SECTION 1 - PCB Assembly

Current BOM & Schematic Revisions

- DIY BOM - v1.04
- Voice Cards - RevA
- Voice Motherboard - RevA2
- Output Board - RevA2
- Panelboard - RevA
- Mainboard - RevA
- DAC Board - RevA
- I/O Board - RevA

VS-1 ENGINEERING CHANGE ORDERS					
DATE	**ECO #**	**BOARD/DOCS AFFECTED**	**DESCRIPTION**	**REASON FOR CHANGE**	**EFFECTIVE**
2-Feb-2024	VS1-1	Output Board Schematic Sheet 1	Change R1 & R31 to 1k 1% Change C5 & C30 to 150pF C0G	Allows for more adjustment over delay times. *Chorus has two modes, fast and slow. Initially, fast mode was Juno mode and slow mode was Dimension D mode. During demo & testing of production units it was found that calibrating slow mode as Juno mode and fast mode as a new (faster) mode gives some pleasing (almost flanging) effects. The change gives the option to calibrate for either options.*	All Production
2-Feb-2024	VS1-2	Voice Mobo Schematic Sheet 5	Change R22 - R29 to 470k 1%	Decrease voice bleed of passively summed voice outputs.	All Production

Tools

- Soldering iron
- Desoldering station or pump
- Solder: 0.025"-0.032" (0.6mm-0.8mm) Sn/Pb w/ standard flux or no clean preferred - only use lead-free solder if you have the proper tools and skills
- Lead forming tool recommended

PCB Details

The VS-1 contains (7) different PCB Assemblies. Two of the boards (IO Board & DAC Board) are already assembled - leaving (5) remaining board designs to build. In total there are (12) individual boards to build:

- (8) Voice Cards
- (1) Voice Motherboard
- (1) Mainboard
- (1) Panelboard
- (1) Output Board

Conventions & Recommendations

- *Components* refer to the actual parts that will be installed on the PCB's.
- *Designators* refers to the name give to each component on the PCB to differentiate them.
- *Part Numbers* shown in the documents are the actual part number we used for all of our parts kits. For passive components such as resistors & capacitors it is not necessary to use the same exact part number. However, the parameters should be the same.

For resistors match these parameters:
1. Value (1k, 10k etc..)
2. Type (Carbon Film, Metal Film)
3. Tolerance (1%, 5%)
4. Power Rating (1/8W, 1/6W, 1/4W)

For capacitors match these parameters:
1. Value (100pF, 0.1uF etc..)
2. Type (Electrolytic, MLCC, Polyester, Polypropylene)
3. Tolerance (5%, 10%)
4. DC Voltage (25V, 35V, 50V, 63V etc...)
5. Size (4mm Ø, 5mm Ø, 8mm Ø etc…)
6. Temp Coefficient (X7R, C0G etc…)
7. Lead Spacing (1.5mm, 2mm, 2.5mm, 3.5mm etc…)

- Most of the resistor footprints are 5mm lead-spacing. This allows for the use of 1/6W or 1/8W resistors for a cleaner assembly. Hence, the BOM calls out for mostly 1/6W or 1/8W resistors. However, 1/4W resistors can be used in a stand-up position in any placements with no problems.

- IC sockets are optional. They can be used for all IC's unless there is a note on the PCB that states **NO IC SOCKET**. They can help greatly when you get to testing the VS-1 - as most of the active components will not be placed at first. It is not necessary to install transistor sockets but there is enough room if desired. IC sockets may sometimes tarnish over time, so there's no guarantee that they will be making good contact in 25 years time. It's up to the builder to decide. If you purchased a full parts kit from us IC sockets are included. We purchased them in bulk so they are packaged loose and some legs may need to be straightened. They weren't originally planned to be included - consider it a bonus.

- There is no required order for installing components. However it is generally easier to install lower profile parts first, such as resistors & diodes, followed by IC's/IC sockets, capacitors & transistors. Lastly trimmers and miscellaneous connectors.

Altium 365 Web Viewer

The primary reference for assembling the boards is the Altium 365 Web Viewer. This is a browser-based tool. You will have to sign up for a free account at https://www.altium.com/altium-365 before accessing. Once signed in you will be able to view the files on any computer, tablet or phone. You will use this tool to reference all of the design documents including the BOM, schematics, PCB & assembly. The assembly view will guide you through the build process and allow you to easily locate and check off each component as it is installed.
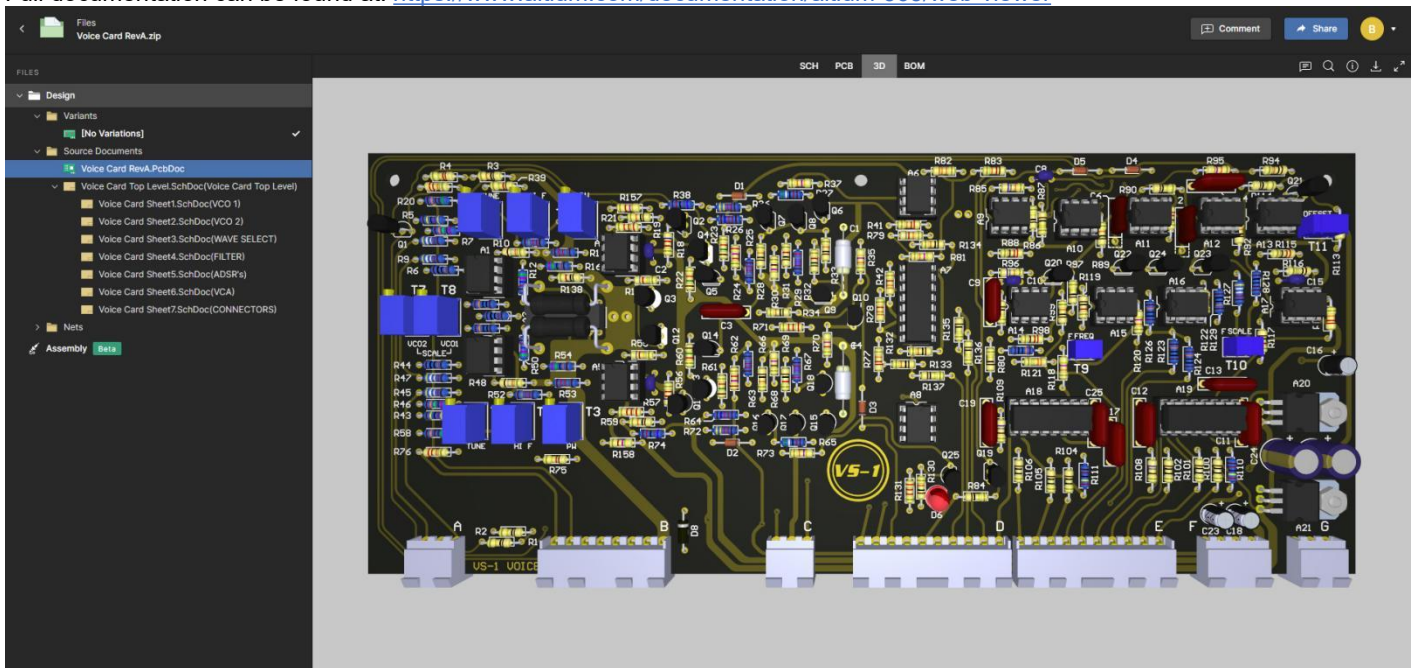
Full documentation can be found at: https://www.altium.com/documentation/altium-365/web-viewer

Image 1: Altium365 viewer example

When you click on a board assembly link from the VS-1 DIY section of our website you will be taken directly to an interactive page such as shown in image 1 above. Here you can view, print & download the BOM, schematics & PCB files. You can view the PCB in 2D or 3D. To aid in assembly & troubleshooting you can also select any *component* or *net* and it will be highlighted on all pages (i.e. cross-probing). You also have full access to the PCB Layer Stack for highlighting and viewing any layers.

Note: A PDF mirror of the design documents is also available in the downloads section of the website in the case you do not want to use the Altium 365 viewer.
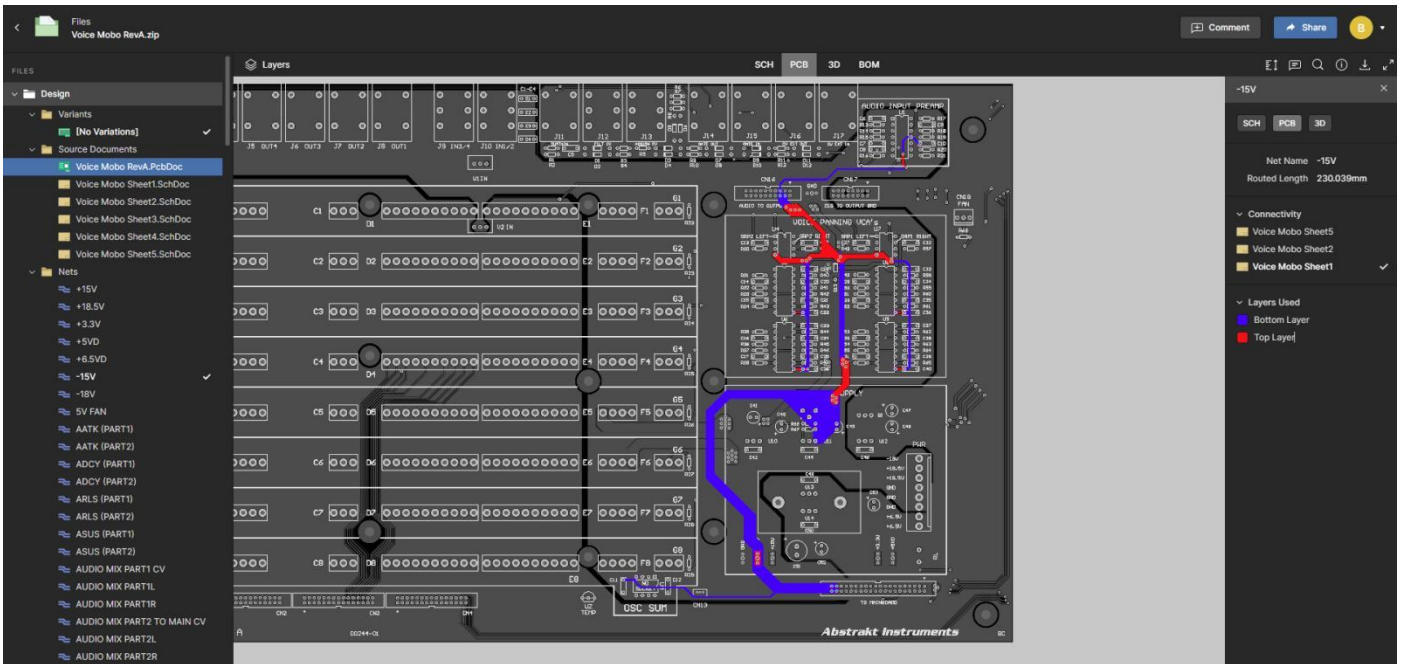
Image 2: Selected net is highlighted in both schematic and PCB views

When you are ready to begin populating a board click on one of the board assembly links in the VS-1 DIY section of the website. The page will open directly in your browser. To begin assembly click on the *Assembly* tab at the bottom left of of the page (see image 3). Once in assembly mode select **Show Info** at the bottom left, this will show more information for the currently selected part (see image 4).
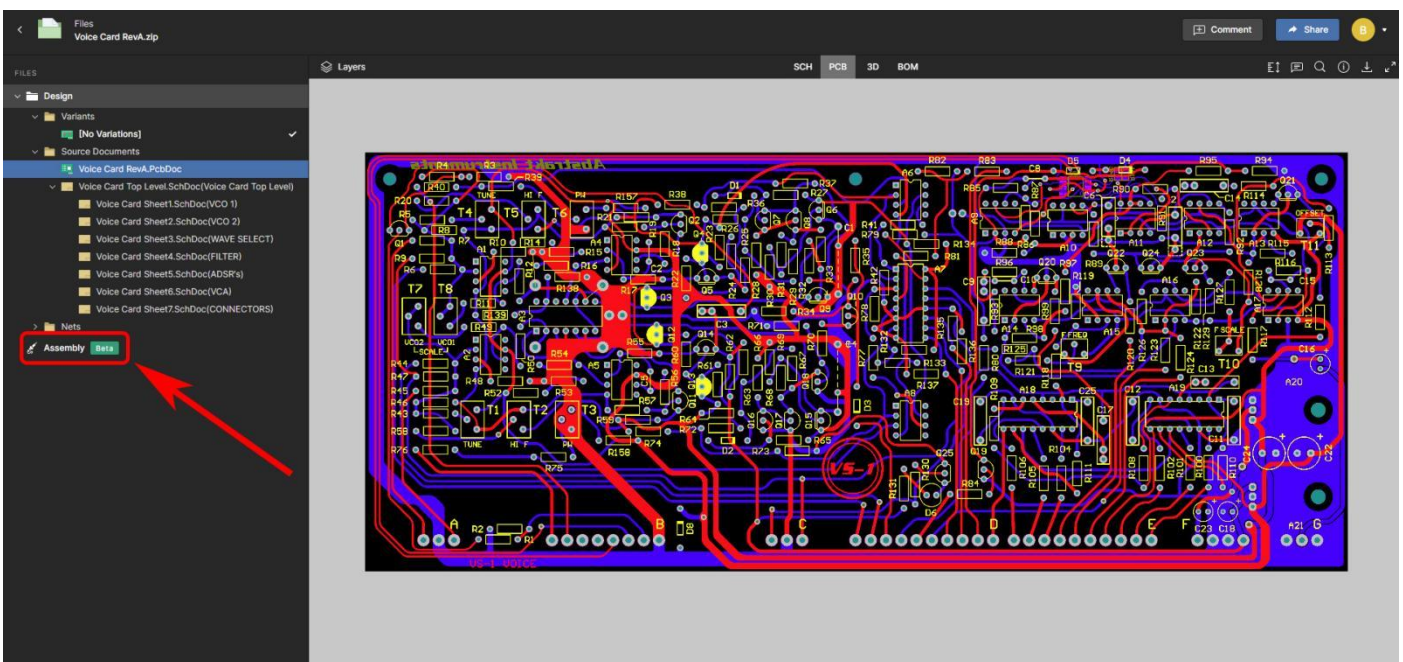

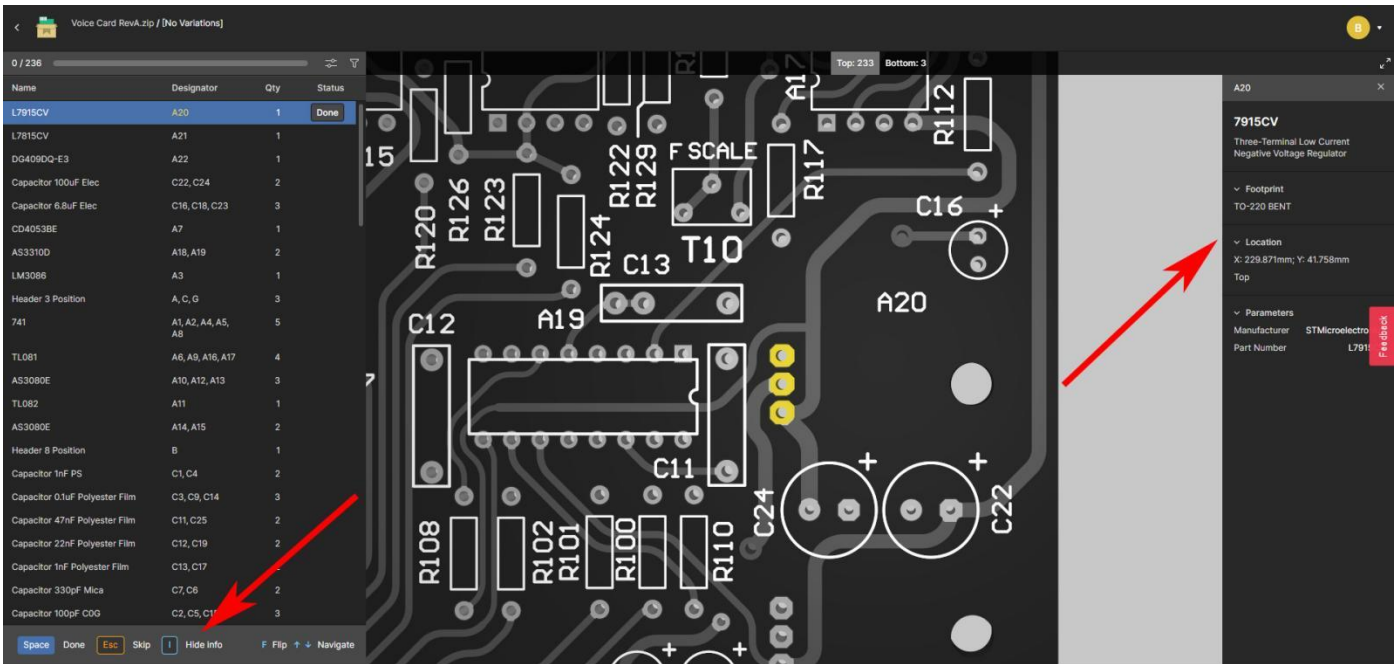*Image 3: Select assembly to proceed to assembly mode*

Image 4: The show info tab allows you to see more info for the selected component

Please note: When using a phone the windows get crammed and it can be difficult to pan and zoom to see all the information easily. It's do-able but a computer or tablet is much better.

When you select a component at the left of the screen it is highlighted on the 3D PCB view. When done installing select *DONE* and the designators will show in green with a check mark. Also, the components will now be shown installed on the 3D PCB view.
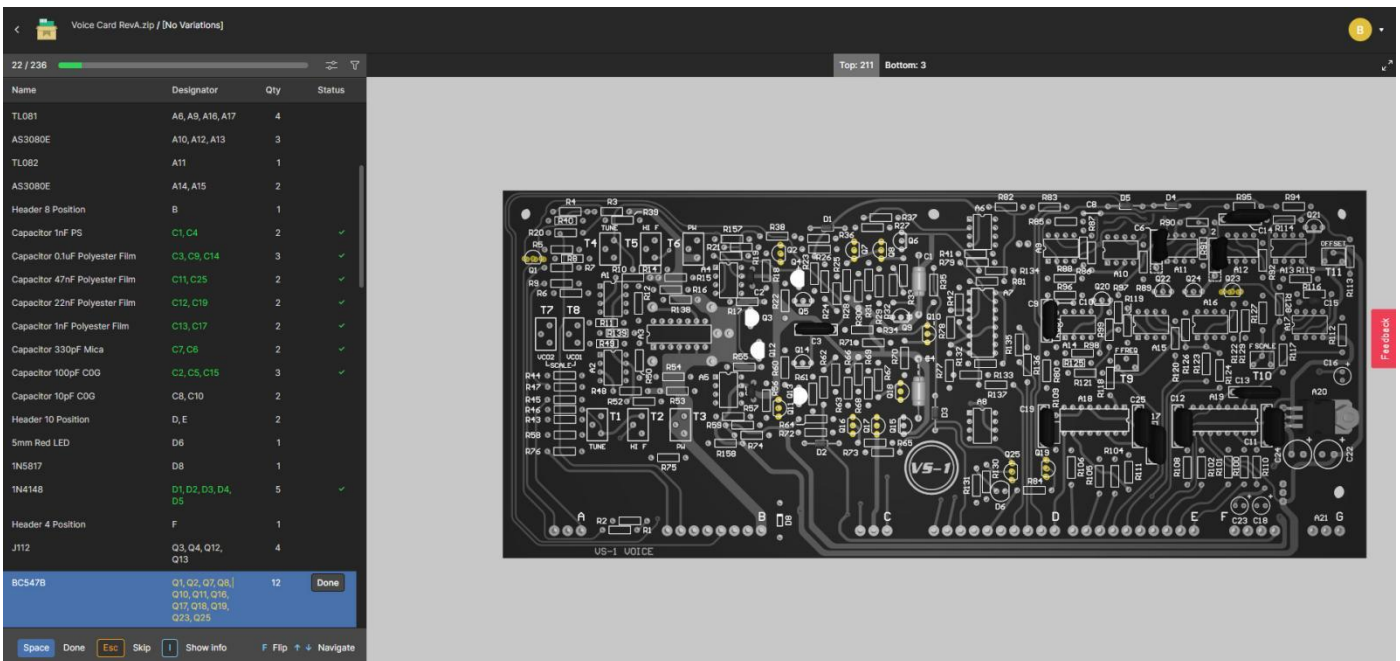

Image 5: completed components highlighted in green text & shown in 3D PCB

A Note About DIY Parts Kits

If you have purchased a Full Parts Kit form us all of the parts were purchased directly from the manufacturer or from major distributors. All parts are genuine and recent stock, not purchased from 2nd or 3rd sources. Rare parts such as the MN3007 BBD IC were purchased in large quantity from reputable obsolete components distributors. We have noticed since around 2018 that almost all TI DIP IC's have legs that are a different color than most IC's. They are less monochrome silver & have a brownish tinge. I was so annoyed I emailed TI. It turns out it's a result of an improved *leadframe* process. There is even a published note about it. I mention it because we don't want anyone to think there is something wrong with these IC's. It actually means they are new stock.
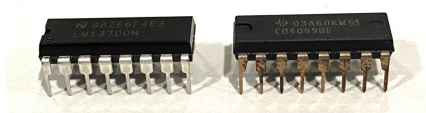
SECTION 2 - PCB-specific Notes & Modifications not stated in Altium Assembly

Voice Card
https://youtu.be/QkYzTwVaPrE

1. There is in error in the hole size for one of the plated holes of connector B. You will see that one hole has a smaller pad size and a smaller hole size. You will need to trim off material from this pin on the connector in order for it to fit in the hole. Use a dremel tool with a Type 125 carving bit to shave off some thickness on the connector pin until it fits through the hole. We have included (4) extra 8-position connectors with every kit (Molex part # 09-48-1084). *(VS-1 Standard Kits shipped in December 2023 do not have the extra 4pcs of Molex part # 09-48-1084 - they will be shipped along with the 2nd package).*

Please note! Do not try to deform the pin with needle nose pliers - it does not work very well. Also, do not try to drill out the hole larger, there will not be enough copper left around the pad to solder the pin.

Voice Motherboard
https://youtu.be/zOCfgMVbDiU

1. Place the TO-220 insulators behind IC's U13 & U14 to insulate them from the large heatsink. Also make sure to use the insulated shoulder washer to insulate the screw from the tab on the IC *(included in bag 20 of full parts kits or purchase from the BOM).* Use the 4-40 x 5/8" pan head screw and 4-40 lock washer from Bag 2 to firmly mount the tabs of U13 & U14 to the heatsink.

2. Make sure that component U2 is installed backwards from what is shown, this is an error on the PCB silkscreen.
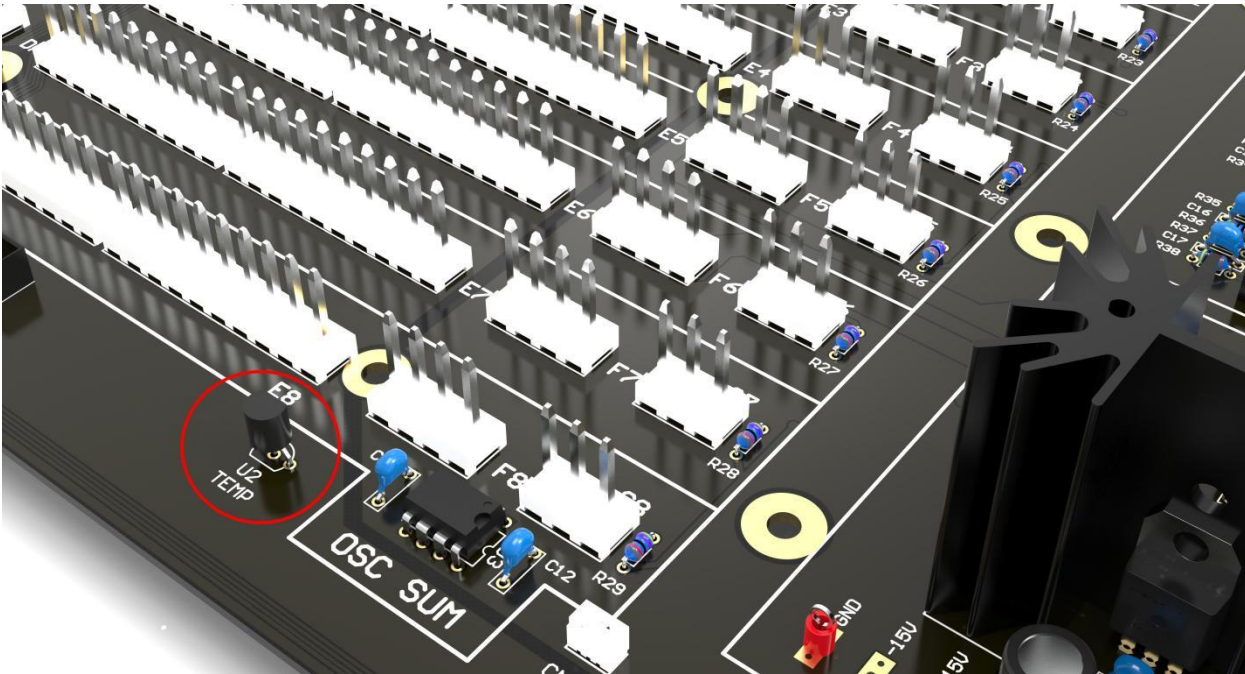

Panelboard
https://youtu.be/6vhZ_CGlTuc

1. Component LED40 is optional. It can be routed anywhere, for instance to light up the inside of the enclosure. The brightness is controllable in the global/utility menu. By default this placement is left empty. If you do choose to use it do not install it in place with a LED standoff - it can be routed with wires to elsewhere in the enclosure.
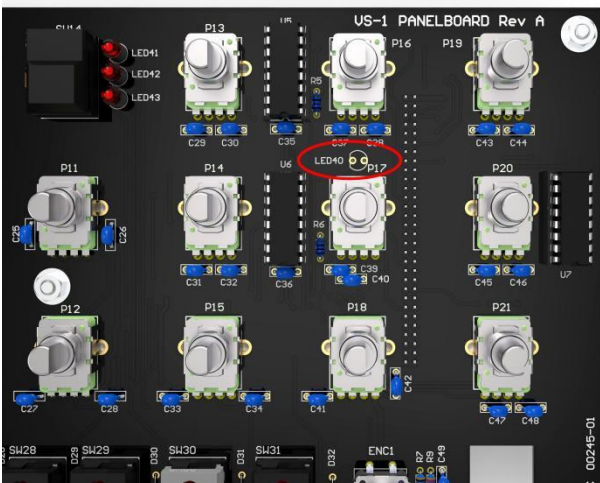
2. Install ENC1 so that it sits 1.5mm (1/16") away from the PCB. This will allow the encoder bushing to be mounted to the front panel. When installed at this height the legs will be about flush with the bottom of the PCB.
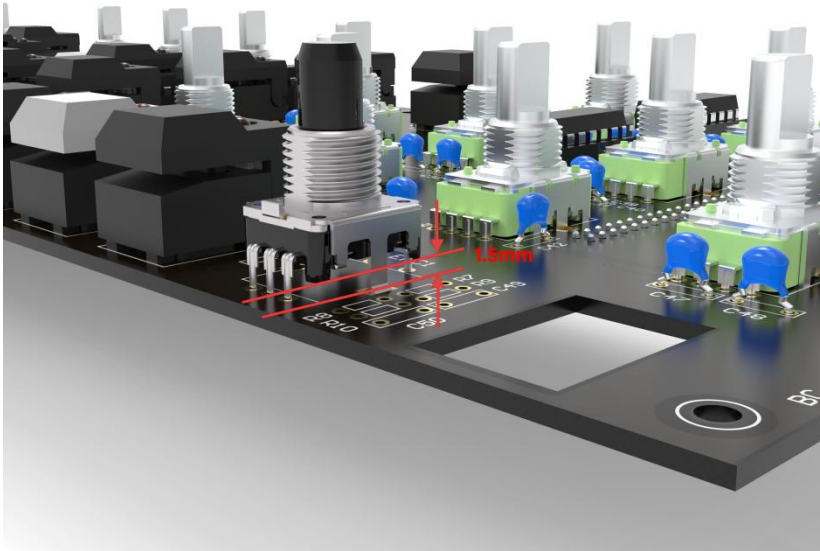
3. The (12) discrete LED's are installed with the flat side facing upwards. It is not easy to see, but look very closely and you will see that one side of the LED is flat. In this case the flat part of actual LED does not indicate the cathode - it faces upwards from *both* legs. Also, since these LED's are the exact ones that are installed into the push switches, the two legs legs are the same length, so the only way to know they are installed correctly is to make sure the flat it facing the top of the PCB.

4. Make sure to install the switch spacers underneath the (31) push switches.

Output Board
https://youtu.be/p7EeIgI0q9E

1. The highlighted 1/4W Resistors R7, R11, R37, R41, R48 & R73 need to be installed so that they are standing off of the board. These are all part of RC filters that aggressively filter the analog supply voltages to reduce noise induced from certain sections of circuitry (i.e. BBD & compander sections). Since these are filtering supply voltages to whole sections there is a modest amount of power dissipated. Hence they are 1/4W and they should be mounted away from the PCB. *When building & testing the output board, if you happen to short the local filtered supply voltages to the BBD or compander sections you may fry one of these resistors. Don't panic - usually the other components are ok - just replace the resistor.*

SECTION 3 - Final Assembly

Note: Do not forget to install lock washers where described during enclosure assembly. The enclosure is made up of 6 individual metal panels. The lock washers are used electrically connect each panel so that the enclosure forms a metal cage around the electronics inside.This is to create a good chassis ground and is necessary to meet regulatory agency requirements for safety & electromagnetic interference (EMI). The chassis is connected to the isolated grounds on the input & output sides of the SMPSU via the PSU enclosure. The earth ground from the power entry module also connects to the chassis via a screw from the bottom panel.

Tools

- Oscilloscope
- Multimeter
- JIS #1 screwdriver
- JIS #2 screwdriver
- Potentiometer Trimmer Tool
- 4.5mm or 3/16" Socket or Nut Driver (Low Profile Nut Driver preferred)
- 5mm or 7/32" Socket or Nut Driver
- 5.5mm Socket or Nut Driver
- 6mm Socket or Nut Driver
- 1/4" Socket or Nut Driver
- 5/16 Socket or Nut Driver
- 10mm Socket or Nut Driver
- 11mm Socket or Nut Driver

STEP 1: INSTALL STANDOFFS INTO BOTTOM PANEL
https://youtu.be/aM15z7anKkk

(14) 6-32 x 1/2" Truss Head Black Oxide Screw *(purple)* (Bag1)
(10) 6-32 x 3/16" Threaded Aluminum Hex Female Standoff *(green)* (Bag 2)
 (4) 6-32 x 3/16" Unthreaded Nylon Spacer *(blue)* (Bag 2)
 (1) #6 Internal Tooth Lock Washer (Bag 2)

INSTALL LOCK WASHER UNDER THE HEAD OF THIS SCREW
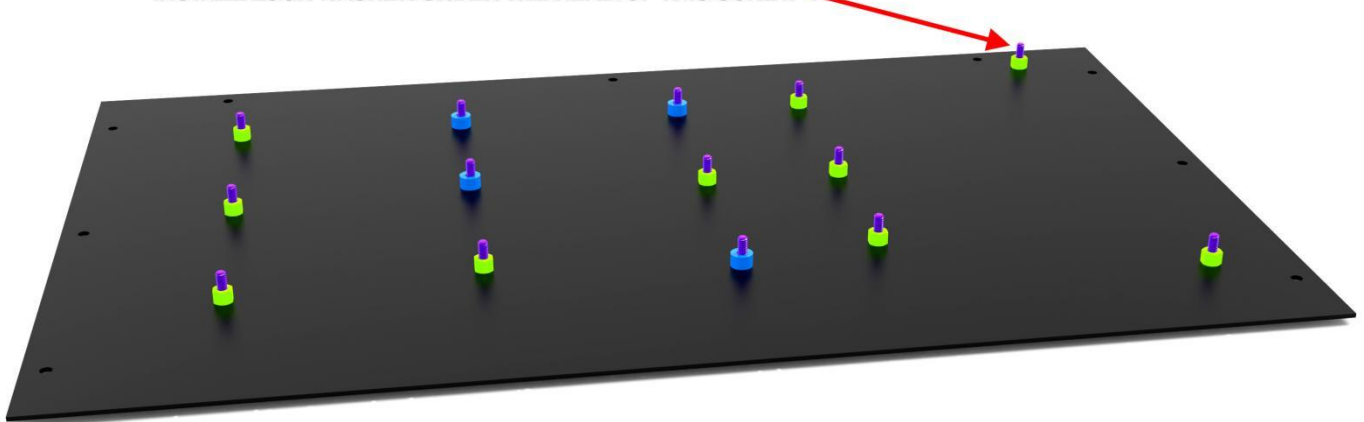
## STEP 2: DEPANALIZE VOICE MOTHERBOARD
https://youtu.be/o-6QKBKbkRY

The tabs around the perimeter of the motherboard need to be removed.They are scored on each side of the PCB and will break off. If you don't have a depanelizing tool use a pair of electricians pliers or other large pliers to grab and bend the tabs until they break off.

STEP 3: INSTALL VOICE MOTHERBOARD
https://youtu.be/abdwWKdTyBA

(12) 6-32 Lock Nut *(green)* (Bag 2)
(2)   6-32 Standard Nut *(purple)* (Bag 2)

Before mounting the voice motherboard double-check to make sure you installed component U2 in the opposite direction as shown on the PCB silkscreen (this is an error in the silkscreen). Also check to make sure you have placed the TO-220 insulators on each voltage regulator that attaches to the large heatsink - and make sure that you have used the insulated shoulder washer so the tabs of the voltage regulators are not shorted together.
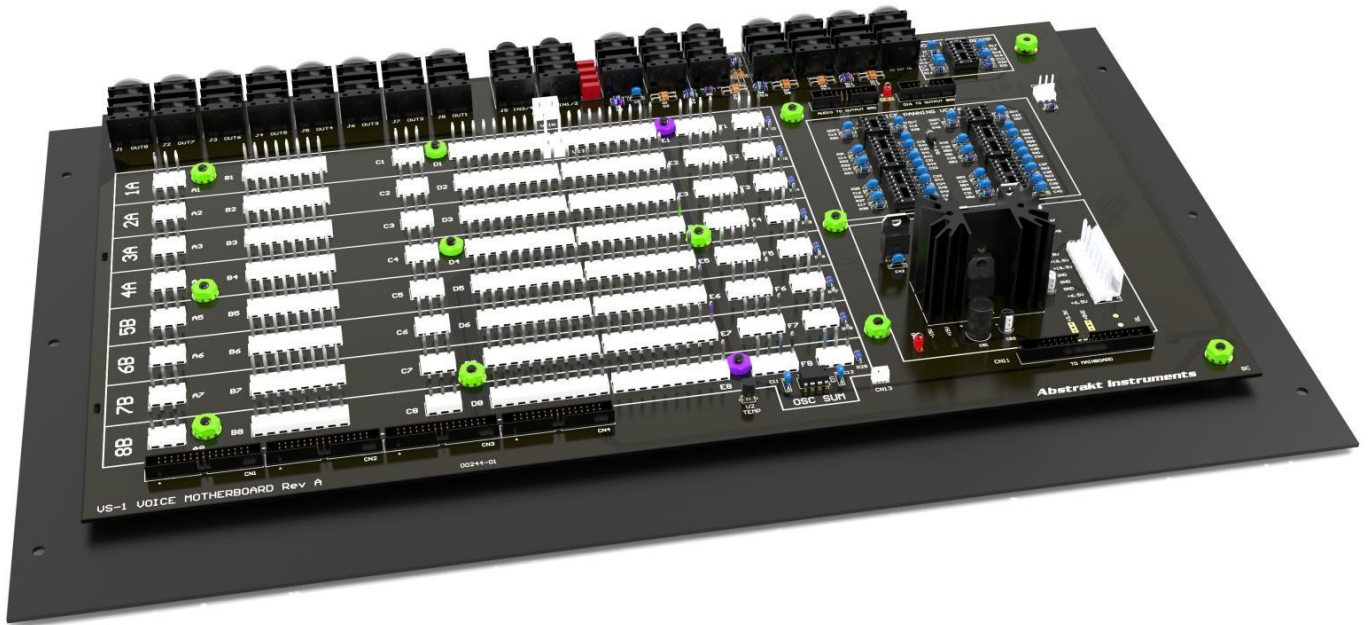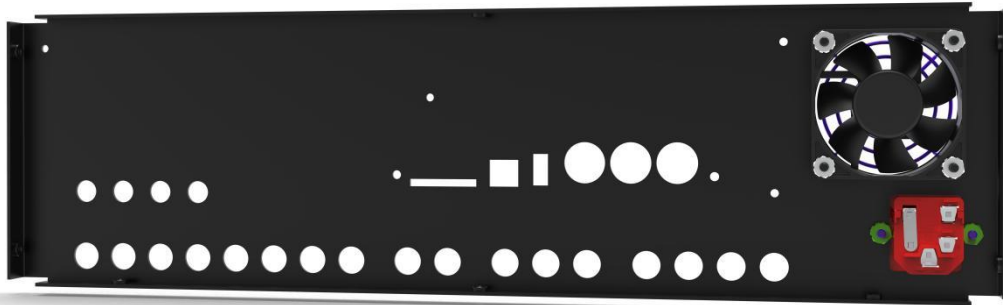
STEP 4: INSTALL FAN & INPUT JACK TO REAR PANEL
https://www.youtube.com/watch?v=pcXoduPB_ns

(1) Fan (60mm x 60mm x 15mm)
(1) Fan Guard (Bag 9)
(4) 8-32 x 1" Pan Head Black Oxide Screw *(purple)* (Bag 1)
(4) 8-32 Lock Nut *(green)* (Bag 2)
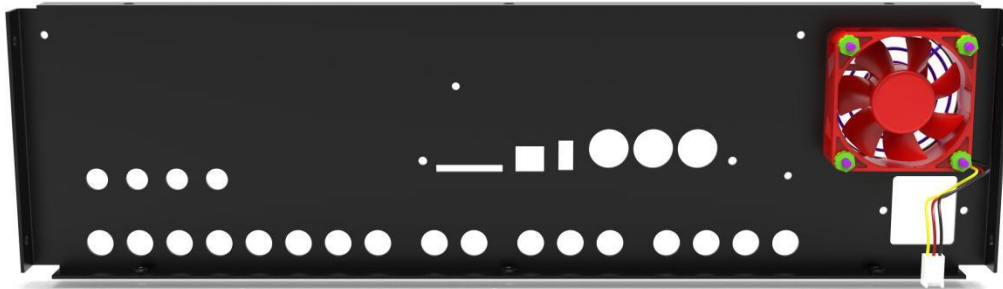
(1) IEC Jack (Bag 9)
(2) 1.0A or 1.5A fuse (fuse is already installed! extra fuse also installed in holder)
(2) 6-32 x 3/8" Pan Head Black Oxide Screw *(purple)* (Bag 1)
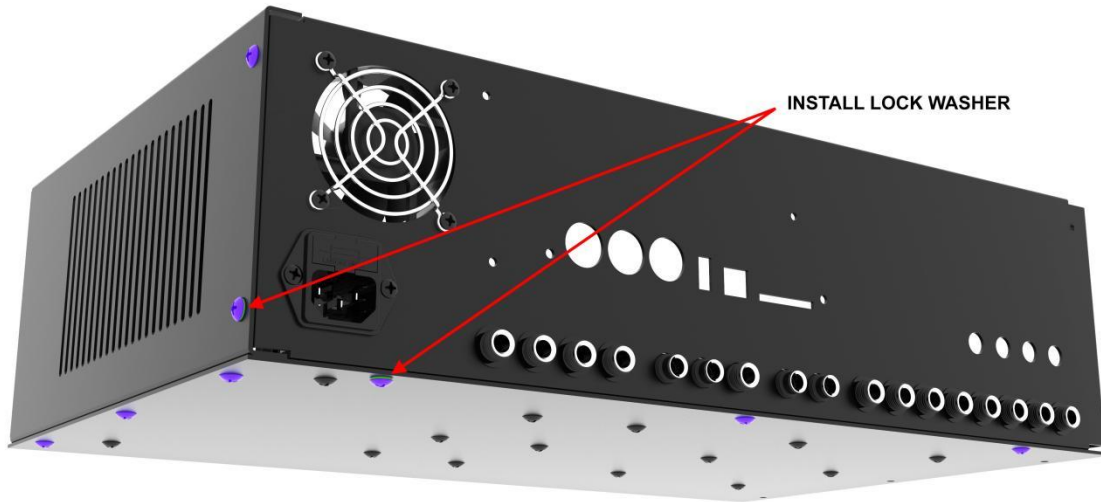(2) 6-32 Lock Nut *(green)* (Bag 2)

STEP 5: ATTACH BOTTOM, REAR & RIGHT-SIDE PANELS
https://www.youtube.com/watch?v=pcXoduPB_ns

(8) 6-32 x 1/4" Truss Head Black Oxide Screw *(purple)* (Bag 1)
(2) #6 Internal Tooth Lock Washer *(green)* (Bag 2)

INSTALL LOCK WASHER

STEP 6: INSTALL PSU

(2) M3 x 5mm Truss Head Black Oxide Screw *(orange)* (Bag 1)
(1) M3 External Tooth Lock Washer *(red)* (Bag 2)
(2) M3 Black Oxide Washer *(blue)* (Bag 2)

Install SMPSU where shown. The slots in the side panel are used to mount the PSU using two M3 screws, two washers, and one lock washer. It should be mounted so that the top of the PSU enclosure is about 16mm (5/8") below the top of the side panel. The 8 position connector should face towards the front of the VS-1. *The ribbon cable clip (red) (Bag 9) will eventually be mounted on top of the PSU enclosure - place it on top temporarily to make sure the PSU is not mounted too high.* The second picture below (right-side view) shows an exploded view to show the sequence of hardware.

## STEP 7: ASSEMBLE POWER SWITCH & POWER SUPPLY CONNECTORS

https://youtu.be/SPTx5pW1WJ0

(1) 3 position JST connector (Bag 9)
(2) 8 position JST connector (Bag 9)
(1) 12" wire w/ pre-crimped JST terminals on one side & 4.8mm quick connect terminal on the other side (Bag 7)
(1) 11" wire w/ pre-crimped 4.8mm quick connect terminals on both sides (Bag 7)
(8) 4" wire w/ pre-crimped JST terminals on both sides (Bag 9)
(1) 4" wire w/ pre-crimped JST one one side & 4.8mm quick connect terminal on other side (Bag 7)
(1) 4" chassis ground cable (Bag 6)
(1) power switch (Bag 9)
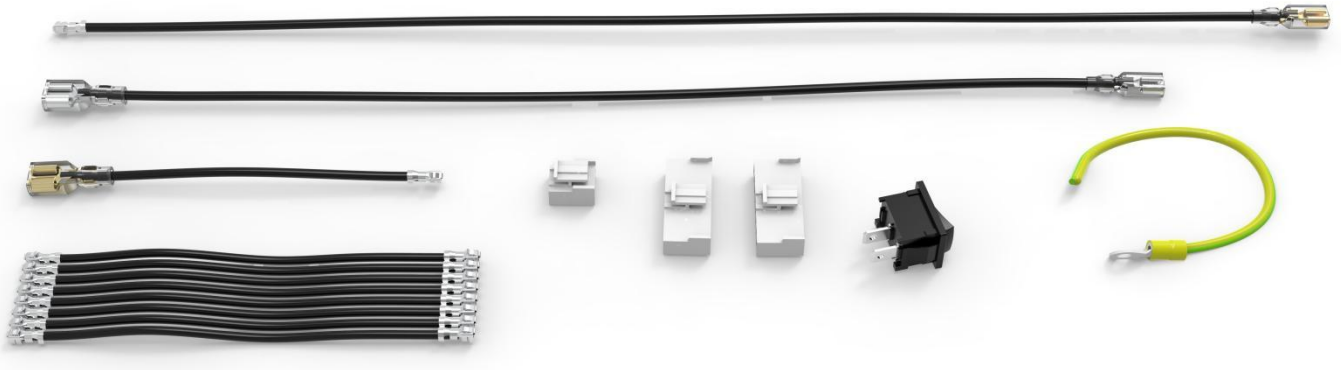
Assemble 8-position power connector as shown below:

Assemble Power Input cable as shown below (wire colors changed to make it easier to see):
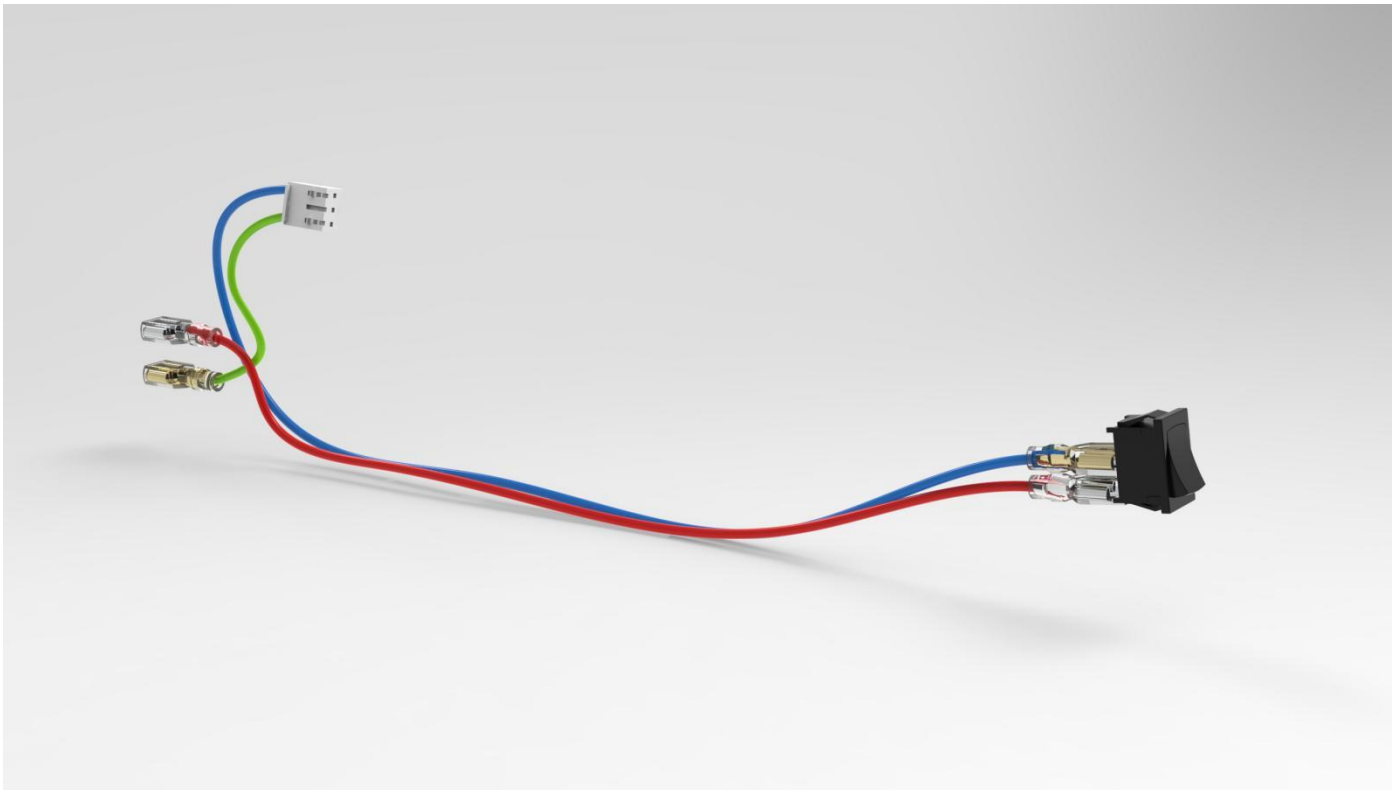
STEP 8 : PLUG IN POWER CONNECTORS

https://youtu.be/CBu8HOL9i-o

The long cable assembly connects between the power entry module, PSU module, and power switch. The wire colors have been changed below to make it easier to see the connections. Make sure to connect the quick connect tabs to the correct positions. The Line and Neutral connections are noted on both the PSU module and the power entry module, and are also shown in the correct orientation in the images below.

Next, solder the yellow chassis ground cable into the bottom ground tab of power entry module and connect the ring terminal where shown. *Note: the image shows a 187"/4.8mm quick connect installed as an option if you have the crimp tool and connector available and don't want to direct-solder.*


Lastly, plug in the 8-position power connector

STEP 9: CHECK & INSTALL FAN CONNECTOR
https://youtu.be/0mD5xvKeexk

The 5V DC fan is a 3-wire version. The yellow wire is the tachometer connection. The recommended fan listed in the BOM has a 3-pin molex header already in place. **PLEASE CHECK** the wiring to make sure it is correct and matches the pictures below - we have received some fans with the incorrect wiring!
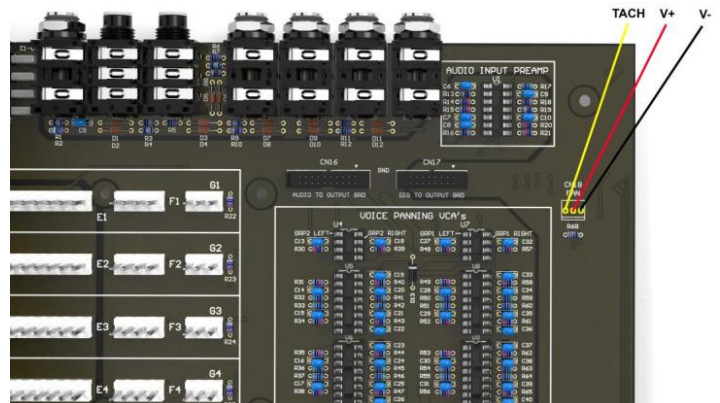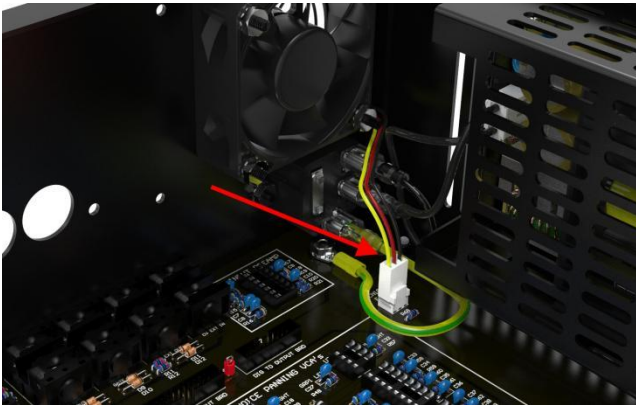
If you use a fan without a connector you will need to solder the wires directly to the voice mobo or install molex crimp terminals. If you want to install crimp terminals the part numbers are below:

(3) crimp terminals molex part # 08-50-0113
(1) header molex part # 22-23-2031 (header on voice mobo)
(1) housing molex part # 22-01-3037 (housing for fan wires)

STEP 10: ASSEMBLE & INSTALL HEADPHONE CABLE
https://youtu.be/htv07R1Nmr8

(1) 12" shielded cable
(1) 1/4" TRS headphone jack
(2) 4" wire ties

Cut off the connector from one side of the shielded cable and solder on the headphone jack. The tip of the jack is the left output, the ring is the right output, and the sleeve is ground. Once the jack is soldered on install the cable to the right side of the enclosure using two of the wire ties. There are slots in the voice motherboard to route the wire ties. Leave some extra cable length at the front of the enclosure as shown.
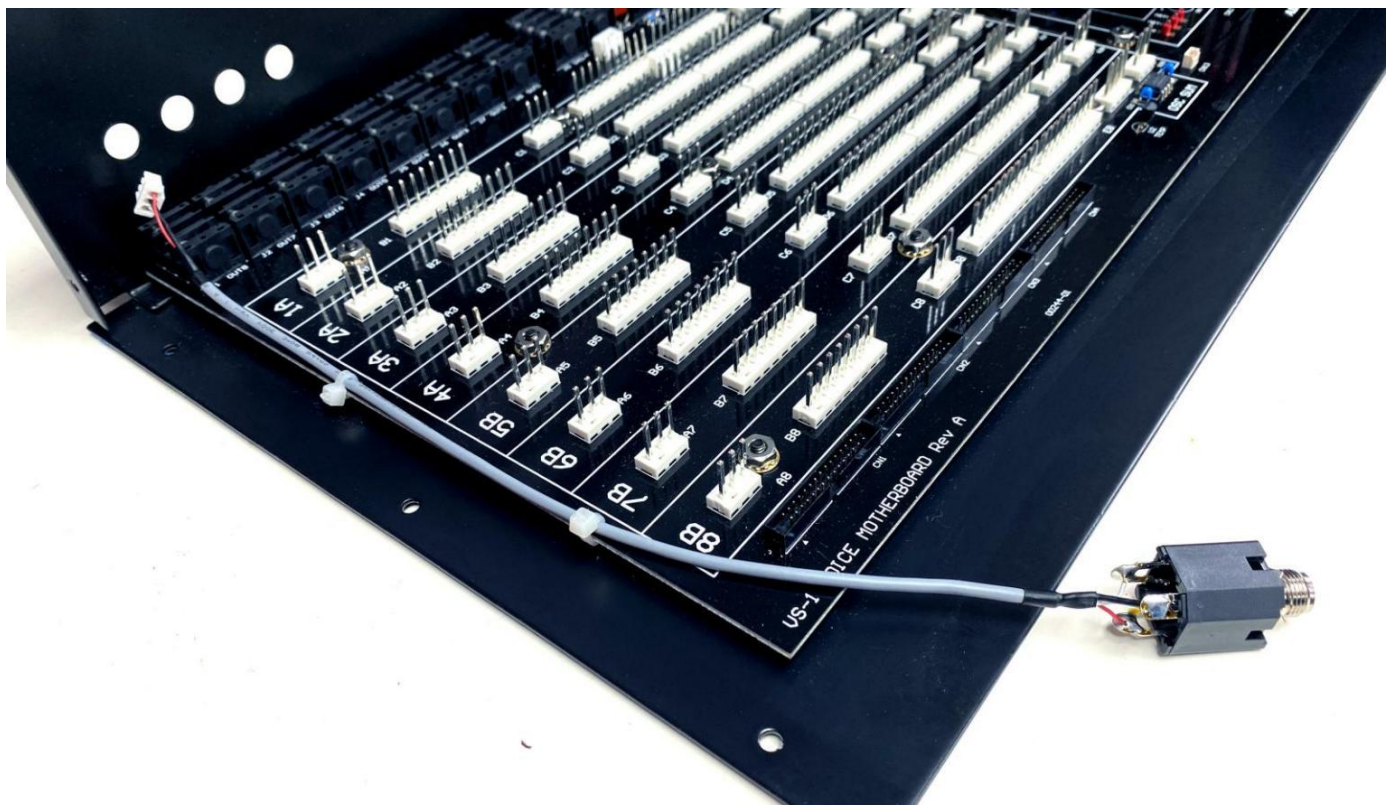
STEP 11: CALIBRATE PSU OUTPUTS
https://youtu.be/wAF4sgTHIrc

WARNING! Be extremely careful when working with line voltage.

1) Make sure the power switch (rocker switch) is on the *off* position.
2) Plug in the power cable.
3) Turn on the power switch.
4) Probe the +18.5V raw output from the PSU. Use the ground test point for the ground lead and clip the other test lead to the appropriate position from the top of the power connector (see PCB silkscreen). Adjust the trimmer on the PSU until the value is +18.5V +/-0.1V.
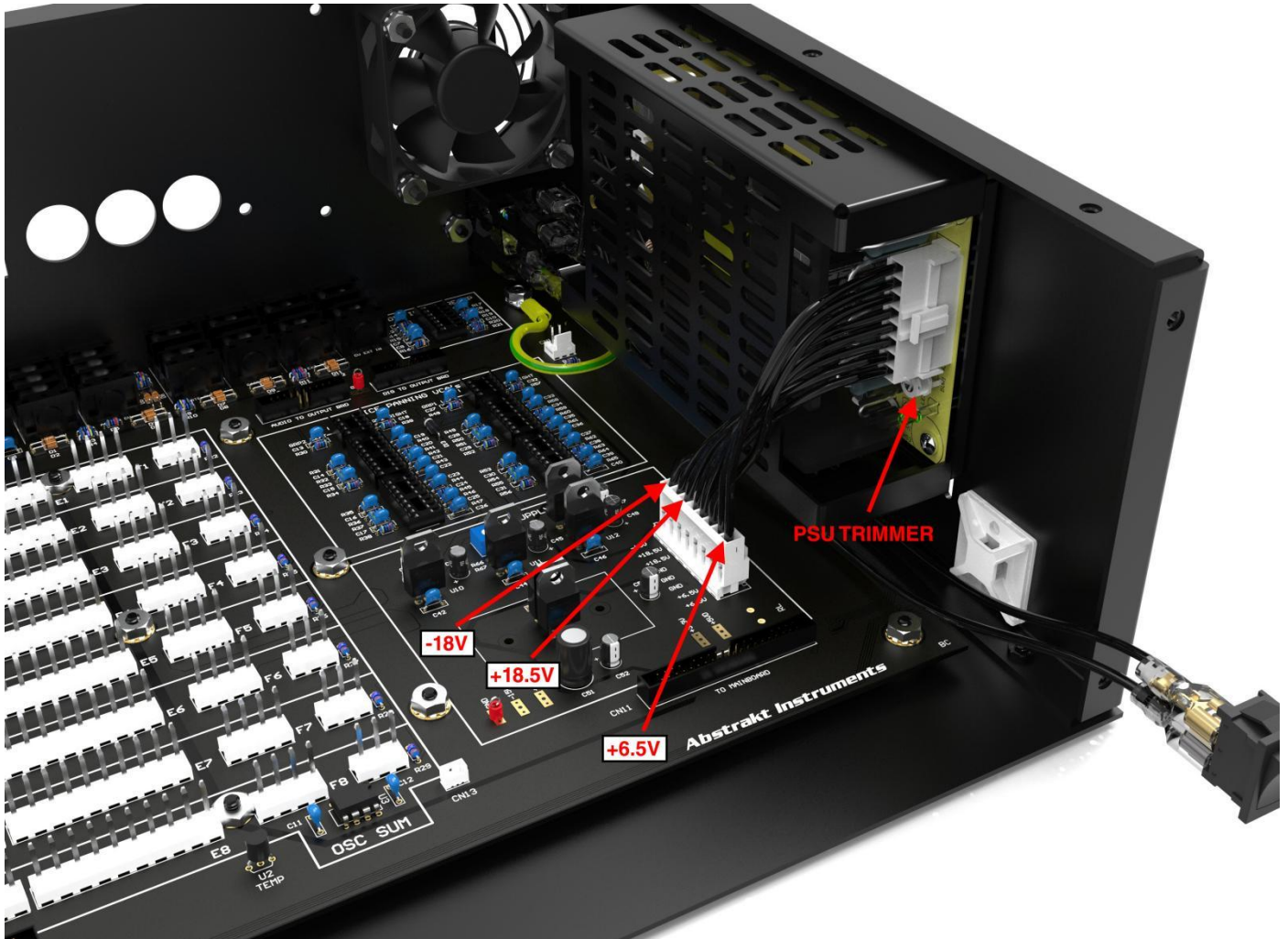
5) Next, connect the voltmeter to the +6.5V raw output from the PSU (the *front* two positions of the connector are +6.5V as shown on the PCB silkscreen).

6) Now check the -18V output and confirm it's -18V +/-0.3V.

Note: When the PSU trimmer is adjusted the ~6.5V output is also affected. The +18.5V output is the most critical so you will be adjusting the voltage specifically for the 18.5V rail. The +6.5V output may end up anywhere between 6.3V and 6.8V. This is ok.

7) Probe -15V at the test pad on the PCB. Adjust TM1 for -15V +/- 0.1V (the -15V rail is used as a voltage reference for some circuitry and should be more precise).

8) Check the fixed +15V rail at the test pad on the PCB. Confirm it is +15V +/-0.3V.

9) Insert IC's (if socketed) and test the analog +/-15V PSU outputs again. You can insert all IC's at once or only a few at a time. There is no order that the IC's need to be installed, and they can be installed in any number or order.

STEP 12: INSTALL I/O BOARD
https://youtu.be/blmTi7bXP-Q

(2) M3 x 6mm Pan Head Black Oxide Screw (Bag 1)
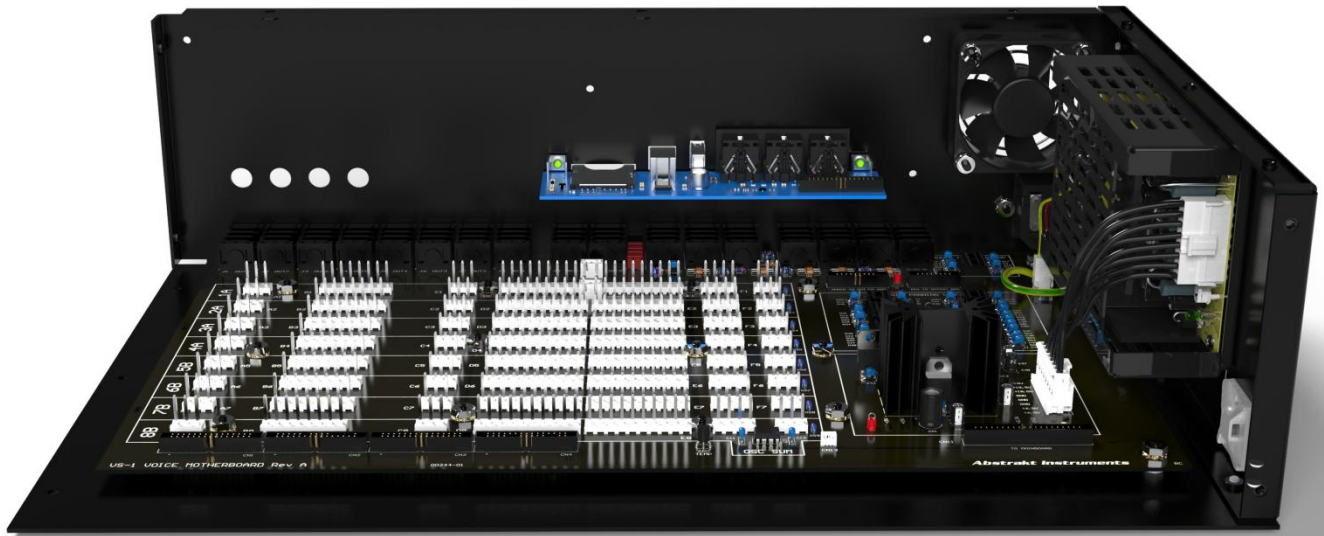
STEP 13: INSTALL OUTPUT BOARD
https://youtu.be/G8QNOahc76Q

(4) M3 x 24mm Female Brass Standoff *(green)* (Bag 3)
(4) M3 x 6mm Narrow Pan Head Black Oxide Screw *(pink)* (Bag 1)
(4) M3 x 6mm Pan Head Black Oxide Screw *(green)* (Bag 1)
(1) 50mm 16-Position Ribbon Cable (Bag 8)
(1) 50mm 20-Position Ribbon Cable (Bag 8)

Connect the CN16 & CN17 ribbon cables, power on the unit, and re-test the +/-15V analog supply voltages to make sure there are no obvious faults w/ the output board connected. If desired, you can first test the output board without the IC's installed.

STEP 14: INSTALL OLED TO PANELBOARD
https://youtu.be/fIApntb4T8E

(4) #4 x 9/32" White Plastic Spacer *(green)* (Bag 2)
(4) 4-40 x 5/8" Phillips Flat Head Screw *(pink)* (Bag 2)
(4) 4-40 Lock Nut *(purple)* (Bag 2)
(1) 4-Pin Header (Bag 2)

Install the 4-pin header into the OLED. Mount the module into the Panelboard using the spacers, flathead screws and lock nuts. The OLED screen is mounted into the panelboard upside-down.

Note: If sourcing your own OLED module make sure the pinout is correct - 1.3" OLED modules are sold with different pinouts. When viewed from the front the pinout should be **GND - VCC - SCL - SDA**.
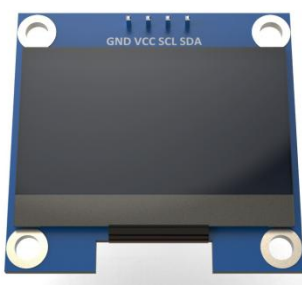
Note: The 82-degree flat-head screws were specifically chosen to work with the recommended OLED. If using a different OLED a different screw type may be required.
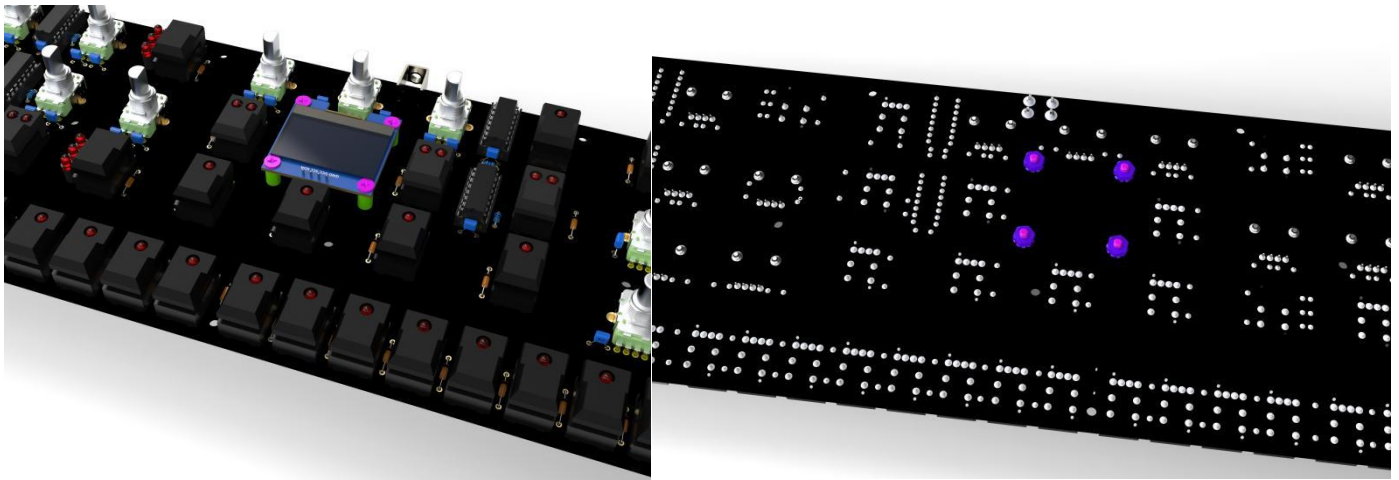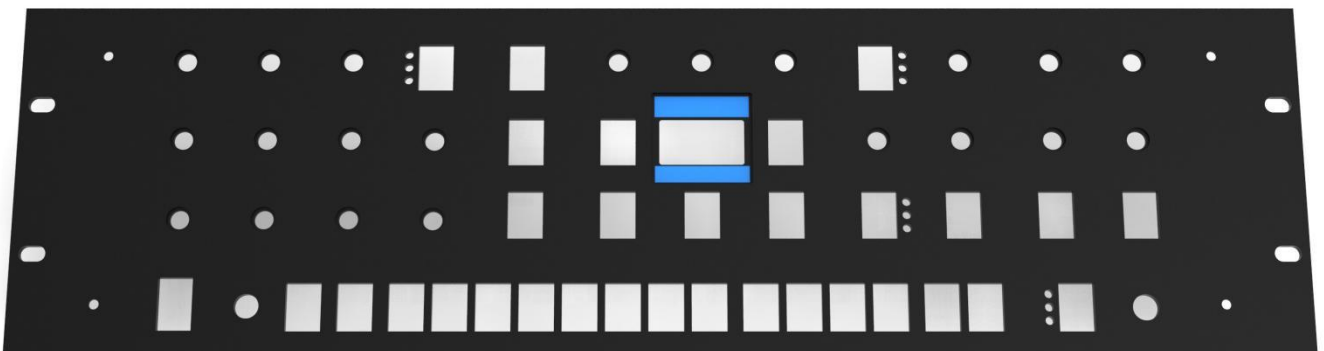

STEP 15: INSTALL OLED BEZEL & FRONT PANEL TEST FIT
https://youtu.be/hrL6ExcvNl0

(1pcs) 3M GPT-020F (*blue*) (Bag 25)

Cut two strips from the included 3M double-sided transfer tape and attach to the back of the front panel.

Attach the OLED acrylic bezel from the back side of the panel and test fit the panelboard. The front panel is machined and the tolerances are tight. Make sure the switches, LED's and potentiometers are aligned well enough for the panel to fit. Be patient with this step, it is likely that one or more parts may need to be adjusted.

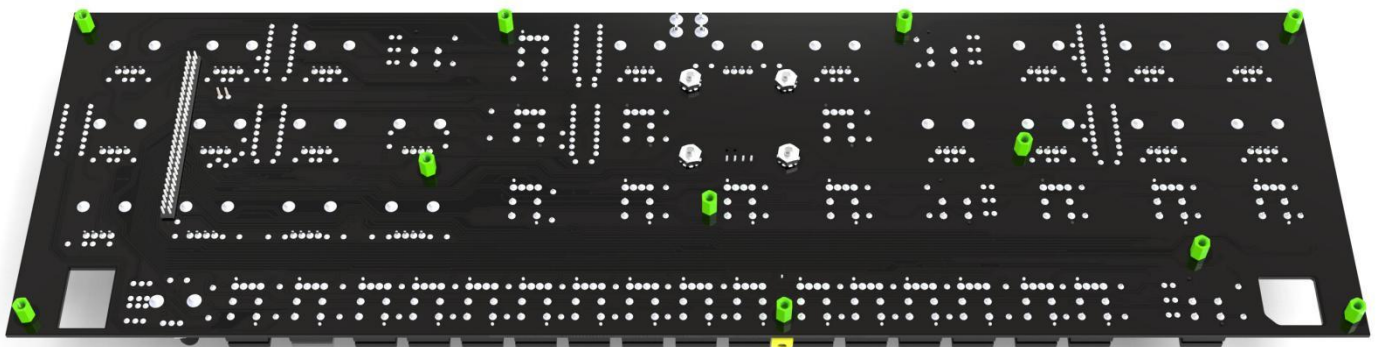# STEP 16: INSTALL MAINBOARD, PANELBOARD & DAC BOARD PCB STACK
https://youtu.be/2RN0ImtVHyM

Part 1: Install Standoffs & L-bracket to Panelboard

(11) M3 x 7mm Male-Female Brass Standoff *(green)* (Bag 3)
(1)   M3 x 8mm Female Aluminum Standoff *(blue)* (Bag 3)
(1)   L-bracket *(yellow)* (Bag 2)
(7)   M3 Serrated Lock Nut *(red)* (Bag 2)
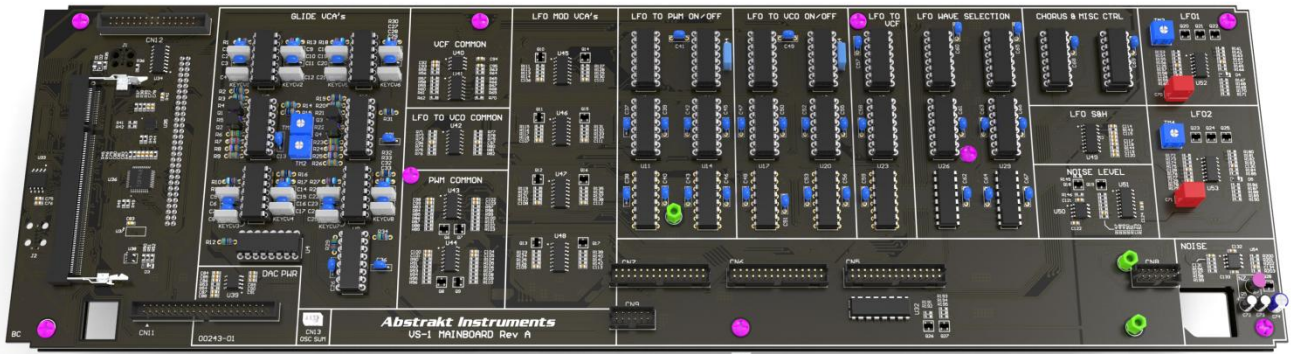(3)   M3 Standard Nut *(orange)* (Bag 2)

TOP VIEW

BOTTOM VIEW

Part 2: Attach Panelboard to Mainboard

(3) M3 x 7mm Male-Female Brass Standoff *(green)* (Bag 3)
(9) M3 x 6mm Narrow Pan Head Black Oxide Screw *(pink)* (Bag 1)
(1) M3 Serrated Lock Nut *(red)* (Bag 2)

serrated nut

Part 3: Attach DAC Board

(3) M3 x 6mm Phillips Narrow Pan Head Black Oxide Screw *(pink)* (Bag 1)

STEP 17: INSTALL PCB STACK TO FRONT PANEL
https://youtu.be/H4GvMA76W70

Part 1: Place 3 or 4 of the M9 fender washers on the encoder bushing to shim the panel to the correct distance from the encoder. The exact number of washers will depend on how the encoder was installed. Usually 3 or 4 washers is what is needed.

(4) M9 Fender Washer (Bag 2)
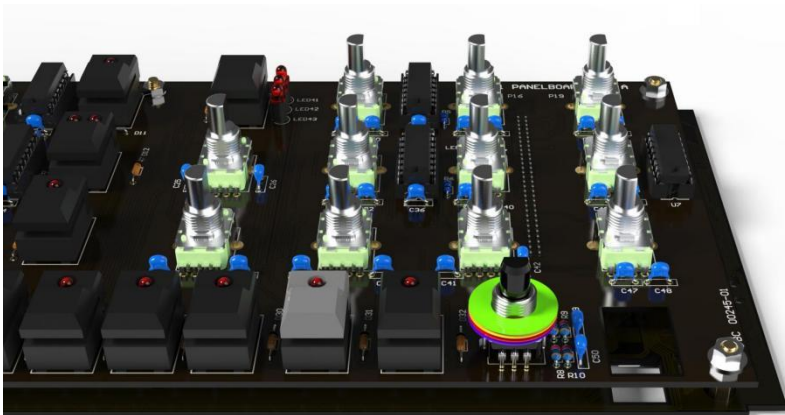
Part 2: Mount the PCB stack into front panel

(21) M7 x 0.75 Panel Nut *(green)* (Bag 18)
(21) M7 x 0.75 Fender Washer (optional) (Bag 18)

Place the panel over the PCB stack. Make sure you have used the correct number of fender washers over the encoder to make sure the front panel is the correct distance from the panelboard. Next, secure the panel with the panel nuts. You may want to install only a few of the panel nuts at this time until the testing is complete. We don't use the fender washers for our retail VS-1's, but they may give additional protection against scratching the front panel finish and screen-printing.

Part 3: Install M9 panel nut to secure the encoder

(1) M9 Panel Nut *(green)* (Bag 20)

STEP 18: TEST POWER TO THE PCB STACK
https://youtu.be/LngRwWWeiq0

(1) 50mm 40-Position Ribbon Cable (Bag 8)
(2) M4 x 6mm Flat Head Black Oxide Screw (Bag 2)

- Do not install the MCU module yet - you will test power first without it.
- Connect the 40-position ribbon cable (CN11) between the mainboard and voice motherboard.. This provides +3.3V, +/-15V, and 5V USB power to the PCB stack.
- Make sure the unit is unplugged.
- Temporarily disconnect the power switch by removing the two quick connect terminals.
- Attach the power switch into the front panel.
- Reattach the two power switch wires by feeding them through the hole in mainboard & panelboard.
- Mount the front panel to the right side of the enclosure to temporarily secure in place. It's best to leave the left-side panel uninstalled at this time as there is more testing to do and it will get in the way.
- Plug in the unit and turn on the power switch.
- Test +3.3V, +5VD, +15V and -15V using the test point on the Voice Motherboard. If ok proceed to the next steps.

STEP 19: TEST POWER TO THE OUTPUT BOARD
https://youtu.be/B2c_dBbDODc

(1) 50mm 20-Position Ribbon Cable (Bag 8)
(1) 50mm 16-Position Ribbon Cable (Bag 8)

- Power off the VS-1
- Plug in CN17 & CN17
- Power on the VS-1
- Verify +15V & -15V on the Voice Motherboard is still good.

STEP 20: INSTALL VOICE CARDS 1A TROUGH 4A
https://youtu.be/RPQ5Z8sHOFY

Each voice card is powered directly from the ~+18.5V/-18V power from the main PSU and have their own +/-15V regulators on-board.

- Power off the VS-1
- Install Voice Card 1A
- Test the +18.5V & -18V supply directly at the PWR connector.

Continue to install voice card 2A, 3A & 4A while testing the ~18.5V & -18V supply after each card is plugged in. Make sure ti turn off the unit before plugging in each card.

After installing the first four cards the ~+18.5V rail may dip under load. This is normal. Readjust the PSU trimmer to bump the voltage back up to +18.5V.

At this time do not install the last four voice cards, this will be done later. At this point your build should look like below:

STEP 21: INSTALL iMX RT1052 MICROCONTROLLER MODULE

https://youtu.be/B8AV3Zovzsk

Before trying to install the module remove the two screws securing the front panel so that you have better access to the backside of the mainboard.

- Make sure the unit is powered off.
- The microcontroller module is made in a 200-pin SODIMM format. Approach the connector at a 45 degree angle, seat the gold fingers against the back of the connector and click the module into place by pressing it parallel to the mainboard. The module will *click* in.
- Turn on the unit.
- Test the 3.3V & 5VD power supplies by using the test pads on the voice motherboard.
- Once power is verified turn off the unit.

STEP 22: INSTALL OPERATING SYSTEM

The primary method for downloading the operating system to the VS-1 is via MIDI system exclusive using USB or DIN-MIDI. There may also be an option for updates via SDcard & USB thumb drive. Updates via MSD (Mass Storage Device) have proven unreliable on Mac, so we will not likely be offering this method. Please see the documents on OS Updates for specifics.

STEP 23: TEST MODE

Once the operating system is successfully installed test mode will allow you to test the interface to make sure the VS-1 is working properly at a basic level. Press the SHIFT key while powering on the unit.

Part 1: Switch & LED manual test

- When each button is pressed the corresponding LED will toggle with each button press. For buttons with multiple LED's the LED's will light alternately with each button press.

Part 2: Potentiometer manual test

- When each potentiometer is rotated the name and current value of the pot will be shown on the screen.

Part 3: Encoder manual test

- When the encoder is rotated the increment/decrement will be shown in the display. When the encoder button is pressed it will also be shown in the display.

STEP 24: INSTALL VOICE CARDS 5B THROUGH 8B

Now that the interface and general operation has been test & working install the last four voice cards one at a time as described in STEP 20.

After installing the last voice card the ~+18.5V rail may dip again under load. This is normal. Readjust the PSU trimmer to bump the voltage back up to +18.5V.