Samodular 277s Build Guide

Version 1 - May 2022

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Preparation & Expectations

The 277s is a relatively easy build that should take approximately 8 hours. Experienced builders may be able to complete this build more quickly. Even though this is an easy build, it is important that you allocate enough time to build the module correctly and resist the temptation to rush through the build process. It's understandable that what you really want is a working module to play with, but a successful build requires careful attention to detail.

Paying careful attention to detail takes time, however paying careful attention to detail throughout the build process takes much less time overall than the hours/days it may take to find and correct a mistake that could have been avoided in the first place.

This guide provides a general build sequence and provides special notes and detailed information on areas that are non-obvious or require extra attention to detail, as such, this guide assumes that you have the necessary tools and general DIY skills to complete a build by following a bill of materials and referencing component maps.

NOTE: the 277s build includes several SMD components. Having the correct soldering tip, solder, and magnification is highly recommended.

Bug Fixes and Modifications

Samodular PCBs have been updated to include the fixes and modifications that were necessary with earlier DIY kits. No bug fixes or modifications are necessary to complete the 277s build. Additionally, the Samodular full kits are delivered with correctly selected critical components where necessary.

Build Overview

The 277s build is broken down into four main steps with additional build breakdown under each step. Steps 2 and 3 can be performed in any order that works for you, though the sequence here is intended to have the panel prep completed first so that when the main PCB is finished the last step is final assembly. **NOTE**: the 277s does not require any calibration.

1. **Verify Kit**
2. **Panel, Jacks, and Power Prep**
3. **Main PCB Build**
4. **Final Assembly**

Step 1: Verify Kit Against BOM

Samodular complete kits ship with all required components needed to complete a module. While great care is taken to ensure that kits ship with all the correct components, occasional component errors do happen. It's worth taking the time to verify components against the bill of materials to ensure that your kit is complete.

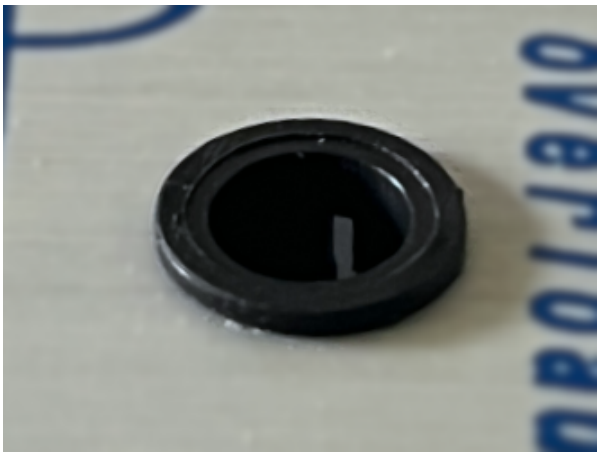
Step 2: Panel, Jacks, and Power Prep

1. **Mount Banana Jack**: There is only one banana jack to mount. Make sure to adequately tighten the banana jack nuts, but not so tightly that you strip the nylon threading on the jack. You don't want a jack coming loose after final assembly.

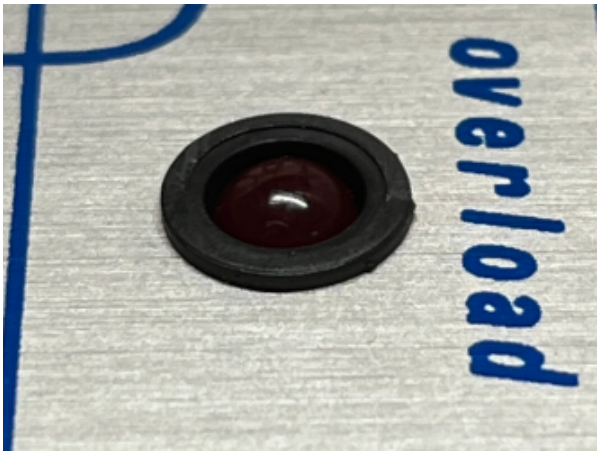
Black Banana Jack	CV Inputs	Quantity 1

NOTE: the 277s panel does have an anti-rotation hole for the banana jack. As such, it is advisable to mount the banana jack with the solder post aligned vertically so that the eyelet is optimally positioned for the hookup wire to the PCB.

2. **Bezel:** the plastic bezel for mounting the LED snaps into the front of the panel and then a collar is attached on the rear of the panel to secure the bezel in place. If the LED is inserted too far into the bezel, the collar will not fit. If the LED is mounted flush with the panel, the collar will be loose and the bezel may slip out of the panel.




To solve this, I added two small drops of gorilla glue to secure the collar to the bezel and panel. I then mounted the LED flush with the panel. **NOTE**: the LED is not installed until the final assembly.

3. **Cut and Prep Hook Up Wire**: Cutting, stripping, tinning (if you use stranded hook up wire), and crimping all of the necessary hookup wire takes a considerable amount of time. No-clean solder is used to tin the ends. Most builders use color coded hookup wire for banana jacks that follows the color scheme for voltage: black for CV input. For Tinijax one approach is using white for signal and black for ground. 3" lengths are a good starting point.

The following table provides the minimum list of necessary hookup wire.

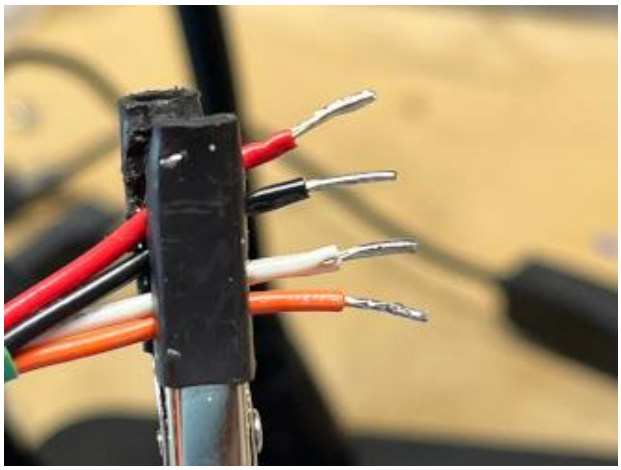
Black hook up wire	Black Banana Jacks - CV input	Quantity 1
White hookup wire	Tinijax tip connection (S) - audio I/O	Quantity 12
Black hookup wire	Tinijax sleeve connection (G) - audio I/O	Quantity 12

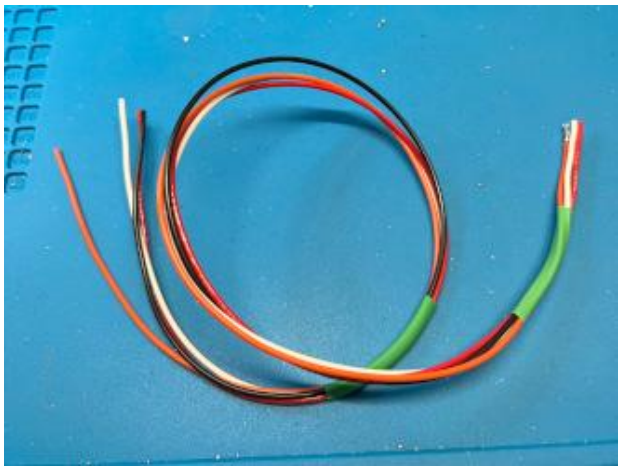
4. **Power Cable and EDAC Prep**: The 277s power cable requires four connections: +15v (red), -15v (white), +5v (orange) and quiet ground (black). The colors listed are the standard colors for 4U power connections.

5. **Cut and Prep Power Hookup Wire**: 18" is a good minimum length for the power cable.

Black Hookup Wire 18"	Quiet Ground, EDAC pin 1	Quantity 1
White Hookup Wire 18"	-15v, EDAC pin 2	Quantity 1
Red Hookup Wire 18"	+15v, EDAC pin 3	Quantity 1
Orange Hookup Wire 18"	+5v, EDAC pin 5	Quantity 1

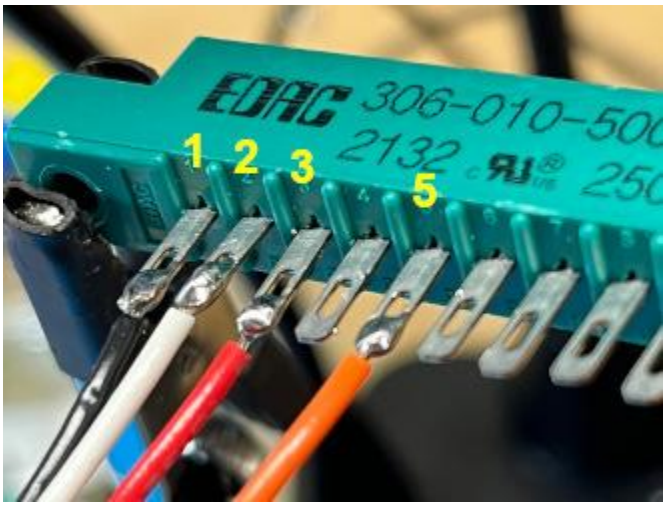
I use stranded wire so it can flex, as such I also strip and tin both ends. No-clean solder is used to tin the ends. I also prefer shrink tubing the cable with two sections of shrink tubing allowing each wire to follow its natural coil. Some builders like using zip ties to keep the power cable together. Either method is fine.



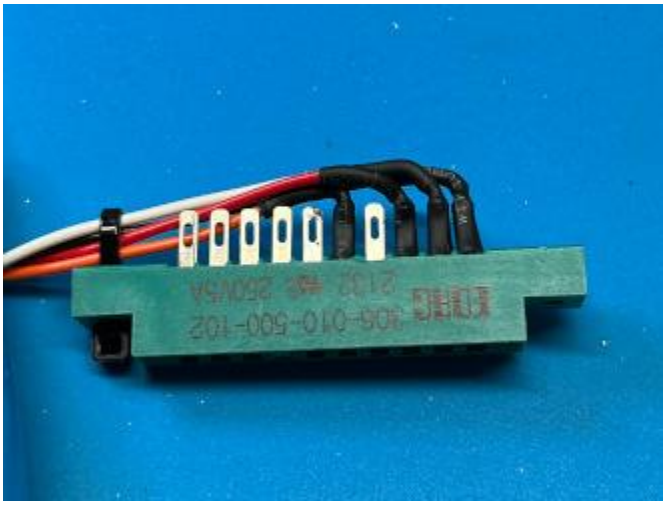


6. **EDAC Prep**: Crimp the tinned wire ends before soldering to form a good physical connection to the EDAC eyelets. The pin numbers and colors adhere to the power connection standards for 4U. No-clean solder is used here.

    - **Pin 1 Black**: Quiet Ground
    - **Pin 2 White**: -15v
    - **Pin 3 Red**: +15v
    - **Pin 4** No Connection
    - **Pin 5 Orange**: +5v



Adding shrink tubing to the eyelet connections and using a zip tie to secure the power cable to the EDAC is optional; though a good practice.



Preventing Reverse Power: If available, insert a polarizing key into EDAC pin 7. The polarizing key ensures that the power cannot be reverse connected. See Mouser part number 587-338-240-328. If you do not have a polarizing key, a solder bridge at pin 7 can also be used.

7. **Tinijax Prep**: The 277s uses Tinijax model 41 which provides tip (S) and sleeve (G). The white and black hookup wire prepped above is used here. No-clean solder is preferred for preparing the Tinijax.

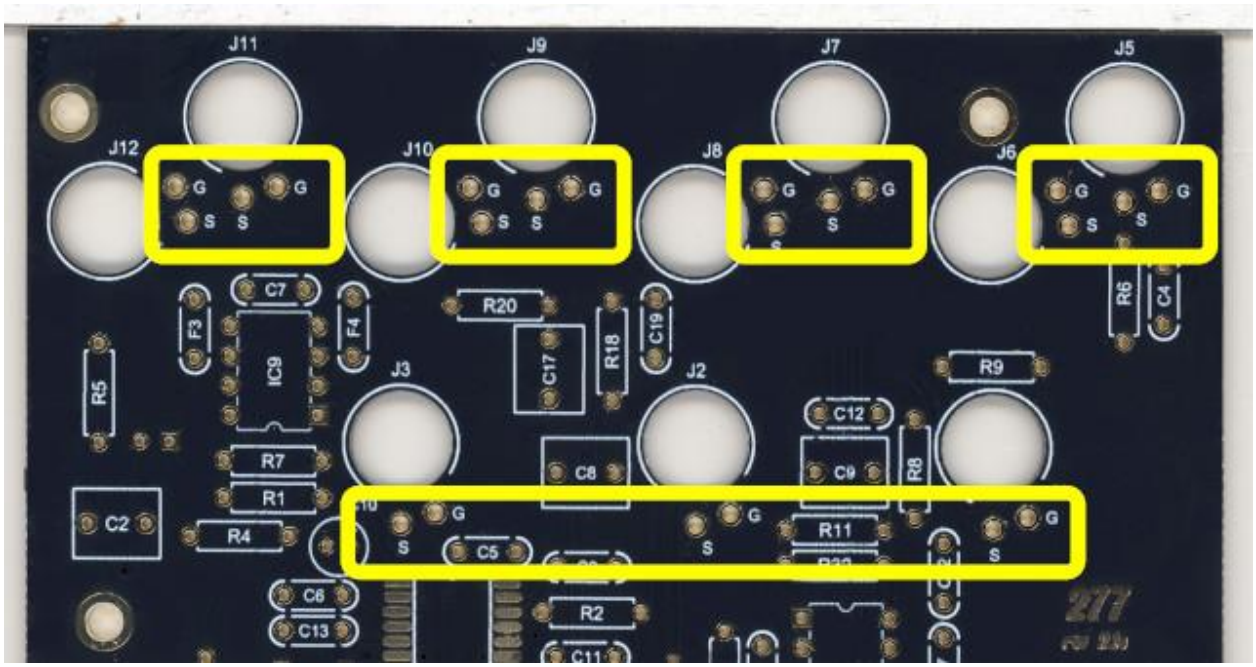
Tinijax 41 tip(S), sleeve(G)	1/4t Outputs	Quantity 2
Tinijax 41 tip(S), sleeve(G)	1/2t outputs	Quantity 2
Tinijax 41 tip(S), sleeve(G)	3/4t outputs	Quantity 2
Tinijax 41 tip(S), sleeve(G)	t outputs	Quantity 2
Tinijax 41 tip(S), sleeve(G)	Signal Inputs A, B, and C	Quantity 2
Tinijax 41 tip(S), sleeve(G)	Modulation Input	Quantity 1

On Tinijax 41 the longer eyelet is tip (S) and the shorter eyelet is sleeve (G). Here, white is used for (S) and black is used for (G).

NOTE: Because of the close proximity of the Tinijax to the standoffs and the orientation of each Tinijax relative to each other, I decided against ground bussing and instead connected each jack to signal (S) and ground (G). Additionally, I added shrink tubing to both posts. Shrink tubing is entirely optional, but helps isolate each jack in this build.

GROUND BUSSING OPTION: Some builders may choose to ground bus the Tinijax. Because of the orientation of the Tinijax and the locations of the (G) pads, creating five ground bussing groups seems to be the common solution; though feel free to use whichever method works best for you.

- **Group 1**: J1, J2, and J3
- **Group 2**: J5, J6
- **Group 3**: J7, J8
- **Group 4**: J9, J10
- **Group 5**: J11, J12



Step 3: Main PCB Build

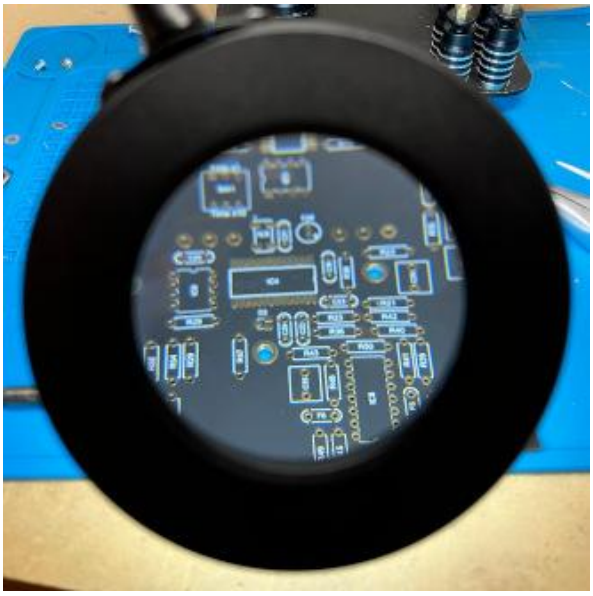
MB build is relatively quick and is divided into two separate phases: Wet Build and Dry Build. Wet Build uses solder with water soluble flux (Kester 331) and covers all of the components that can be washed in water. Dry Build uses no-clean solder (Kester 245) and covers all of the components that cannot get wet.

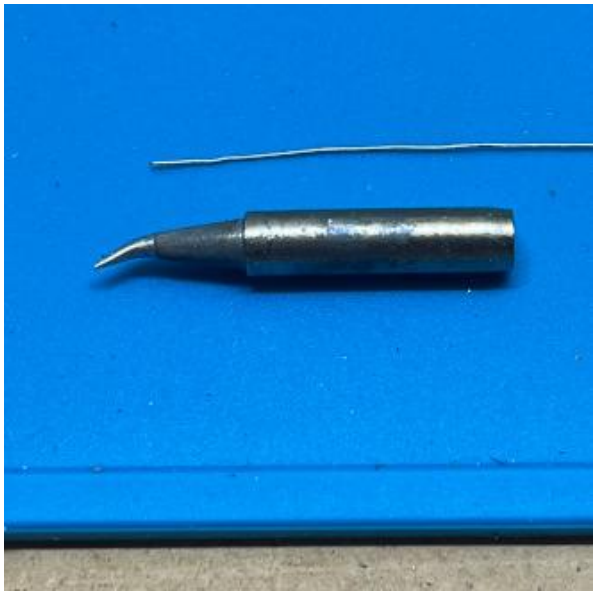
NOTE: The 277s PCB silkscreen denotes part number as documented in the bill of materials. It is highly recommended that builders make use of the component maps available here.

1. **Wet Build SMD Components:** The 277s contains an SMD diode, SMD IC's, SMD voltage regulator, and SMD clock crystals. I install the SMD components first because I like working closely using magnification and tweezers. As such, I like having as much room as possible to position my soldering tip.

SMD (component maps)		
BAT54S Diode	D2	Quantity 1
SPIN FV-1 DSP	IC1, IC4	Quantity 2
Clock Crystals 32.768KH	IC2, IC5	Quantity 2
TLM1117 Voltage Regulator 3.3V	IC7	Quantity 1

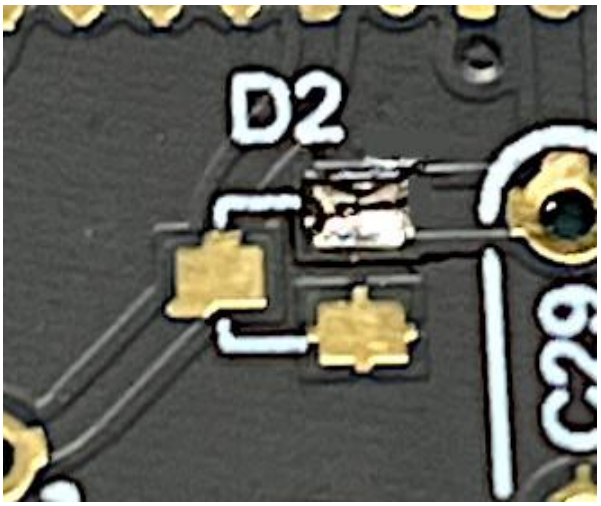
NOTE: Hand soldering these particular SMD components is fairly easy provided you have the correct tools. At minimum, you should have lighted magnification, the correct soldering tip for SMD work, tweezers, solder braid, and thin solder. I use a magnified light ring, standard SMD tip for my iron, and thread thin .015" water soluble flux solder.

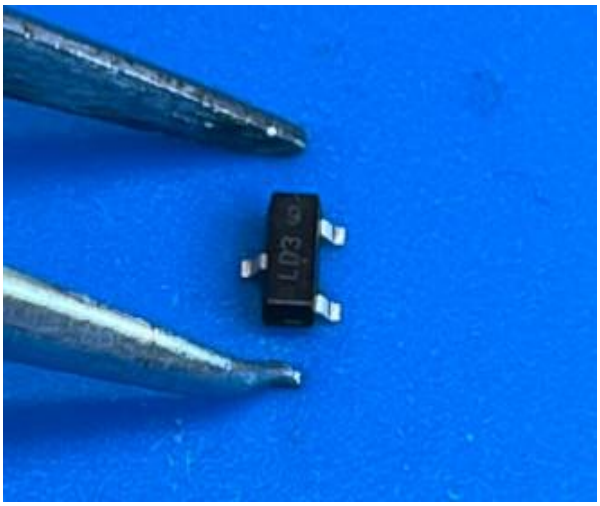


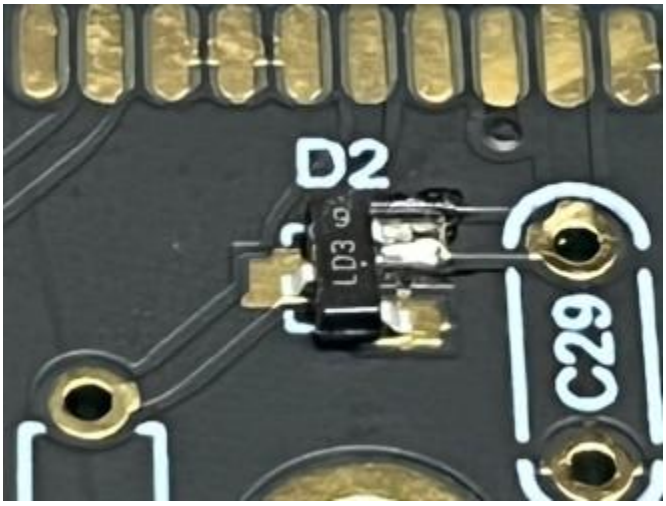


BAT54S Diode: The BAT54S diode is the smallest component in the 277s build using a SOT-23-3 footprint. Soldering it is not difficult provided you have the necessary tools and technique. Use of magnification and tweezers are highly recommended.

1. Tin one pad of the D2 footprint
2. Move the component into place with tweezers noting the correct orientation
3. Reflow the tinned pad while holding the component in place
4. Solder the other two legs
5. Touch up the first leg if needed

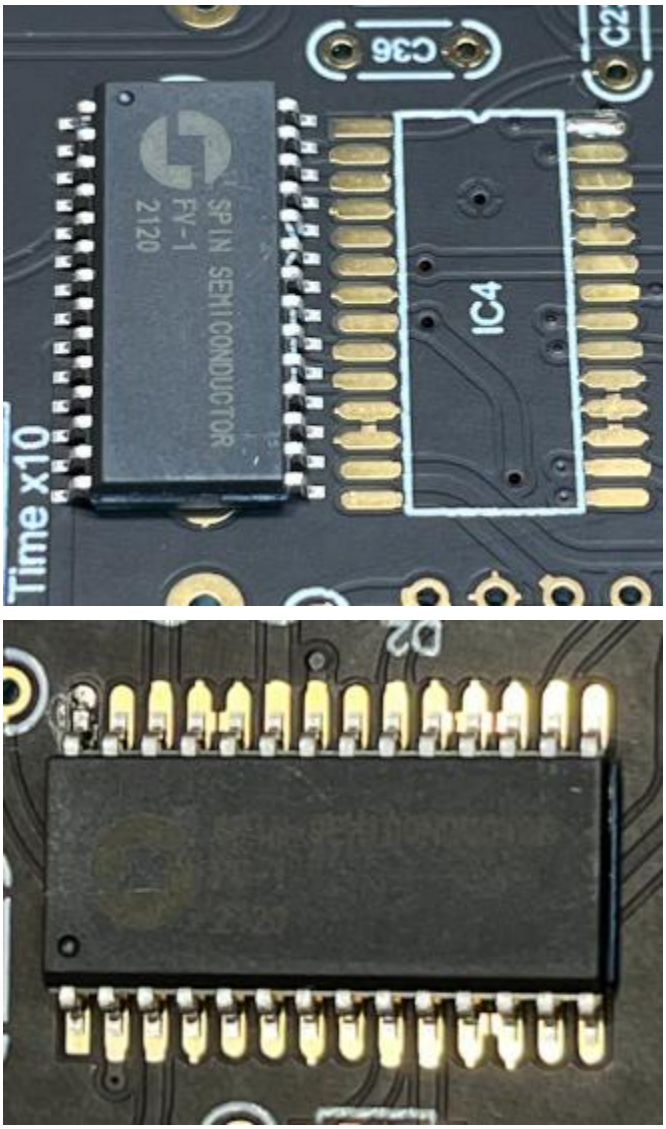






SPIN FV-1 IC1, IC4: Soldering the SPIN FV-1 is not difficult. Use of magnification and tweezers are highly recommended. Solder braid is helpful while soldering the SPIN FV-1. The pads are very close together and even with the best soldering technique bridges are likely to form. Clean bridges as you go.

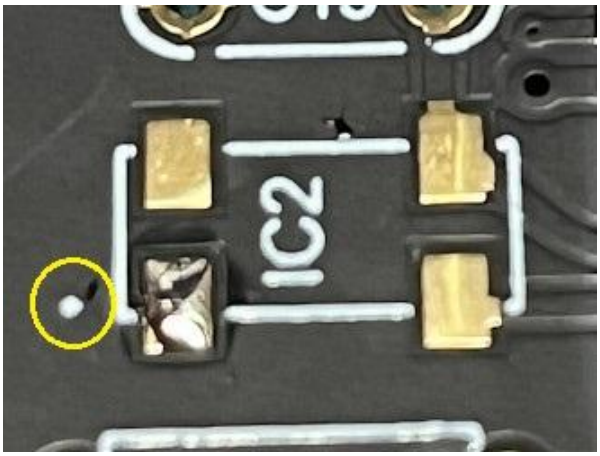
1. Note the orientation of pin 1 IC1 and IC4 (IC4 pictured)
2. Tin pad 28 of IC1 and IC4
3. Move the component into place, note orientation and pin 1
4. Reflow pad 28 while holding the IC in place.
5. Ensure all of the legs are centered on their pads
6. Solder the remaining legs

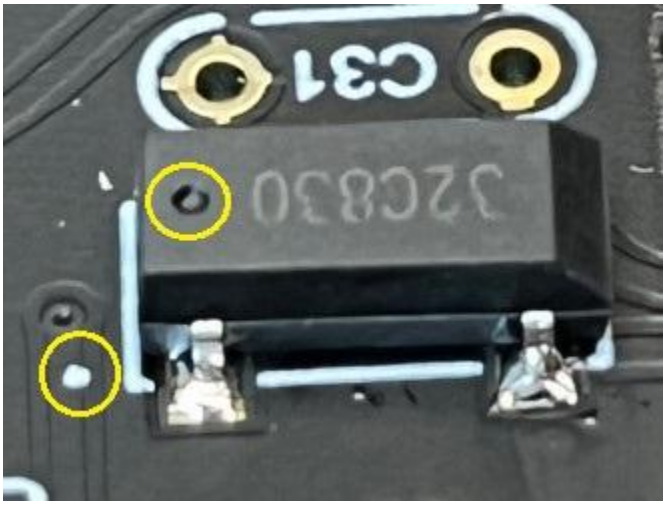


Optional Clean Up: Use solder braid to clean up each pad/leg.

Clock Crystals IC2, IC5: Pay special attention to the orientation of the clock crystals. The clock crystal package has a slope on the front and a dot at the rear. Orient the clock crystal on the PCB so that the dot on the package faces the dot on the silkscreen.

1. Tin 1 pad of IC2 and IC5
2. Move the clock crystal into position with tweezers, note the orientation of the dots
3. Reflow the first pad holding the crystal in place with tweezers
4. Solder the remaining pads





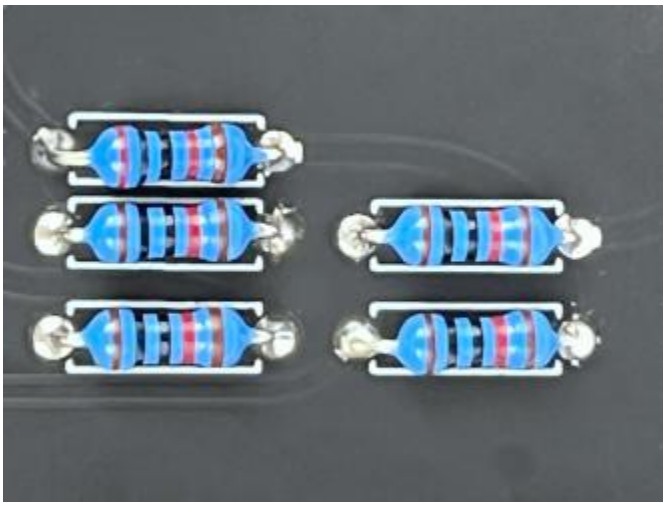
LM1117 3.3V Voltage Regulator: The LM1117 is provided in a TO-252-3 package and can be hand soldered using a standard tip without magnification. No special instructions are needed.

2. **Wet Build Resistors**: All resistors are through-hole. Lead spacing is consistent for all resistors. Resistor installation on the MB is straightforward with no special considerations.

   Refer to the component maps here for all resistor locations.

Resistors (component maps)		
10R 1% 1/4W	R2, R23	Quantity 2
220R 1% 1/4W	R4	Quantity 1
470R 1% 1/4W	R1, R8, R18, R21, R25, R33, R38, R47	Quantity 8
8.2K 1% 1/4W	R9	Quantity 1
10K 1% 1/4W	R42, R51, R52, R53, R54	Quantity 5
20K 1% 1/4W	R12, R13, R26, R28, R29, R34, R39	Quantity 7
27K 1% 1/4W	R6	Quantity 1
30K 1% 1/4W	R5, R11, R20, R22, R27, R35, R43	Quantity 7
49.9K 1% 1/4W	R7	Quantity 1
51K 1% 1/4W	R19, R37	Quantity 2
82K 1% 1/4W	R24, R32	Quantity 2
100K 1% 1/4W	R3, R10, R17, R36, R40, R41, R44, R45, R46, R48, R49, R50	Quantity 12
150K 1% 1/4W	R16	Quantity 1

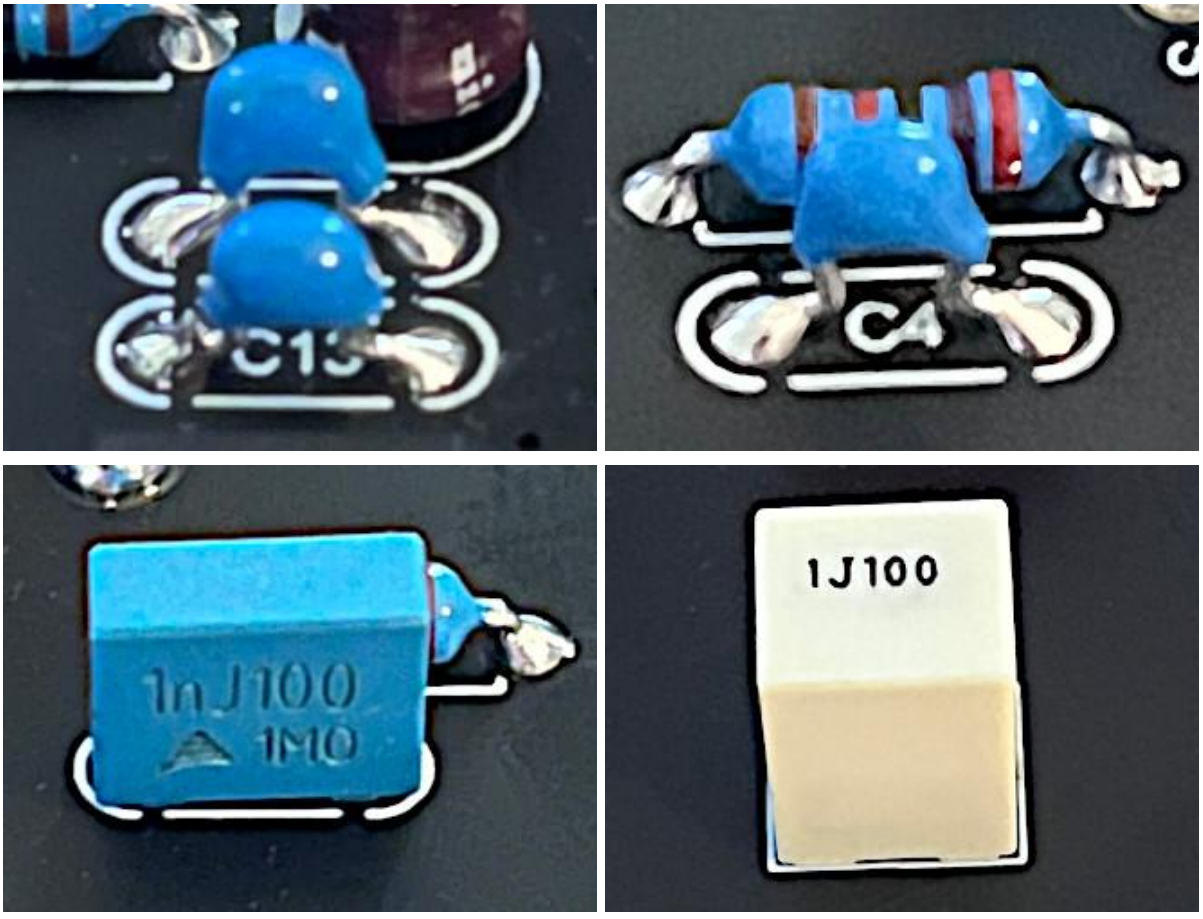
NOTE: it is possible to solder all resistors on the top side of the board as shown here. This makes stuffing components and soldering very quick.



3. **Wet Build Capacitors**: There is a mix of ceramic, film, and electrolytic capacitors on the main board. Installation is straightforward with a few notes below. Refer to the component maps here for all capacitor locations.

Capacitors (component maps)		
12pF 5mm Ceramic	C13, C31	Quantity 2
100pF 5mm Ceramic	C4, C7, C14, C21, C32	Quantity 5
1nF 5mm Film	C5, C12, C19, C23, C30, C34, C36	Quantity 7
0.1uF 5mm Ceramic	C3, C6, C11, C22, C24, C29, F1, F2, F3, F4, F5, F6, F7, F8	Quantity 14
1uF 5mm Film	C1, C2, C8, C9, C15, C17, C20, C25, C33, C35	Quantity 10
10uF 2mm Electrolytic	C10, C16, C18, C26, C27, C28 NOTE Polarity	Quantity 6

NOTE: the 12pF, 100pF, and 0.1uF capacitors can all be soldered on the top side of the board.



4. **Wet Build Banana Jack Hookup Wire**: Installation of the banana jack hookup wire is optional at this point. Installing banana jack hook wire now allows using solder with water soluble flux for a cleaner final PCB.

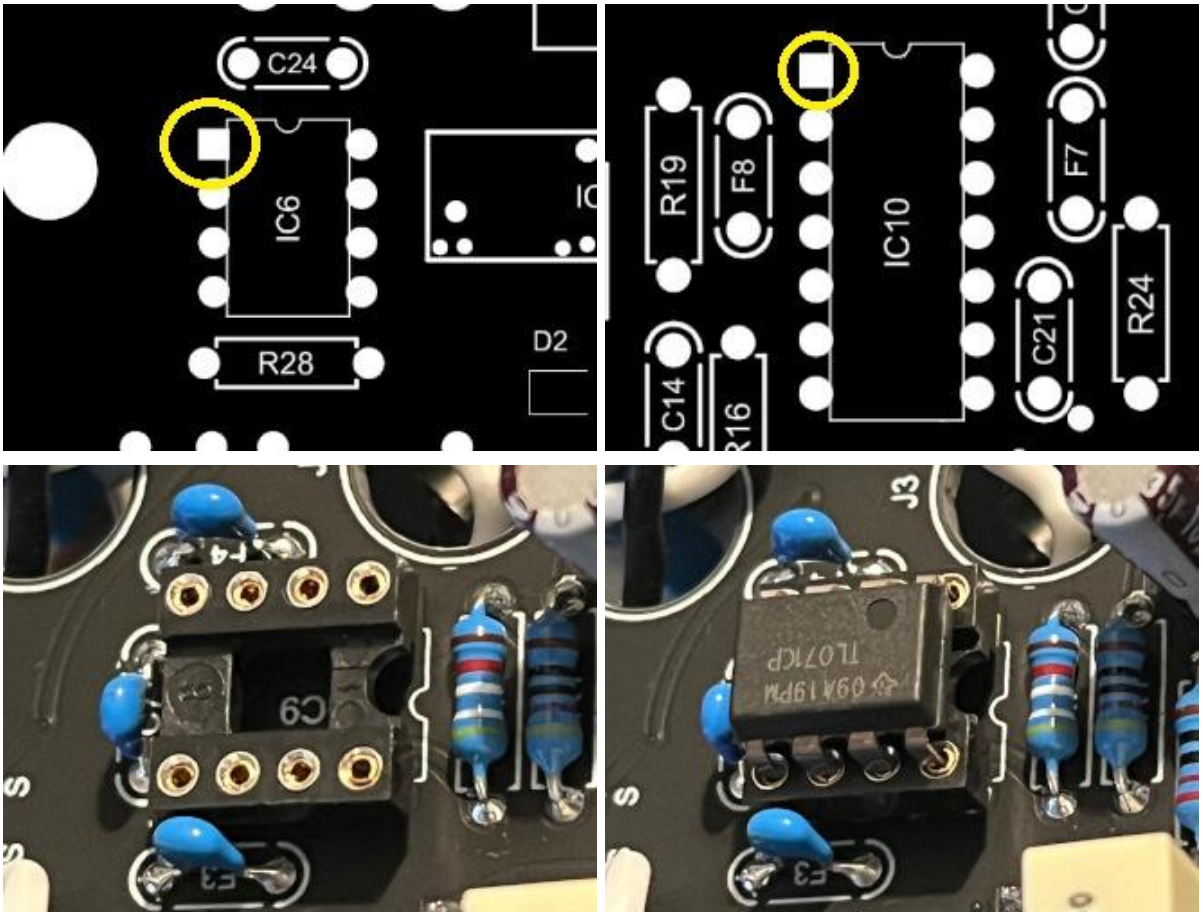
Black hook up wire CV input	B1	Quantity 1

It is marginally easier to install the banana jack hookup wire to the PCB then solder to the banana jack after MB assembly. Banana jack hookup wire is mounted on the rear of the PCB and soldered on the front. Standing the PCB allows for the quickest installation of the banana jack hookup wire.

5. **Wet Build IC Sockets**: IC sockets are the last component installed during wet build. There are five IC sockets: 3x 8 pin DIP sockets and 2x 14 pin DIP sockets.

DIP Socket - 8 pin	IC3, IC6, IC9	Quantity 3
DIP Socket - 14 pin	IC8, IC10	Quantity 2

Pin 1 is marked by a square pad and the dip socket notch lines up with the notch on the silkscreen to help ensure that IC's are mounted in the correct orientation.



6. **Wash MB in Hot Water**: scrub lightly with a soft toothbrush under running hot water (120 to 140 degree F). Water soluble flux (Kester 331) will lather up and help clean the PCB leaving a nice, flux-free finish.

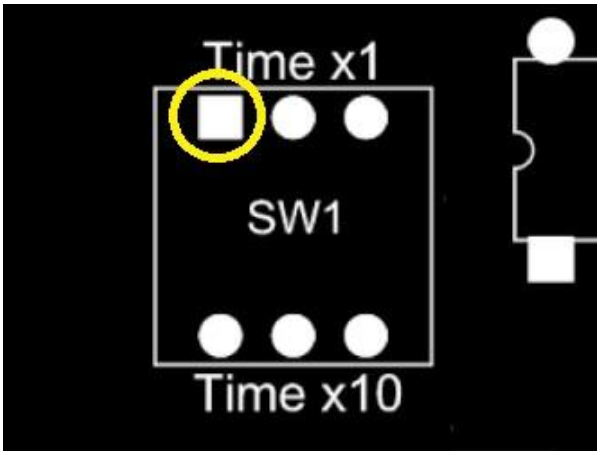
NOTE: The Kester 331 Flux Cored Wire Technical Bulletin recommends cleaning within 48 hours. Most people clean within an hour or so. See kestor.com for details.

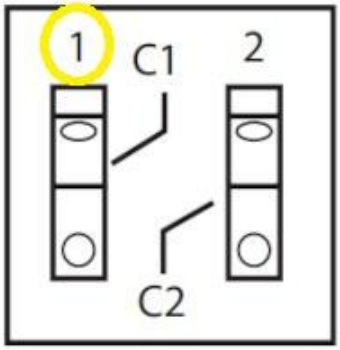
NOTE: Dry PCBs thoroughly after washing before beginning the Dry Build. <u>Let the PCB dry overnight if possible</u>. After the PCB has dried completely, switch to no-clean solder for the remainder of the MB build.

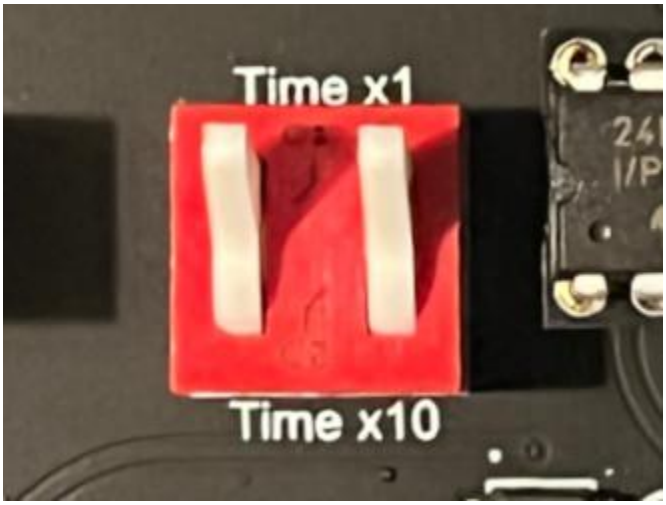
7. **Dry Build DIP Switch SPDT**: The dip switch allows selecting 1x and 10x delay times. There are six pins to solder. Tack one pin into place then reflow that pin while pressing the switch against the PCB to ensure that it sits flush against the PCB. No-clean solder is used here.

DIP Switch SPDT	SW1	Quantity 1

Pin 1 on the SW1 is the square pad. Orient the DIP switch so pin 1 is mounted in the correct location.







Installation of the DIP switch is the final step in the MB build. Move on to the final assembly.

Step 4: Final Assembly

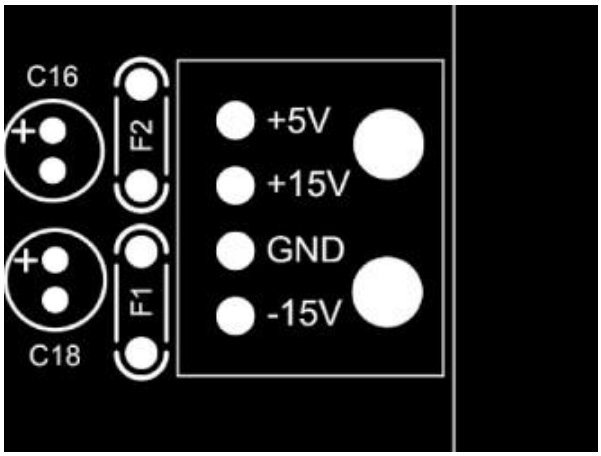
Finalizing the assembly of the 277s MB to the Panel is best accomplished by mounting the stand offs to the MB, placing the MB on its back with the potentiometers and Tinijax facing upwards, then lowering the panel down onto the MB.

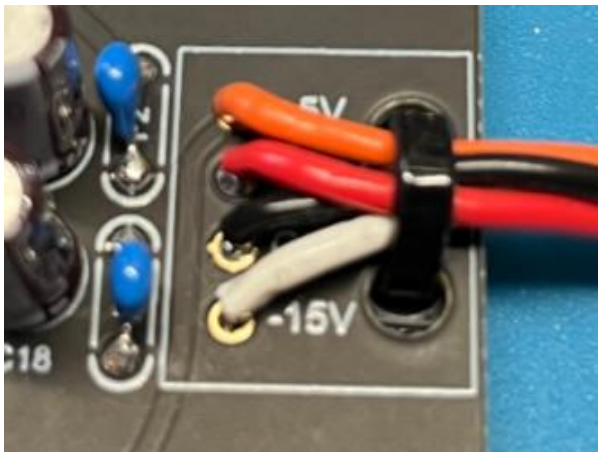
1. **15mm Standoffs**: there are eight 15mm standoffs that attach to the front of the MB.

Standoff	15mm	Quantity 8

No special attention is required for mounting orientation of the standoffs.

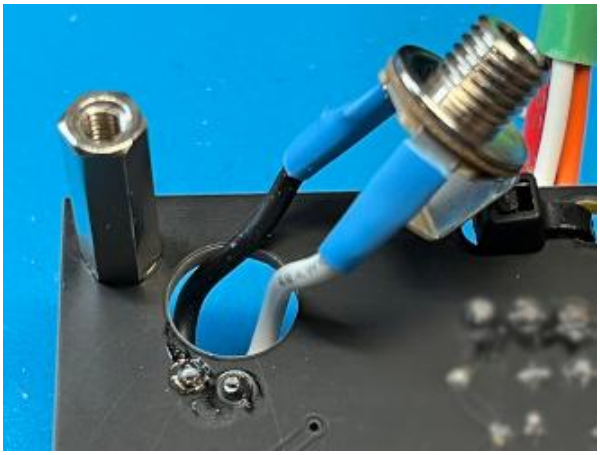
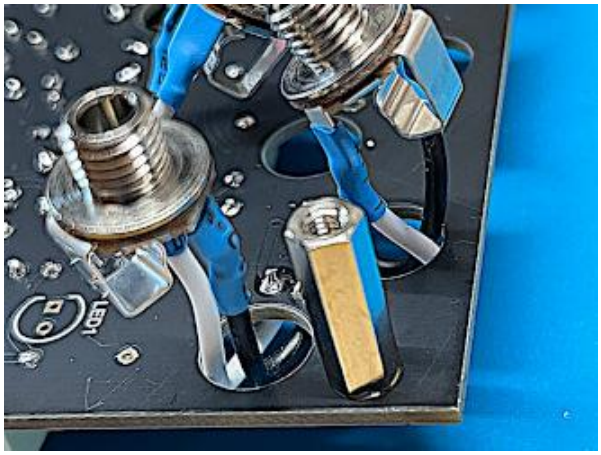
2. **Power Cable Installation:** The power cable pads for +5v (orange), +15v (red), Quiet Ground (Black) and -15v (white) are clearly labeled on the silk screen. No-clean solder is used to attach the power cable to the PCB.



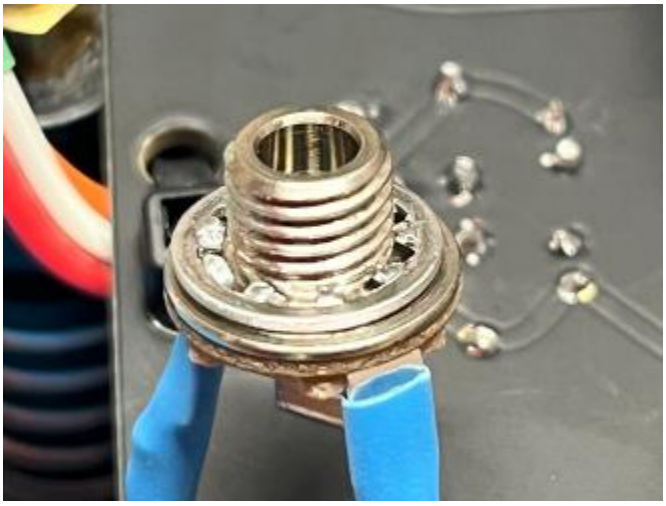


The 277s PCB provides a power cable mount point. Use a zip tie to secure the power cable to the PCB using the zip tie holes.

3. **Tinijax:** for a small build, I solder the Tinijax hookup wire to the PCB before installing the panel because I prefer soldering the hookup wire from the bottom. I also prefer trimming and cleaning the hookup wire solder pads before installing the panel. Some builders may prefer attaching the Tinijax to the panel then soldering after the panel is installed. Use whichever method works for you. No-clean solder is used here.

Add the star washer to all of the Tinijax before attaching the panel.

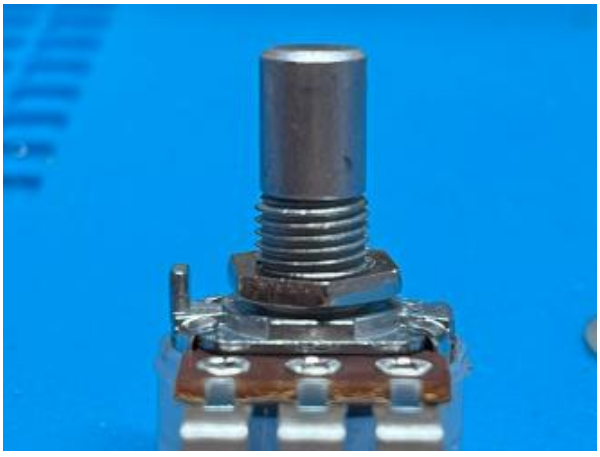


4. **Alpha 16mm Potentiometers:** the 277s uses two types of 16mm potentiometers: 2x 100K linear and 4x 100K logarithmic.

Alpha 16mm linear Pot. (B100K)	POT4, POT6	Quantity 2
Alpha 16mm logarithmic Pot. (A100K)	POT1, POT2, POT3, POT5	Quantity 4

The linear pots (B100K) are used for CV input and delay time. The logarithmic pots are used for audio signal inputs and audio modulation input.

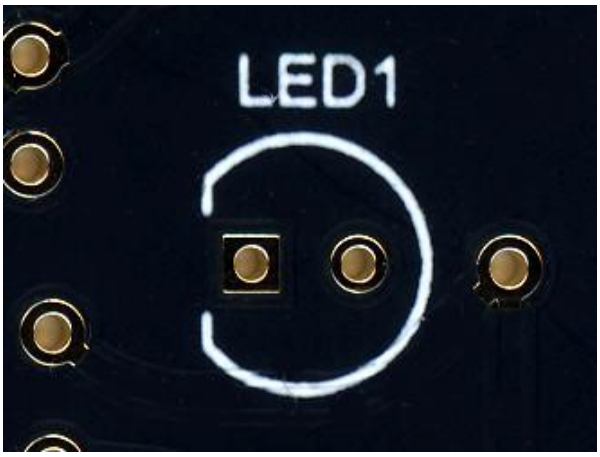
Each potentiometer in the 277s build includes two nuts and a washer. Attach one nut to the shaft as shown to help stabilize the pot against the panel.

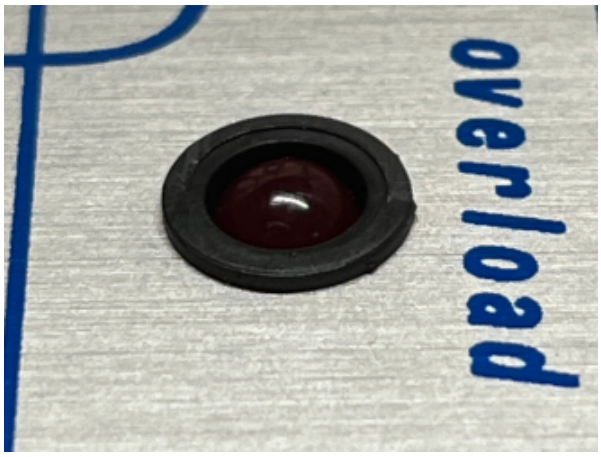


5. **LED**: The LED is the last item added to the MB before installing the panel. LEDS install on the front and are soldered on the back of the MB..

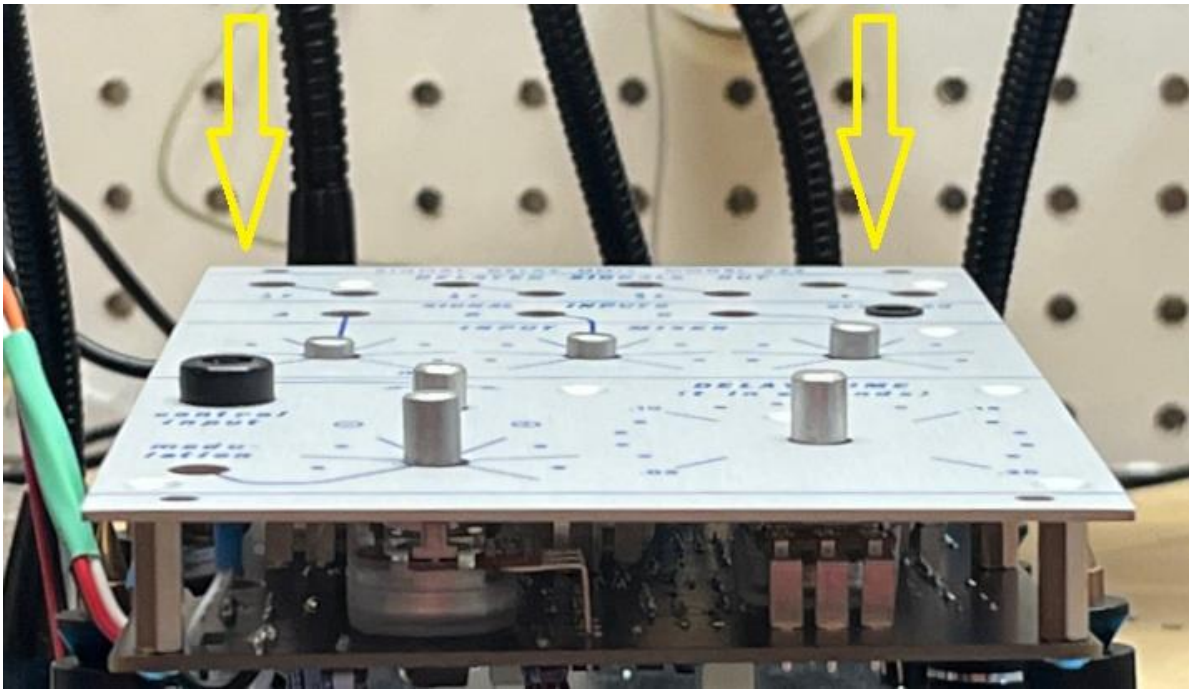
LED 5mm Red	LED1	Quantity 1

The LED cathode is the shorter leg and is inserted into the square pad. The LED fits firmly in the bezel and mounts flush with the panel.



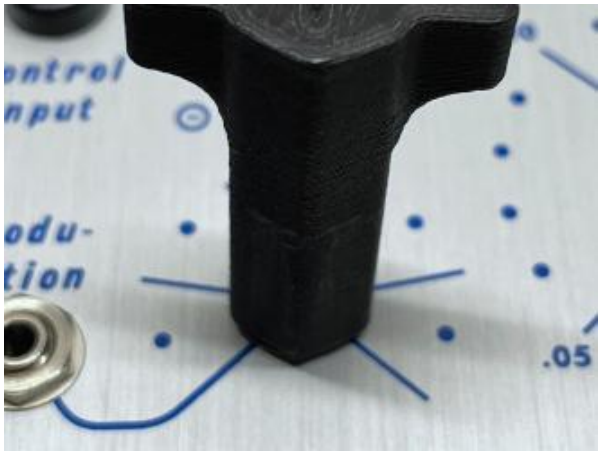


6. **Panel Installation**: With the MB front facing upwards, lower the panel onto the MB. The potentiometers are not soldered at this point. Pull the potentiometer shaft through the panel and attach the washer and nut. It may take a little adjusting to get the switches through.



Once the panel is seated correctly, install the flat head screws into the countersunk holes for securing the panel to the standoffs.

Pull the potentiometer shaft through the panel and attach the washer and nut. If available, use the 3D printed nut tightening tool to protect against scratching the panel. Solder the potentiometer legs after attaching the panel nut. No-clean solder is used here.

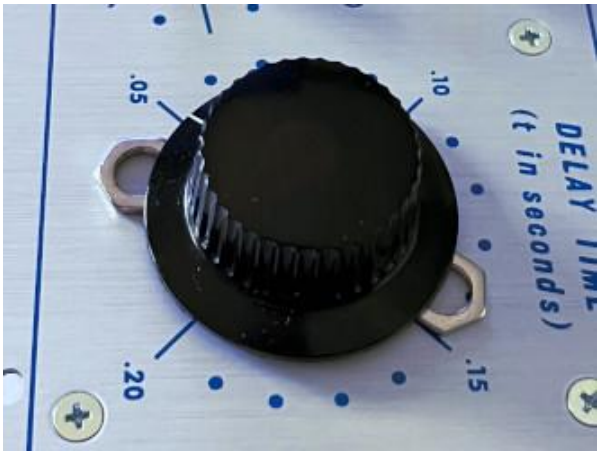


When finalIzing the Tinijax pay special attention to the jacks that mount next to stand offs as the position of the tip connection needs to face away from the stand off.

7. **Dry Build MB Final Soldering**: Complete the MB & Panel by soldering the remaining components using no-clean solder.

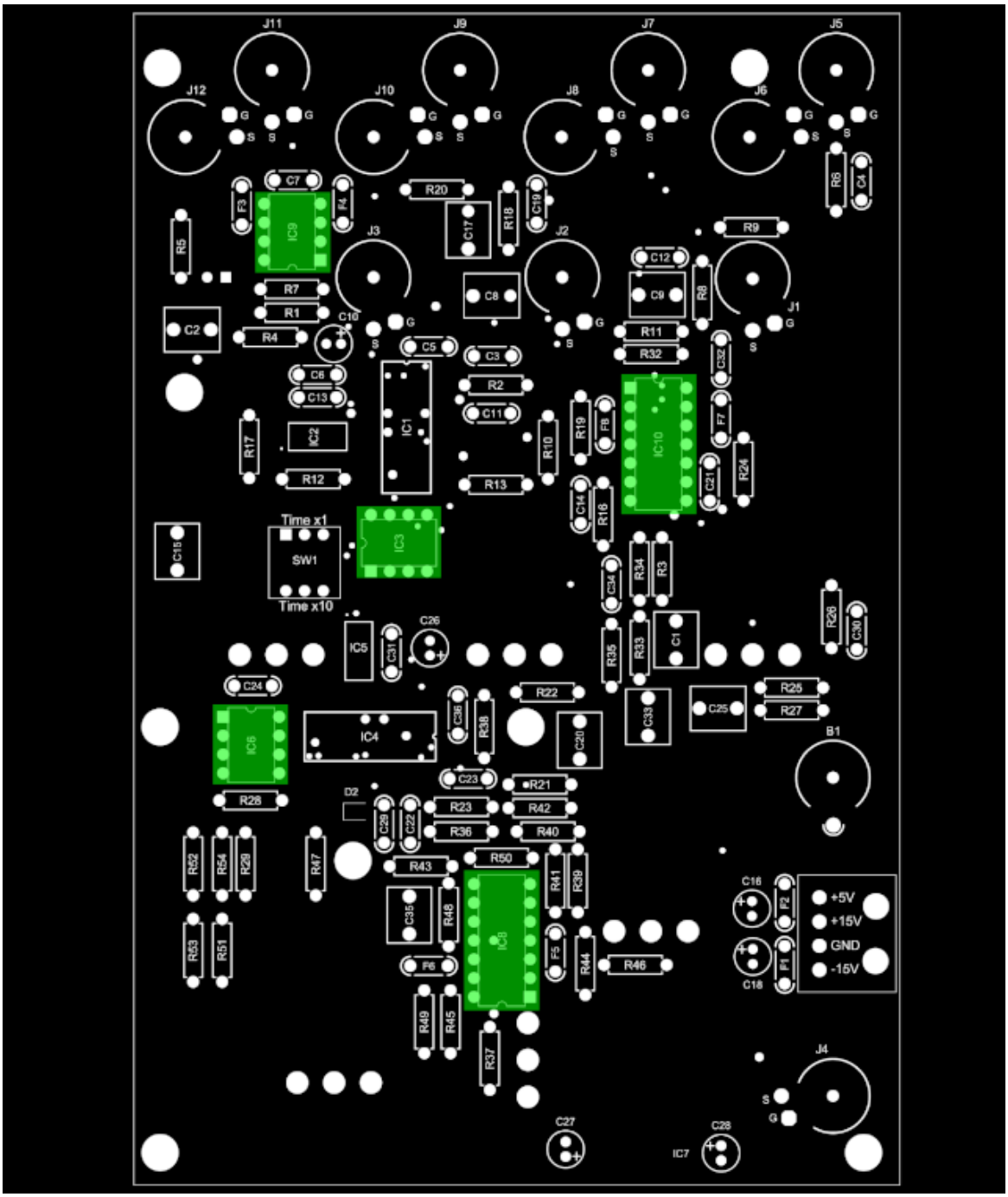
    a. 16mm potentiometers
    b. LED
    c. Tinijax hookup wire
    d. Banana jack hookup wire

8. **Install knobs**: the 277s requires 1 large knob and 5 small knobs. Use Davies or Rogans depending on your preferences. Regardless of knob choice, the potentiometer nuts make a good spacer for mounting both the large and small knobs .



9. **Install IC's**: there are 5 IC's to install. IC locations are marked by part number on the PCB silkscreen and correlate to the parts numbers in the BOM.

24LC32A EPROM	IC3, IC6	Quantity 2
TL071 Op Amp	IC9	Quantity 1
TL074 Quad Op Amp	IC8, IC10	Quantity 2



With the knobs installed and IC's inserted, the module is complete. There are no calibration requirements for the 277s.