DRAWBAR CONTROLLER D9X

An open-source Do-it-yourself
project based on Arduino.

MOUNTING INSTRUCTIONS

Welcome to the mounting instruction sheet for the GMLAB D9X Drawbar Controller kit. To assemble this kit correctly and set it up to work properly, a certain skill with electronics and computers is required, plus some tools and a little bit of patience and attention.

REQUIRED TOOLS

1. Soldering iron, preferably a temperature-controlled 60W iron with a 1,5 ~ 2,5 mm wide tip;
2. Solder, preferably good quality 0,8 ~ 1 mm diameter;
3. Good quality cutters;
4. Phillips screwdriver;
5. A computer with Arduino IDE installed.

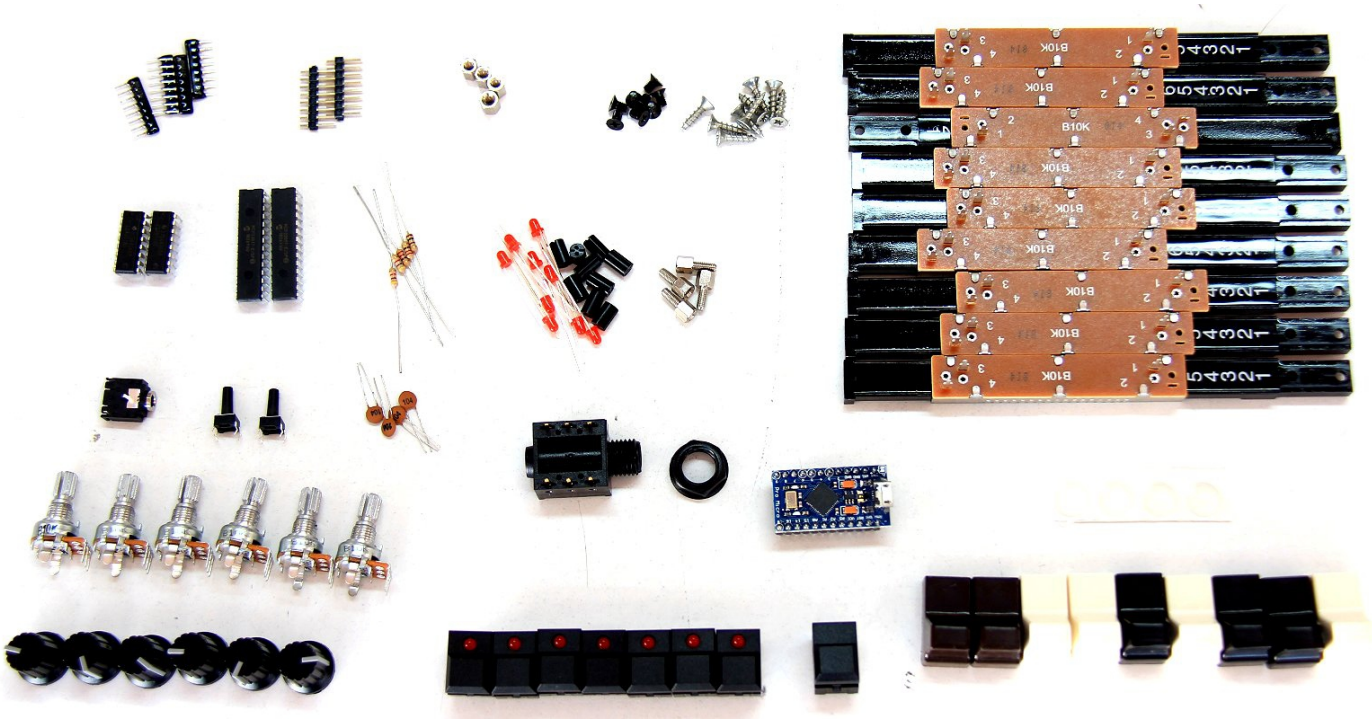
PREPARATION

Prepare a clean and tidy surface, with just the required tools handy and make sure you have discharged your body from electrostatic charge by touching some metal object that makes contact with the floor. Optionally, wear an ESD wristband.

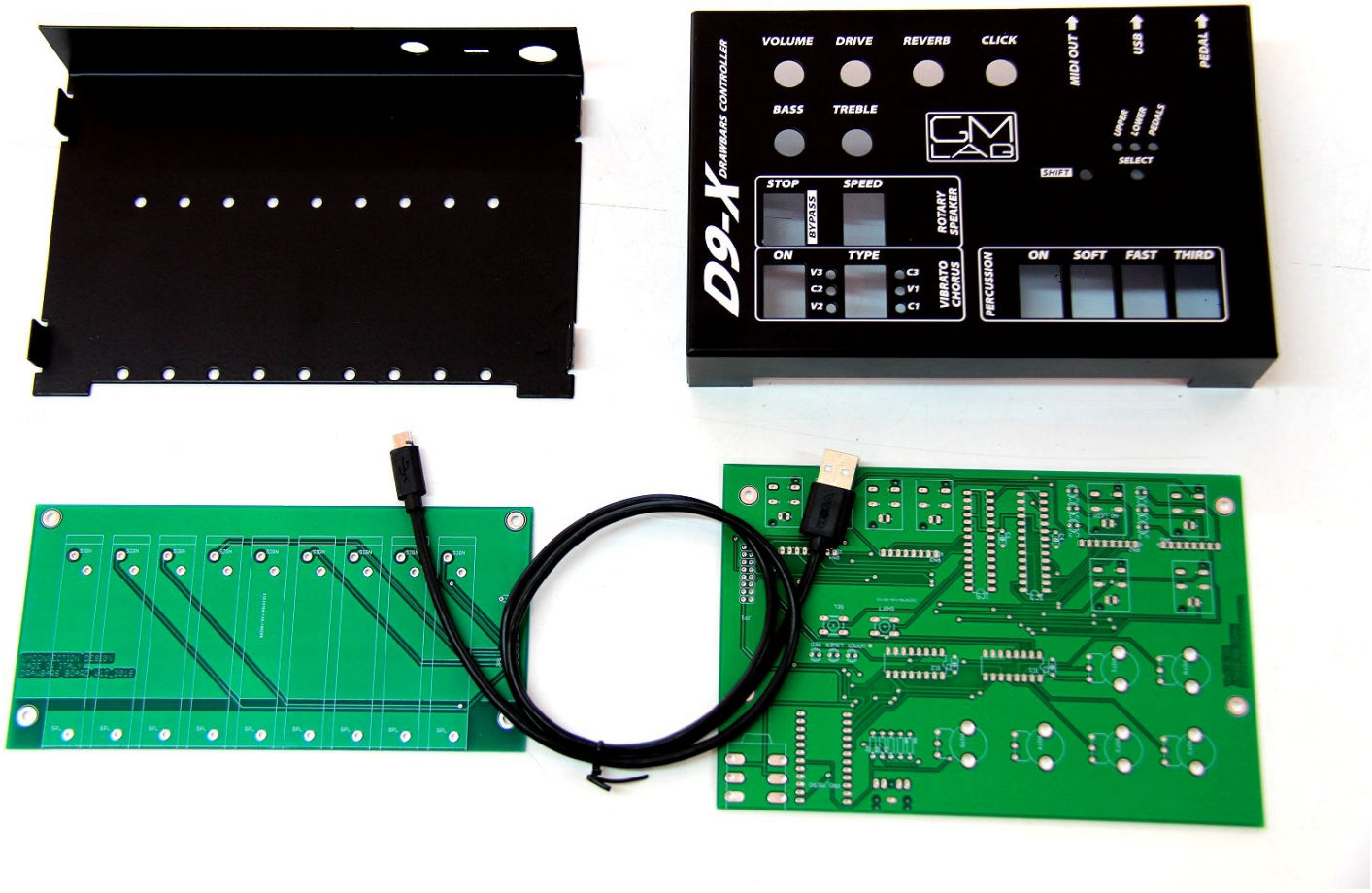
WHAT'S IN THE KIT

- 1x PCB Drawbars
- 1x PCB D9X main board
- 1x Arduino Pro Micro (Leonardo clone)
- 1x Metal bottom piece
- 1x Metal top cover
- 9x Drawbars
- 2x Brown Caps
- 3x Black Caps
- 4x White Caps
- 2x MCP23017 I2C expanders
- 2x CD4051 analog 8x1 multiplexers
- 2x 220 ohm 1/4W resistors
- 2x 4700 ohm 1/4W resistors
- 1x 100 ohm 1/4W resistor
- 4x 4x220 ohm 1/4W resistor networks
- 4x 100 nF ceramic capacitors
- 9x Red 3mm LED with spacers
- 1x 2x8 DIL Strip (or 2x 1x8 SIL strips)
- 1x TRS 3.5mm Jack connector
- 1x TRS 6.3mm Jack connector
- 2x Tactile switches
- 7x Push-buttons with red LED
- 1x Push-button without LED
- 6x 10 Kohm linear potentiometers
- 6x potentiometer caps
- 1x USB – MicroUSB cable
- 4x Adhesive rubber feet
- All required screws and spacers

View of all electronic parts:



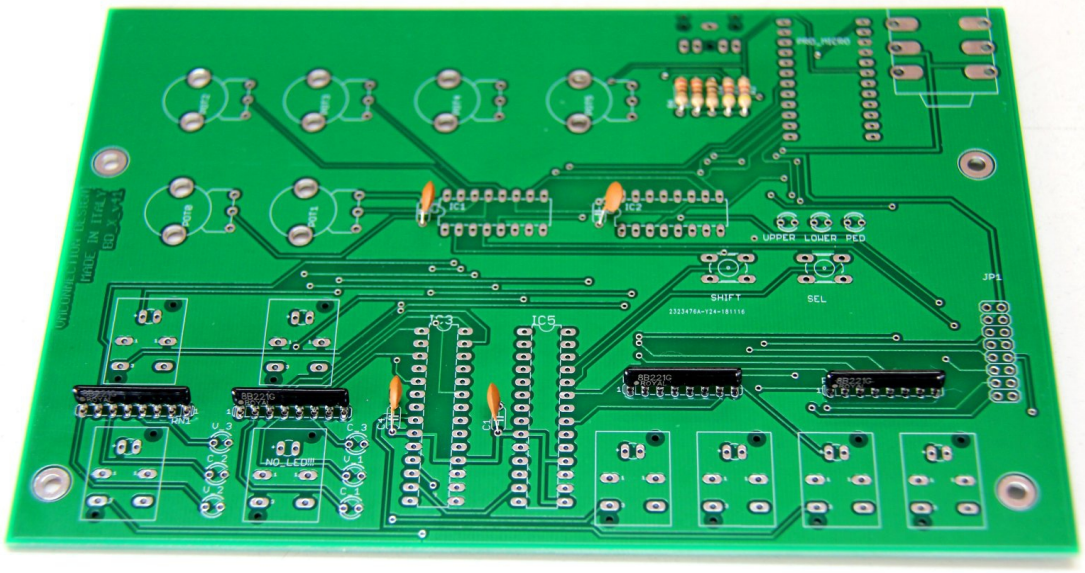
View of the container parts and the printed circuit boards:



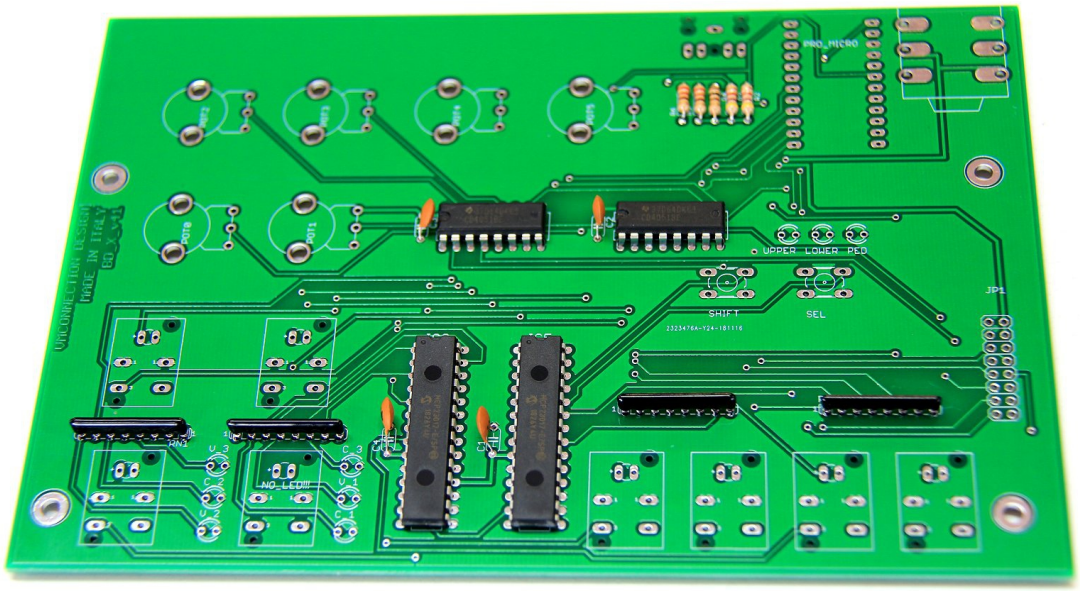
STEP 1: Let's start from the electronics. All passive components, first, starting from the lowest till the tallest. Take the resistors, bend the terminals 90 degrees and add them to the Main PCB in the correct positions (check the schematics and the component numbering). Do the same with the capacitors and the resistor networks.

Note: the capacitors are all ceramic without polarity, so you don't have to find wich pin is the positive or negative.

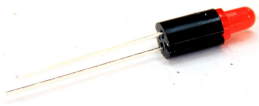
Note: the resistor networks are all parallel, so once again don't worry about the direction, even though they have a mark on the first pin.



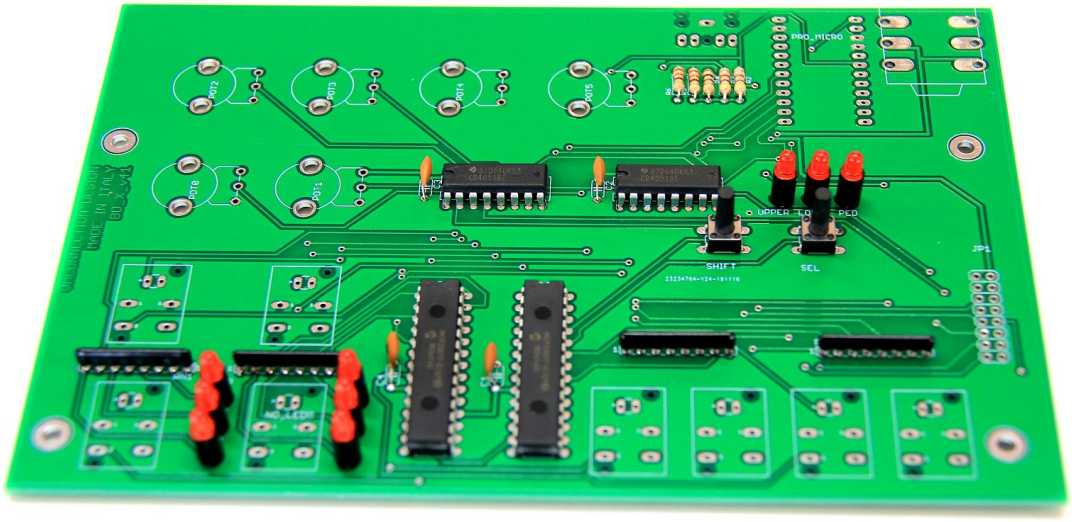
STEP 2: Add the Integrated Circuits. Pay attention not to keep the solder pin for too long, and that all pins have been soldered correctly. Do not solder two or more pins together, each pin is soldered separately from the surroundings. Also pay attention to the direction. Drawings on the PCB have a notch on a side indicating where pin 1 goes. The same notch is generally present in the IC itself, or you'll also find a small dot.



STEP 3: Add the LEDs and the tactile switches. The LEDs must be mounted with their spacers.

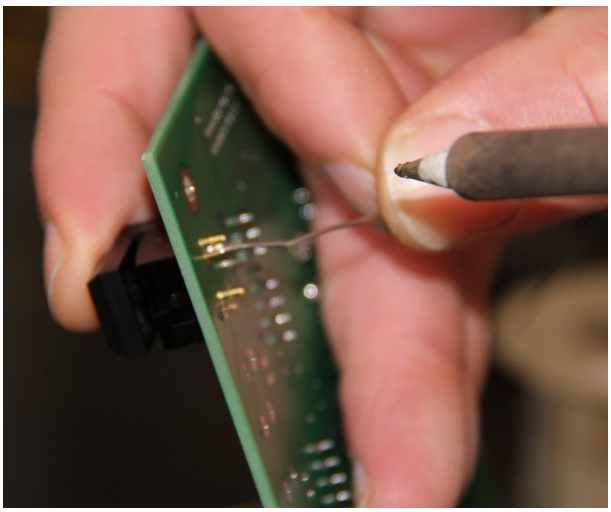


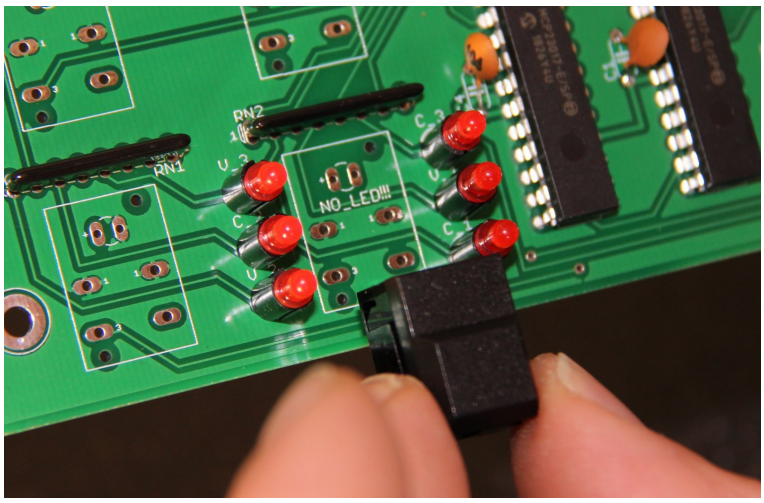
NOTE: Pay attention to let them sit straight vertically on the PCB, or these components will not get through the panel holes correctly. Also, pay attention to the polarity. LEDs generally have a cut on a side, that's where the negative pin is. Also, the longer pin represents the positive. A plus sign on the PCB indicates the positive. Please also refer to the EAGLE schematics.

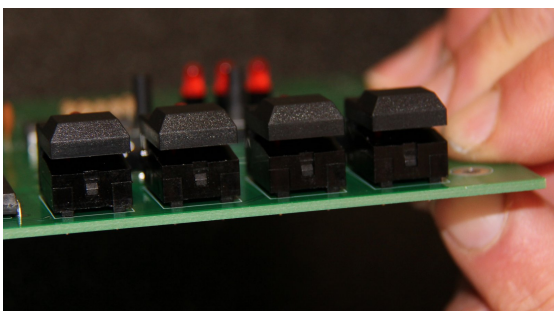


STEP 4: Add the potentiometers and the Push-buttons. Once again, pay much attention to have them sit perfectly on the surface of the PCB, so they will pass through the panel holes correctly. Our advice is to keep the button with a finger and solder just one pin, repeat this operation for all buttons, at the end solder the rest of the pins.

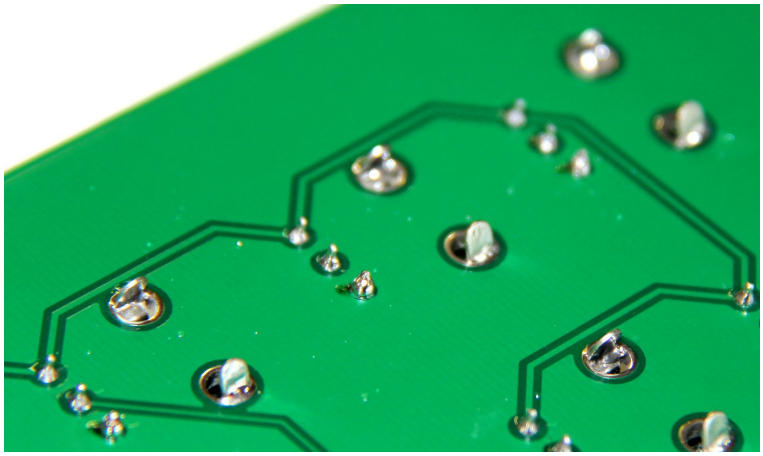
NOTE: there's only one button without the LED, this goes for the Vibrato/Chorus selection where you read the label "NO LED".



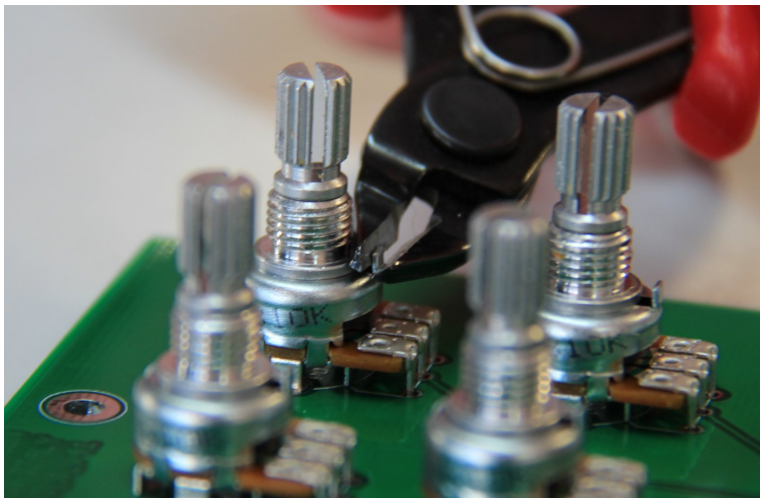




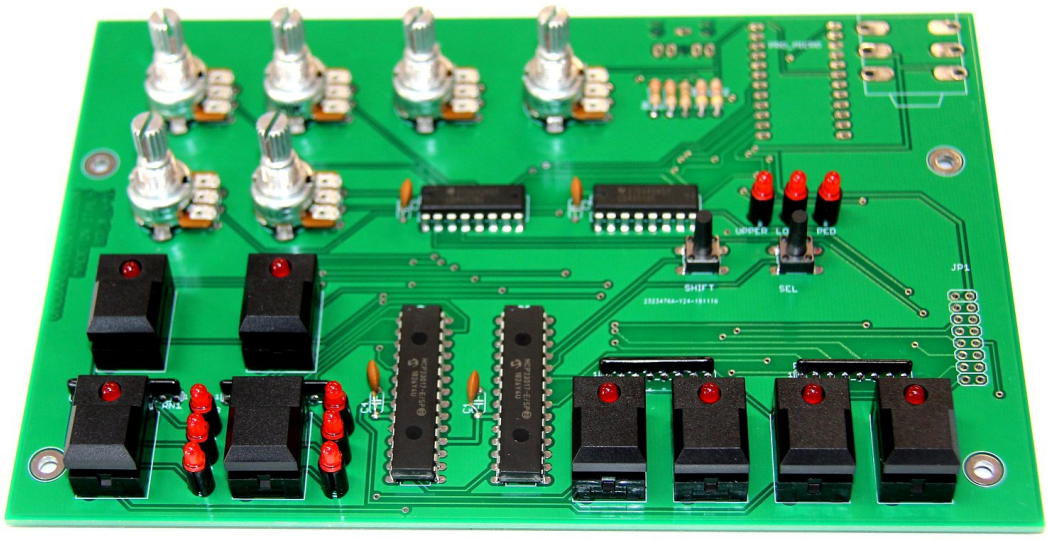
When you're done with the buttons, mount the potentiometers. Each potentiometer has 3 pins for the potentiometer itself, plus two terminals that only serve to let the component stay well tied to the PCB. Do not forget to solder these as well.



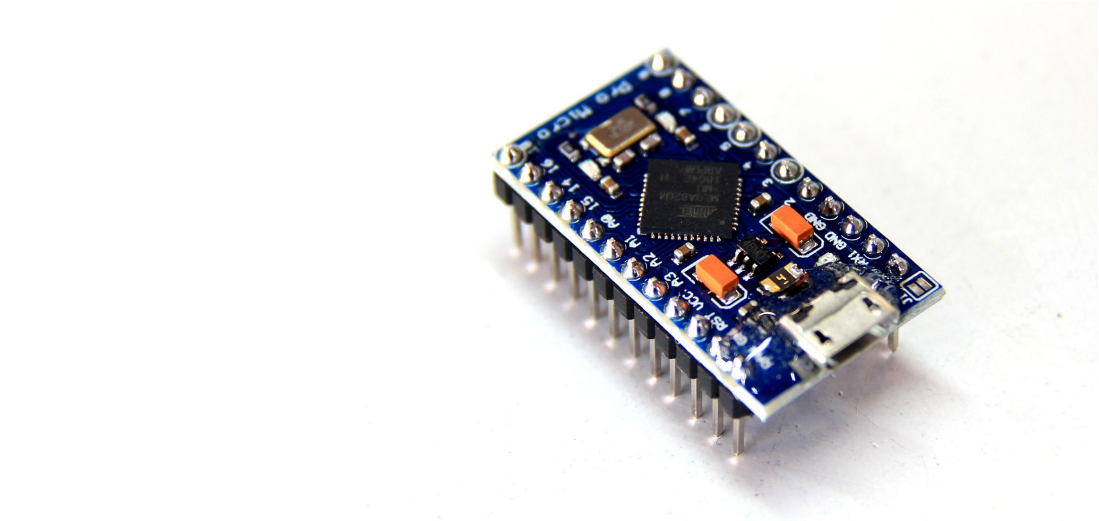
NOTE: There's one last thing to do with the potentiometers before moving on. You'll have to use your cutter to cut the small mark that you see pictured here below:



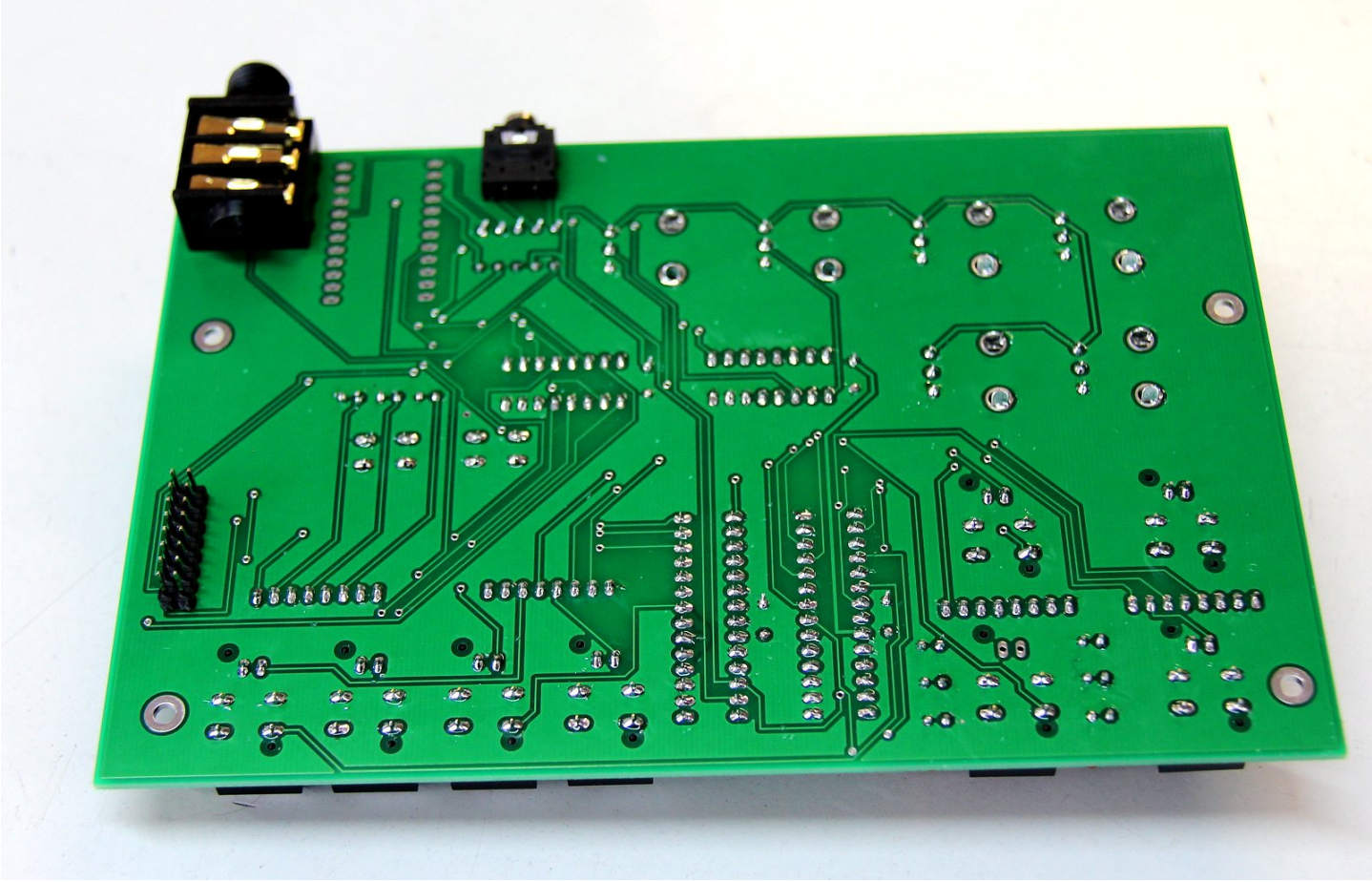
Do this for all potentiometers after you've soldered them correctly.



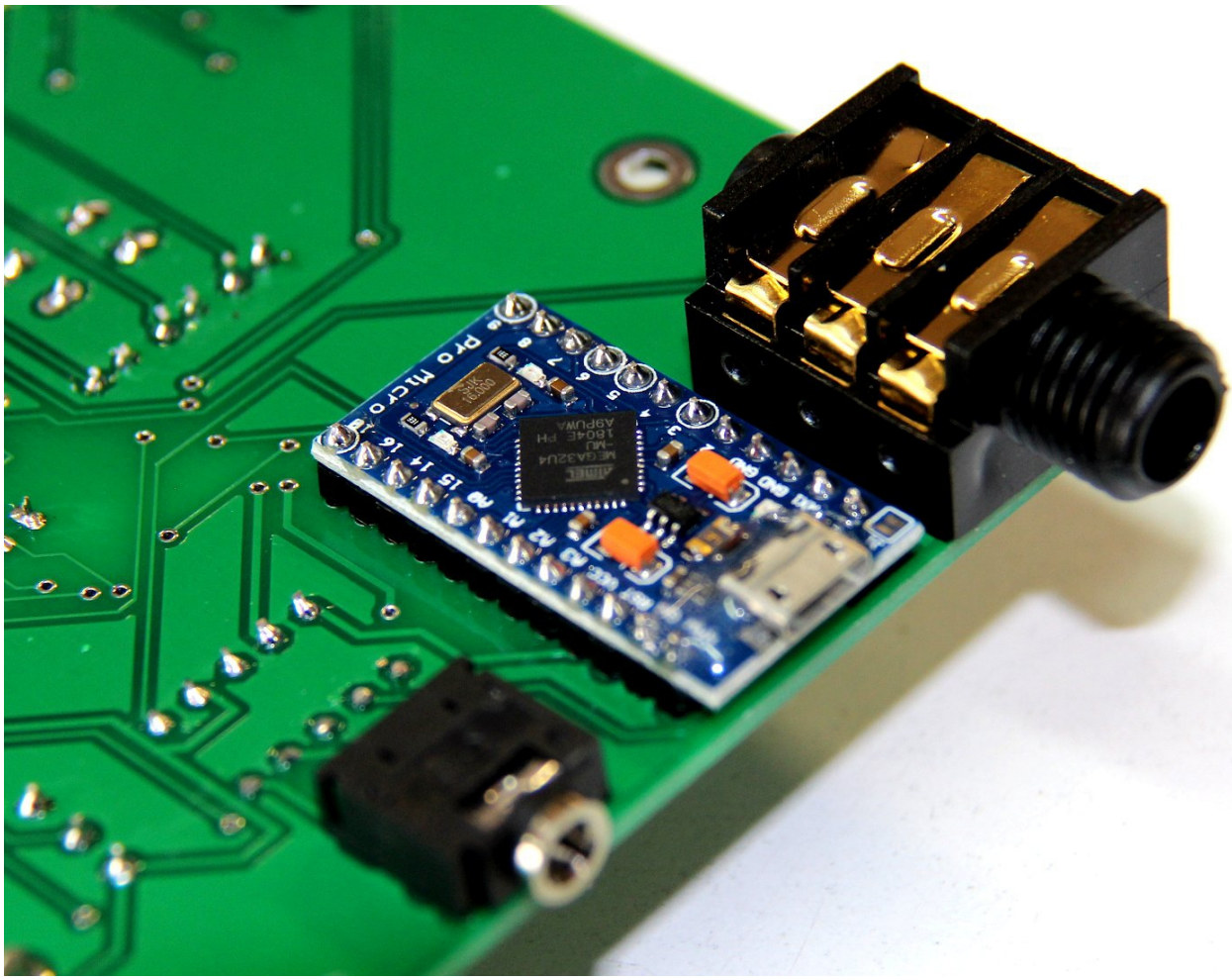
STEP 5: There are four components that need to be mounted to the other side of this PCB, the two TRS jack connectors, the 2x8 DIL connector and **the CPU board**. The latter **comes pre-programmed** with the default Arduino sketch and comes with all SIL terminals soldered. This board contains active SMT electronics and is subject to ESD and overheat, make sure that your soldering iron doesn't exceed 350 °C (~660°F) and don't keep the soldering pin on the solder pads for too long.



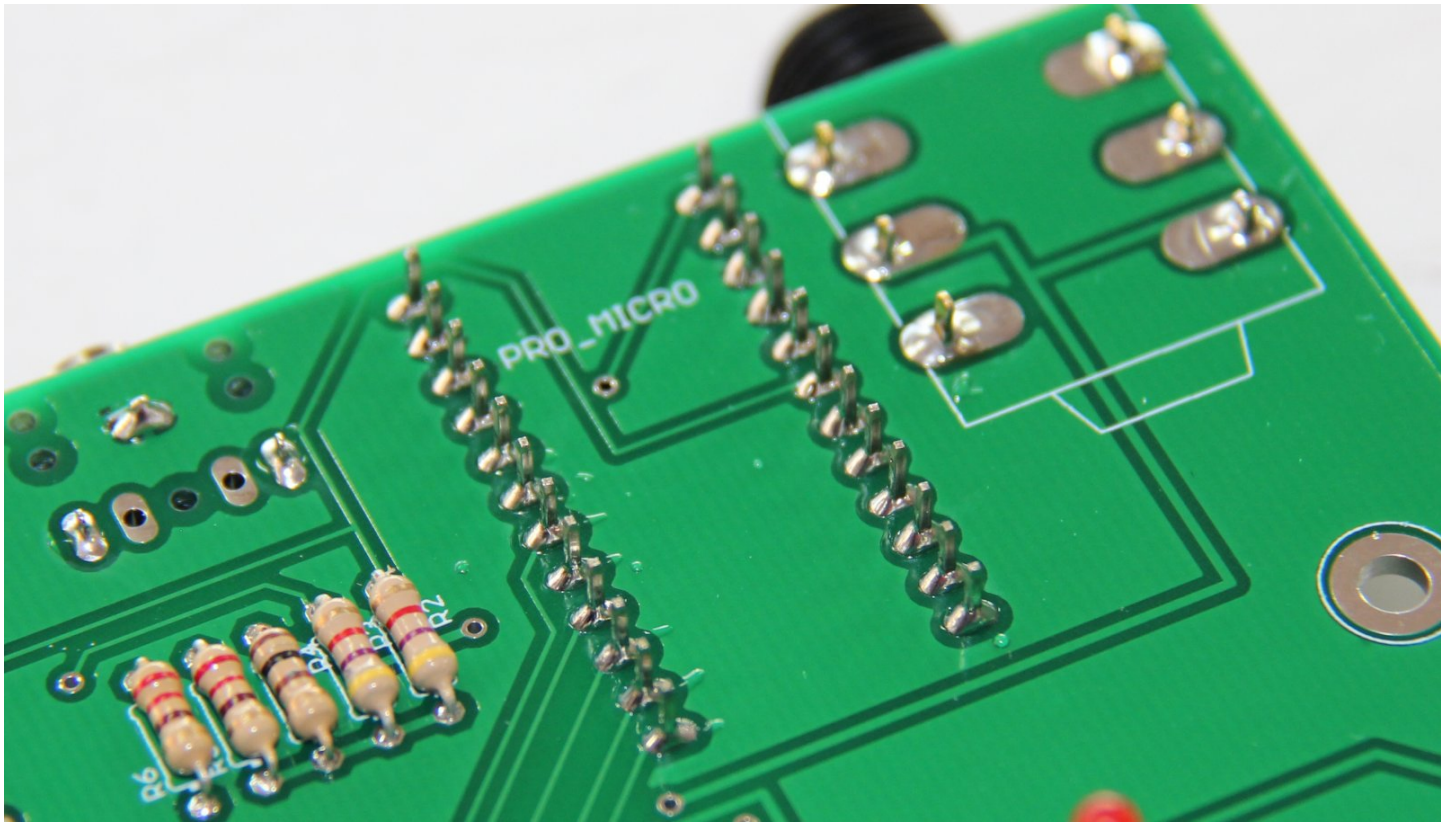
Mount the two TRS connectors first, paying attention to let them sit parallel to the edge of the board, so they'll find their way easily though the holes on the back panel. Then, mount the 2x8 DIL connector. This could also come as 2x 1x8 SIL connectors that must be mounted with accuracy.



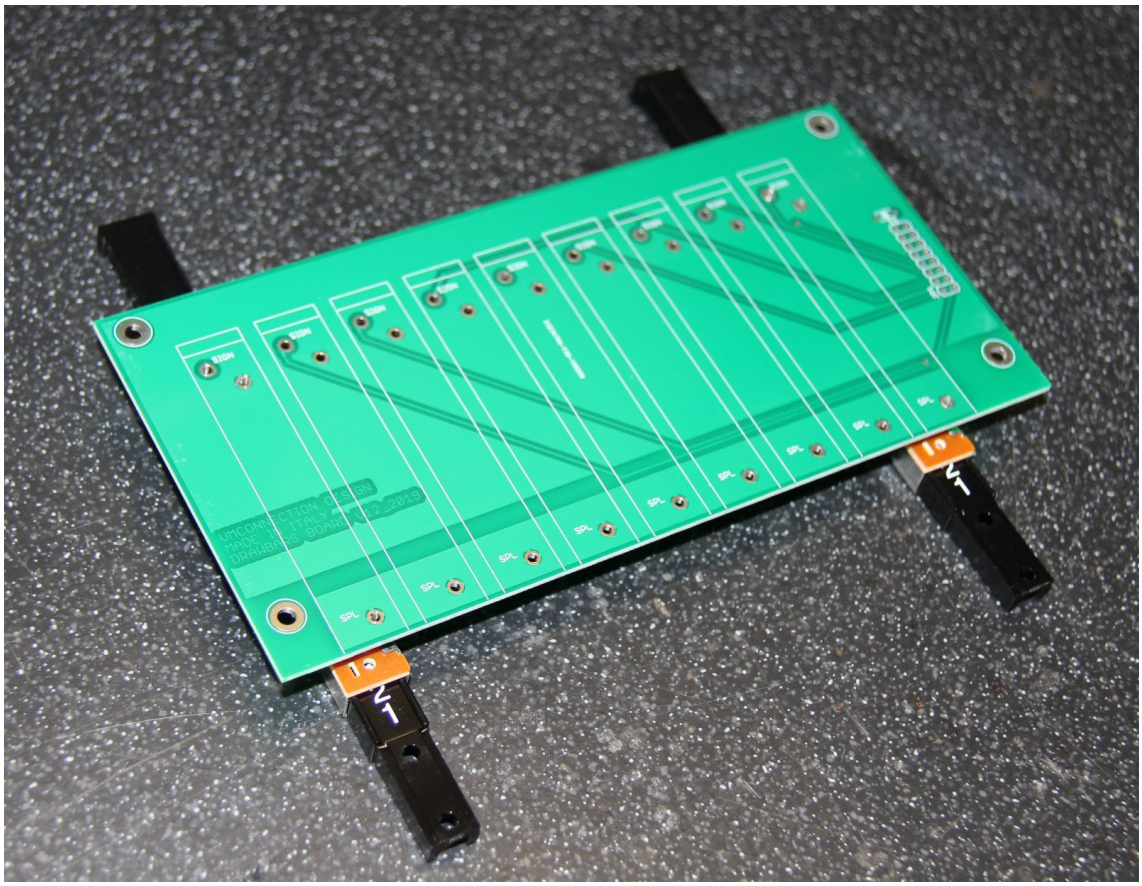
Now add the CPU board. Be careful and precise.



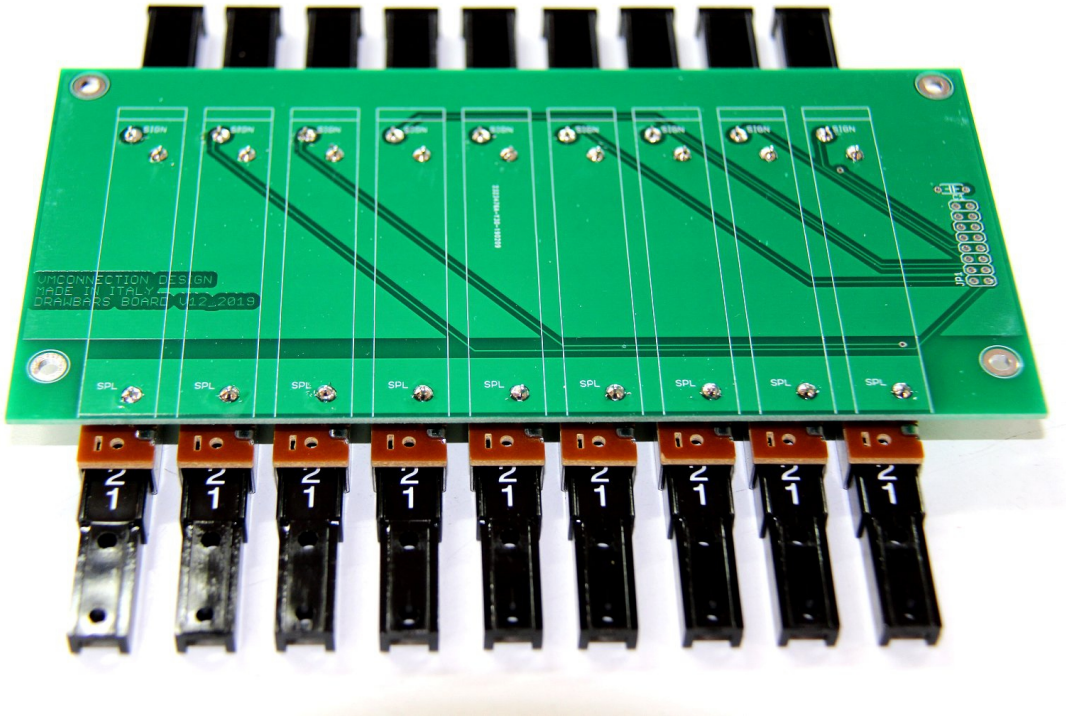
The picture below also shows the correct order of the 5 resistors.



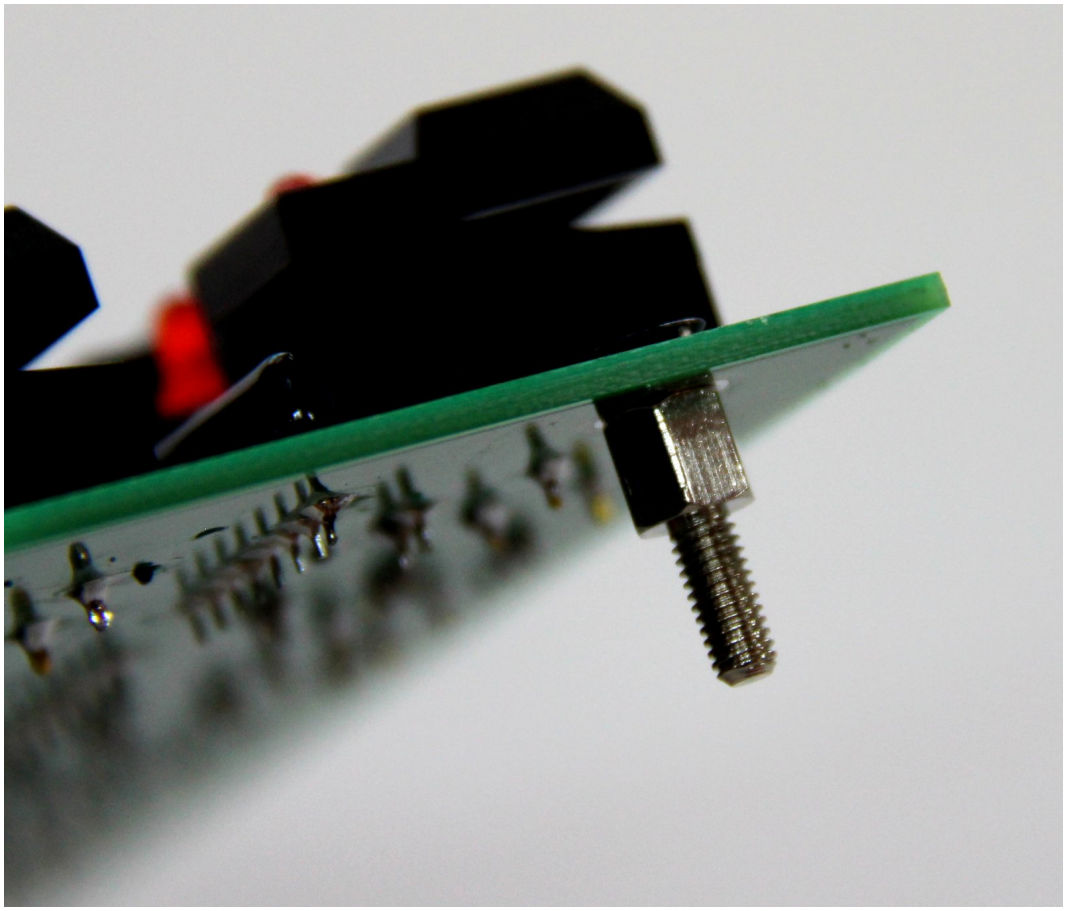
STEP 6: At this point, the main board is complete. We need to mount the other board with the 9 drawbars, and couple them using the supplied hardware. Take two drawbars, set them on a flat surface and let their terminals pass through the holes of the first and the last drawbar, like shown below:



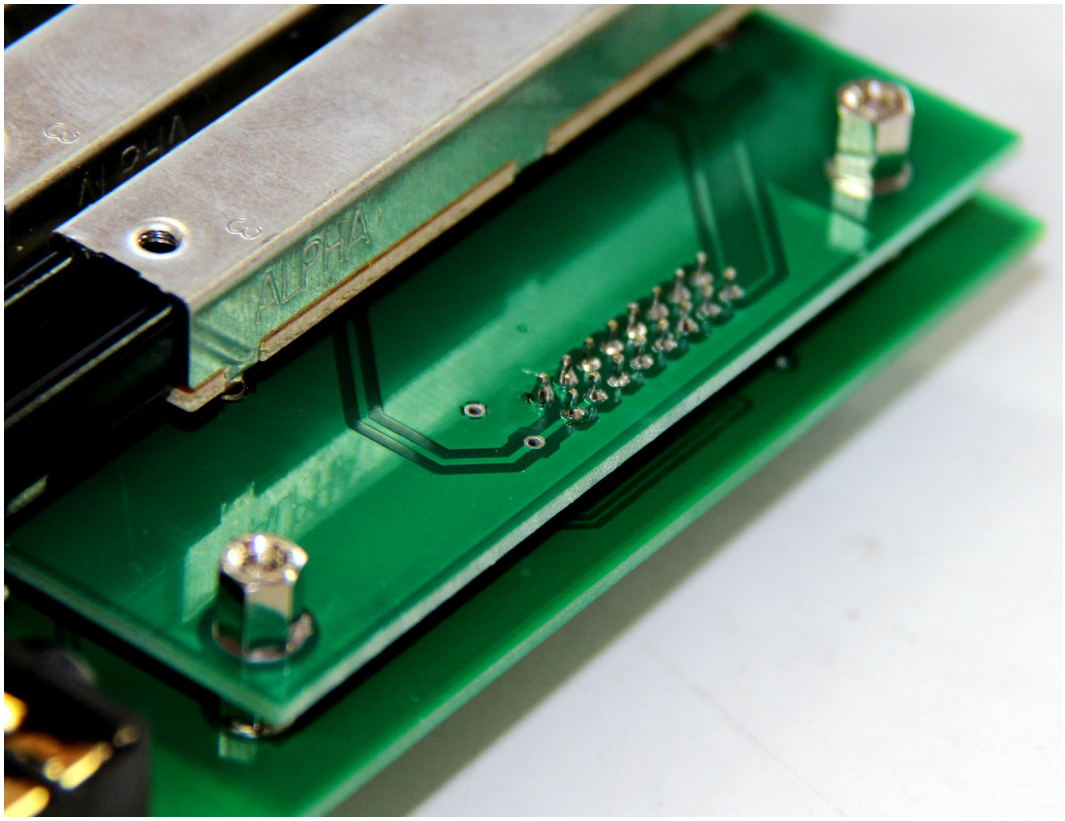
Solder them. This will function as a good support for easily mounting the remaining seven drawbars.



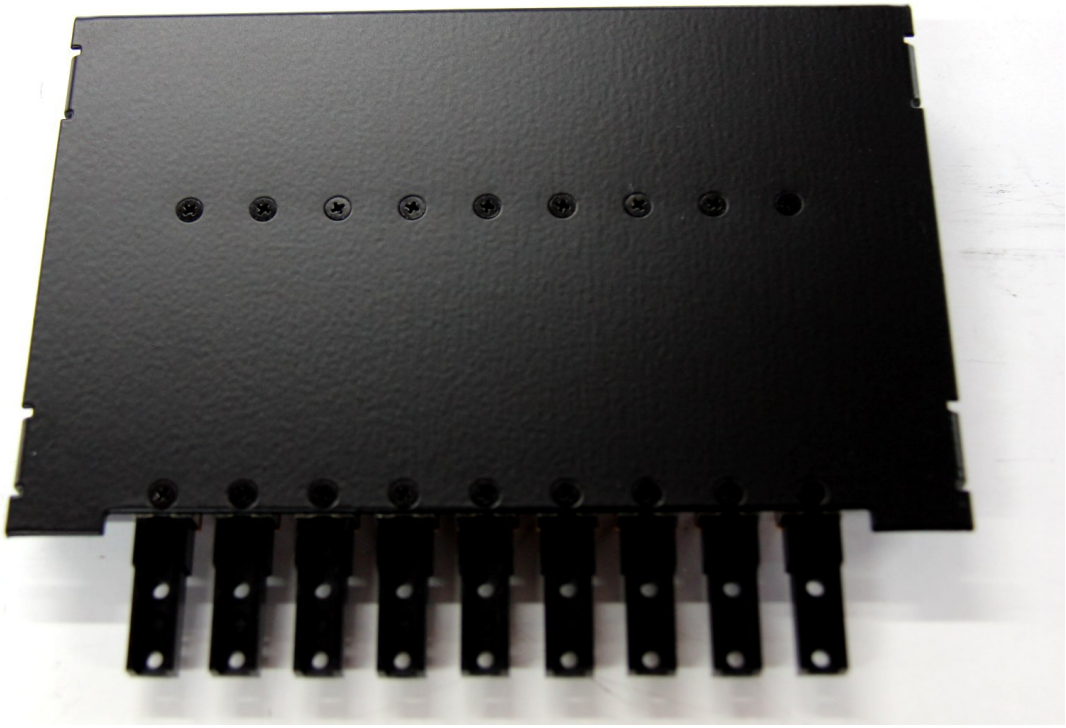
STEP 7: Couple the two boards. Take four M3X4 black screws and four M3 spacers, and mount them as shown below, for each of the four holes on the corners of the top board:



Fix the boards using the four M3 bolts and solder the 8x2 DIL strip that will carry the signals from the drawbars to the main board.



STEP 8: Use 18 M3X4 black screws to fix the drawbars to the metal bottom piece, as shown in the picture below.



STEP 9: Mount the cover, use four M3x4 black screws, two for each side. Also, mount the 1/4" TRS Jack plastic bolt.

STEP 10: Add the plastic drawbar caps. First set them in position using the following color sequence:

BROWN – BROWN – WHITE – WHITE – BLACK – WHITE – BLACK – BLACK - WHITE

Once done, turn the whole assembly upside down on a soft surface and fix them using the 9 M3X6 screws. While the unit is upside down, stick the four rubber feet.

STEP 11: Mount the potentiometer caps. Turn all potentiometers completely counterclockwise (at zero position), then align the white notches to the bottom-left corner of the unit, they must face south-west, and apply some force to slide them in completely.

PLASE NOTE: The Arduino board supplied with the D9X come pre-programmed with the default D9X sketch. If you don't need to modify the source code yourself, you can skip this whole section.

To program an Arduino board, you need a computer with Arduino IDE installed. Download it from the following URL:

https://www.arduino.cc/en/Main/Software

Install it on your computer following all the instructions given by the Arduino documentation.

If you haven't downloaded it yet, go to www.gmlab.it and download the Arduino sketch for the D9X from the Document section.

PLEASE NOTE: before compiling the sketch, make sure you have installed the required libraries. The default sketch for the D9X uses the following libraries (that should be installed separately using the IDE library functions, in case they aren't pre-installed):

- MIDI Library by *Fourty Seven Effects* - https://github.com/FortySevenEffects/arduino_midi_library Used to generate MIDI messages to be sent to the UART PORT
- MIDIUSB by *Gary Grewal* - https://www.arduino.cc/en/Reference/MIDIUSB Used to generate MIDI messages to be sent via USB
- EEPROM (built-in) Used to store and recall the current status into the internal EEPROM
- Adafruit MCP23017 from *Adafruit* - https://github.com/adafruit/Adafruit-MCP23017-Arduino-Library Used to communicate with the two MCP23017 I2C 16-bit expanders
- MillisTimer by *Brett Hagman* - https://github.com/bhagman/MillisTimer Used to obtain two timers with millisecond precision

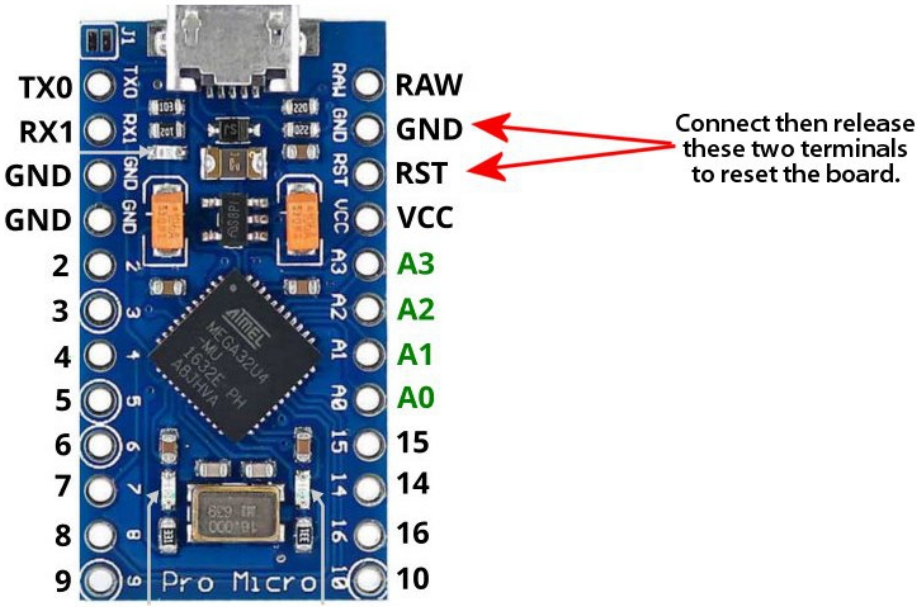
Connect the D9X to your comptuer using the provided USB cable, start the IDE, load the sketch, then:

1. From the TOOLS menu, select BOARD -> Arduino Leonardo;
2. From the TOOLS menu, make sure the selected PORT points to Leonardo;
3. Click the icon with the arrow pointing right, this will compile the sketch and upload it to the board.

PLEASE NOTE: once the sketch is properly uploaded to the board, the USB port will not be seen by the IDE because it changes its function to USB-MIDI. To check that it is actually seen as a MIDI device, if you're using Windows (preferred), download and install the free application MIDI-OX and check that the ARDUINO MIDI device is listed among your MIDI ports, select it as an input port to MIDI-OX and check that it is correctly sending the expected CC messages.

An alternative to installing MIDI-OX is this quick and easy web-based MIDI Monitor utility (requires Chrome): https://www.gsidsp.com/midimonitor/

In case you need to reprogram the board, one second before clicking the "LOAD" icon in the Arduino IDE, you have to "reset" the board by making a contact between the terminals labeled RST and GND using a small screwdriver.



USING THE OPTIONAL SERIAL MIDI OUTPUT

The D9X can also be used with traditional MIDI devices that use the common DIN5 connector, but needs a special "MiniJack to DIN5" adapter (not supplied). This kind of MIDI connection has become a standard in the recent years, but there are two types. More informations can be found on the MIDI.org website at the following URL:

https://www.midi.org/articles-old/updated-how-to-make-your-own-3-5mm-mini-stereo-trs-to-midi-5-pin-din-cables

The D9X uses TYPE B.

Use a 5V cellphone USB Charger/PSU to power the D9U and use your adapter for the MIDI connection.

GMLAB D9X is sold on-line on the web sites www.gmlab.it and on www.MyRigShop.com by V.M.Connection, an enterprise based in Veneto, Italy.

Get the source code for this and other project on our GitHub account: https://github.com/ZioGuido

If you need spare parts or blank PCBs, just let us know.