Tubbutec OrganDonor

Installation manual for the Korg PS-3100 Polyphonic Synthesizer

Tools you will need:

- Screwdriver
- Large towel (for resting the front panel face-down on the keyboard)
- Soldering iron
- Wire clipper & stripper (28 AWG for ribbon cables)
- Shrink tubing (and heat gun) or electrical tape
- 1x length of hookup wire (30cm)

Included in the kit:

- 1x OrganDonor Main Board
- 3x OrganDonor Switch Boards
- 6x connection cables:
    - 1x 10-pin cable to connect Main board to Switch board #1 (60cm)
    - 2x 10-pin cables to connect Switch board #1 to #2, and #2 to #3 (10cm)
    - 1x 20-pin cable to connect Switch board #1 to pitch terminals (30cm)
    - 2x 16-pin cables to connect Switch boards #2 and #3 to pitch terminals (30cm)
- Power connector assembly (30cm):
    - Includes 3 wires for +15V, GND, -15V
- 13x plastic adhesive standoffs to mount boards to interior metal frame
- MIDI connector assembly, including:
    - 5-pin DIN connector (optional)
    - Assembly wiring (45cm if using existing front panel 5-pin DIN connector)
    - 2x M3 bolts and 2x M3 nuts for mounting DIN connector (optional)
    - Drilling template (optional)
- Learn button (optional)

Principle of operation

OrganDonor uses analog switches to simulate keyboard presses when a MIDI Note arrives. Normally this would require soldering two wires for each key, but this can be avoided by grouping common signals. OrganDonor features solder bridges to connect common signals on the back of each analog Switch board.

The PS-3100 has 48 keys distributed over several keyboard blocks. The keyboard uses one common contact bus, and each keyboard block connects to this bus in a daisy-chain, where the leftmost keyboard block is the start of the chain, and the chain terminates at a dedicated +15V keyboard contact at the power supply.

The keyboard's common bus connections and the 48 pitch connections are located underneath the wood frame that separates the keyboard from the front panel. Behind the panel is a metal frame that holds the PS-3100's edge cards, and this frame blocks access to most of the backside of the keyboard. Luckily all of these connections are wired to more easily accessible locations.

Note that while OrganDonor's Main board includes connection points for generating additional voltages (controllable via MIDI CCs), the kit only includes what's necessary for pitch control of the synth. Additional information on these other outputs is available from Tubbutec.

Installing the OrganDonor boards

Main board

Mount the Main board on the inside of the metal frame wall that's shared with the power supply. The Main board should face the Korg KLM-76 (CONTROL 3) edge card (see Figure 1). Temporarily remove KLM-76 if you need more room to work.

Use the plastic adhesive standoffs to affix the board to the wall. Be careful to orient the locking tabs on the standoffs in such a way that leaves room to depress them to release the board. For initial placement, lightly press the board onto the standoffs so that they don't lock into place. This makes it easier to pull out the board if needed before completing the work.

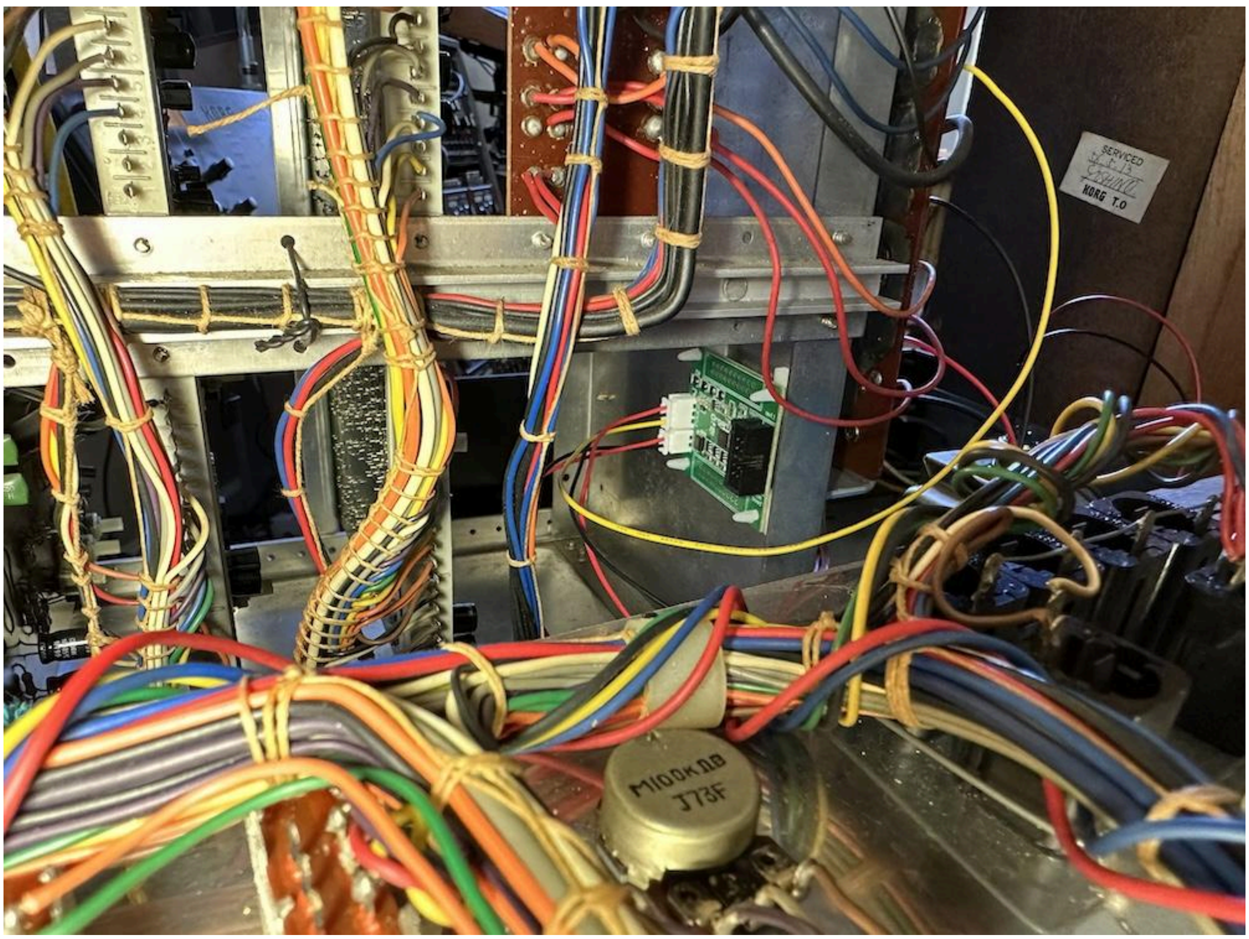

Figure 1: Main board placement as viewed from the front of the synth

Switch boards

Before placing the Switch boards, verify that the solder bridges are connected on each board so that when the ribbon cables are connected there's continuity from point B1 on Switch board #1 to point B16 on Switch board #3 (see Figure 2). This is the common keyboard contact for all 48 pitches.

The red boxes indicate the solder bridges that should have a dab of solder applied to them. This joins all of the contacts on the B row. Ensure you have continuity from end to end before mounting the Switch boards.

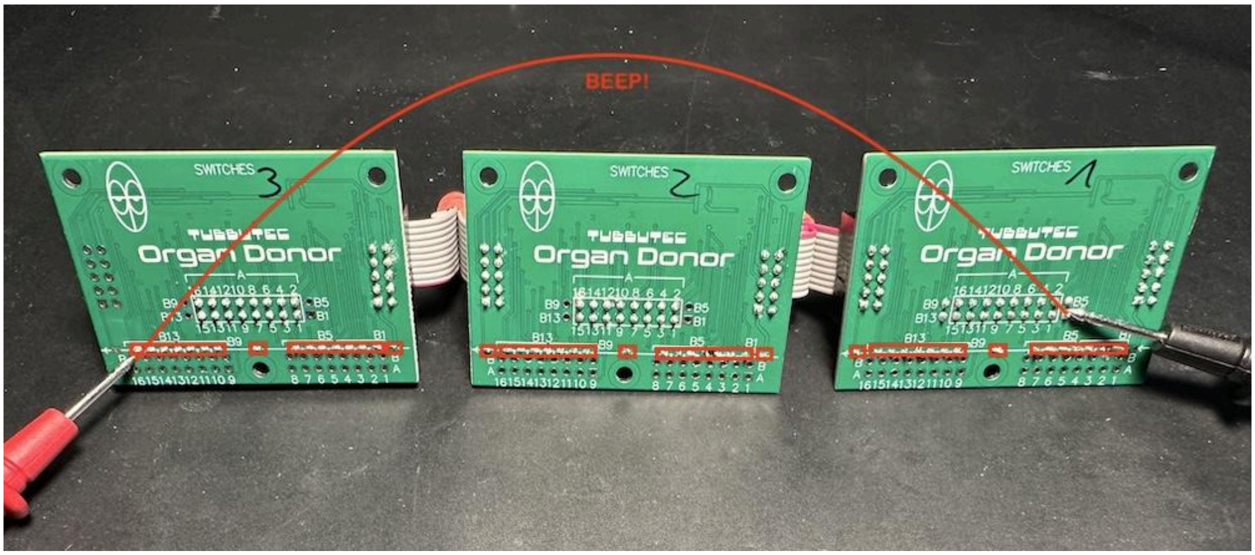

Figure 2: The bridges requiring solder to join B1 on Switch board #1 to B16 on Switch board #3

Place the three Switch boards on the metal frame wall facing the four KLM-69 (GATE) edge cards. Temporarily remove all four cards to give you room to work.

As before, be mindful of the orientation of the plastic standoffs' locking tabs, or you'll have a difficult time removing the boards if you ever need to.

Connect the Main board and the Switch boards to each other using the 10-pin ribbon cables. The longest one connects the Main board to the first Switch board and can be run along the front side of the metal frame. In Figure 3, which is viewing the KLM-69 section from the rear of the synth, this cable can be seen entering from the front at the top of the first Switch board.

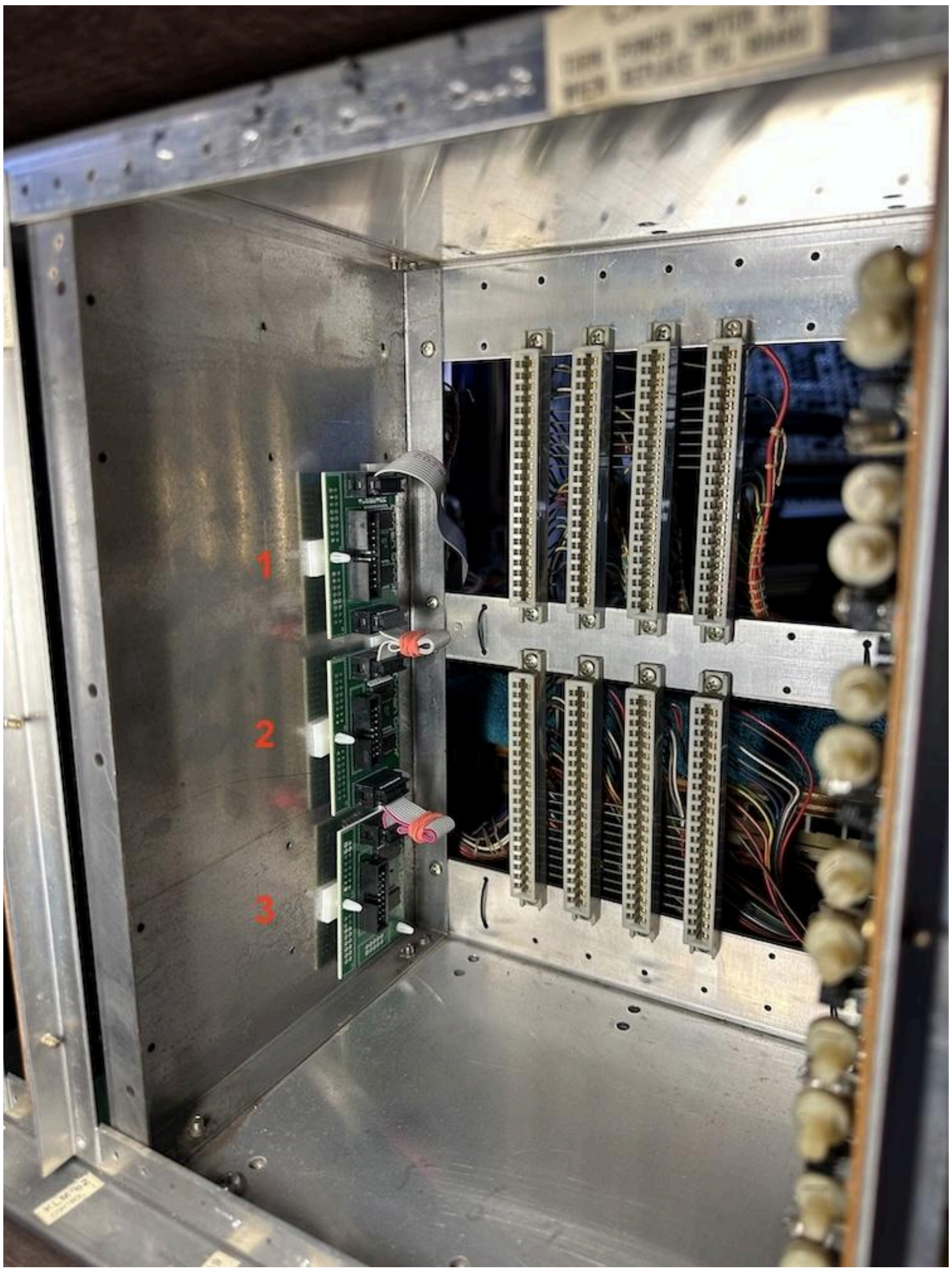

Figure 3: Placement of the Switch boards as viewed from the rear of the synth

Installing the Power connections

Connect the supplied power wire assembly to the Main board. Connect the three wires to the points indicated in Figure 4. The terminals of interest are printed on the PS-3100 power supply board as follows:

- Terminal 3: -15V
- Terminal 4: GND
- Terminal 6: +15V

There should be unoccupied solder pads available for each of these, but you can also double up on a pad with an existing wire. Just make sure any doubled-up wires are securely connected.

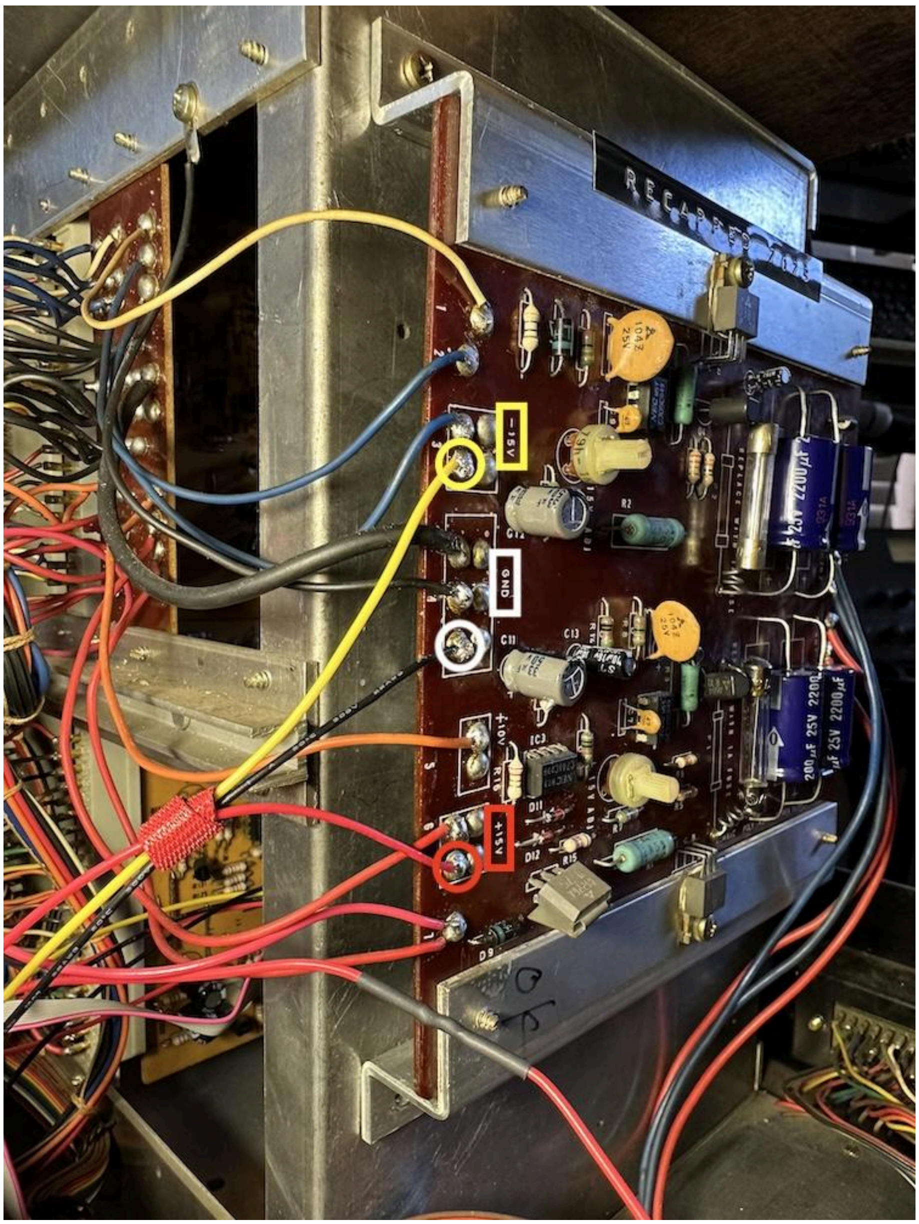

Figure 4: Power supply connections

Installing the MIDI connections

The PS-3100 already has two 5-pin DIN connectors on the front panel which can be repurposed for MIDI connectivity (they're wired internally to the 6.35mm Voltage Processor jacks, but can be disconnected without affecting the jacks). If you don't want to use those, the MIDI connector assembly can be installed elsewhere (the kit includes a drilling template). The advantage to using one of the existing panel connectors is that it keeps the MIDI connection readily accessible, and the modification is easily reversible.

If you decide to use the front panel DIN connector on the right (for example), it's very simple to do. You'll notice that there are several wires connected to it (Figure 5, left). For MIDI we only need two wires, but the DIN connector's existing wiring uses one of the terminals we need (green circle). Desolder that wire from the DIN connector (Figure 5, left) and seal off the end of the wire so that it doesn't make contact with anything (Figure 5, right).

Snip off the two wires from the MIDI assembly's DIN connector (if present), and take note of which wires were connected to which pins. Solder the wires to the corresponding pins on the front panel DIN connector (the yellow and green circles in Figure 5, right). Plug the other end of the MIDI assembly into the 2-pin MIDI connector on the Main board.

If your kit does not include a new DIN connector at one end of the assembly, the DIN terminal circled in yellow should connect to the upper pin on the Main board's MIDI connector (when viewed right side up), and the DIN terminal circled in green should connect to the lower pin on the Main board's MIDI connector.

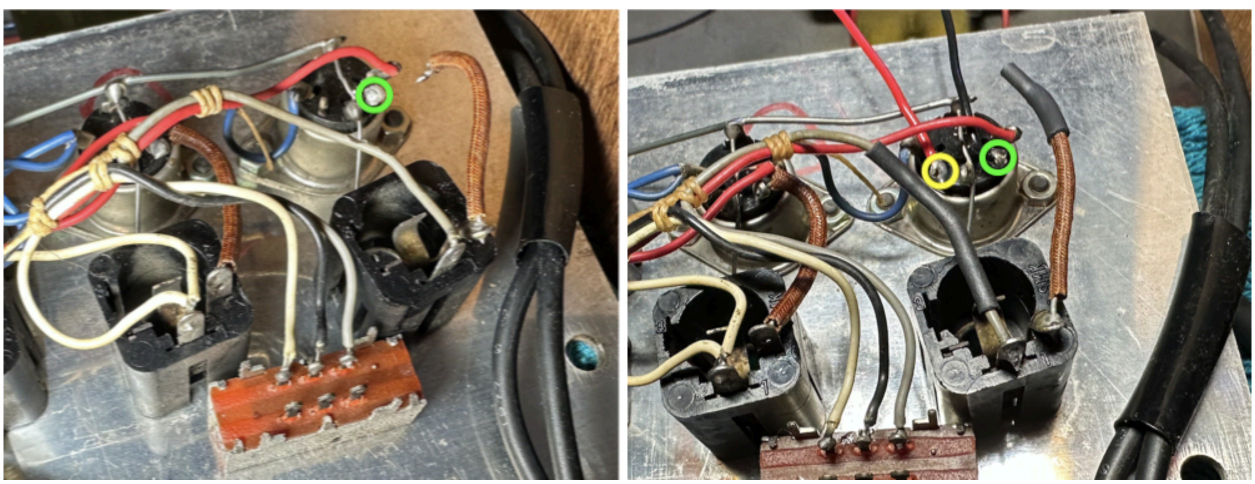

Figure 5: Converting one of the DIN connectors for MIDI

At this point you can verify MIDI connectivity before proceeding, if you wish (see the 'Configurator tool' section further down). If you do, be sure to power off the synth before moving on to installing the keyboard connections.

Installing the keyboard connections

Split apart the unfinished ends of the 20-pin and 16-pin Switch board ribbon cables so that the individual wires dangle free for about 4-5cm, and strip no more than 0.5cm from the ends. Twist the stranded threads of each wire and tin them to make them easier to solder.

Plug the three ribbon connectors into their Switch boards and pull the ribbons through the front of the metal frame. The first Switch board's cable should come through the opening above the horizontal bracket, and the second and third Switch boards' cables should come through the opening below the horizontal bracket.

This is demonstrated in Figure 6, though the ends of the ribbons have not yet been split apart in the photo. The uppermost 10-pin cable connects the first Switch board to the Main board off to the right.

Also note that in Figure 6 the power was on to test MIDI connectivity (which is why the Main board is lit up). Don't work on this synth while it's powered on!

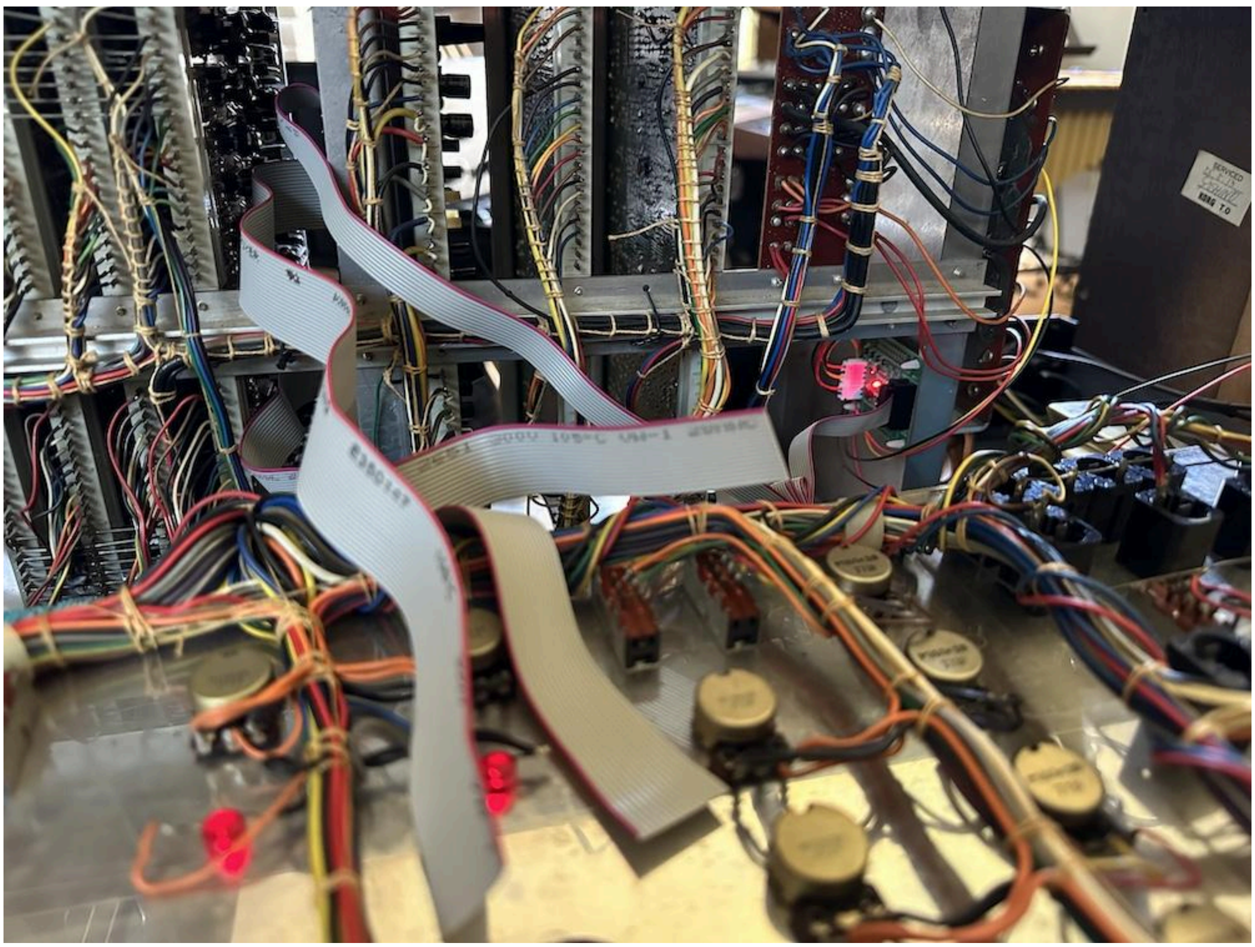

Figure 6: Switch board ribbon cables threaded through the openings

The first Switch board's 20-pin connector wire (the red one) is used for the common keyboard connection. Peel this wire away from the ribbon for 5cm or so. It will ultimately connect to a separate solder pad on the PS-3100's power supply (Terminal 7), which is the end of the daisy-chain that starts with the keyboard's left-most block.

This is where the 30cm length of hookup wire (not provided) comes into play. The hookup wire is spliced onto the Switch board's common keyboard wire, and the other end is connected to the power supply, as shown in Figure 7.

Use shrink tubing or electrical tape to cover the splice so that it won't short if it touches anything (the entire metal frame, for example, is connected to GND). If hookup wire is not available to you, request an extra long 20-pin ribbon cable when placing your order. 60cm should do it.

There's ample solder on Terminal 7's pad, so it's enough to reflow it and insert the new wire into it. Just make sure both wires are solidly connected. For peace of mind, you can turn on the synth to make sure the keyboard still responds to key presses, and then turn it off again before proceeding.

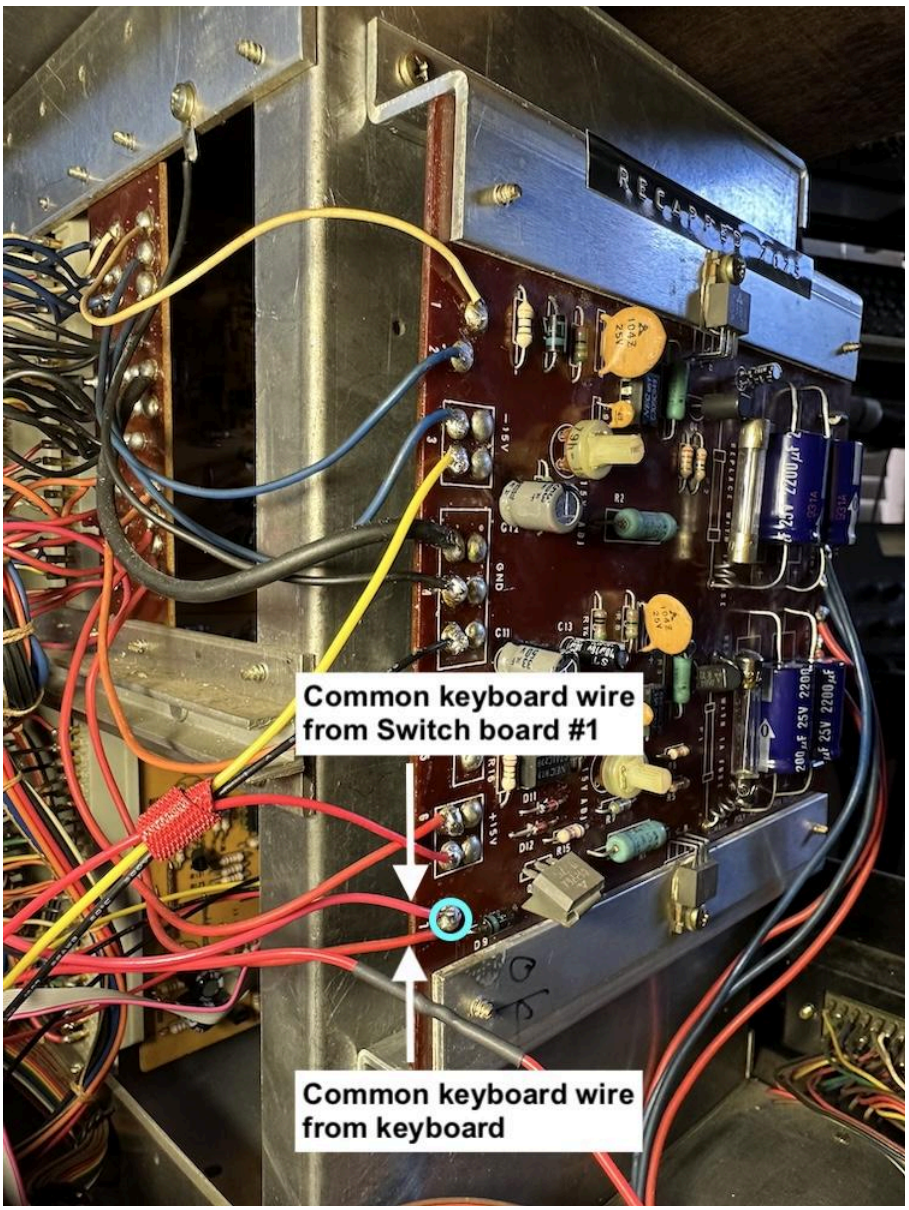

Figure 7: Common keyboard connections

The remaining Switch board wires (well, 48 of them anyway) will be connected to terminals on the KLM-69 GATE cards where the keyboard's existing wires are connected. But first orient yourself to the layout of the GATE cards' pitch terminals, referencing Figure 8.

Viewed from the front of the synth, the four KLM-69 GATE cards span the synth's four octaves from left to right. Each edge card has a pair of 22-terminal edge connectors that flank the horizontal bracket, and each connector's terminals are numbered 1-22 from the bottom to the top.

Each octave's pitches (F through E) are distributed over Terminals 11-22 at each of the four lower edge connectors (i.e. the final 12 terminals just below the horizontal bracket). See Figure 8.

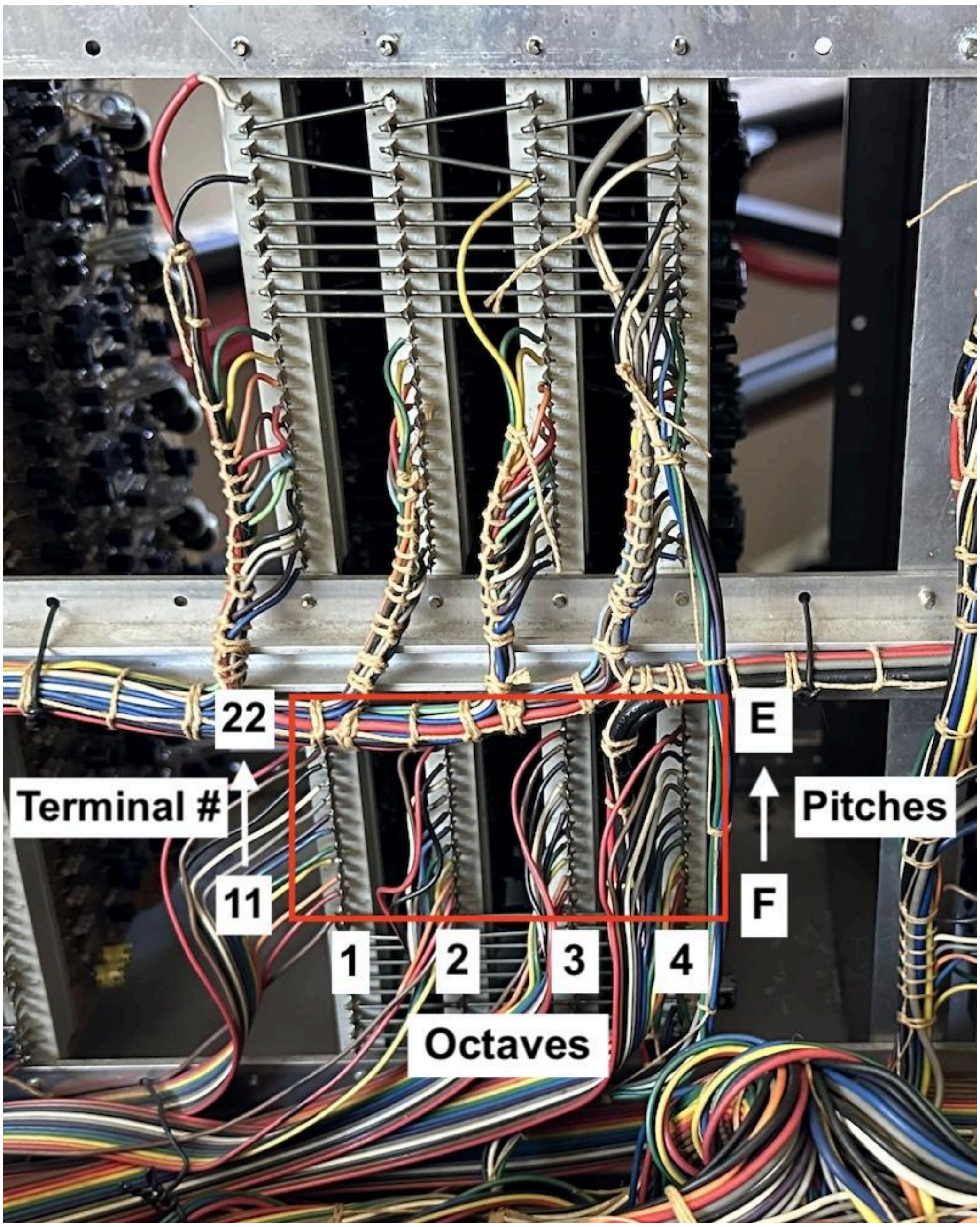

Figure 8: Location of the 48 keys' pitch terminals on the four KLM-69 GATE cards

With the three Switch boards mounted to the right of the GATE cards, connect their wires to the GATE terminals working from right to left, and from bottom to top. This will keep the wires out of your way as you go. Be careful to not desolder the existing keyboard wires. You may want to complete an octave's worth of pitches, turn on the synth and test the keyboard (and MIDI) for each completed octave. Just remember to power off the synth before continuing work.

Proceed in this order:

1. Connect Switch board #3 wires 5-16 to GATE #4 terminals 11-22. This completes Octave 4.
2. Connect Switch board #2 wires 9-16 to GATE #3 terminals 11-18
3. Connect Switch board #3 wires 1-4 to GATE #3 terminals 19-22. This completes Octave 3.

At this point it should look like Figure 9, where GATE cards 3 & 4 are fully populated. Notice in the photo that the next wires to connect haven't been pre-tinned yet, which means it'll have to be done in this uncomfortable position…

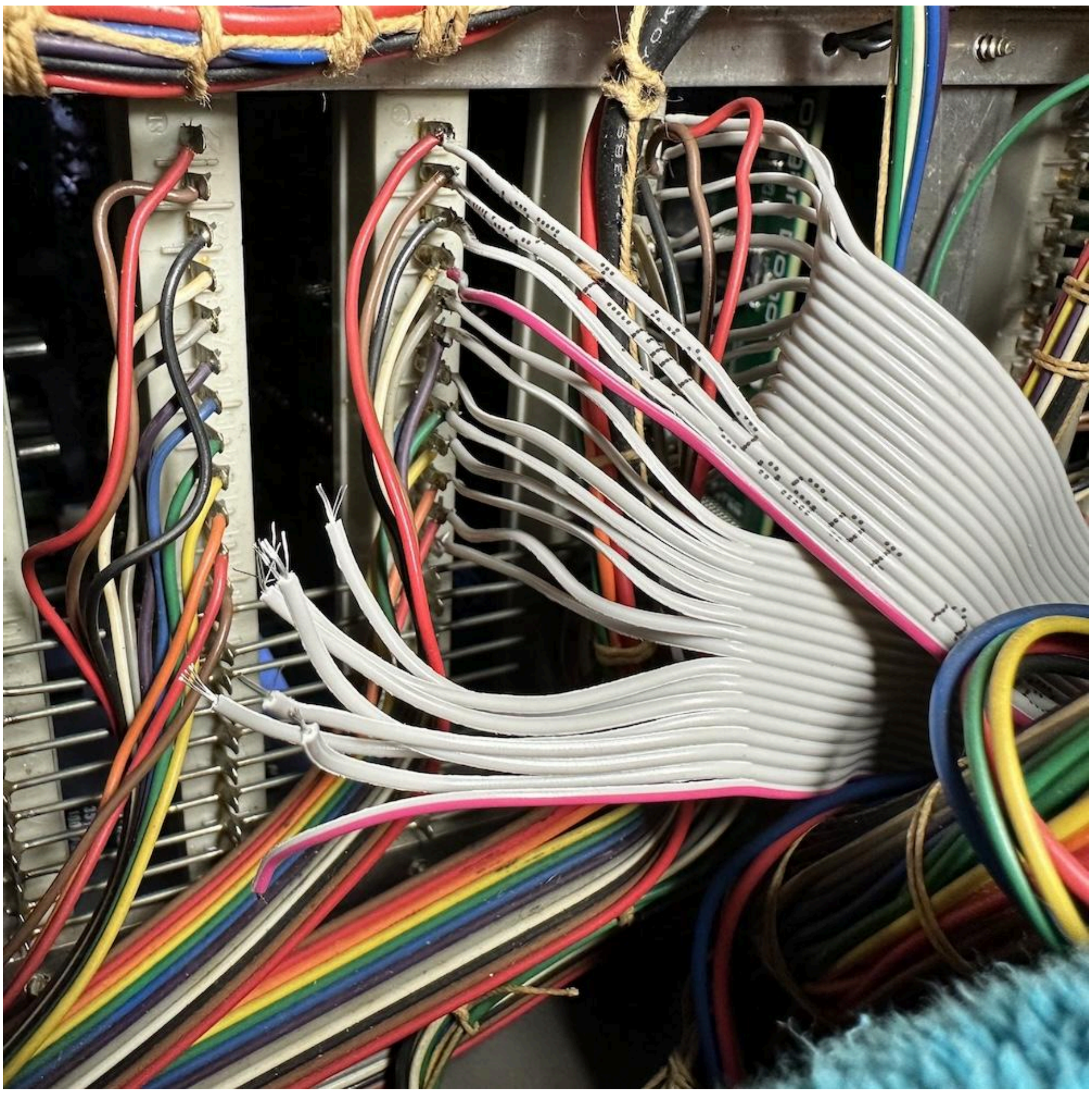

Figure 9: Halfway through connecting the pitch wires

Continuing on:

4. Snip Switch board #1 wires 19-20 (unused)
5. Connect Switch board #1 wires 15-18 to GATE #2 terminals 11-14
6. Connect Switch board #2 wires 1-8 to GATE #2 terminals 15-22. This completes Octave 2.
7. Snip Switch board #1 wire 2 (unused)
8. Connect Switch board #1 wires 3-14 to GATE #1 terminals 11-22. This completes Octave 1.

With all three Switch boards' wires connected, it should look something like Figure 10. Notice that Switch board #1's first wire curls back at the bottom of the photo and is spliced to a length of red hookup wire. That's the common keyboard wire that's routed back to the power supply, seen earlier in Figure 7.

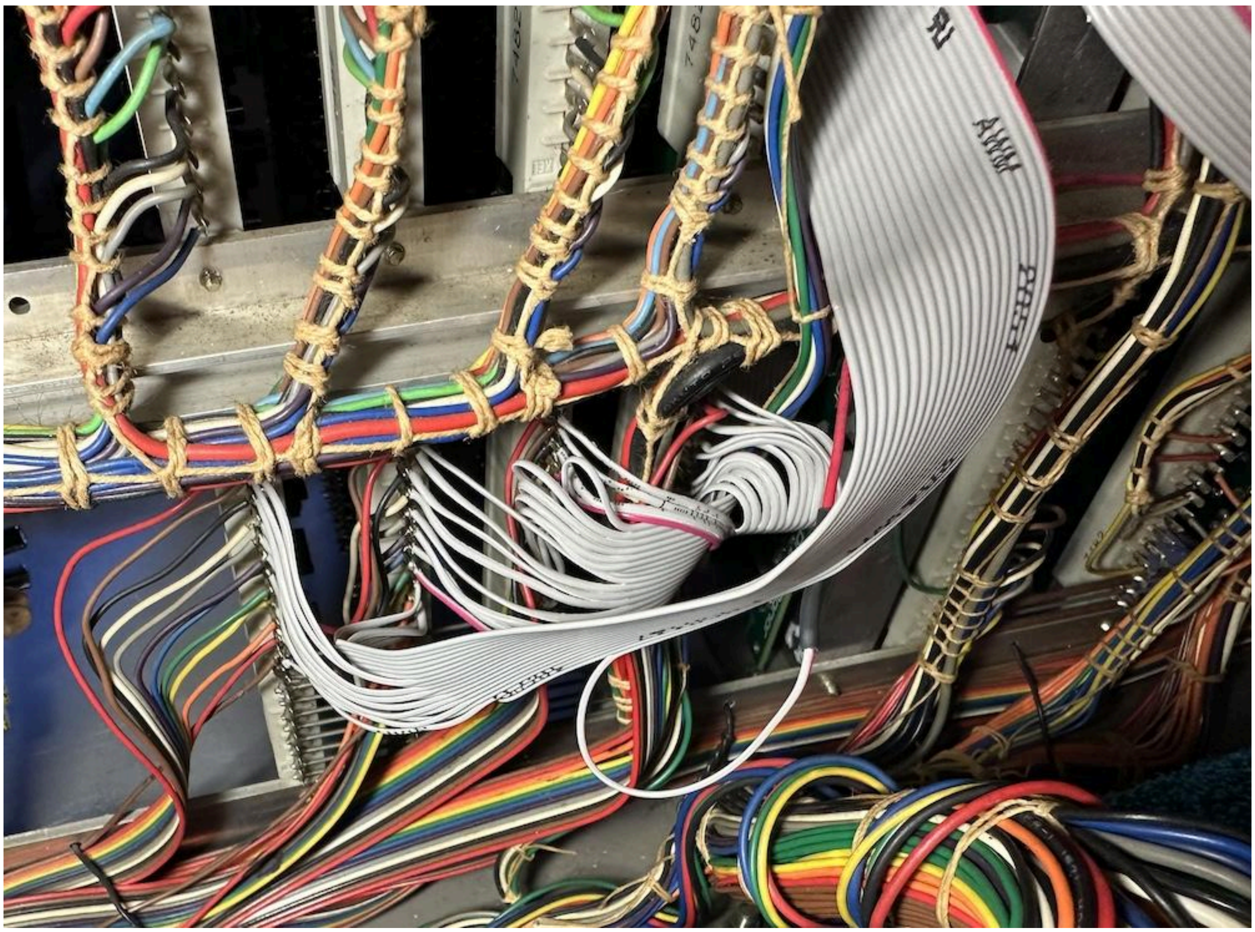

Figure 10: Pitch wiring completed

Installing the Learn button

The optional Learn button can be used to set the MIDI channel. It needs to be connected to the IO "2" and "G" points on the Main board (the back of the board is labeled). Wires are not included in the kit.

Press the Learn button and keep it pressed while sending a MIDI Note on any MIDI channel. OrganDonor will use this MIDI channel going forward, and the setting is saved.

Note that the MIDI channel can be set or changed without the Learn button by using the OrganDonor Configurator tool (see below).

Configurator tool

A software configuration tool is available for changing MIDI settings and key assignments. This is a browser application that works with Chrome natively. Firefox needs to be configured for web MIDI. Safari does not work at this time.

It can be found here:
https://tubbutec.de/files/organDonor/tubbutecOrganDonorConfigurator.html

The configurator allows you to upload your settings directly from your browser to OrganDonor, save and load settings, and export settings as SysEx files for sending to OrganDonor via a SysEx tool like Sysex Librarian or MIDI-Ox.

To start out, the settings in Figure 11 should work to begin sending MIDI Notes to the PS-3100. 'MIDI Base Note' can be adjusted as needed for your MIDI keyboard, and the keyboard Note will update in the table automatically. When you're ready, choose your MIDI output interface at the top of the screen and then press 'Send configuration'. The LED on OrganDonor's Main board will flash once to indicate receipt of the settings. The settings are saved through power cycles.

Figure 11: Suggested Configurator settings for the PS-3100

Alternative location for power and pitch connections

You might have noticed that each of the keyboard's pitch contacts have two wires attached. One wire goes to the KLM-69 GATE cards, as we've already seen. The other wire goes to the 60-pin connector at the back of the synth, which is an expansion port for a variety of PS-3xxx accessories.

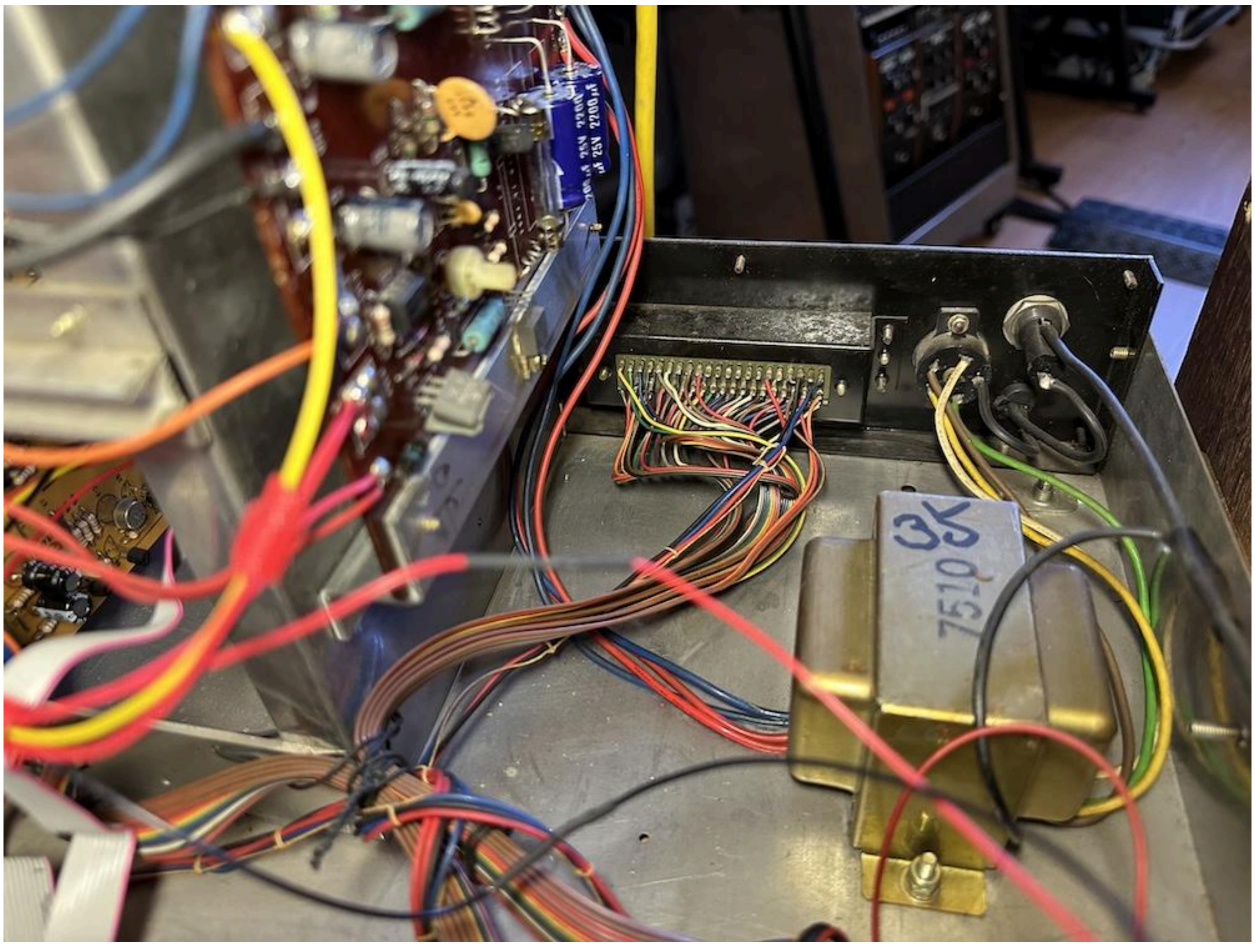

Figure 12: 60-pin rear expansion connector

Viewed from the inside (as in Figure 12), the pins are arranged in three rows, numbered from left to right starting at the bottom row. The bottom row has 21 pins, the middle row has 18 pins, and the top row has 21 pins.

The 60-pin connector's pin assignments are as follows:

Top row:

40-48: Pitches G#4 through E4
49-54: unused
55: +15V
56: unused
57-58: GND
59: unused
60: -15V

Middle row:

22-39: Pitches D2 through G4

Bottom row:

1-21: Pitches F1 through C#2

Note that these pitch names (F1, E4, etc.) are relative to the PS-3100's own keyboard. They don't necessarily map to MIDI Note numbers (unless you configure them to do so with the Configurator tool).

These pins, therefore, cover most of the connection points needed for OrganDonor. Only the common keyboard bus connection and the two MIDI connections are missing, but those are nearby anyway. So while the spacing is tight, and ominously close to the power inlet and power supply, this could be an alternate location to connect things.

Keep in mind that using the pins on this connector instead of the GATE cards may influence where you decide to mount the Main board and switch boards, which may in turn affect the lengths of ribbon cables you'll need.

Photos and instructions provided by Ty Hodson (https://lab.sublevel9.net)