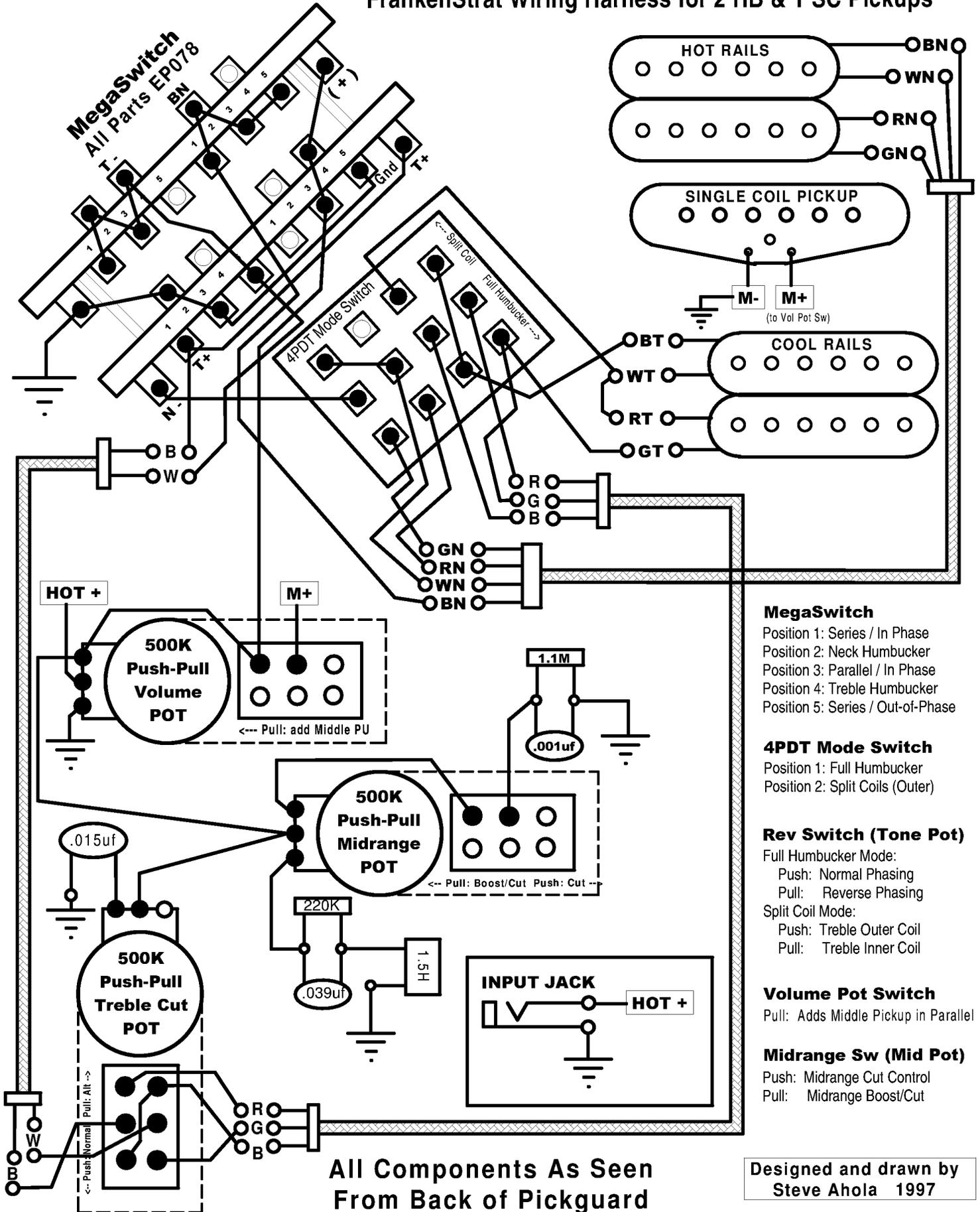


- MegaSwitch**  
Position 1: Series / In Phase  
Position 2: Neck Humbucker  
Position 3: Parallel / In Phase  
Position 4: Treble Humbucker  
Position 5: Series / Out of Phase
- 4PDT Mode Switch**  
Position 1: Full Humbucker  
Position 2: Split Coils (Outer)
- Rev Switch (Tone Pot)**  
Full Humbucker Mode:  
Push: Normal Phasing  
Pull: Reverse Phasing  
Split Coil Mode:  
Push: Treble Outer Coil  
Pull: Treble Inner Coil
- Volume Pot Switch**  
Pull: Adds Middle Pickup in Parallel
- Midrange Sw (Mid Pot)**  
Push: Midrange Cut/Control  
Pull: Midrange Boost/Cut

All Components As Seen From Back of Pickguard

Designed and drawn by Steve Ahola 1997

# FrankenStrat Wiring Harness for 2 HB & 1 SC Pickups



- MegaSwitch**  
 Position 1: Series / In Phase  
 Position 2: Neck Humbucker  
 Position 3: Parallel / In Phase  
 Position 4: Treble Humbucker  
 Position 5: Series / Out-of-Phase
- 4PDT Mode Switch**  
 Position 1: Full Humbucker  
 Position 2: Split Coils (Outer)
- Rev Switch (Tone Pot)**  
 Full Humbucker Mode:  
 Push: Normal Phasing  
 Pull: Reverse Phasing  
 Split Coil Mode:  
 Push: Treble Outer Coil  
 Pull: Treble Inner Coil
- Volume Pot Switch**  
 Pull: Adds Middle Pickup in Parallel
- Midrange Sw (Mid Pot)**  
 Push: Midrange Cut Control  
 Pull: Midrange Boost/Cut

All Components As Seen From Back of Pickguard

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