OpenCockpits MCDU Assembly Tutorial

Introduction

In the various forums (fora?) on the Internet I repeatedly saw questions about how to put together the MCDU kit from OpenCockpits.

As I have just completed this task myself, I will describe here how I did that. I am not a professional writer by any means, but I hope I can make clear what has to be done.

Apart from the OC kit, you wil also need the TFT assembly as I took from a Sony PS1 screen. Instructions on how to do this can be found on the Internet; I enclose various links in Appendix A.

The OC shop also offers this screen for sale; I have not bought it from them as I already had the Sony one, but it looks exactly the same; so I assume my solution will fit that variation too.

Then you will also need various mounting materials:

- – 9 white LEDs for the annunciators

- – 14 bolts M3x20mm (the black ones above look good to me)

- – 6 metal standoffs M3x30mm

- – 56 nuts M3

- – a piece of experimenters PCB

- – a piece of 3 or 4mm plexiglass of at least 15x23cm

- – A set of 3mm plexiglass plates as described in the article linked to in Appendix A, (M)CDU Construction. I

made a CorelDraw drawing of them and had them laser-cut for me. That .cdr file has been uploaded to MyCockpit.org together with this tutorial.

How to assemble the MCDU

To begin with, look at the first picture:

In the rear, from left to right, you see the faceplate, the lightplate, and the backplate or mounting plate, with their protective backing sheets already removed.

In front are the dummy handle and a pair of transparent key bases. The handle will later be glued to the faceplate, when the assembly is complete.

First turn the mounting plate on its "front" side, and countersink all the switch-contact holes to about 4mm wide. This will later enable you to solder the wiring to the contact legs.

Then continue with peeling off the backing sheets from the keytops and the bases, and remove any burr from the edges:

Now we need to glue the keytops and their respective bases together. I did that by first laying the lightplate on top of the backplate, and inserting all key-bases into their holes.

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(Screw these two plates together using only the six holes NOT also present in the faceplate!)

Now put the faceplate on top, taking care that the large monitor holes in front- and lightplate line up nicely; then screw the three plates together. This locks the key-bases in place so that you can glue the keytops on them. Superglue does a nice job here, but be very careful with it so that the keys are not also glued to the faceplate or the lightplate!

Now turn the whole thing upside down (provide a sheet of paper for it to lie on, so as not to damage the paint on a hard surface), and remove the nuts holding the stuff together.

Take off the backplate, and put the nuts back on. Screw the two front plates together firmly without disturbing the monitor hole alignment. Put another nut on top of each one, which will give you just the right distance for the switches on the backplate.

If you later want to apply backlighting, now is the time to paint the key-edges black to block any excess light.
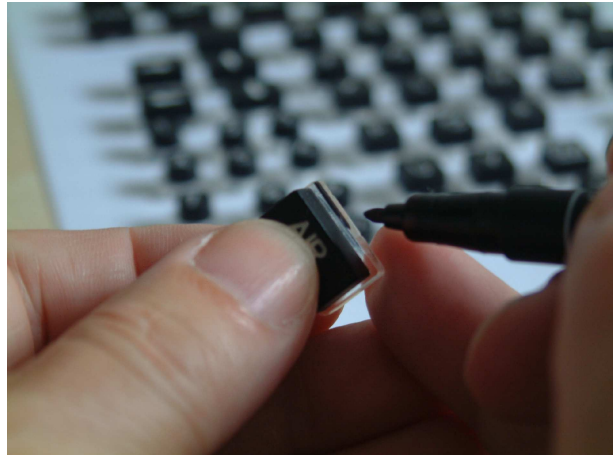

Now first make some plexiglass strips for the annunciator LEDs. I had a piece of 4mm plexi left over, which I also used for the bottom plate which I will describe later. My 1.8mm high-efficiency white LEDs fit nicely into a 2-3mm hole drilled partly into these strips.

The annunciator legends come with the package; unfortunately I have no pictures of them. But you'll find where they should go without much trouble. I painted the orange and green colors for those annunciators that need colored light, with a simple felt tip marker, on the back side of the legend blocks. Two or three layers should give sufficiently strong color for the legends.

Insert the legend blocks into their holes in the front plates assembly. You only have to apply some glue to the annunciators on the left and right side; those for the top row fit quite well.

Then, glue the LED holding strips to the back of the lightplate. Paint their sides black, so that their light does not interfere with the others.
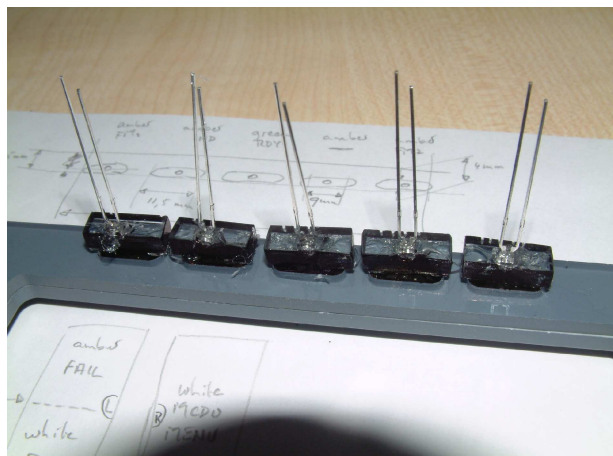
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With all keys still (or again) in their holes, put the tactile switches into the square holes of the key-bases.

Place the mounting plate on top of the switches. This will need some juggling with switch contacts, but after a few tries every switch contact leg will fall into its designated hole in the mounting plate. No glue needed here!
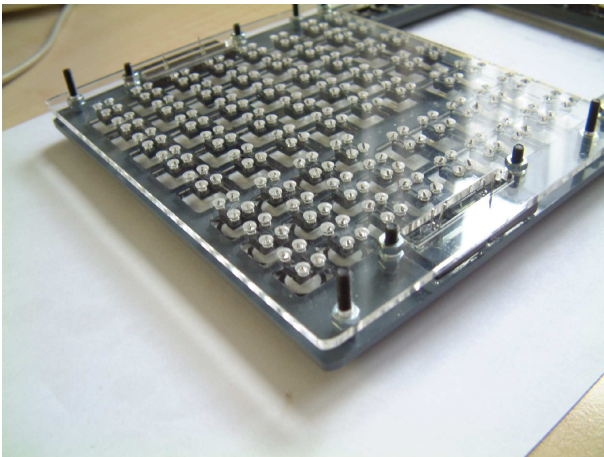

(I first tried this the other way around: lay the mounting plate flat on its back, put the switches into their holes, put all keys on top of the switches, and then try fo fit the face-/lightplate assembly over them – but that actually turned out to be much more difficult. Keys would sag sideways under the lightplate, not fitting into their hole; getting them straightened out with e.g. forceps introduced the risk of damaging the paint on them...).

So now fasten the mounting plate to the assembly with another set of nuts. Tighten firmly.

It's time to start connecting the switches. I used some sort of matrix wiring, in order to reduce the number of wires in the module. Look in Appendices C and D for my matrix and the corresponding encoder_keys.ini file for the OpenCockpits' USBKeys card.
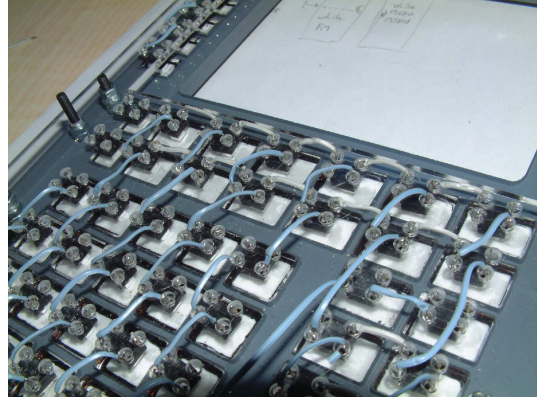

We're almost there. What we still need is the monitor, which is best made from the famous Sony PSOne screen.

Several tutorials exist on the web for taking it out of the casing, and separating the screen from the electronics PCB. I included some links at the end of this document; most of these are fairly old, and several others I have seen in the past even do not exist anymore. So don't wait too long in looking for them...

On the other hand, it is a relatively simple matter to remove the casing, expecially if you do not want to keep it for re-use!

On the web I found a way of mounting the PCB over the assembly (see Appendix A, (M)CDU Construction), which at the same time took care of fixing the monitor in its place. It consists of three pieces of 3mm plexiglass, glued together and then fitted over 4 of the bolts holding the assembly together (mine are M3x20mm, enough to hold a 30mm metal standoff on top of the latest nut we placed. These will later carry the protective bottom plate for the module).

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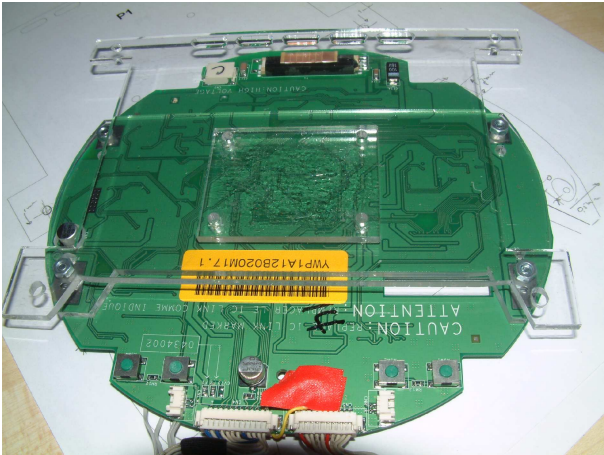
In the above picture you can see four holes in the center of the plexi pieces; these were used to keep the pieces together while the glue settled. There is no space between the plexi and the PCB for the bolt heads or the nuts, so you have to remove them).

The bottom plate can now be fitted over the standoffs, as shown in the next picture. I drilled some holes in the plate for tie-wraps which hold the remaining parts together. From left to right in the picture you see the (green) Sony PCBs for the video- and power-connections, a piece of experimenter's PCB for the switch- and annunciator-wiring, and (green again) the OC USBKeys card.
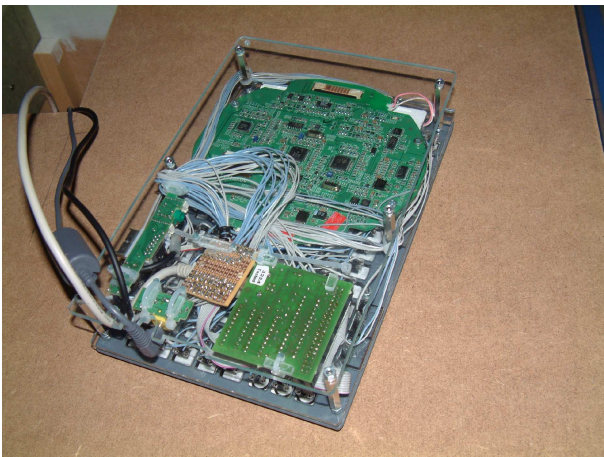

The small ribbon cables at the lower side of the experimenter's board are the connections to the USBKeys card; the bundle of wires at the top side come from the annunciator LEDs. Note: the BRT/DIM buttons go directly to the PCB!

The board is still to be finished; a 10-pos IDC connector for receiving a ribbon cable is still missing. That 10-wire cable is to be used for the

9 annunciator LEDs (plus a single return wire). The other side of the cable will go to an OC Master card (or USBOutput card) to let me control the LEDs with a SIOC script.

Here is the (almost) completed MCDU, ready to be placed into the pedestal.
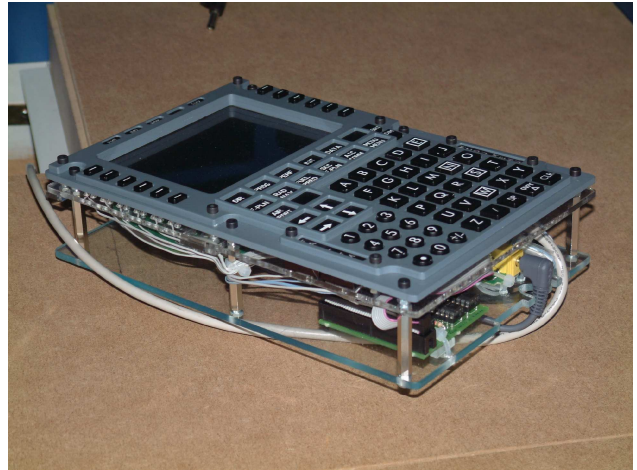
The final picture shows it in its future environment; all other modules there are paper dummies for the time being.

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I hope that this tutorial has cleared away any uncertainty as to how this module is to be assembled. Good luck with your own build, and as always:

Safe Landings!

Hans Jansen

Appendix A: Links

PSOne Disassembly

PSOne LCD Mod (VGA)

http://www.pcmodz.info/viewtopic.php?id=159

(this one also describes a modification to connect the screen directly to a VGA output; I have not (yet) gotten that to work. For the time being, I use the S-VHS output of my graphics card).

PSOne screen mods

PSONE LCD Mod

http://forums.bit-tech.net/showthread.php?t=62951

Long forum discussion about an article like the above.

Hacking a PSOne LCD into thinking it's a monitor

http://freespace.virgin.net/john.laura/Hacking a PSOne LCD.htm

Changing the screen into a "real" monitor – not tried either, but looks promising...)

(M)CDU Construction

FMC page – by Geza Szabados-Hann

http://www.edtk.de/fmc.htm

My main inspiration for this construction – Thanks Geza!

Photos and Drawings

My photos on MyCockpit.org

http://www.mycockpit.org/photopost/showgallery.php?cat=655

The pictures from this tutorial, in full size

Appendix B: PSOne Fixation Plates

P1

P2

P3
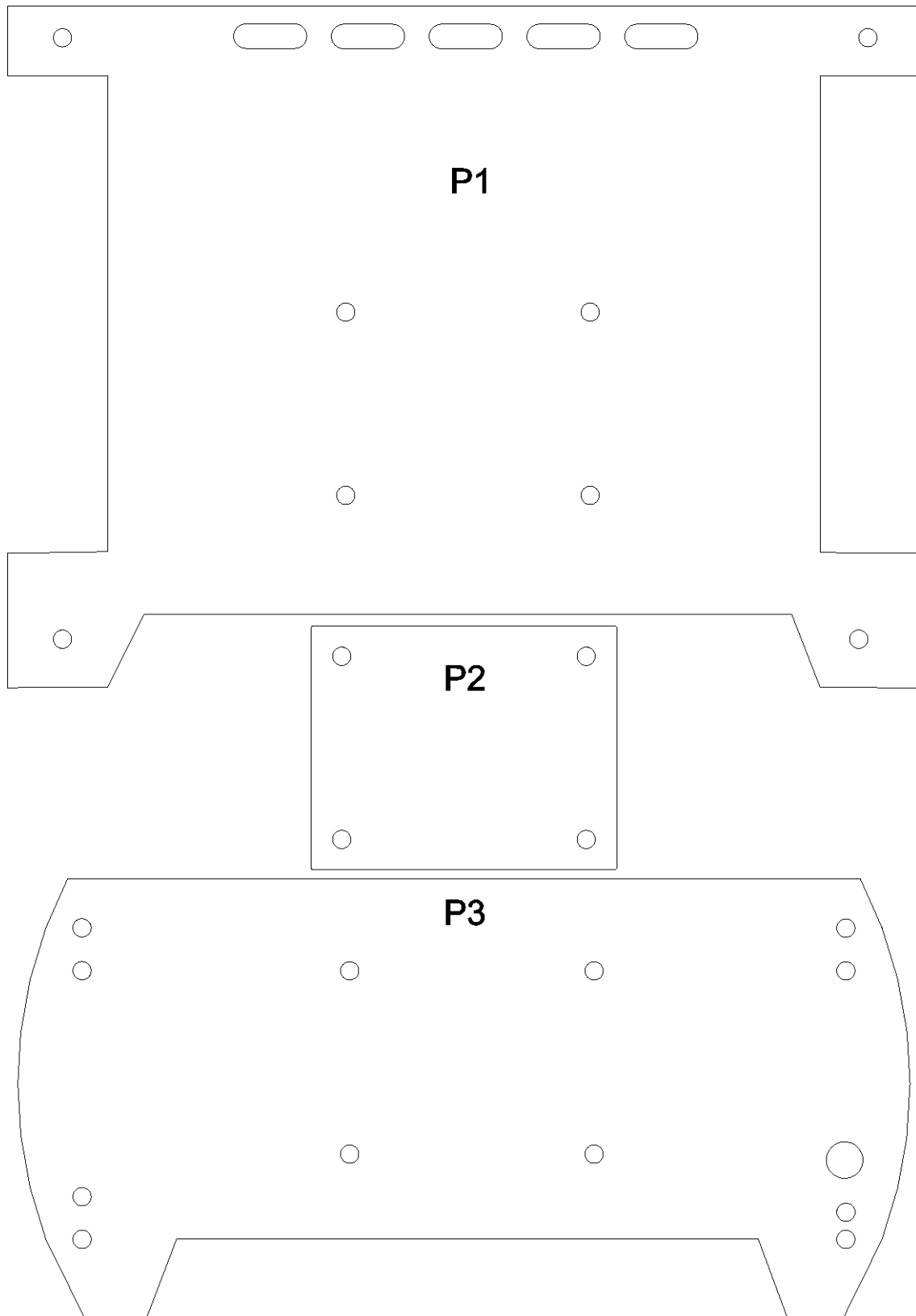
Appendix C: Keyboard Matrix

N.B.: Rear-side View!
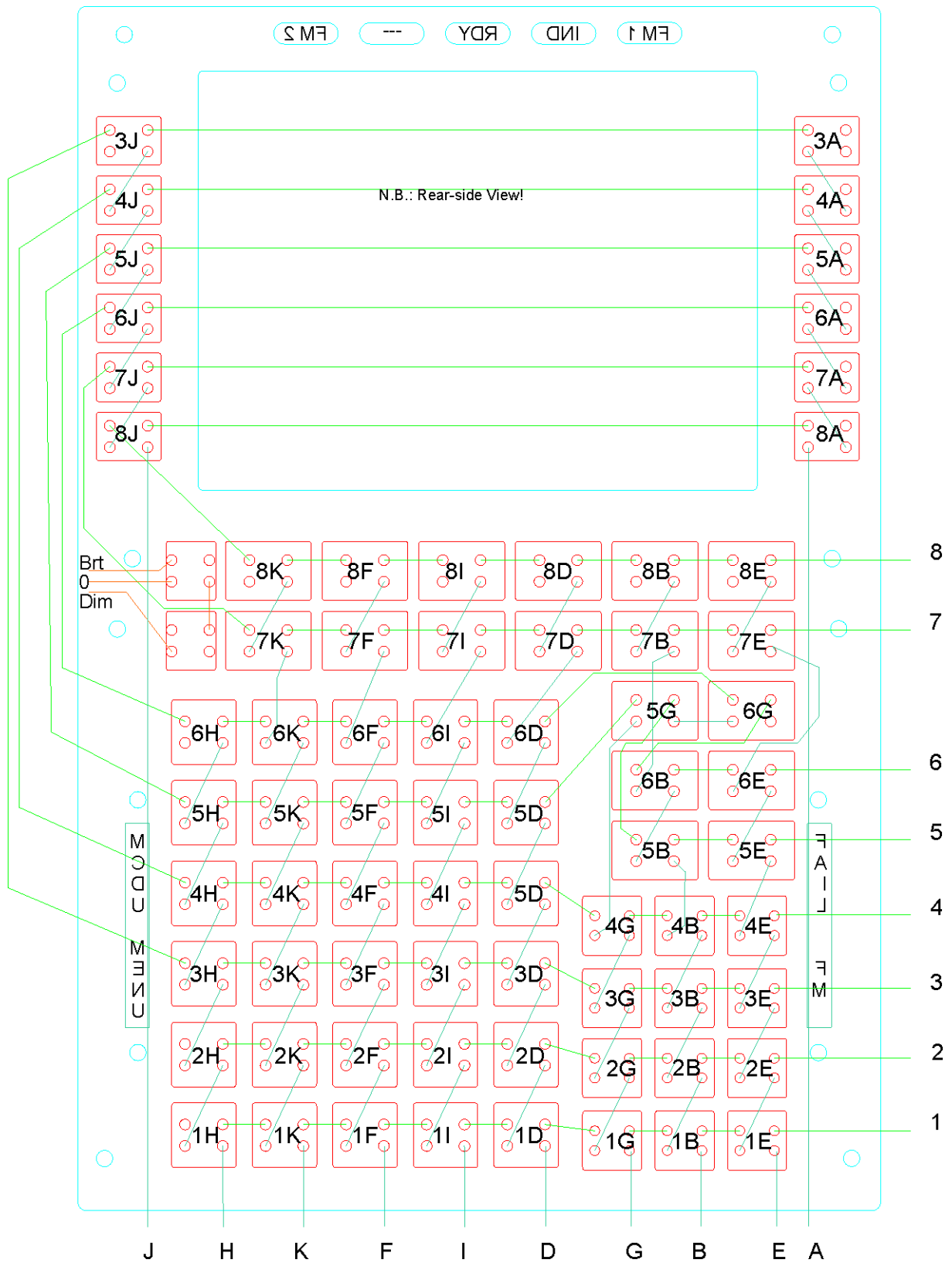
Appendix D: encoder_keys.ini

```
[ Configuration file for USBKeys ]
[ (For my definitive version of ]
[ the OC MCDU) ]
[ Author: Hans Jansen 01-11-2009 ]

[ Non unique USB ]
MUSB=No

[ USB Device number ]
deviceUSB=2048

[ Name of window for key send ]
window = "AST A320 MCDU1 BUILD: 31"
[window = "a.txt - WordPad"]

[ key assignments ]

[ Block A ]
#1=
#2=
#3=\F
#4=\E
#5=\H
#6=\G
#7=\J
#8=\I

[ Block B ]
#9=
#10=
#11=
#12=
#13=
#14=
#15=
#16=

[ Block C ]
#17=8
#18=0
#19=2
#20=5
#21=\S
#22=\T
#23=e
#24=l

[ Block D ]
#25=7
#26=.
#27=1
#28=4
#29=\U
#30=\V
#31=f
#32=m

[ Block E ]
#33=<U
#34=<Z
#35=<K
#36=<P
#37=<A
#38=<F
#39=d
#40=k

[ Block F ]
#41=9
#42=o
#43=3
#44=6
#45=g
#46=n
#47=
#48=

[ Block G ]
#49=<W
#50=p
#51=<M
#52=<R
#53=<C
#54=<H
#55=b
#56=i

[ Block H ]
#57=<V
#58=/
#59=<L
#60=<Q
#61=<B
#62=<G
#63=c
#64=j

[ Block I ]
#65=<Y
#66=r
#67=<O
#68=<T
#69=<E
#70=<J
#71=
#72=

[ Block J ]
#73=<X
#74=q
#75=<N
#76=<S
#77=<D
#78=<I
#79=a
#80=h

[ Block K ]
#81=
#82=
#83=\L
#84=\K
#85=\N
#86=\M
#87=\P
#88=\O
```