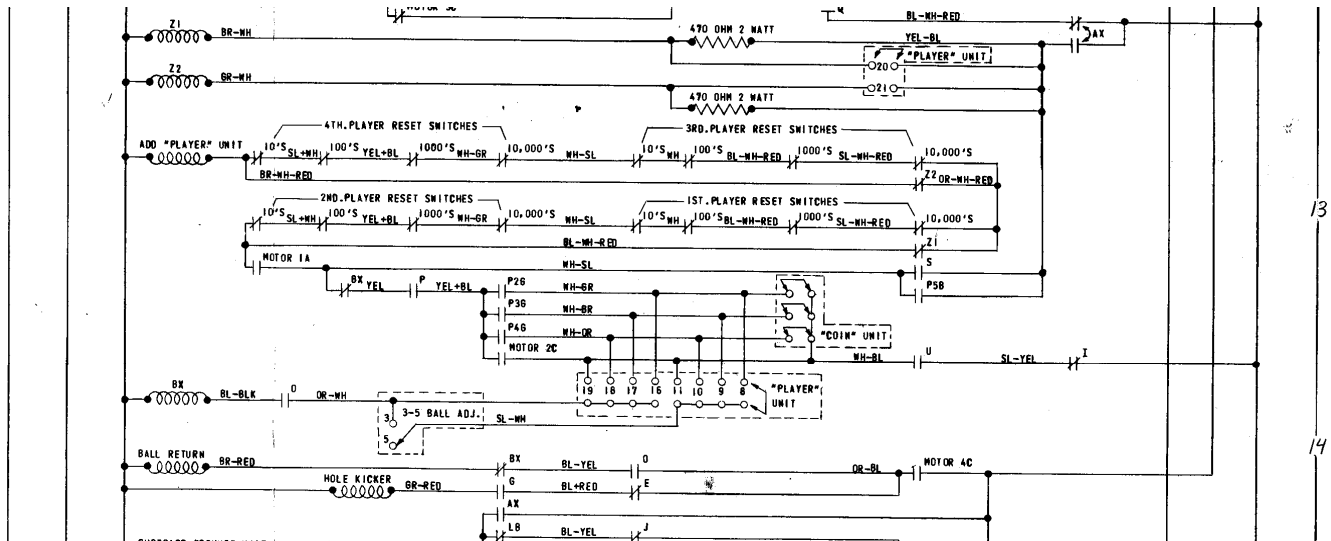


# EM Pinball Troubleshooting – Testing Switches with a Jumper Wire

Testing EM switches with a digital multi-meter (DMM) is tricky because there are so many coils in parallel; the reading across an open switch is only a few ohms. Parallel paths may be other coils, but may also be the power transformer. Described here is a method to test switches by briefly connecting a jumper wire across switches to isolate the non-working one.



Section of Schematic from 1976 Gottlieb “Spirit of 76”

In this example we are focusing on the BX relay, whose coil is shown second from the bottom. The wire on the far right is the red-white wire that runs most everywhere in the cabinet. The BX relay is energized when all the switches in the path from the right side of the coil are closed. What we’re going to do is test the switches from left to right by jumpering (shorting) across them.

A wire with an alligator clip works best; connect it to the red-white wire. Use care when shorting briefly to the test points. It only takes a split-second to see if the relay is energizing. You need to have a fairly heavy jumper wire as there are several amps of current involved. There will likely be some arcing as you make the connections, so be ready for it.

The first step is to get the machine into the state where the BX relay should energize. This is probably the hardest part, and may not always be possible. In this case you manually advance a 1-player game to the 5<sup>th</sup> ball and close the outhole switch. Now, test the following points, always jumpering from the red-white wire to the point indicated.

	Jumper to...	wire color	If BX relay doesn't trip...
1	Right side of BX coil	blue-black	BX coil is bad
2	Left side of O switch	blue-black	Blue-black wire is bad
3	Right side of O switch	orange-white	Clean/adjust O switch
4	Coin unit	white-green	Player unit problem (1)
5	Coin unit	white-blue	Coin unit problem
6	Left side of U switch	white-blue	Player/Coin Unit problem
7	Right side of U switch	slate-yellow	Clean/adjust U switch
8	Left side of I switch	slate-yellow	Slate-yellow wire it bad
9	Right side of I switch	red-white	Clean/Adjust I switch

(1) Note that it is possible to jumper to points in the player unit IF your jumper is really long (it's in the back box). Best to skip that first and test the easy things.

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