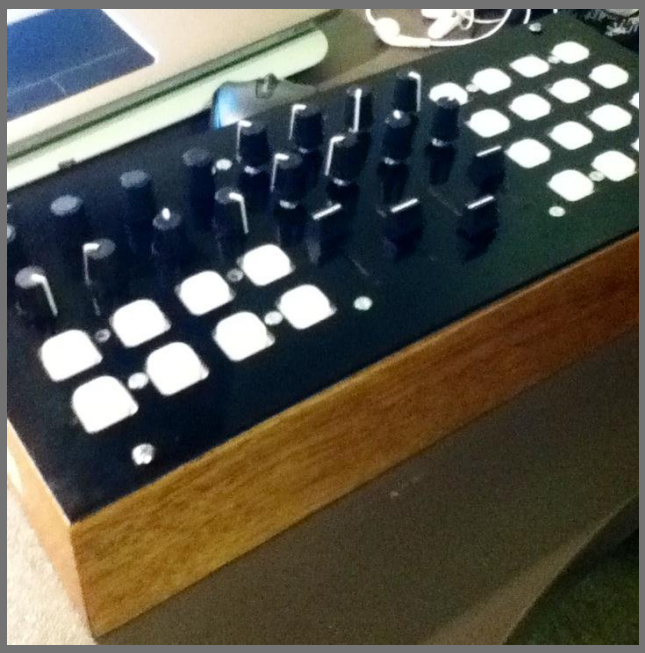
2012 & 2013

How to Design and Build a DJ MIDI Controller



By Daniel Robertson

Introduction:

In this manual you will find useful information on building a DJ MIDI controller. There will be information on where to buy the parts, how to design a controller to your liking and most of importantly a detailed step by step build process. The guide will mainly explain how to put the Omni boards together, and then inform you on how I built the top piece and the box. I started the whole project with a forum that helped me to get ideas. (Australian Dj Forums)

Parts:

The quantities for the parts are under the section of the design. Keep in mind that if you decide to vary your project to the one in the manual, you may need different components. If the designs are going to have the same components as this manual though, you will need only to follow the steps for each section.

These parts can all be bought from Livid Instruments (where the Brain v2 is made). The website is (Livid Instruments) There are many other ways that you can build a MIDI controller, I chose this one because it was simple and didn't require programing later on

Designing:

To design this MIDI, there is some basic information you need to know. An Omni board is used to make different configurations and designs of a set of buttons, sliders and knobs. On this board there are 16 ports. These ports can have connections for buttons sliders or faders. If sliders are used, you will have to use 20 ports per slider. For example if you wanted four 30mm sliders on this board, you would use 8 slots. The sliders require two connections because it is so long. The one thing that is tricky is that the sliders can only go in one direction, because of the setup of the board.

When designing, just do simple designs and draw them on paper or on a word document, you won't need measurements on the design, but just need to know how many ports that component will use on the

Figure 1 Finished component product

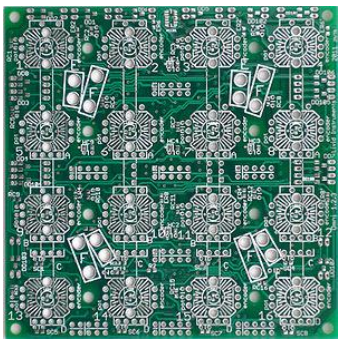


Figure 2 top of Omni board

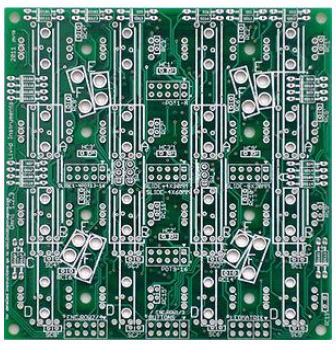


Figure 3 Bottom of Omni Board

board. This is all you really need before ordering. You can also use the website http://wiki.lividinstruments.com/wiki/Omni_Board for reference to parts and designs. Feel free to use other websites such as (Numark), (Pioneer) or (Native Instruments). If you do want a different design and there is going to be different components, you may need to work out what components are needed to work. After you have ordered, and are waiting for parts you can design what the casing is going to look like. The wood I chose to use was Meranti, and I decided that I would cut the top piece (acrylic) out with a CNC mill.

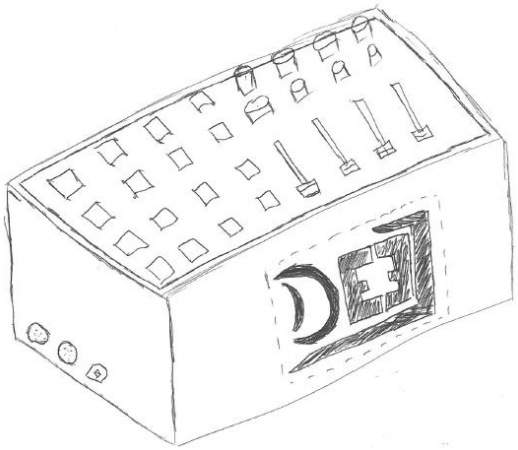


Figure 4 one of many designs

The casing at this stage is the least important thing, so don't worry about to this about too much until the MIDI is fully functional. The Omni board is also a very complicated design, but uses a minimal amount of wires, so this makes putting it together a lot easier.

The Build

Figure 5 (4K4E8B)

The length of the box was cut for my design specifically, and I would recommend that you figure out your own dimensions. The way the sides connect is by the corners being cut at a 45° angle. The hole for all the cords is cut first, which is on one of the small ends. You can choose the size of the hole for yourself. First we glue one long side and one short side together, ensuring they are at a right angle. This is then left to dry. Repeat for the other long and short sides.

Figure 6 sanding down a spacer

Once these two sets of right angles are dry, they are glued to one another. To ensure that they are in the right shape, place them over the base. Clamp them down if needed, otherwise watch them to make sure they don't dry in the wrong position. Once these have dried the base is glued in. The holes for the Brain are then drilled into the bottom. Once all this is done, it is varnished and sanded up to 4 times. The way to put the boards together are as follows:

The first board on the design is the 4 encoder knobs, 4 plain

knobs and 8 buttons. The parts below are for this particular board, and are different for every design. The parts required are:

- 1 x Omni Board
- 8 x Hi Efficiency Red LED's
- 4 x Encoders
- 16 x Single Diode
- 4 x 15mm Rotary Pot
- 4 x Rotary Knobs
- 4 x Encoder Knobs
- 2 x 4x1 Omni Keypads
- 1 x 4x2 Spacer Layer for Omni Keypads
- 4 x Ceramic Capacitor .01uF
- 3 x 10 Pin Ribbon Cables
- 3 x 10 Pin Headers
- 1 x Ceramic Capacitor 10uF

Figure 7 Two of the three boards being tested for correct measurements on the acrylic

Naming Conventions

- SC - Fader (slider) capacitor
- RC - Rotary capacitor
- HC - Header capacitor
- SD - Single diode
- ER - Encoder resistor (jumper)

Figure 8 Testing the casing is big enough (2 Omni boards)

To put this board together, you must do it in the following order; because it is hard to put small pieces in when the knobs are in. This is the same with all three boards.

Step 1: Find ER2, ER2', ER6, ER6'. Solder a bridge by applying a small amount of solder until the two pads are connected.

Step 2: Find SD 1-8, SD 11-18, and put a single diode through each set of holes. Ensure that the diode line is in line with the diagram on the board.

Step 3: Find the LED position 9-16 (Labelled) and insert the LED's solder. Cut all the wires that are extruding if you haven't already. Make sure you put the positive in the positive hole.

Step 4: Find RC5-8. Insert and solder a .01uf capacitor into the holes.

Step 5: Find HC1'(HC1) and insert and solder a 10uf capacitor.

Figure 9 soldering Components into the Omni board

Step 6: Find the headers: (Buttons/ EncRows1/3), (LED Matrix) and (Pot1-8). Insert 10 pin pin-headers on the bottom side of the board.

Step 7: Find pots 5-8. Solder rotary potentiometers with the 3 pins facing the side of the board that says “Pot”.

Step 8: Find the Encoder positions 1 - 4. Solder Encoders with the 3 pins on the side of the board that says “encoder”.

Step 9: To Attach Omni to the Brain, plug ribbons cables into each pin header on the Omni board with the red line lining up with the arrow. Then attach the But/Enc into the first available position on the brain under the section Button B1-B8. Then plug the Led Matrix into the first available LED position on the brain. Finally attach the Pot 1-8 pin to the analog header on the brain. Make sure all arrows at in line with red stripe.

For the second Omni board in the series which is the 4 faders and the 8 knobs we use the following parts:

- 1 x Omni Board
- 4 x 30mm Fader/Slide Potentiometer
- 4 x Battle Style Fader Knobs
- 8 x 15mm Rotary Pot
- 8 x Rotary Knobs
- 12 x Ceramic Capacitor .01uF
- 2 x 10 Pin Ribbon Cables
- 2 x 10 Pin Headers
- 2 x Ceramic Capacitor 10uF

Figure 10 (8K4F)

To put it together the steps are as follows:

Step 1: Find SC1, SC2, SC3, and SC4. Insert and solder a .01uf capacitor each.

Step 2: Find RC 9-16. Insert and solder a .01uf capacitor each.

Step 3: Find HC2' and HC3'1 and insert and solder a 10uf capacitor each.

Step 4: On back of board find headers: Slide 4x30mm/4x60mm and Pot 9-16. Insert and solder a 10 pin pin-header.

Step 5: Find slide pots (A) positions and place 30mm slide pots with 4 pins on the bottom and 2 pins on the top.

Step 6: Find rotary pot 9-16 and insert and solder rotary potentiometers into each hole.

Step 7: Plug a ribbon cable into each pin header on the Omni board lining up the arrow with the stripe. Then plug the both these cables into the next free position on the Analogs section on the Brain. Ensure the stripe lives up with the arrow.

And for the final board, the parts and steps are:

- 1 x Omni Board
- 16 x Hi Efficiency Red LED's
- 16 x Single Diode
- 2 x 10 Pin Ribbon Cables
- 2 x 10 Pin Headers
- 4 x 4x1 Omni Keypads
- 1 x 4x4 Spacer Layer for Omni Keypads

Figure 11 (16B)

Step 1: Find LED 1-16 and insert and solder LEDs.

Step 2: Find SD 1-8 and 11-18 insert and solder a signal diode in each position. Make sure the line on diode matches the direction of the line diagram on the board.

Figure 13 cutting the acrylic to length

Step 3: Find the headers: But/Enc.Row1/3 and LED matrix. Insert and solder a 10 pin pin-header in each spot.

Step 4: Insert the ribbon cable onto the Omni board. Plug the button cable into the first available section of the button headers. Then plug the LED matrix cable into the first available spot on the LED headers on the brain.

Note: Soldering irons can be bought at any (Jaycar) store, same as with the solder used.

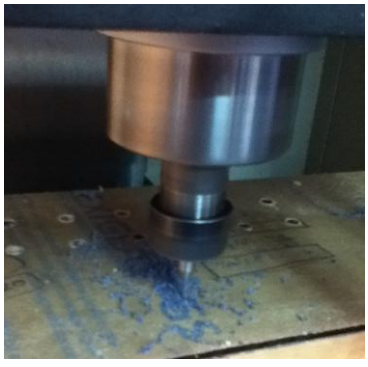


Figure 12 CNC milling

Then the top piece of the box was designed. I did this using Autodesk inventor. I did it on this, because I had access to it at school, but you can design it on any designing program. The dimensions may vary, depending on the way you want your board laid out and how much big you want your board. So it would be appropriate to get the dimensions yourself. Once designed, it was programmed into a CNC Mill and cut out on a 7mm thick piece of acrylic

Figure 14 varnishing the box

The final part is putting it all into the box and sealing it off. This is as simple as it sound, and only

Figure 15 The Brain inside the Box

requires a few screws and a drill. Once you have done this it can be as simple as plugging into the computer and Djing. The Dj program I use is by (Native Instruments)and requires you to program each button and knob to whatever you want. There are many other Dj programs out there such as (Serato). These may or may not require Programming. If they do there are many sets of instructions online.

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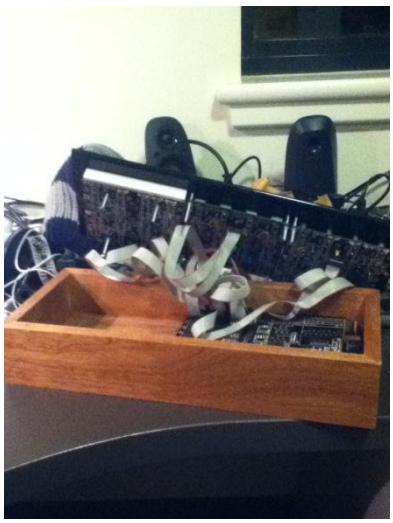
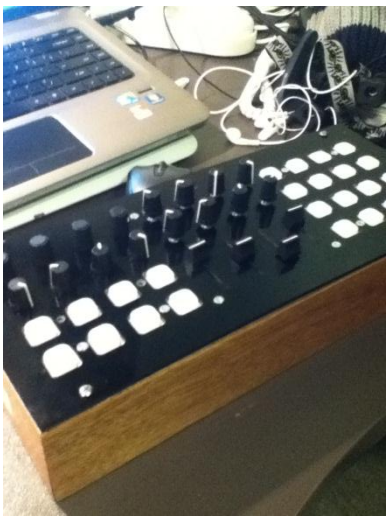


Figure 16 all the components connected and the lid about to be screwed on



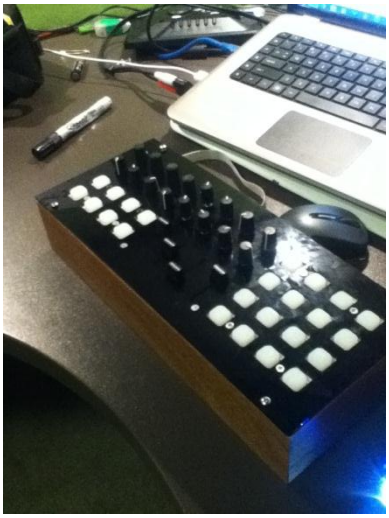


Figure 17 and 18 the finished product