

The Line 6 Floor Board Exposé

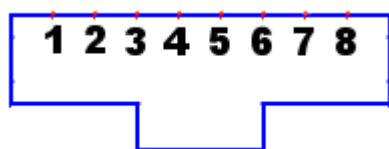


While dreaming up ideas for my **Murgatroid** amp, I realized that I could save myself a *lot* of trouble if I could use my Line 6 Floor Board instead of making a new pedal board from scratch. Line 6 wouldn't tell me how to talk to their Floor Board, so I figured it out myself - at least well enough to use it for my own evil purposes. Here's what I've learned so far...

NOTE: I'm *not* an electrical engineer, so I feel a responsibility to note that there are some of the aspects of the POD and Floor Board that I don't understand. I'm just giving you my own observations of the hardware I have in front of me, and you should assume that there is some variation among the thousands of units out there. I may someday get the energy to actually trace out the Floor Board circuit and post a schematic, but if you choose to design a circuit based on the info here you should keep in mind that these are just one person's observations! Some day soon (I hope!) I'll write a little microcontroller code to verify my reverse engineering, but this should be enough info to get a project off the ground.

Connections

The POD & Floor Board use standard "Category 5" network cables for connection. The connectors on these cables (and the receptacles in the POD and Floor Board) are known as **RJ-45s**. They're just like standard phone jacks, but with 8 pins.



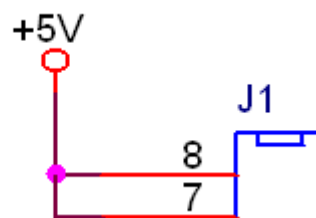
The pin numbering I'll use for RJ-type jacks starts at 1 and goes from left to right looking into the receptacle (the female socket on the POD or Floor Board) with the locking tab slot on the bottom, like

the diagram on the right. "Standard" or not, that's the numbering I'll be using here.

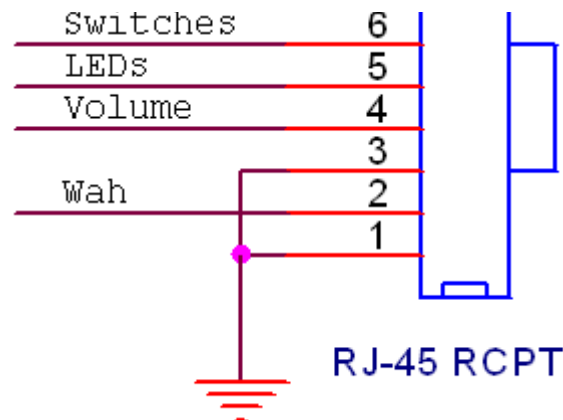
I'll be referring to the various signals from the POD's point of view. The switches and pedals are inputs, and the LEDs are an output.

Signals

The diagram on the right shows the connections at the RJ-45 receptacles in the POD and the Floor Board. The three inputs to the POD (the two pedals and the switches) are all analog, but the LED output is digital.



The two pedal inputs are implemented using LEDs and phototransistors, with a shaded plastic strip moving between them as you move the pedal. The output of each phototransistor drives a 2N4401 transistor, and the output of the 2N4401s is the input to the POD. When connected to an operating POD, I've measured voltage levels on the pedal inputs from 0.25V to 4.1V. On my unit the two pedals don't have exactly the same range (one only goes down to about 0.4V).



The POD has some very strange (to me, anyway) circuitry on its inputs that I assume are for protection of the POD, so I've also looked at the Floor Board independently. When it's connected to a 5V supply (no POD) with 10k pull-ups on the Wah and Volume lines, the voltage range is a little lower (0.2V to 3.7V).

The switches are implemented as a resistor ladder. Each switch taps the series of resistors at a different point, making a variable voltage divider. The resistances are arranged so that some combinations of multiple switches are also detectable (see below). The POD appears to have the equivalent of a 1k pull-up on the Switches line.

The LEDs are controlled by a series of digital pulses whose lengths determine the on/off outputs of four shift registers connected to the three 7-segment LEDs and the various single-purpose indicators.

Switch Input Details

As mentioned above, the switches are connected to some kind of resistor ladder. The table below gives both the input voltages measured at the POD and the resistances from the Switches pin to ground with the Floor Board disconnected from the POD.

<u>Switch (or combination)</u>	<u>Resistance</u>	<u>Voltage</u>
Tap Tempo / Tuner	0	0.040
Channel Select / Effect On/Off	100	0.490
Wah (under pedal)	220	0.900
Channel A / EQ	370	1.38
Channel B / Trem/Chorus	570	1.83
Channel C / Delay	810	2.23
Channel D / Reverb	1.1k	2.67
Bank Up + Bank Down	2.7k	3.65

Bank Up	3.7k	3.88
Bank Down	5k	4.1
none	20k	~5

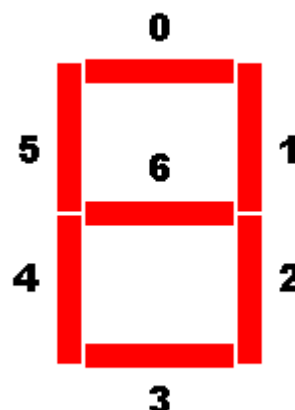
LED Output Details

The LEDs line carries a series of pulses whose widths determines the states of the various LEDs in the Floor Board. The POD always sends 32 pulses per update, which refreshes all four of the shift registers that latch the states of all the LEDs. The pulses are routed through a 7414 inverter that uses the pulse width to generate the clock and data signals needed by the 74HC595 shift registers.

Long pulses (3 μ s high, 3 μ s low) turn LEDs off and short pulses (1 μ s high, 5 μ s low) turn LEDs on. The POD keeps the line low between transmissions. Generally, the POD only shifts out the LED pulses when there is a change in the LEDs, but if any of the LEDs is blinking they're updated every 120ms or so.

The four bytes of LED states are sent MSB (bit 7) first. I will call them D0, D1, D2 and D3, with D0 being the first byte sent. I'll use D0.n to indicate an individual bit in D0, where the value of n ranges from 0 (LSB) to 7 (MSB).

<u>Bit(s)</u>	<u>LED (nearest label)</u>
D0.7	Distortion (pointer)
D0.6...D0.0	right 7-segment LED
D1.7	Bank Down (pointer)
D1.6...D1.0	middle 7-segment LED
D2.7	? (Wah?)
D2.6...D2.0	left 7-segment LED
D3.7	Tap Tempo / Tuner
D3.6	? (Wah?)
D3.5	Distortion (select)
D3.4	Drive / Boost
D3.3	Channel D
D3.2	Channel C
D3.1	Channel B
D3.0	Channel A



The picture to the right of the table shows which segments correspond to which bits.

The "pointer" LEDs are the ones off to the left of the Distortion and Bank Down labels that tell you whether you're the POD is using the Floor Board in Effect On/Off or Channel Select mode. The question marks about the Wah LED will be resolved the next time I can borrow a digital scope from work for a day or two &ndash I forgot about the Wah LED when I first looked at it...

Unknowns

I don't really understand the circuitry just inside the POD. There are diodes that appear to be intended to protect the POD against voltage spikes, and there is a pull-up effect that seems to be equivalent to 10-15K on the pedals and 1k on the switches.

The FB4 Foot Controller

I don't have an FB4, but it appears to be equivalent to the Floor Board with the pedals and several switches and LEDs removed. Mapping is left as an exercise for the reader... {grin}

Other Line 6 pedals and boxes

[Line 6](#) has apparently changed their pedal designs since the Floor Board and the FB4, because the Floor Board and FB4 are not compatible with the various "XT" models of the POD and other newer products. As far as I know the information here is applicable to the AX2, Flextone, Flextone II, POD, POD Pro, Bass POD, Bass POD Pro and Spider.

Since I only own a POD and a Floor Board I have *no* information about how these newer products work. If someone else has figured them out, I'd be happy to post a link here.

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