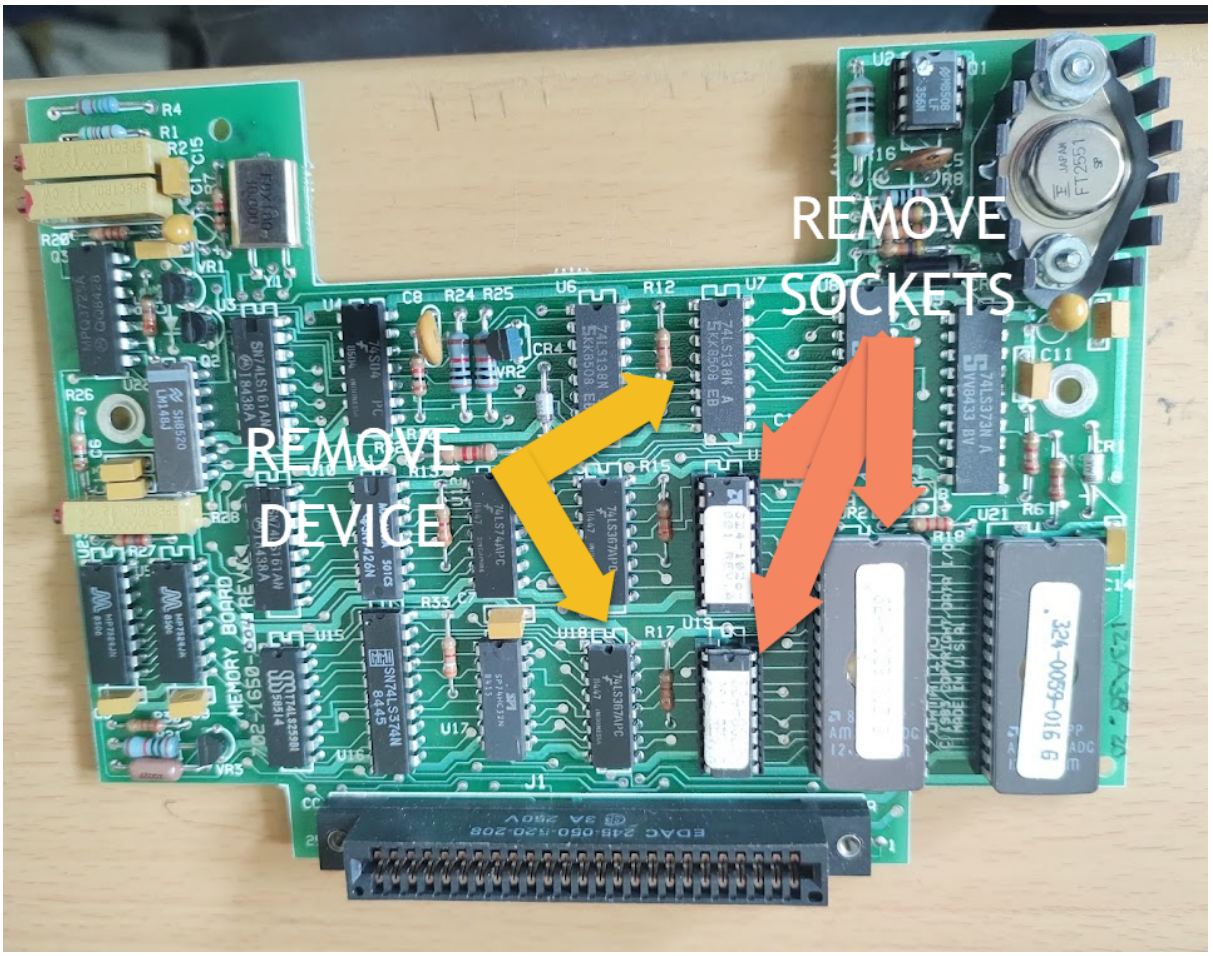
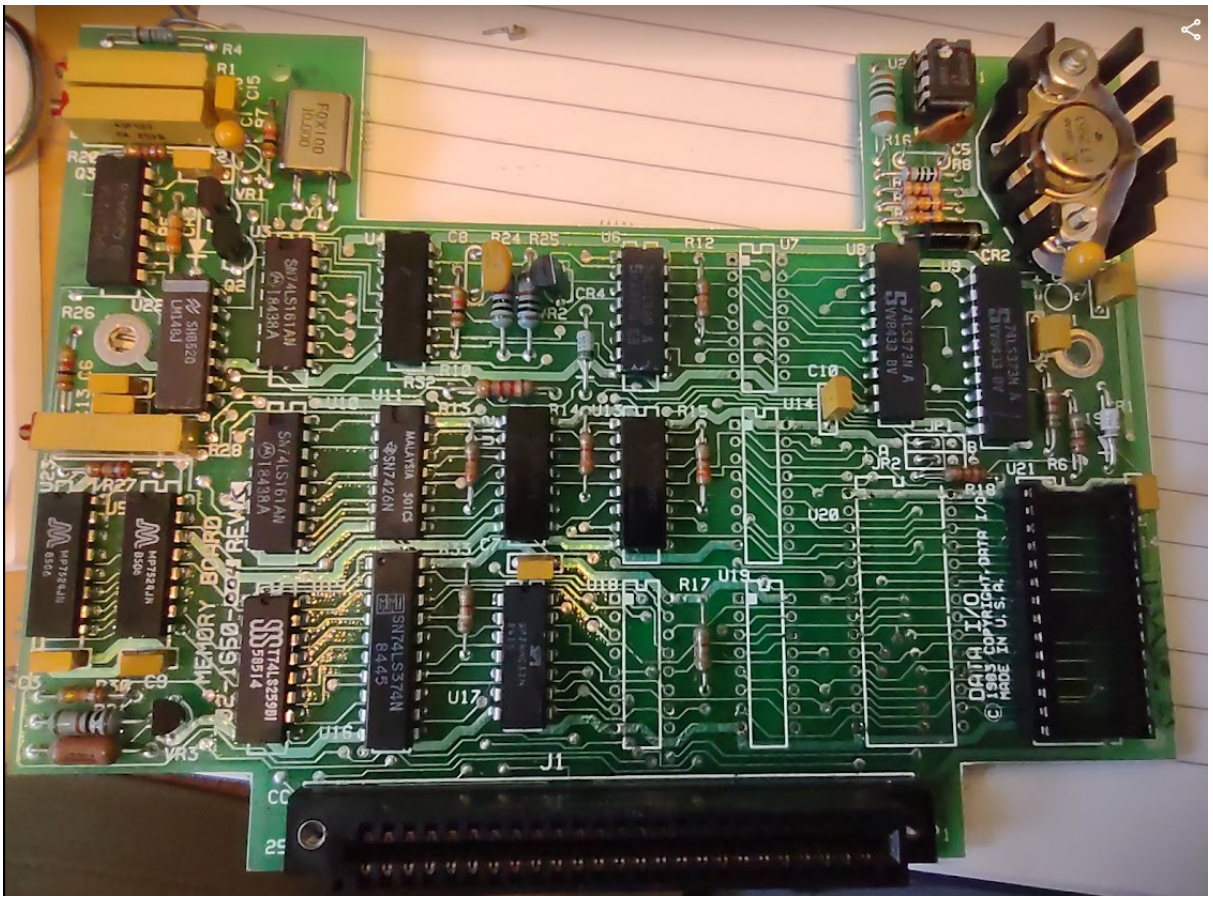
Data I/O Memory Board 30-702-1650 Upgrade to v27 Firmware



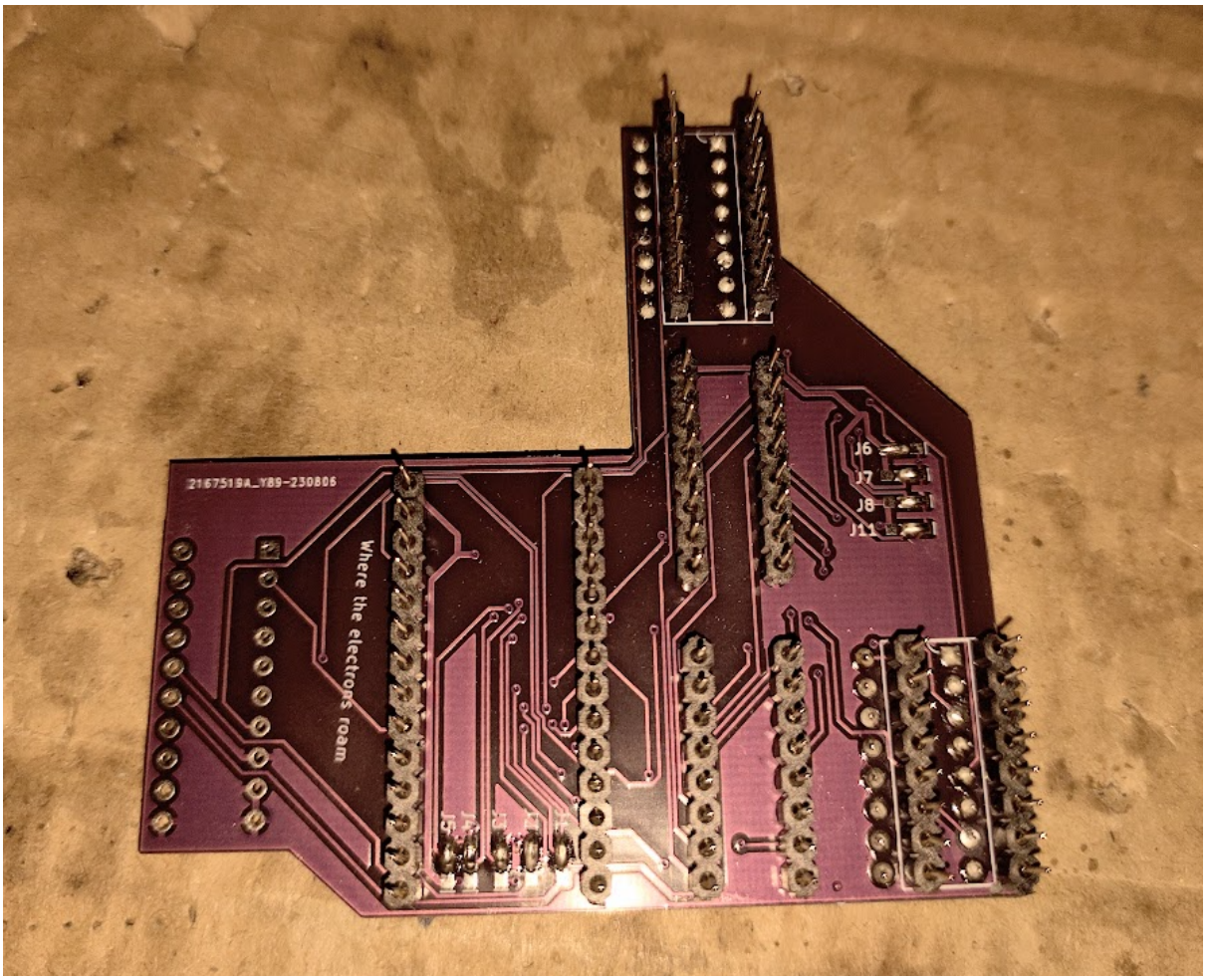
The Data I/O 29B Memory card wrangler replaces the U14 and U15 decoding and the ROMs at U20 and U21.

Remove devices and/or sockets at U7, U14, U18, U19 and U20. Keep the devices from U7 and U18 for re-use. U14, U19 and U20 can be put aside; additionally **also remove U21** but its socket can remain without change but empty; put the U21 ROM aside.

Once the devices and sockets have been removed your board should look like this…

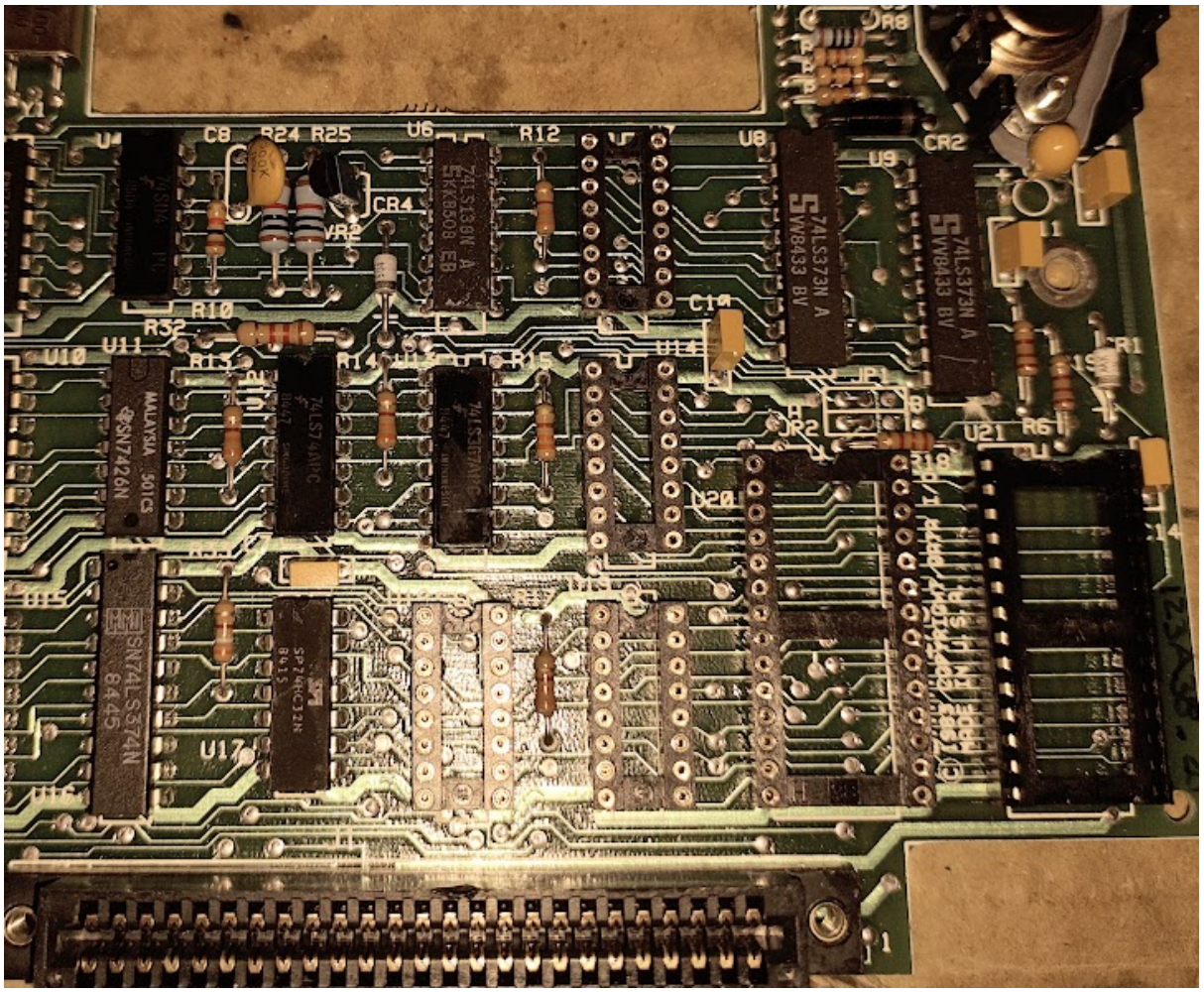


The Memory Wrangler plugs into the Memory board using Machined Pin Headers into Machined Pin Sockets…



So a clever way of ensuring the alignment is perfect with the sockets you are about to install is to use the Memory Wrangler plugged into all the machine pin sockets as a template whilst soldering the new sockets to the original memory board.

If all goes according to plan you should have something that looks like this…



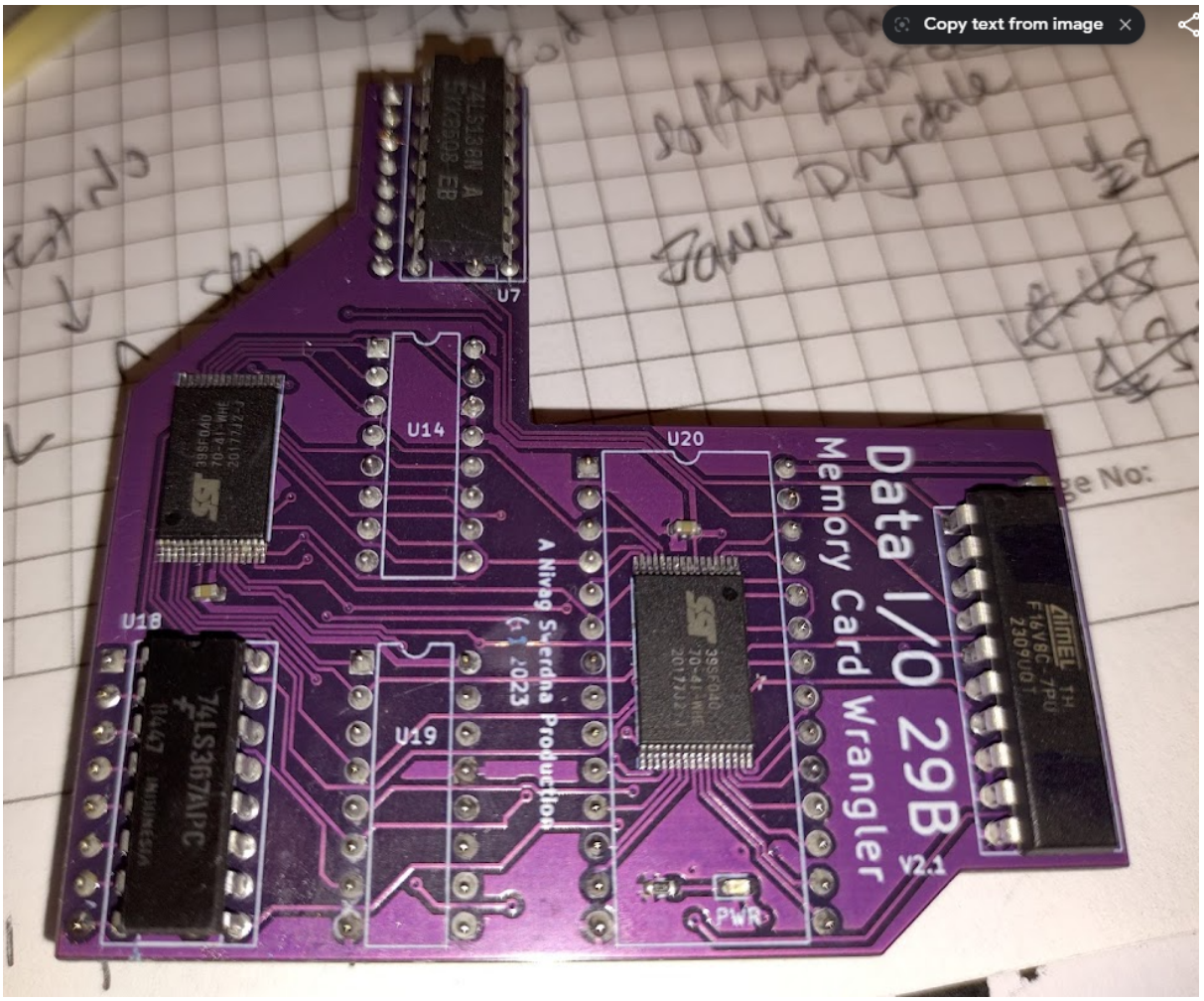
Be gentle when removing/installing the Memory Card Wrangler as there are plenty of pins to align and getting one that doesn't line up will ruin your day.

The removed U7 (74LS138) is then soldered into the wrangler at the offset U7 position and likewise the removed U18 (74LS367). Neither of these should be socketed as vertical height is at a premium when the board is put back into the UniPak2(b).

Then you just plug in the Data I/O 29B Memory card wrangler, reassemble your UniPak and try it out!

Theory of Operation

The 702-1650 memory board is very similar to the later 701-2126 board in terms of operation but uses a different scheme for memory address decoding and ROM access. In particular the 702-1650 board uses two PROMs U14 and U19 to do the majority of the decode whereas the more modern board uses PALs. The decoding essentially maps different areas of the address space onto their various functions on the UniPak and then distributes these signals as enables to the other parts.
For the 702-1650 board there is additionally a scheme that allows the ROM space to be further decoded using a single bit Page1/nPage0 addressed as part of the U4 register on the Address card. In the 701-2126 this ROM paging scheme is replaced with a custom paging register implemented by a registered PAL at U13.
A small quirk is that on the 701-2126 board the A11 address line is inverted by U3; this function is handled by the Wrangler by transforming the ROM image in FLASH and hence no inverter gate is required.



The wrangler needs to capture some signals from the board and to do this it intercepts U7 and U18. The actual devices for U7 and U18 are still required so these are moved up to the

PCB. You can use the originals as long as you do not damage them during the desoldering process.
The decode functionality of U14 and U19 is replaced by the Flash U1 on the left and fed back down to the board using the U14 and U19 headers to the sockets below.
The ROM functionality (U20 and U21) is replaced by the Flash U2 on the right. Signals on U21 are not required so that socket can be left empty; the ROM signals go back down into the U20 socket.
Finally the paging register U13 on a 701-2126 is implemented by the 16V8 PAL on the right hand side of the board.

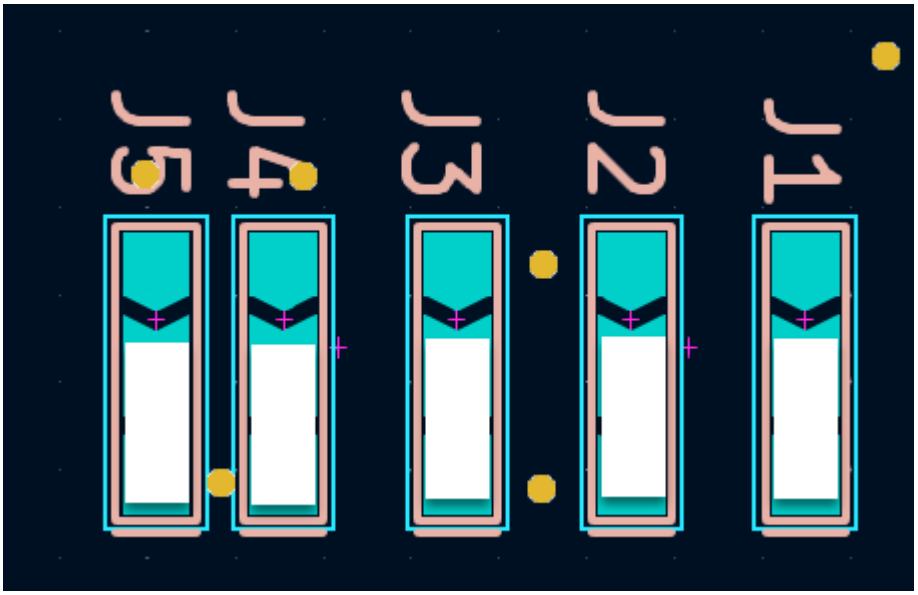
The memory map for the new scheme (used by the 701-2126) is almost identical to that of the 702-1650 but with an additional memory range being writable for the paging register. Additionally the GateEnable range is extended to allow data for the page register to be driven onto the Memory Card from the Mainframe.

	pin	value		Signature			Signature			
U7	15	0	ROM nOE	5FF1	R 6000-9BFF		0001	-		
	14	1	Alternate ROM nOE	0001	-		0001	-		
	13	2	Address Latch	0001	-		A7F7	W 9E00-9EFF		
	12	3	Page Register	0001	-		HA3U	W 6000-60FF		
	11	4	nC3	F38P	R 9C00-9CFF		F38P	W 9C00-9CFF		
	10	5	nC7	6271	R 9D00-9DFF		6271	W 9D00-9DFF		
	9	6	nC4	A7F7	R 9E00-9EFF		0001	-		
	7	7	Pulse	0001	-		U6A7	W 9F00-9FFF		
	pin	value								
U14	12	1	C1	0001	-		A68P	W 00A0-00AF		
	11	2	ROM nCS	5FF1	R 6000-9BFF		0001	-		
	10	4	C2	0001	-		CF21	W 0090-009F	W 00B0-00FF	
	9	8	GateEnable	5AU8	R 6000-9EFF		300U	W 0090-00FF	W 9C00-9FFF	W 6000-60FF

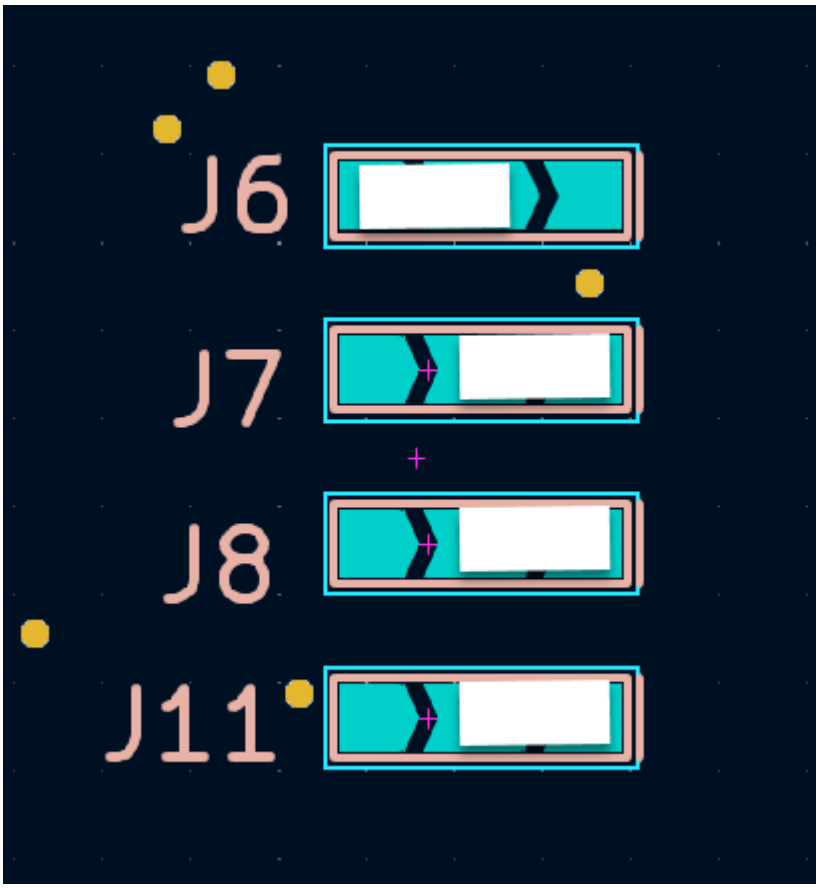
Additionally I have used pin 12 of U7 as an easy way to enable the paging functionality of the PAL U3 on the Wrangler. Pin 12 is not used on the 702-1650 so can be pressed into service. With the Wrangler pin 12 will be active low for writes to the range 0x6000-0x60ff where the paging register is incompletely decoded.

Additional Configuration things you probably don't want to know!

The solder jumpers should be configured as follows for v27



And the other solder jumpers like this for the v27 enhanced decoding scheme…



Other combinations are possible but you need to know what you are doing!