

## Sky Skipper Project

### TPP2 Conversion Board BOM + Assembly Instructions

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## Disclaimer

**Use of this document and/or the conversion board constitutes acceptance and agreement to the following:**

- Acknowledgement that this is a zero-dollar (non-compensated by you to the Sky Skipper project members) gift to you, the recipient, and you will hold anyone and everyone associated with the Sky Skipper Project free from any pursuit of compensation or retaliation (monetary, verbal, video) from any perceived (real or otherwise) loss you may experience by using this conversion board or feel compensation owed due.
- Agree to not reverse-engineer the board for profit or distribution online or to other channels. Doing so is counter to the intent and spirit under which this board was produced and gifted to you, the recipient.

**This is a passion project with you as the benefactor of such pursuits.**

## General Notes

Now – onto the good stuff - this board is meant to provide you a means to continue to run Sky Skipper on hardware in your cabinet in case you have issues with your TNX boardset.

Successfully completing the TPP2 Popeye -> Sky Skipper conversion requires a properly-running TPP2 board stack \*with\* the Security IC installed in location 7K on the CPU PCB.

It's best to go ahead and separate your TPP2 board stack so that you have free access to both the CPU board and the Video board, as there will be some modifications needed to each that will require plenty of desk space to work with.

You WILL need access to a ROM burner and blank EEPROMS as well as the Sky Skipper game ROMS and color PROMS – those can be obtained from a few different sources (i.e, Mike's Arcade or Stefan at HobbyROMS) if you do not have the hardware (i.e, ROM burner), time or desire to dump the ROMS and PROMS on your existing TNX boardset.

No code distribution is provided with these instructions or as part of the conversion board kit.

Note that your TPP2 boardset may act differently than others or you may run into issues with getting the game running on the TPP2 boardset. If that's the case, post into the FB group for help.

*This is a living document and there very well could be errors – no warranty is expressed or implied. We reserve the right to amend any portion of the document (disclaimer, notes, procedures, recommendations, etc.) at any time and use therein constitutes acceptance thereof.*

*If you have suggestions or questions, please post in the group and we'll do our absolute best to assist.*

*If the document needs revisions, the right is reserved to do so at any time. Please refer to the document posted in the group to ensure you're working with the most current version.*

## Version History

Version	Date	Notes
1.0	3/15/24	Initial release

# Bill of Materials

The following items are needed to finish the assembly of your conversion board:

Part Number	Qty	Item	More details, purchase
<b>74LS157N</b>	3	16-pin multiplexer, programmable counter	<a href="https://mou.sr/3Tx7SKn">https://mou.sr/3Tx7SKn</a>
<b>74LS273P</b>	1	20-pin Flip-flop	<a href="https://www.digikey.com/en/products/detail/texas-instruments/SN74LS273N/277303">https://www.digikey.com/en/products/detail/texas-instruments/SN74LS273N/277303</a>
<b>74LS161AN</b>	2	16-pin 4-bit sync counter	<a href="https://mou.sr/49Ov65h">https://mou.sr/49Ov65h</a>
<b>74LS04P</b>	1	14-pin Hex inverter	<a href="#">SN74LS04N Texas Instruments   Mouser</a>
<b>74LS367A</b>	1	16-pin Hex Bus Driver	<a href="https://mou.sr/45SJSFT">https://mou.sr/45SJSFT</a>
<b>D103Z25Z5VF63L6R</b>	8	Ceramic thin-film capacitors	<a href="https://mou.sr/4cewHD6">https://mou.sr/4cewHD6</a> 50V, .01uf – any low value will work here These are optional, but recommended – the board will work just fine without these being installed.
<b>CFR0W8J0472B00</b>	1	Resistor	<a href="https://mou.sr/3Tfcx35">https://mou.sr/3Tfcx35</a> 1/8w, 4.7K ohm Pull-down resistor This is optional, but recommended – the board will work just fine without it being installed.
<b>4816-3000-CP</b>	6	16-pin dual-wipe sockets	<a href="https://mou.sr/3vhzqLk">https://mou.sr/3vhzqLk</a>
<b>4820-3000-CP</b>	1	20-pin dual wipe sockets	<a href="https://mou.sr/3PhhLKS">https://mou.sr/3PhhLKS</a>
<b>4814-3000-CP</b>	1	14-pin dual-wipe sockets	<a href="https://mou.sr/48YvZY4">https://mou.sr/48YvZY4</a>
<b>855-D01-9923246</b>	114	2.54mm Header pins	<a href="https://mou.sr/48P8r7M">https://mou.sr/48P8r7M</a>

**Note – refer to page 16 to ensure you also have the appropriate RAM and Security IC for your TPP CPU PCB**

# Assembly Instructions

## Step 1 – mounting the dual-wipe sockets

Refer to the following picture to help with the installation of the dual-wipe sockets

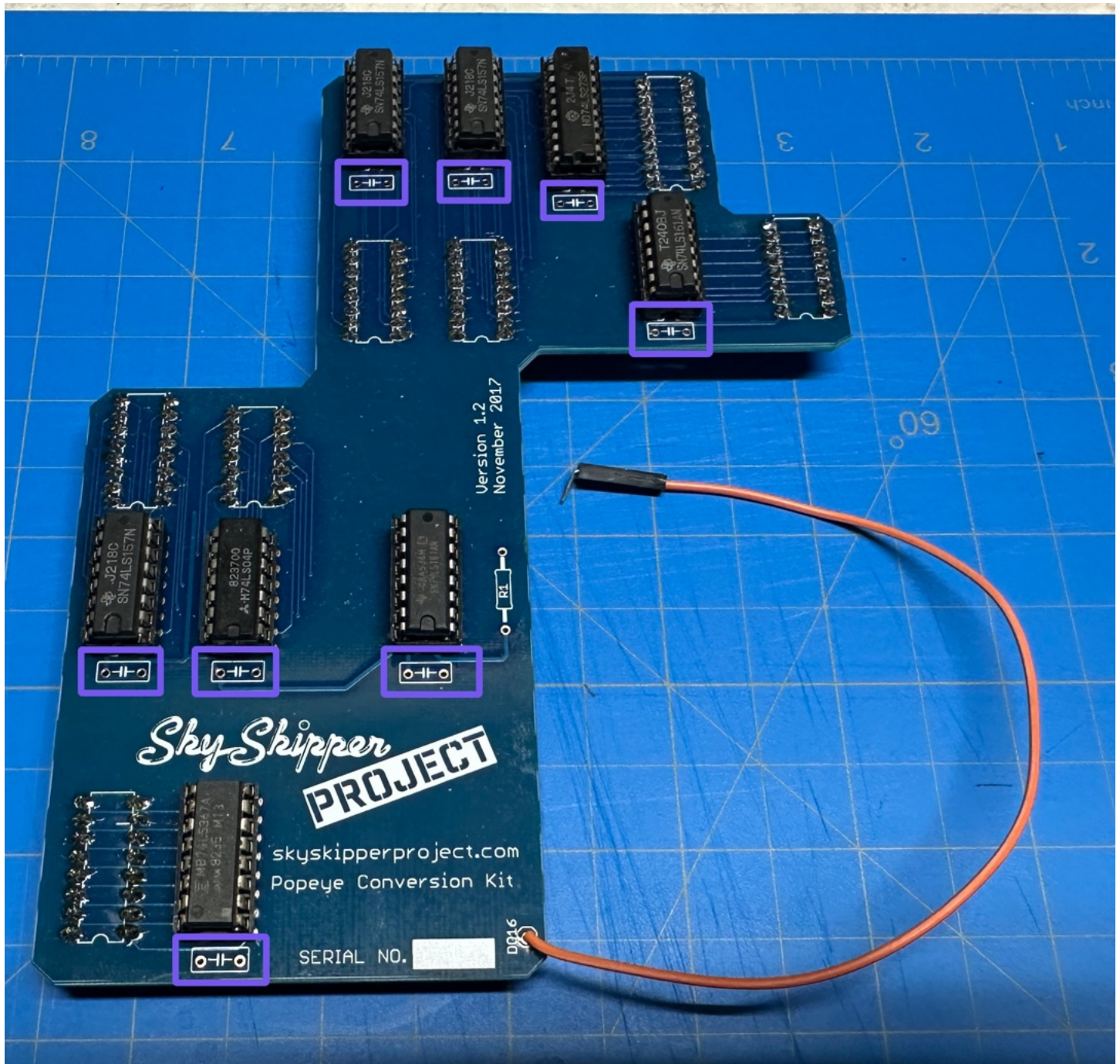
- Install a 14-pin socket in the location with the yellow marker
- Install 16-pin sockets in the locations with the red marker
- Install a 20-pin socket in the location with the green marker





## Step 2 – installing the film capacitors

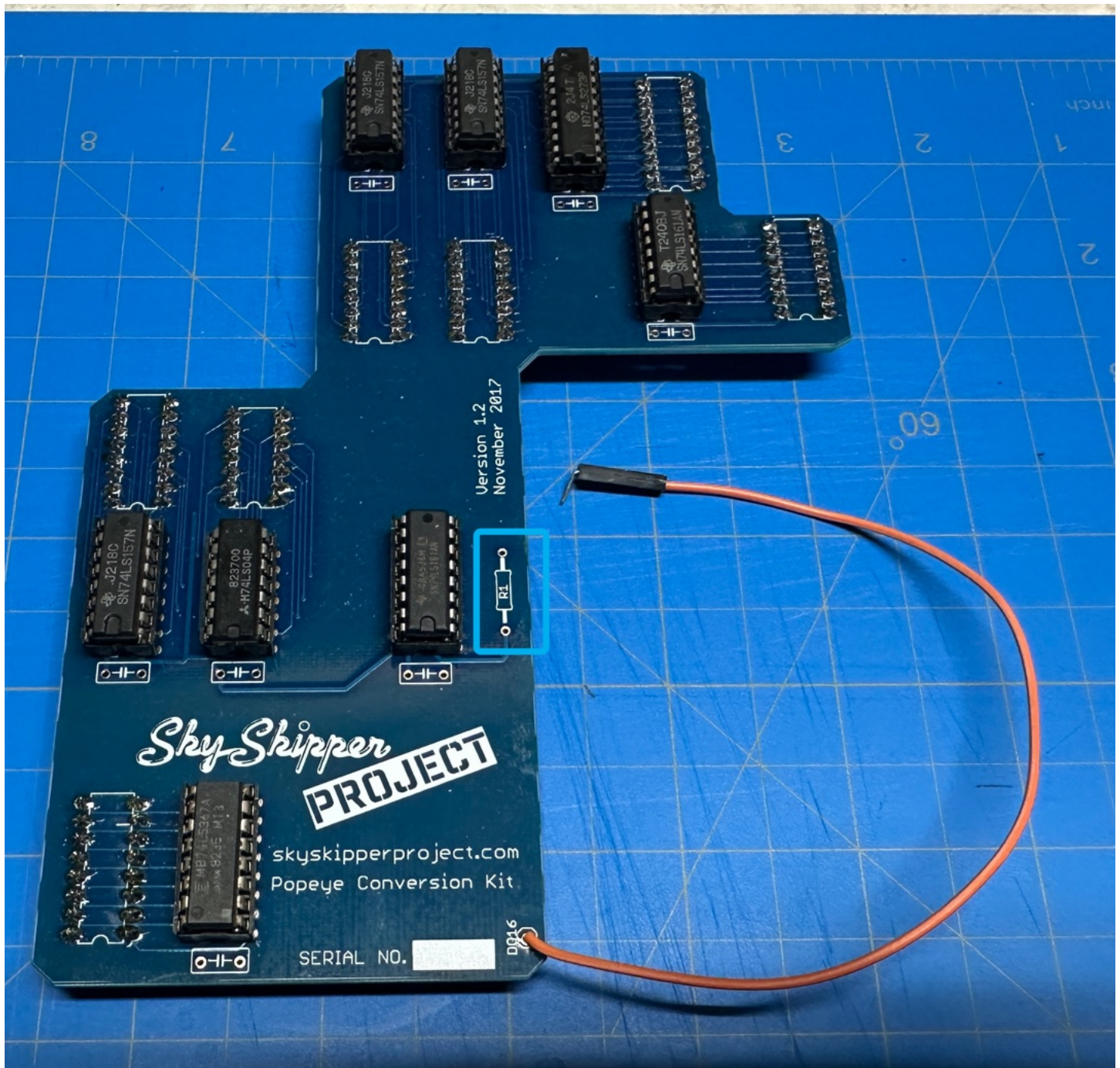
Refer to the following picture to help with the installation of the 50v 0.01uf ceramic disc capacitors in each of the locations with the purple marker:





### Step 3 – installing the resistor

Refer to the following picture to help with the installation of the 1/8w, 4.7K ohm Resistor in the location of the blue marker:



## Step 4 – mounting the pin headers

Mounting the pin headers is one of the more challenging parts of the build. It's recommended to lay the TPP2 Video board onto the work surface for this part of the build.

Proceed as follows:

- Remove the following IC's from the TPP2 video board:
  - 4U
  - 6T
  - 6U
  - 7R
  - 7S
  - 8N
  - 7M

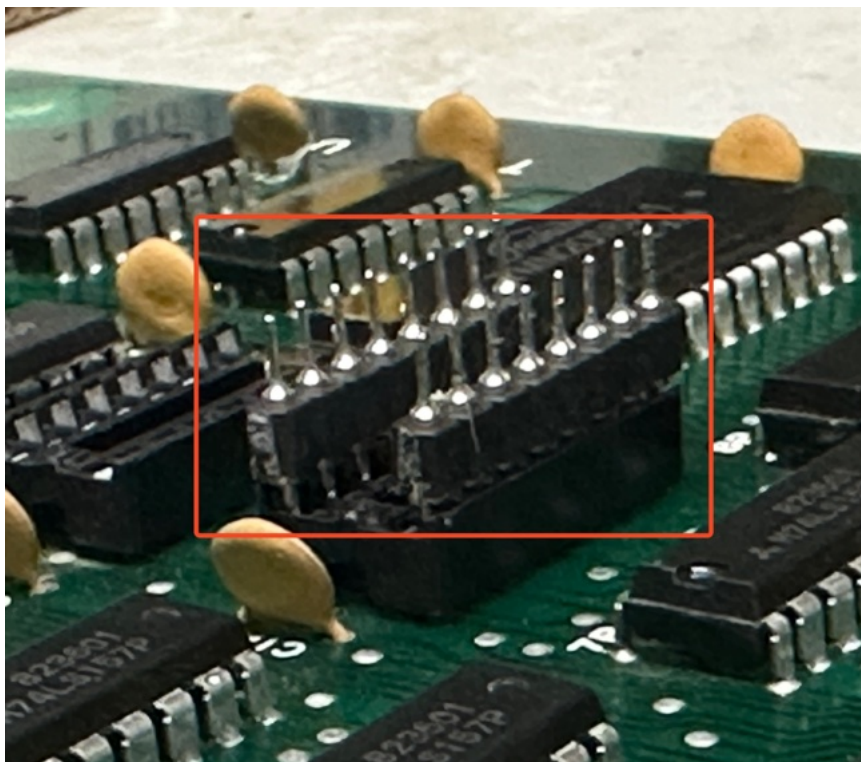
**Note that some, all or none of these IC's may be socketed – it will differ by board. If they are not socketed, then carefully desolder and remove and install a dual-wipe socket in place of.**

Set the respective IC aside, as it will be used later.

- Separate the pin headers (included with the kit) and install them into the now empty sockets on the TPP2 video board at each of the locations noted in the previous step.

**Be sure to check alignment here and ensure that the rows of pins are as straight as possible!**

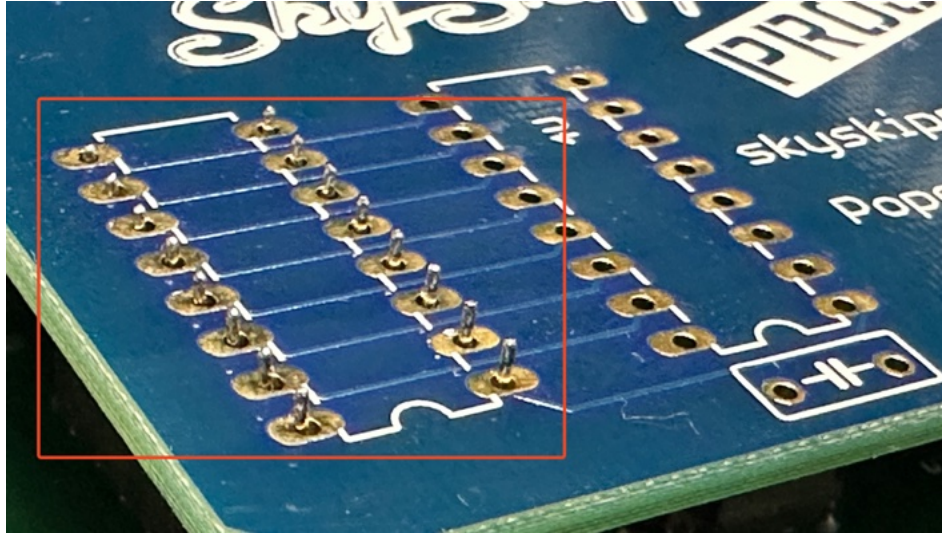
Refer to the picture below to see how the pin headers should be installed in each of the sockets:



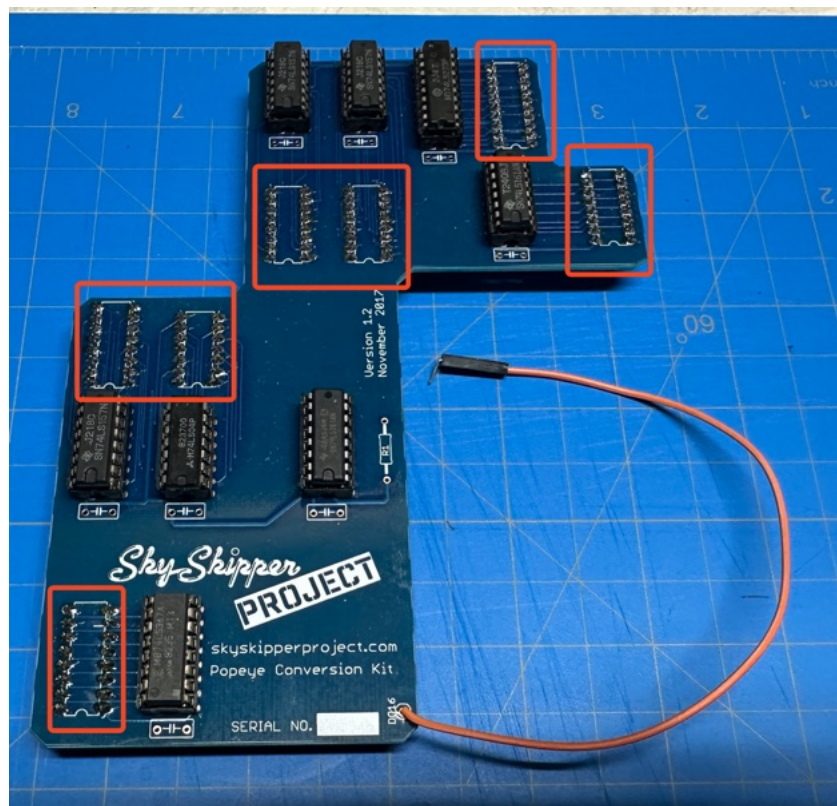


- Place the conversion board over the TPP2 video board and work with the board until it sits atop the installed pin headers.

When installed correctly, you'll see pin headers clearly through all the remaining holes on the conversion board and the board will be resting level on the TPP2 video board, as shown in the following picture:



- Refer to the following picture to help you locate all the pin header locations (red marker)



Once all the pin headers are through the conversion board, go ahead and solder them in place and then clip the ends flush with a pair of flush/side cutters.

At this point, the conversion board should be firmly mounted onto the TPP2 Video PCB with the pin headers installed and soldered into place.

The conversion board can be removed, if needed, but reinstallation can be a bit of a challenge due to pin alignment back into the sockets, so exercise care when removing and reinstalling the conversion board!

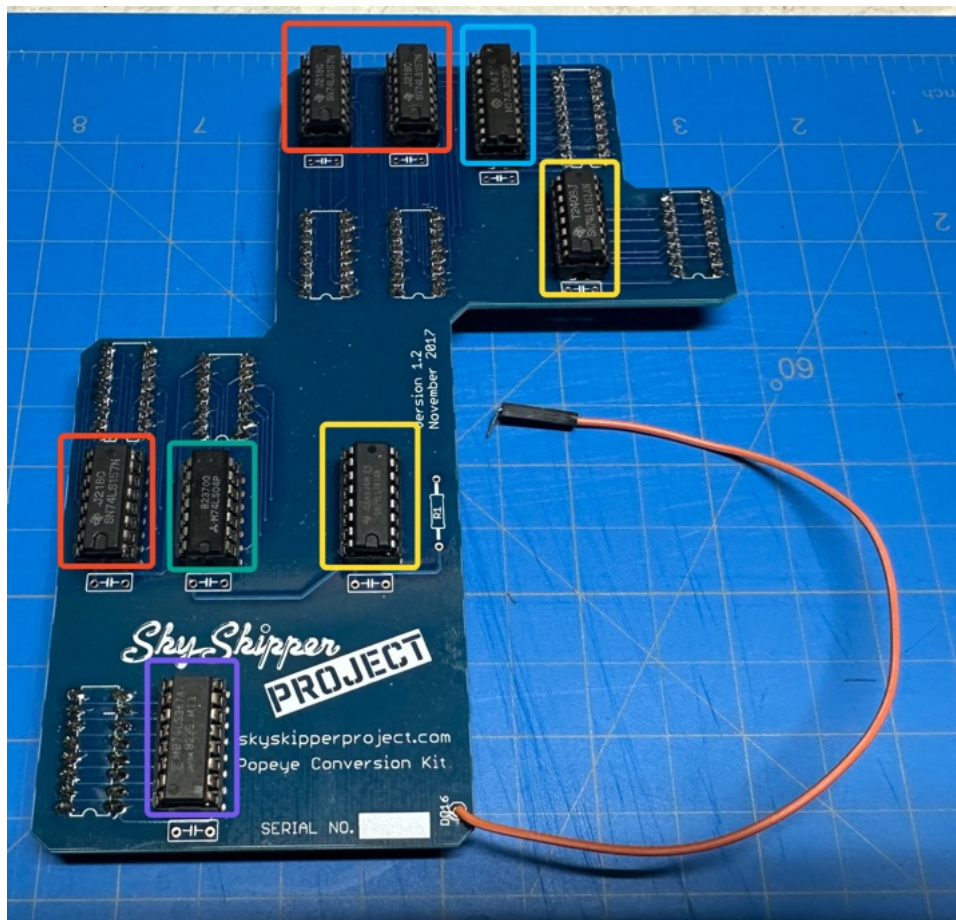
## Step 5 – installing the logic IC's

With the sockets, capacitors and resistor placed and the conversion board mounted onto the TPP2 video board, it's now time to install the logic components on the conversion board.

Refer to the following picture for reference on where logic IC is installed:

- Install a 74LS157N in the locations with the red marker
- Install a 74LS273P in the location with the blue marker
- Install a 74LS161AN in the locations with the yellow marker
- Install a 74LSS04P in the location with the green marker
- Install a 74LS367 in the location with the purple marker

Note that you may be able to re-use some or all of the IC's removed in Step 4. If that's not the case for your TPP2 video board, then refer to the list above and the BOM to ensure you install the proper IC's at the locations specified.





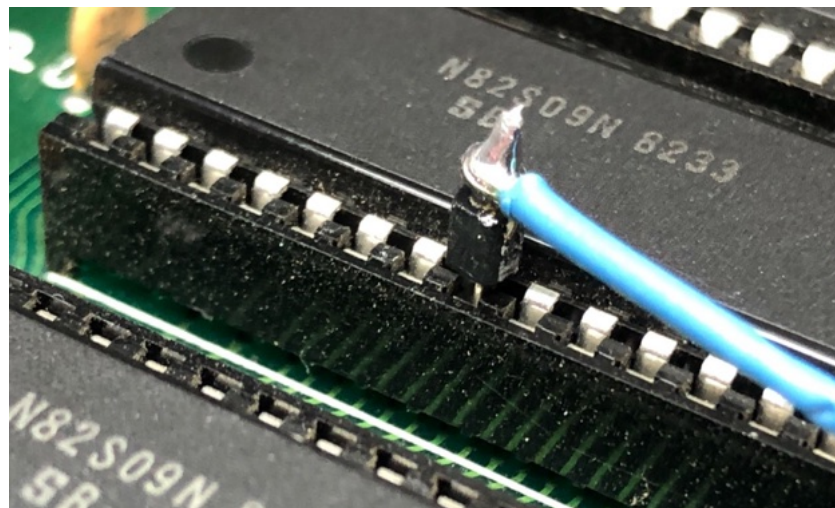
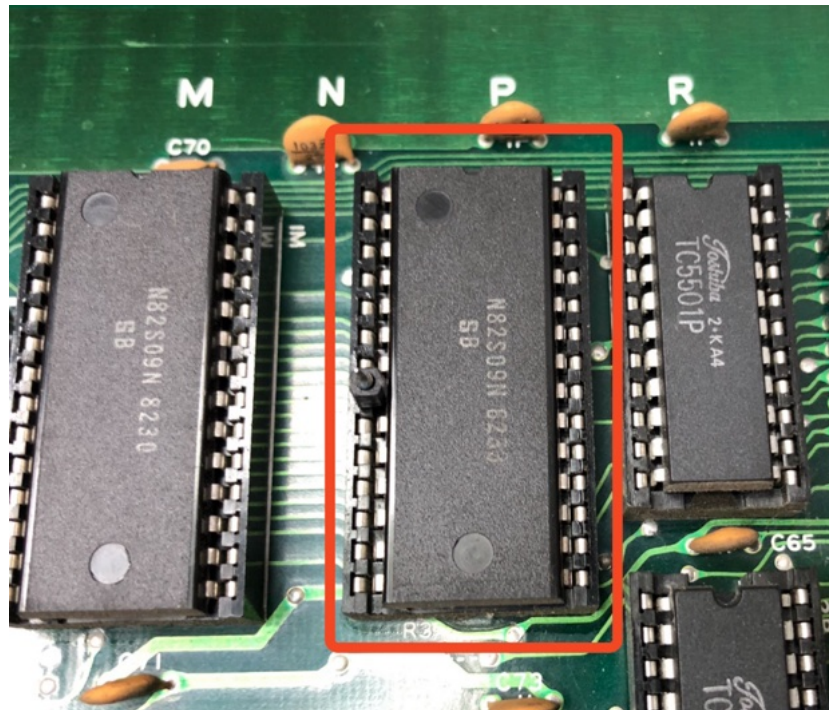
## Step 6 – installing the timing signal tap

The last remaining step for board assembly is the installation of the timing signal tap. This is required to ensure the conversion board is in proper time with the graphics generation done by the TPP2 video board itself.

Solder a small pickup wire (gauge isn't really important as this line carries no significant voltage, just signal) to the conversion board in the location noted by the red marker.



The wire should be long enough to reach over to P1 on the video board and allow you to tap the signal at pin 8 on that IC – refer to the pictures below for reference:





## Step 7 – Prepping the TPP2 CPU Board

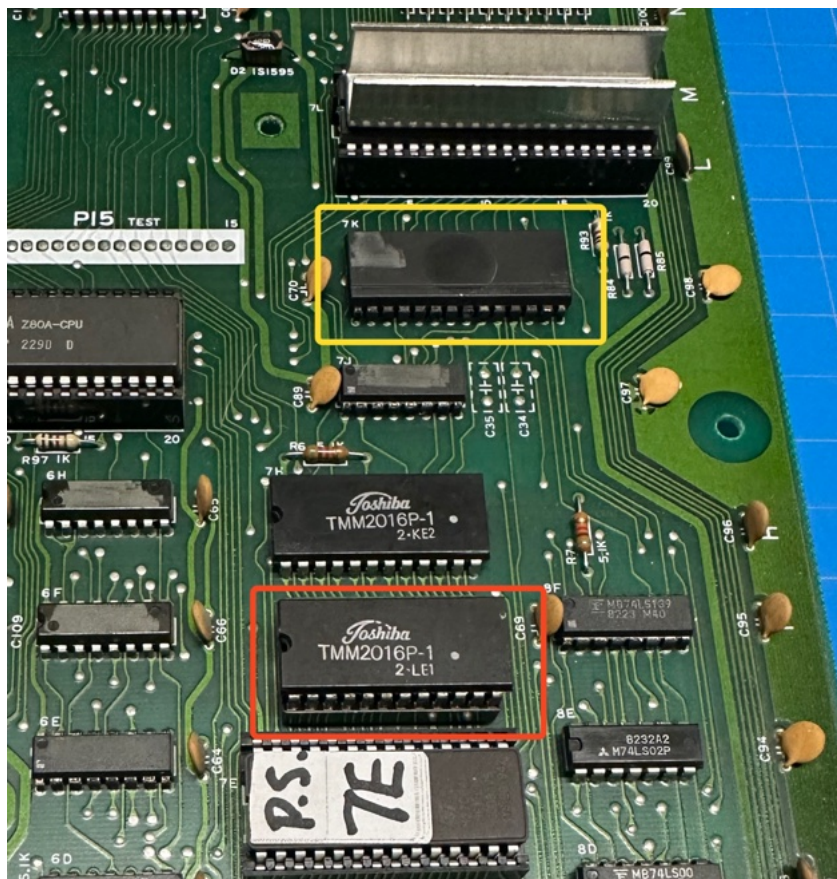
The last step of the conversion board “install” process is to ensure the TPP2 CPU board is prepped for proper operation running Sky Skipper vs. Popeye.

This involves verification and/or installation of the following two components:

### 1. Security IC located at 7K – (yellow marker)

Hopefully your CPU board has this already – if not, you’ll have to source one yourself (either by finding the IC bare or harvest from another TPP2 CPU board that has it installed) and install it onto your TPP2 CPU board.

### 2. 2016 RAM located at 7F (Red marker)



If your TPP2 CPU PCB is missing either of these components – **which is entirely possible based on the Popeye ROM set and board revision your stack is comprised of** – then they will need to be installed to ensure proper operation of the conversion board.

Without the extra RAM, Sky Skipper will not boot and play properly and without the security IC, the Sky Skipper ROMs cannot be decoded properly – hence another “no boot” situation.

# Running Sky Skipper on the TPP2 PCB Stack

With the Conversion board, the TPP2 Video PCB and the TPP2 CPU PCB now prepped, the only remaining procedure is to install Sky Skipper ROMS and PROMS.

This procedure is a three-step process:

1. ROM install on the CPU PCB
2. ROM install on the Video PCB
3. PROM install on the Video PCB

For these steps, you will need to supply your own Sky Skipper ROMS and PROMS. Either copy (dump) the ROMS and PROMS from your TNX board stack with a ROM burner or contact Mike's Arcade or Stefan at HobbyROMS for the additional help.

**No code distribution is provided with these instructions or as part of the conversion board kit.**

The game ROM sizes and quantity are different between the TPP and TNX board stacks, so the goal is to get the TNX-based Sky Skipper ROMS into a format that can be utilized on the TPP CPU PCB.

Refer to the TNX -> TPP ROM map table below for the following three procedures:

ROM/PROM Mapping Table

TNX Board	TNX ROM/PROM	TPP ROM/PROM	TPP Board
Video	3H (x2)	5N	Video
TIF	1E (x2)	1E	
	2E (x2)	1F	
	3E (x2)	1J	
	5E (x2)	1K	
TIF	1A (PROM)	3A (PROM)	CPU
	4A (PROM)	4A (PROM)	
	2A (PROM)	5A (PROM)	
	3A(PROM)	5B (PROM)	
	3J (PROM)	7J (PROM)	Video
CPU	2A	7A	CPU
	2B		
	2C	7B	
	2D		
	2E	7C	
	2F		
	2G (x2)	7E	

## ROM Install on the TPP CPU PCB

The ROMS for the TPP CPU PCB are comprised of the following ROMS on the TNX CPU PCB:

- 2A, 2B, 2C, 2D, 2E, 2F and 2G

Since the game ROM code from the TNX TIF PCB is split across seven 32K EEPROMS, we have to perform an operation to allow that code to fit into the 4 ROM slots we have available on the TPP CPU PCB.

This can be accomplished by doing a binary copy of the existing TNX ROMS into a new file that will then be flashed to a 64K EEPROM that is then installed in the TPP CPU PCB.

You'll need a PC or Mac for this procedure (we'll use a PC in this example) in this example:

1. Dump all the TNX game code ROMS to like-named files into a folder on your computer hard drive
2. From a command prompt, use the copy command to "double stack" the TNX game code into a properly-sized image that can be burned to an EEPROM:

**a. C:\skyskipper> copy /b TNX2a.bin + TNX2b.bin TPP7a.bin**

**b. C:\skyskipper> copy /b TNX2c.bin + TNX2d.bin TPP7b.bin**

**c. C:\skyskipper> copy /b TNX2e.bin + TNX2f.bin TPP7c.bin**

**d. C:\skyskipper> copy /b TNX2g.bin + TNX2g.bin TPP7e.bin** – note we have to copy 2G over itself twice to make sure we fill up the 8KB used in 7e since we have an odd number of TNX ROM files that need to fit into an even number of TPP EEPROMS.

3. Take the newly-created TPP EEPROM images and burn them to 64K EEPROMS, label them accordingly and install them into the TPP2 CPU PCB in their corresponding locations.



## ROM Install on the Video PCB

The ROMS for the TPP Video PCB are comprised of the following ROMS on the TNX PCBs:

- TIF: 1E, 2E, 3E and 5E
- Video: 3H

Since the game ROM code from the TNX TIF and Video PCB are all 4KB in size (32Kb) they will have to undergo the same “double stack” procedure to fill the 8KB (64Kb) EEPROMS that need to be installed in the TPP PCB stack.

You’ll need a PC or Mac for this procedure (we’ll use a PC in this example) in this example:

1. Dump all the TNX game code ROMS to like-named files into a folder on your computer hard drive
2. From a command prompt, use the copy command to “double stack” the TNX game code into a properly-sized image that can be burned to an EEPROM:

- a. **C:\skyskipper> copy /b TNX3h.bin + TNX3h.bin TPP5n.bin**
- b. **C:\skyskipper> copy /b TNX1e.bin + TNX1e.bin TPP1e.bin**
- c. **C:\skyskipper> copy /b TNX2e.bin + TNX2e.bin TPP1f.bin**
- d. **C:\skyskipper> copy /b TNX3e.bin + TNX3e.bin TPP1j.bin**
- e. **C:\skyskipper> copy /b TNX5e.bin + TNX5e.bin TPP1k.bin**

3. Take the newly-created TPP EEPROM images and burn them to 64K EEPROMS, label them accordingly and install them into the TPP2 Video PCB in their corresponding locations.

## PROM Install on the CPU and Video PCB

Install the PROMS per the table reference on page 17.

**Note:** that there is a possibility you may have to rearrange the PROMS on the TPP board stack to get the colors to more closely match what you see when Sky Skipper runs on its native hardware. It would be best to compare the colors against a TNX board stack running Sky Skipper natively to verify PROM placement for your TPP hardware.

Due to hardware differences between the TPP and TNX board stack, running Sky Skipper PROMS in the TPP board stack will not result in 100% perfect color rendition for each and every sprite and background in the game when compared to running the same PROMS in the TNX board stack. The only way to resolve this is to create a custom set of color PROMS for the TPP PCB stack and that involves binary editing of the TNX PROM set or running wire mods on the TPP board stack to address signal changes needed for that hardware. Creating custom TPP PROMS for Sky Skipper is an ongoing effort and is hence beyond the current scope of this document. With that, the color differences are minimal with the most notable observed being the night-time backgrounds beyond the first level – the hue of blue is off when compared to original hardware; there may be others. The game is totally playable using the Sky Skipper PROMS and should not detract from enjoyment or operation of the conversion board in any way.

If you find any additional differences, please let us know. If you feel compelled and are willing to contribute to this effort then by all means reach out on the FB group and we will gladly work together.