Pennant Fever - System 8 to System 9/11 Conversion

The System 8 PCB is very similar to the System 9 and 11 PCBs. In general, the System 9 and 11 have additional functionality over the System 8. The one major item that System 8 includes, which is lacking the System 9 and 11, is the circuitry to drive the displays. Fortunately, this circuitry is the same as what is contained on the System 7 and 9 display boards.

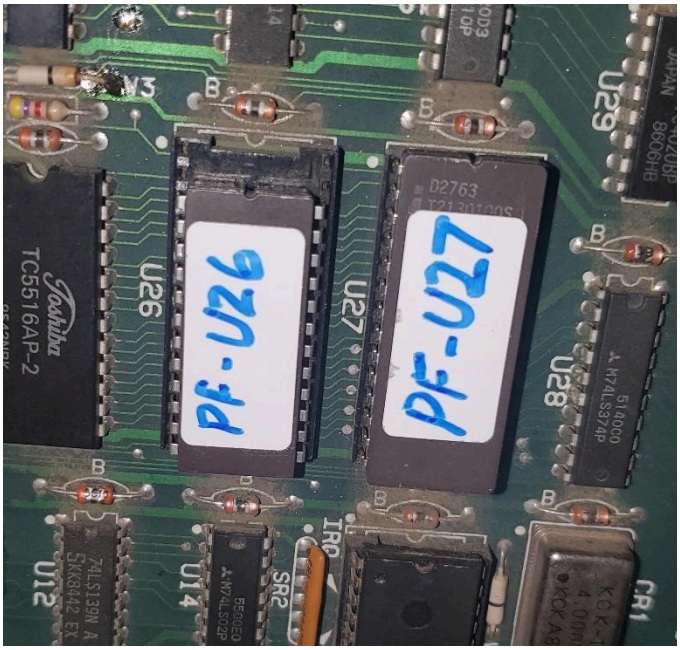
For the conversion, you will need the following items:

- System 9 / 11 (nothing) PCB – A System 11A, B or C may be able to be used if the sound section is repopulated and jumpers properly set. Those changes won't be covered in this document.
- System 7 or 9 Display PCB – The PCB used on Comet and some shuffle alleys is best since it uses normal Molex connectors instead of the somewhat difficult to find edge card connectors. If using a shuffle alley board, there are 8 jumpers (W1-8) which will need installed.
- Wire – some old harnesses are great for this if you have any laying around.
- Connectors and pins.
- Heat shrink tubing.
- Plastic Standoffs (4)
- Wire ties

The EPROMs are installed as follows

System 8	System 9	System 11 (W3 installed)
U19 (2732)	U19	U26
U20 (2764)	U20	U27
U49 (27128)	U49	U21

Note that on System 11, the 2732 EPROM in U26 will be mounted towards the bottom of the socket when installed in the game.



Sound Issues

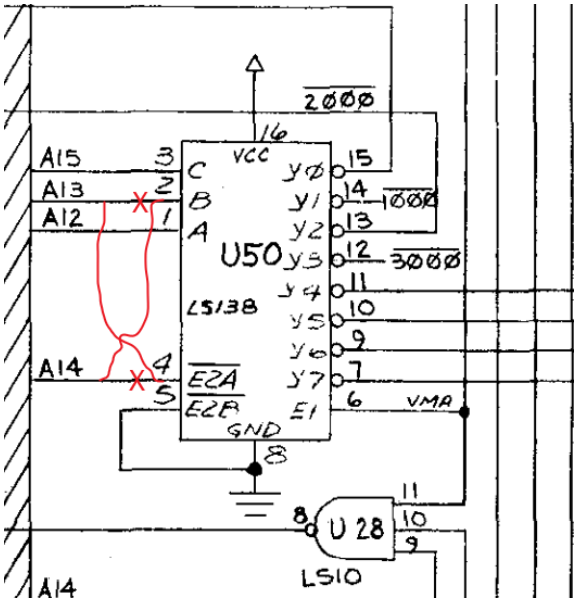
The 6821 PIA for the sound system on Pennant Fever is not located at the same memory location as it normally is on System 9 or 11. On System 9 and 11 it is located at memory location 2000 hex. Even though the Pennant Fever schematic indicates the 6821 being at that location, the jumpers on the board are set to address it to 4000 hex.

So, we have two options to relocate the 6821 to the proper location. We can either modify the PCB or the EPROM code to make it work. After successfully modifying a System 11 board, I decided it would be better to modify the ROM to work on a standard board. Even though I ended up modifying the code, I will cover the necessary board modifications for the original sound EPROM to operate in a System 9 and 11 (note that I have only tested the System 11).

System 9 Sound Modification (Untested)

The modification to the System 9 requires two track cuts and two jumpers.

- Locate U50 and cut the tracks to pins 2 and 4.
- You will then connect the track that went to pin 2 to pin 4 and vice-versa. Ultimately, this will put A13 on pin 4 and A14 on pin 2. Since we won't be using a speech board, this won't affect anything else.


2000
16
VCC
A15
A13
A12
A14
3
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1
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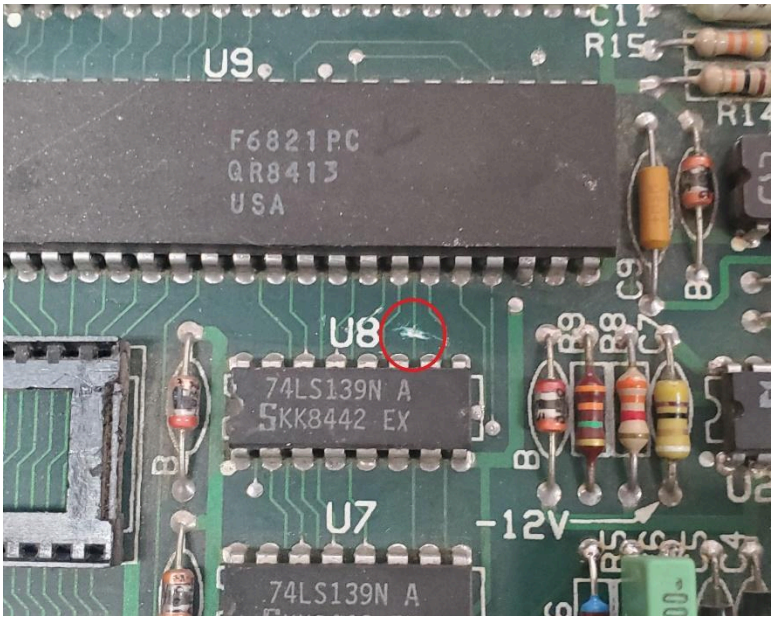
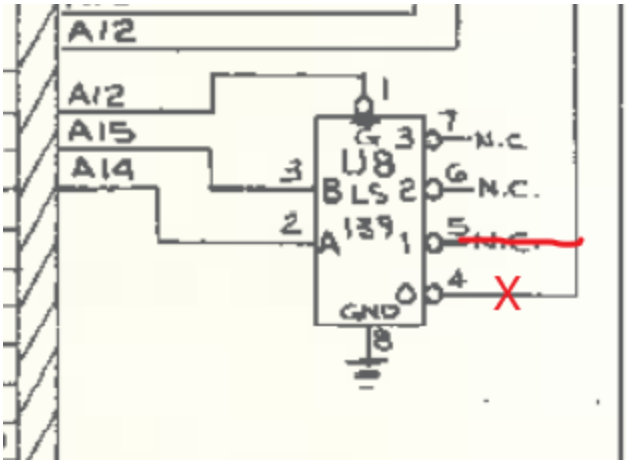
5
C
B
A
E2A
E2B
GND
8
U50
LS138
Y0
Y1
Y2
Y3
Y4
Y5
Y6
Y7
E1
15
14
13
12
11
10
9
7
6
1000
3000
VMA
11
10
9
8
U 28
LS10
A14

System 11 Sound Modification (Tested)

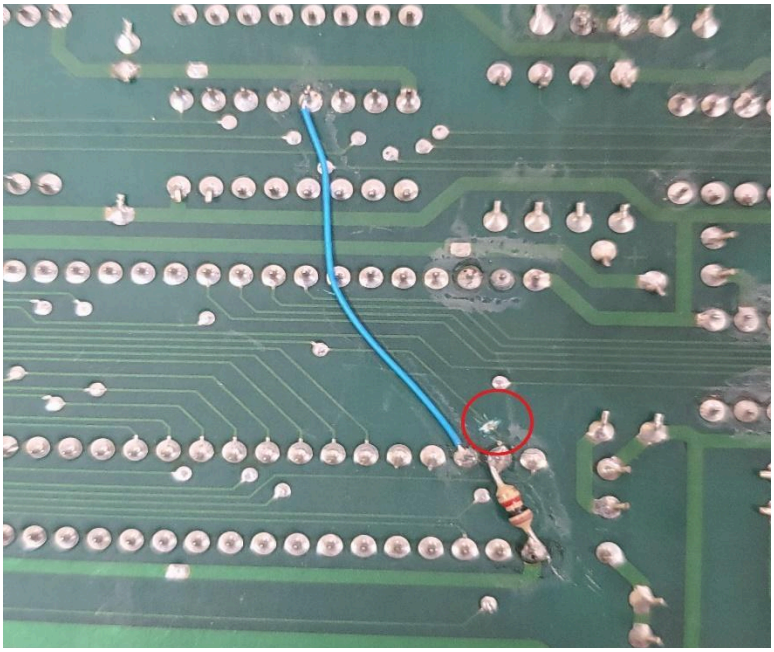
The modification to the System 11 requires two track cuts along with a jumper and a 1K resistor.

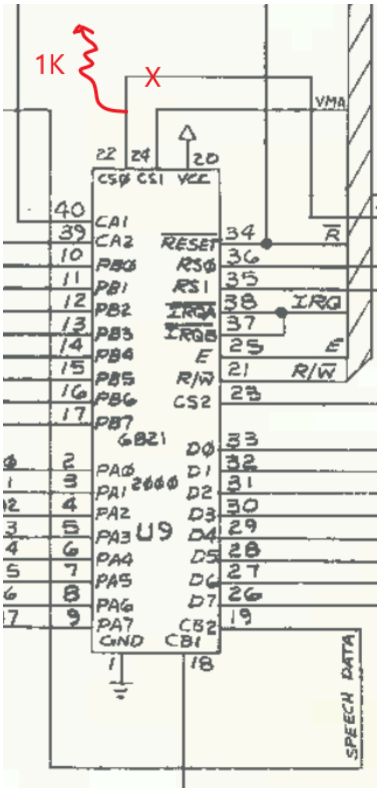
- Locate and cut the track to U8, pin 4. The easiest place to cut this track is between U8 and U9 on the component side of the PCB.





- Locate and cut the track to U9, pin 22.
- Add a 1K resistor between U9, pin 22 and U10, pin 20.
- Add a jumper wire from U9, pin 23 to U8, pin 5.





Display Board Addition

Adding a separate display board is pretty straightforward but a bit time consuming.

- Obtain four plastic standoffs and attach the PCB to the rear of the light board with screws.
- Connect the ribbon cable from the top display to Player #1 (take care in locating pin 1 with the stripe).
- Connect the ribbon cable from the bottom display to player #2 (take care in locating pin 1 with the stripe).
- Assemble the wiring harnesses. The parts you will need depend on the style of display PCB you've chosen.

System 7 or early System 9 Display PCB material

- 18 pin 0.156 edge card shell
- 9 pin 0.156 edge card shell
- 6 pin 0.156 edge card shell
- (2) 9 pin standard 0.156 Molex shell
- 6 pin standard 0.156 Molex shell
- 12 pin standard 0.156 Molex shell
- Associated pins
- Wire

Late System 9 Display PCB material

- (4) 9 pin standard 0.156 Molex shell
- (2) 6 pin standard 0.156 Molex shell
- (2) 12 pin standard 0.156 Molex shell
- Associated Pins
- Wire

This is the pinout for the three signal harnesses. This includes the strobes and BCD data along with the blanking signal. You will not need to wire the comma signals so they have not been included.

Signal Wiring Harness Pinout			
Signal	System 9 / 11 CPU	System 7/9 Display PCB	System 9 (Late) Display PCB
Strobe 8	1J1-1	J5-3	J9-1
Strobe 7	1J1-2	J5-11	J9-2
Strobe 6	1J1-3	J5-10	J9-3
Strobe 5	1J1-4	J5-9	J9-4
Strobe 4	1J1-5	J5-8	J9-5
Strobe 3	1J1-6	J5-7	J9-6
Strobe 2	1J1-7	J5-6	J9-7
Strobe 1	1J1-9	J5-5	J9-9
Strobe 16	1J2-1	J5-14	J8-1
Strobe 15	1J2-2	J5-16	J8-2
Strobe 14	1J2-3	J5-17	J8-3
Strobe 13	1J2-4	J5-13	J8-4
Strobe 12	1J2-5	J5-12	J8-5
Strobe 11	1J2-6	J5-15	J8-6
Strobe 10	1J2-8	J5-2	J8-8
Strobe 9	1J2-9	J5-4	J8-9
D1	1J3-1	J7-4	J10-1
C1	1J3-2	J7-2	J10-2
B1	1J3-3	J7-1	J10-3
A1	1J3-4	J7-5	J10-4
D2	1J3-5	J7-8	J10-5
C2	1J3-7	J7-7	J10-7

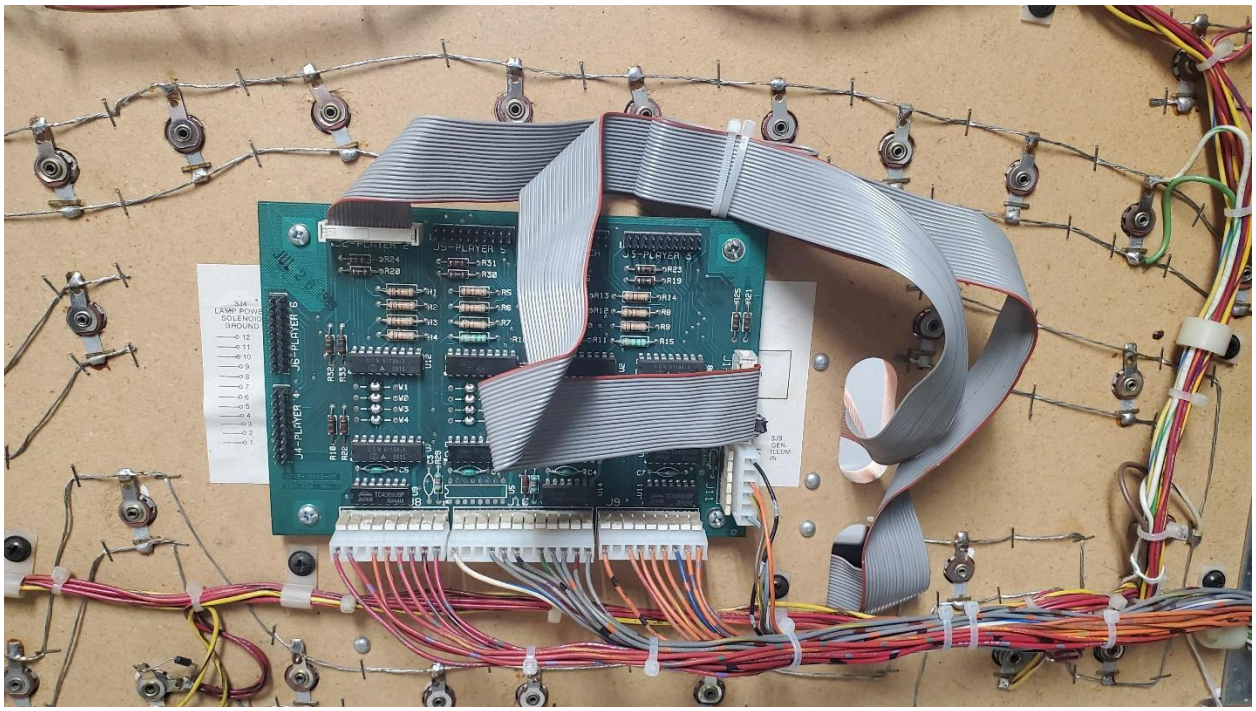
B2	13-8	J7-6	J10-8
A2	1J3-9	J7-9	J10-9
Blanking	1J3-12	J7-3	J10-12

Finally, you will need to get the power wiring over to the new display PCB. You can remove the original display power harness and build a new one from the display to the power PCB or build an adapter and extend the original harness. This is the direction I went just in case a System 8 board is put back into the game at some point.

- First, you will need to build or purchase a 6 pin Molex “Z” connector. I built one from a couple of 6 pin headers and filled it in with some hot glue.

- Next you will build a harness to go from the old harness to the new display PCB. Take care in building the harness. There is high voltage on the connector so a mistake could prove costly.

Power Harness Extension Pinout			
Signal	Original Harness	System 7/9 Display PCB	System 9 (Late) Display PCB
+100V	Pin 2 – Black / Orange	J6-2	J11-4
-100V	Pin 6 - Orange	J6-6	J11-3
+5V	Pin 3 - Gray	J6-3	J11-6
Ground	Pin 5 - Black	J6-5	J11-1


J5-PLAYER 5
J6-PLAYER 6
J4-PLAYER 4
J3-PLAYER 3
J2-PLAYER 2
J1
J9
J10
J11
J12
J13
J14
J15
J16
J17
J18
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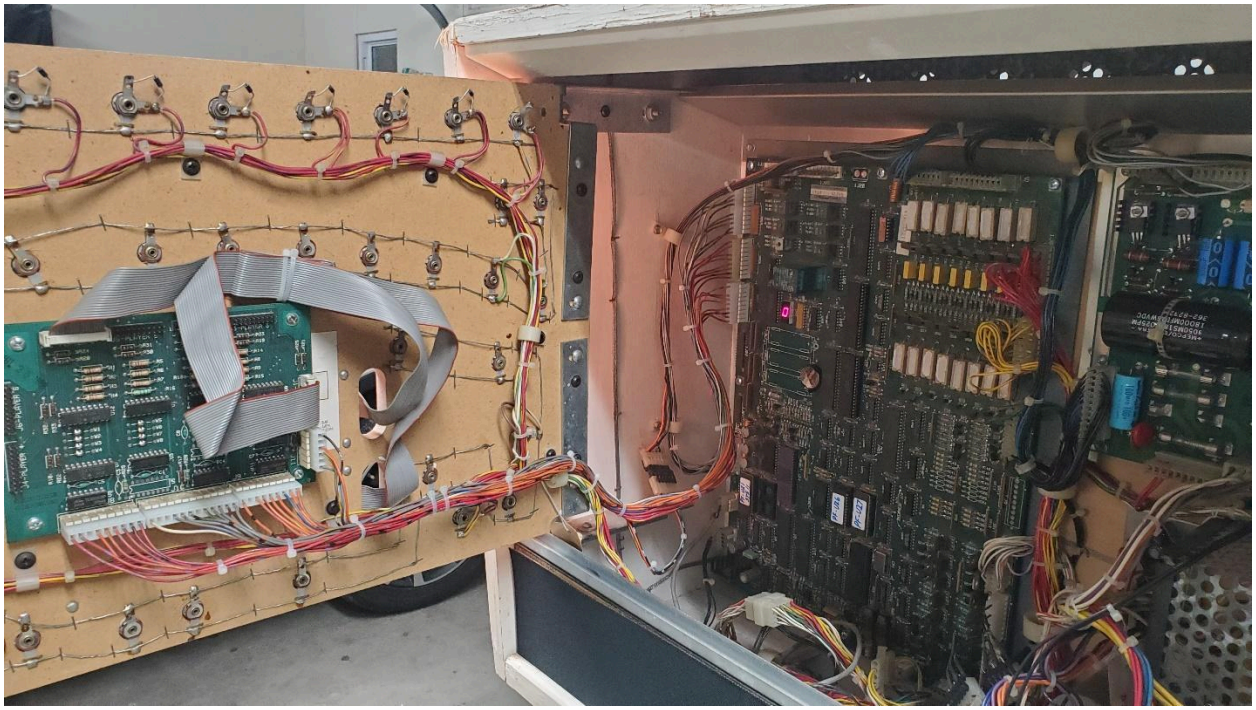
J100

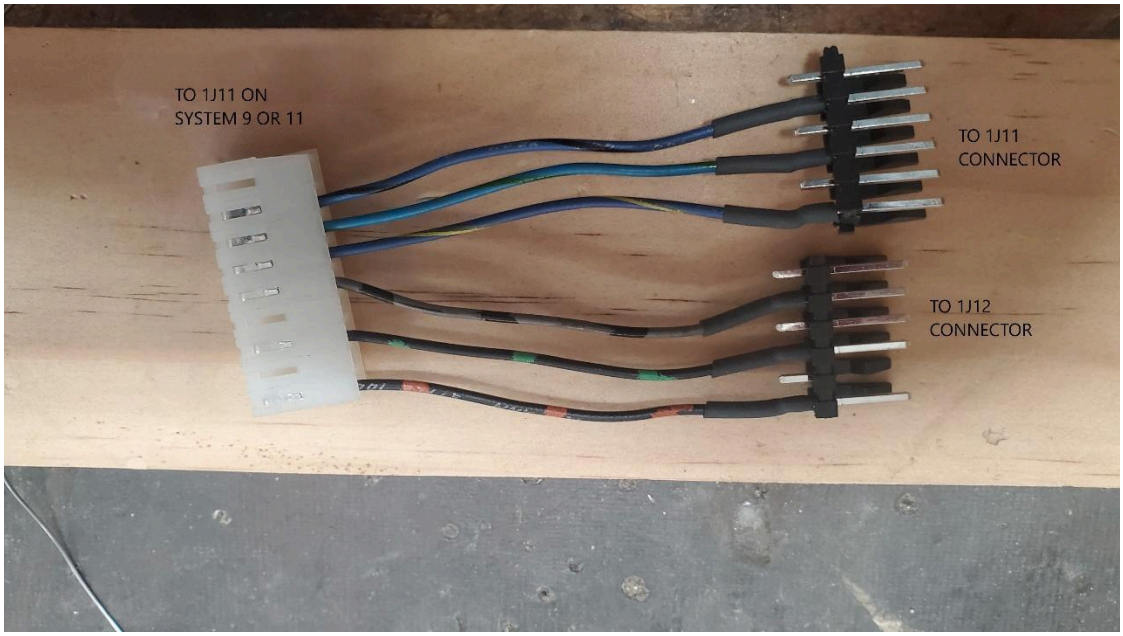


Solenoid Wiring

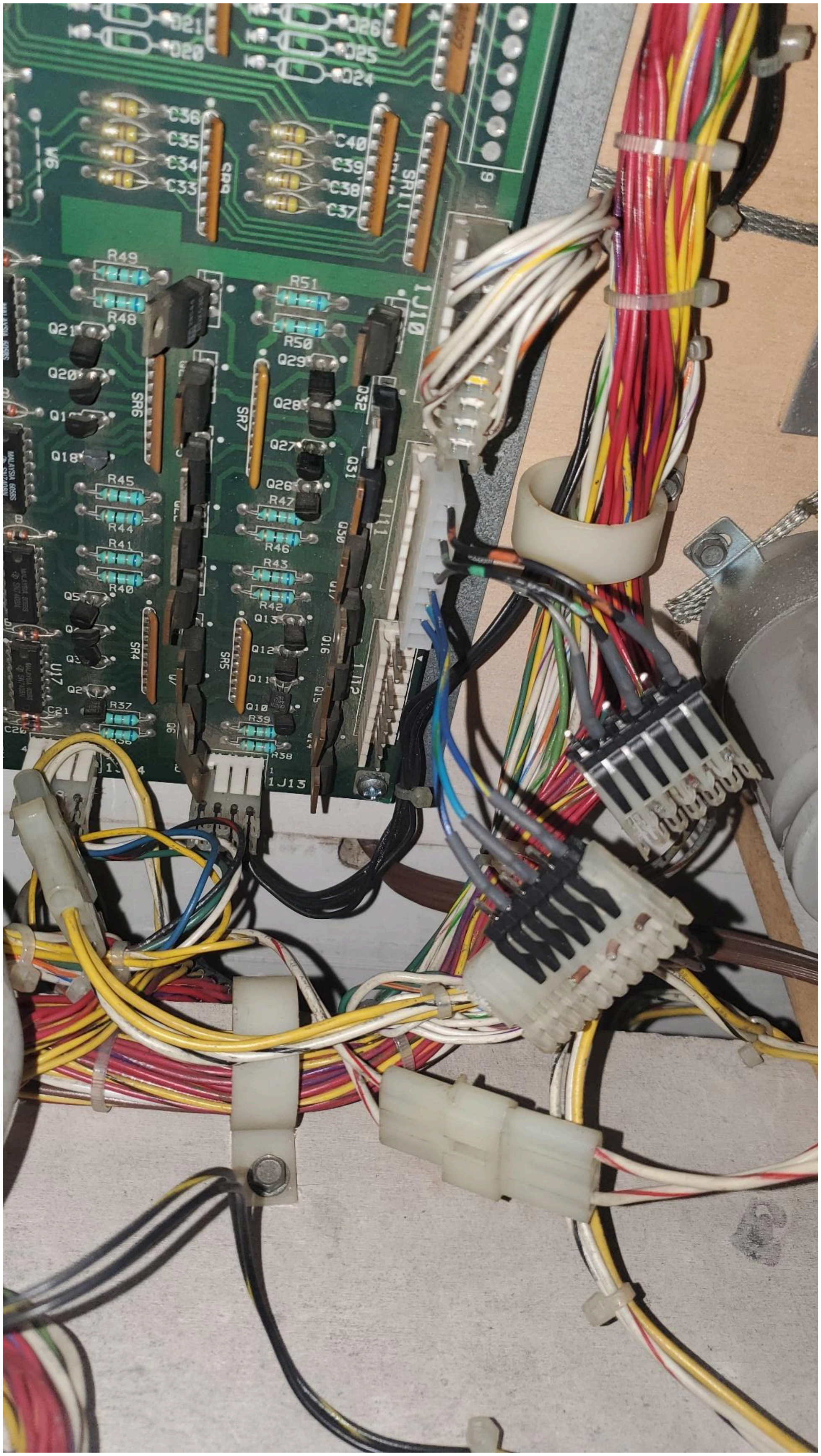
Other than a small difference in the connector layout, the solenoid drivers on the System 8 PCB are included in System 9 and 11. A small adapter cable needs to be made to connect the old connectors to the new board. It's notable that the Pennant Fever schematic doesn't seem to properly list the solenoid names so this harness is based directly on what was wired on the game and the solenoid number used.

For the adapter, you'll need

- 9 pin standard 0.156 Molex shell
- (2) 6 pin 0.156 Molex headers (one with the key pin trimmed as shown)
- Wire
- Heat shrink tubing
- Molex Pins



Solenoid Adapter Harness		
Solenoid	System 9 / 11	System 8
1	1J11-1	1J12-1
2	1J11-3	1J12-3
4	1J11-5	1J12-5
5	1J11-6	1J11-1
6	1J11-7	1J11-3
7	1J11-8	1J11-5


D21
D20
D26
D25
D24
C36
C35
C34
C33
C40
C39
C38
C37
W6
SR11
R49
R48
R51
R50
1J10
Q21
Q20
Q29
Q28
Q27
Q26
SR6
SR7
Q18
R45
R44
R47
R46
R41
R40
R43
R42
Q13
Q12
Q11
Q10
SR4
SR5
U17
R37
R39
R38
1J13
1J12
1J11