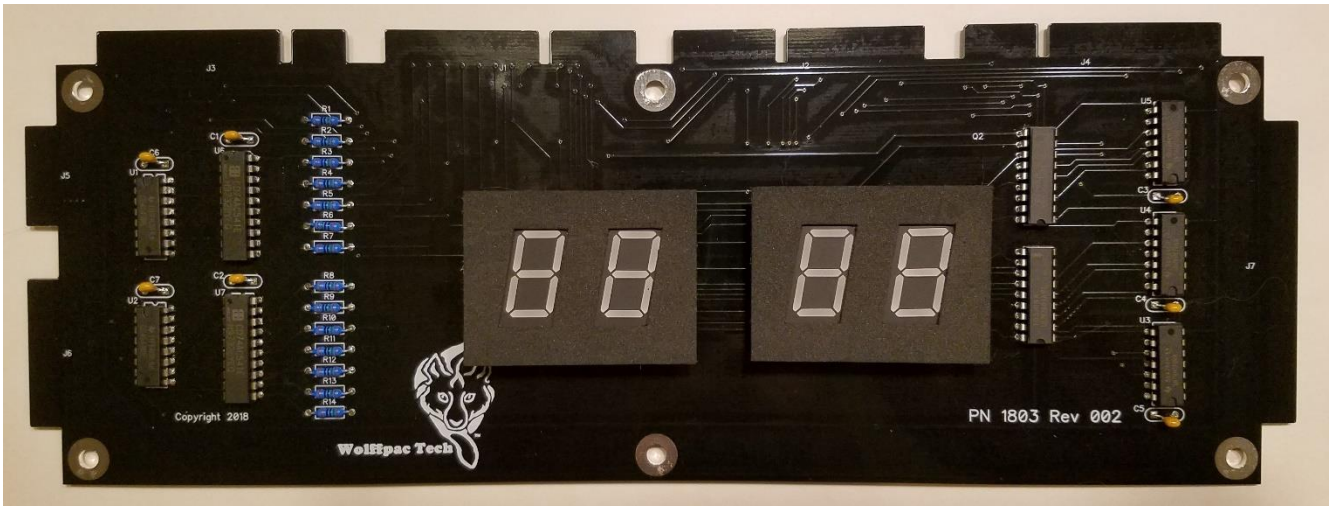
Wolffpac Technologies

Williams™ System 3-6 Replacement Display Kit



Assembly Instructions

wolffpactech.com

Rev. 4

When assembled, this display will replace the displays used on Williams solid state pinball machines from which use the “System 3” though “System 6” controller. For the complete list of compatible machines, see the list at the end of these instructions.

Tools:

Soldering iron - A small to medium power soldering iron of 25-50 watts with a small tip, preferably temperature controlled, is recommended.

Wire cutters - A set of diagonal or wire cutters intended for cutting electronic component leads.

Alcohol –Isopropyl Alcohol, Denatured Alcohol or Flux Remover to be used for cleaning the board after assembly.

Solder - Use only solder designated for electronic component assembly. Either lead-based or lead-free flux-core solder are both acceptable.

→ Use of solid core, acid core or plumbing solder is not acceptable and will void the warranty. ←

All soldering should be done on the bottom (non-printed) side of the boards. This kit uses “old school” through-hole components requiring only basic soldering skills to assemble. However, if you have never soldered before or are unsure of your skill level, it is recommended that you first practice soldering on a scrap board before beginning to assemble this kit. There are many references on the internet which can help you learn how.

Caution - Warning

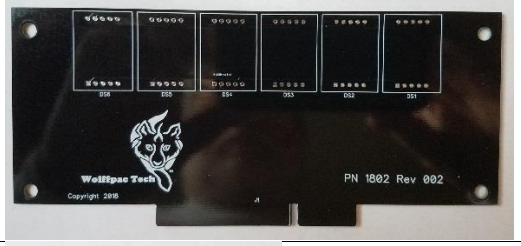
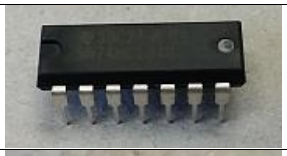
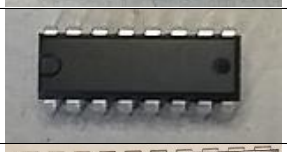
Solder melts at around 400°F to 600°F (200°C to 300°C). Remember to use care when soldering as both the soldering iron and solder are extremely hot and can produce serious burns. Make sure that you use an appropriate work surface since molten solder may drip and hot solder and components may damage or burn many materials.

Eye protection is recommended as solder can splash and component leads may fly when cut.

We are not responsible for any damage or injury as a result of assembling this kit.

Remember: Solder and components will remain very hot for several minutes after soldering.

Parts List:

Part Description	Ref	Qty	
Printed Circuit Board 'Master', Marked: P/N 1803		1	
Printed Circuit Board 'Slave', Marked: P/N 1802		4	
IC, Marked: ULN2803 or TBD62083	Q1,Q2	2	
IC, Marked: 74HCT04	U3,U4, U5	3	
IC, Marked: CD4543	U1, U2	2	
IC, Marked: 74ACT541	U6, U7	2	
Capacitor 0.1uF, Marked: 104	C1-C7	7	
7-Segment LED Display	DS	28	
6-digit Foam Bezel		4	
2-digit Foam Bezel		2	
Spacer		22	

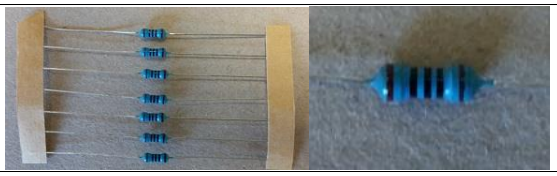
Resistor, See table 1 for value and marking based on the color of the LED digits in your kit:	R1-R14	14	

Table 1, Resistor value (R1-R14)		
LED display color	**Value**	**Marking**
Orange	150 Ohm	Brown-Green-Black-Black-Brown
Red	150 Ohm	Brown-Green-Black-Black-Brown
Blue	100 Ohm	Brown-Black-Black-Black-Brown
Green	150 Ohm	Brown-Green-Black-Black-Brown
White	100 Ohm	Brown-Black-Black-Black-Brown

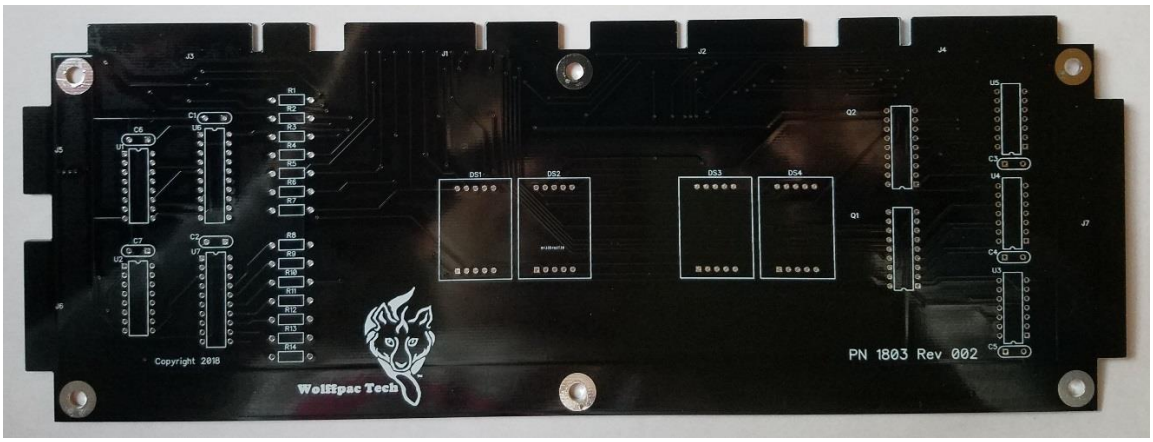
Start Here:

Before starting, check the components received against the parts list on page two. (We do occasionally make mistakes!) If any components are missing, or you have any questions regarding these assembly instructions please contact Wolffpac Tech at 'wolffpactech@gmail.com'.

If you have any problems with the display after assembly, you may contact Wolffpac Tech at 'wolffpactech@gmail.com'. If you need to return the display for repair, we will provide a pre-paid return label. Any problem found to be due to defective components will be repaired free of charge within 1 year of purchase. Any problem found to be due to assembly error or damage will be charged for postage and the cost of any components which need to be replaced.

'Master' Board:

Step 1: Start with the larger 'Master' PC Board (marked P/N 1803):



Insert U1 (CD4543) into the board from the top side (the side with the lettering) so that one pin goes through each hole at the location labeled 'U1'. Each chip is marked with a 'U'-shaped notch on one of the short ends:

This end should line up with the notch printed on the PC board. You may find that you have to bend the legs of the chip slightly in order to get both rows to line up with the holes in the board. You can do this with needle nose pliers or by laying the chip on its side with the pins of one side on a hard surface pointing away from you and gently pressing down and away on the body of the chip. Be careful not to bend the pins too far. Once inserted, bend the pins at the corners from the bottom slightly in order to hold the chip in place.

Make sure that all of the pins from the chip are completely inserted through the holes in the board before soldering in place from the bottom. Repeat for U2.

- ➔ Note: The chips on the left and right side of the Master board are oriented in opposite directions. Ensure that each part is correctly aligned with the direction of the notch printed on the circuit board.

Step 2. Repeat for U3, U4 and U5 (74HCT04)

Step 3. Repeat for U6, and U7 (74ACT541)

Step 4. Repeat for Q1 and Q2 (ULN2803 or TBD62083).

Step 5: Locate resistors R1-R14. Bend the leads of one resistor approximately 90° near the body of the resistor so that it forms a 'U' shape. Do not force the bend any closer than it will go with light finger pressure or you may damage the component. Insert the resistor into the board at the position marked R1 on the board. The direction does not matter. The leads should line up easily with the holes on the board. Once inserted through the board, bend the leads slightly from the bottom to hold the resistor against the board. Solder from the bottom. Trim the excess leads from the bottom of the board with diagonal cutters leaving about 1 mm. Repeat for R2 through R14.

Step 6: Locate capacitors C1 –C7. Insert one capacitor at the positions marked C1 on the board. The direction of these component does not matter. Bend the leads slightly from the bottom of the board to hold in position and solder in place. Trim the excess lead length to about 1 mm. Repeat for C2-C7.

Step 7: 7-Segment LED's. The 7-segment LED's are installed in positions DS1-DS4. Install the LEDs so that the end with the decimal point ('.') is closest to the bottom of the board, i.e. the side with no edge connectors. and that all 10 pins are correctly seated in the holes. Lay the board face down and solder one pin in each row of the LED. Inspect to ensure that the LED is seated flush with the PC board. If not, reheat the pin while pressing on the display from the front of the board. Once the LED is correctly seated, solder the remaining pins. Repeat for the remaining 3 LED displays.

'Slave' Board:

Step 1: Your kit will come with 4 'Slave' boards marked P/N 1802:

Step 2: 7-Segment LED's. The 7-segment LED's are installed in positions DS1-DS6.

Install one 7-segment LED in each position. Insure that the component is installed with the decimal point ('.') towards the edge connector J1 and that all 10 pins are correctly seated in the holes. Lay the board face down and solder one pin in each row. Inspect to ensure that the LED is seated flush with the PC board. If not, reheat the pin while pressing on the display from the front of the board. Once the LED is correctly seated, solder the remaining pins. Repeat for the remaining 5 LED displays.

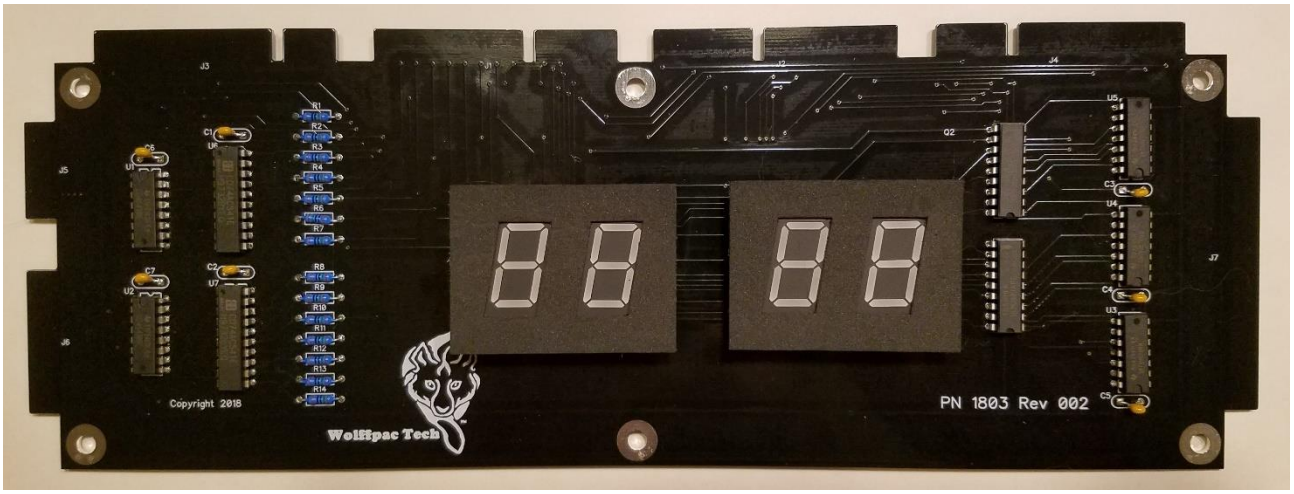
Final Assembly

Step 1. Wipe or rinse the boards with Isopropyl Alcohol, Denatured Alcohol, Flux Remover or water depending on the type of solder used to remove the solder flux residue.

Step 2. When the boards are completely dry, peel the clear plastic protective film from the front surface of each LED display.

Step 3. Remove the paper backing covering the adhesive from the 2-digit foam bezel. Carefully line the openings with the LEDs on the 1803 board and Install as shown below.

Note: The adhesive is very aggressive. Be careful when handling the bezel after removing the paper backing to avoid sticking it to something or somewhere you didn't intend!



Step 5. Remove the paper backing covering the adhesive from one of the 6-digit foam bezels. Carefully line the openings with the LEDs on one of the 1802 boards and Install as shown below. Repeat for the remaining three 1802 boards.

Step 6. Each mounting post that holds the display boards in the head box has a spacer held on with a nut. Some machines were shipped with a large spacer. If your machine has spacers which are noticeably larger than the ones contained in the kit, they will need to be changed in order to maintain the space between the displays and the backglass. If they are the same size, there is no reason to change the spacers. You may skip this step and the ones in the kit can be discarded.

For each mounting post, remove the nut, replace the spacer with one of the spacers supplied with the kit and replace the nut.

Step 7. With the power off, install the displays in your pinball machine and attach the original cables. The high voltage power supply in your pinball machine is no longer required. If you want, you can remove fuse F1 on the power supply board to disable it.

Note: It is okay to operate the system without any or all of the slave displays installed.

Caution: All five boards must be changed to use this display. DO NOT mix components of the original display with this display. Operating your pinball machine with these slave displays attached to the original master board will void the warrantee.

Apply power and enjoy!

This is believed to be an accurate list of machines with displays compatible with this replacement. Since we are unable to test this board in every configuration, we take no responsibility for any errors. However, we do welcome feedback as to any errors that are found so that we can update this list.

System 3

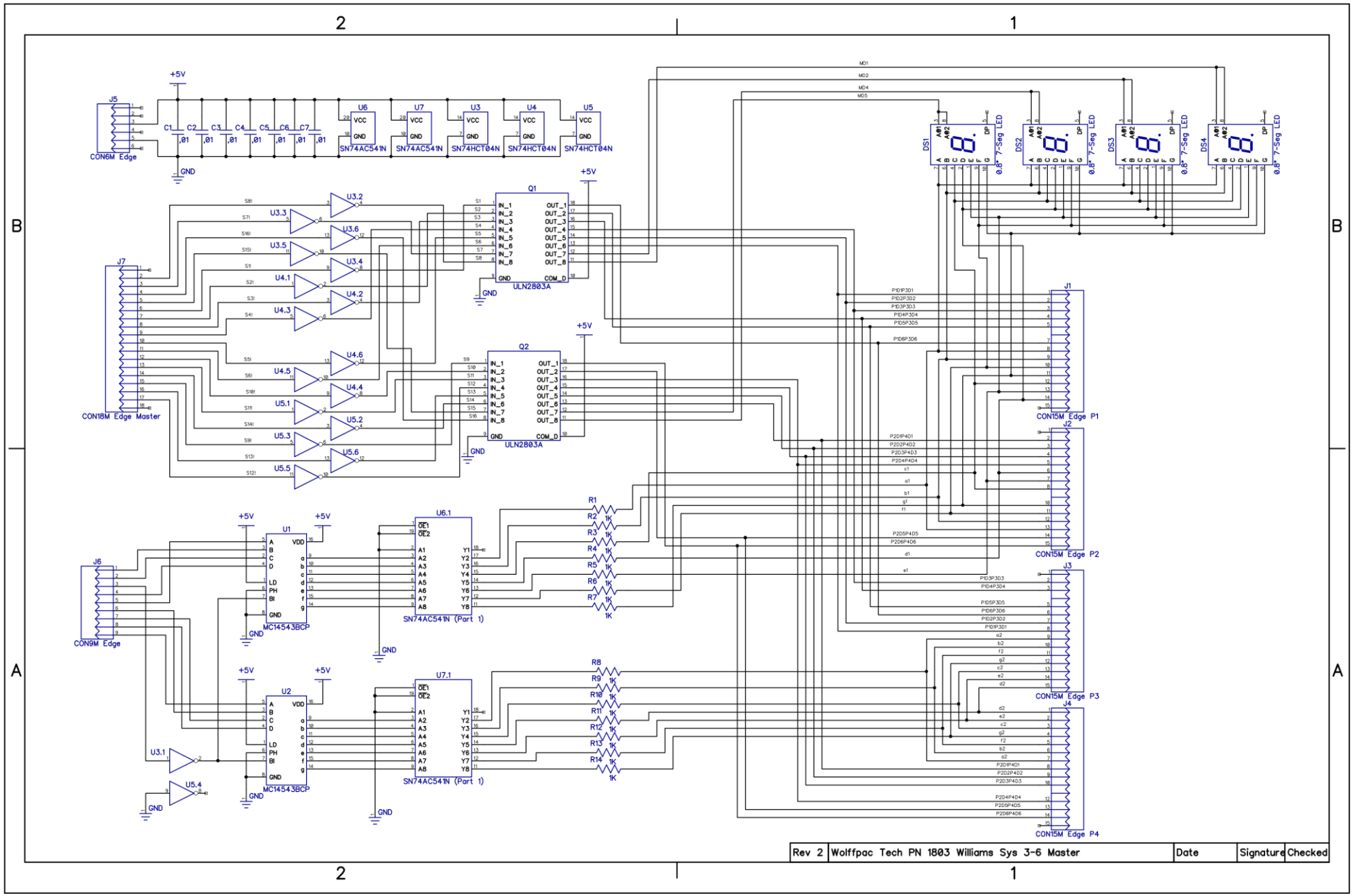
Hot Tip	11-1977
Lucky Seven	03-1978
World Cup	05-1978
Contact	05-1978
Disco Fever	08-1978

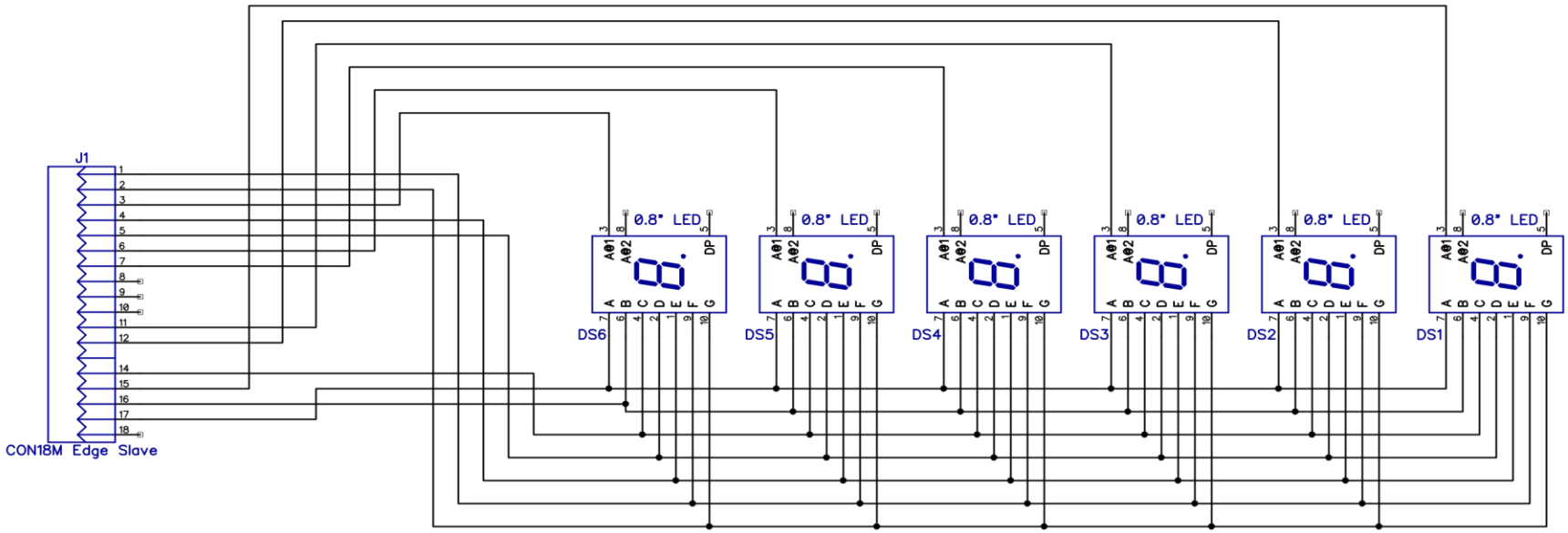
System 4

Pokerino	10-1978
Phoenix	11-1978
Flash	01-1979
Stellar Wars	03-1979

System 6

Tri Zone	07-1979
Time Warp	09-1979
Gorgar	12-1979
Laser Ball	12-1979
Firepower	02-1980
Blackout	06-1980
Scorpion	07-1980


2
1
B
A
+5V
GND
J5
CON6M Edge
C1 .01
C2 .01
C3 .01
C4 .01
C5 .01
C6 .01
C7 .01
U6 SN74AC541N
U7 SN74AC541N
U3 SN74HCT04N
U4 SN74HCT04N
U5 SN74HCT04N
DS1 0.8" 7-Seg LED
DS2 0.8" 7-Seg LED
DS3 0.8" 7-Seg LED
DS4 0.8" 7-Seg LED
MD1
MD2
MD4
MD5
J7
CON18M Edge Master
U3.1
U3.2
U3.3
U3.4
U3.5
U3.6
U4.1
U4.2
U4.3
U4.4
U4.5
U4.6
U5.1
U5.2
U5.3
U5.4
U5.5
U5.6
Q1
ULN2803A
Q2
ULN2803A
J1
CON15M Edge P1
J2
CON15M Edge P2
J3
CON15M Edge P3
J4
CON15M Edge P4
J6
CON9M Edge
U1
MC1454.3BCP
U2
MC1454.3BCP
U6.1
SN74AC541N (Part 1)
U7.1
SN74AC541N (Part 1)
R1
R2 1K
R3 1K
R4 1K
R5 1K
R6 1K
R7 1K
1K
R8
R9 1K
R10 1K
R11 1K
R12 1K
R13 1K
R14 1K
1K
Rev 2
Wolffpac Tech PN 1803 Williams Sys 3-6 Master
Date
Signature
Checked



Rev 1	Wolffpac Tech PN 1802 Williams Sys 3-6 Slave	Date	Signature	Checked