The controller box build

Disclaimer: **This build requires <u>240V</u> wiring and can KILL. All 240v wiring must be checked by a qualified person.**
Never work on the unit with it plugged into the power outlet.
All exposed metal MUST BE EARTHED.
Although care has been taken to make sure the information contained within is correct, no responsibility will be taken for errors.
No responsibility will be taken for any injury or death that occurs in attempting this build.

Please read these instructions carefully and decide if you have the skills and equipment to complete the build safely.

These instructions are for building a braumiser controller to control a maximum 10amp load and a 12v DC pump

The parts required for this build is as follows:

The brauduino kit

Bonjuino or arduino

12v 2 amp dc powersupply

25A 240vac 3 – 32v dc controlled zero crossing SSR

IP67 BOX   (Jaycar HB6224)
IEC power Male (Jaycar PP4009)
IEC power female (Jaycar PS4002)
3 x black pushbuttons (Jaycar SP0656)
1 x red pushbutton (Jaycar SP0657)
2 pin connector Male (Jaycar PP2013)
4 pin connector Male (Jaycar PP2010)
2 pin connector Female (Jaycar PS2014)
4 pin connector Female (Jaycar PS2012)
Heatsink 110 x 75 2.5 degc/w (Jaycar HH8572)
4 15mm nylon standoffs (jaycar HP0926)
some 3mm screws and nuts

First start with the box, I laid out the SSR/ heatsink and power supply so I could judge where the best place for them was

as you can see I have positioned the parts so that the AC wiring is all up in one corner, that was done to try and keep the separation between AC and DC to a maximum and also if water gets in the box then the AC is up the top so it should stay dry. The other tricky thing was to position the heatsink so that it didn't cover the power supply's mounting screws. Once you are happy with the layout mark and cut out the box, I have tried different methods to cut out the holes, the standard method of drilling holes so that a hacksaw blade will fit and the cutting with that works well but it is slow and it needs a lot of filing to smooth it out. I have a cheap dremel ripoff and have found that using the metal cutoff discs works well if you take your time, what it does is it melts the plastic more than cutting it and then after you have cut the hole the clean up with the file is easier.

I drew up a layout on the computer to help with the cutout locations and holes.
Next step is to drill the heatsink, I drilled and tapped the SSR mounting holes but a bolt and nut arrangement would work just as well.

When mounting the heatsink put a bit of thermal paste on to assist heat transfer

Screw on the heatsink and add the earth wire to one of the mounting screws to earth the heatsink (any piece of metal that could come in contact with 240V and can be touched MUST BE EARTHED). If you are using the nut and bolt mounting make sure you remove a bit of the anodisation (black coating) from where the nut makes contact with the heatsink.

Because this unit is going to be used near liquid I have tired to choose parts to keep the water out, the box was IP rated but now has holes cut in it. To try and reduce the chance of water getting in I put a bead of silicone sealant around all the holes before I mounted the parts

SSR and heatsink just before it is going to be mounted in the box

Now that all the parts are mounted and sealed its time to start wiring up the box, for the wires I used 18awg (0.8mm^2) V90 (rated at 90 deg c) 300v wire that I got off an old computer power supply, make sure the wire you are going to use is suitably rated for the current you are going to draw. I soldered the connections for the AC sockets and then put heat shrink over them to reduce the exposed AC wiring

The earth wiring

The Active wiring

The neutral wiring

For all the screwed type connections I 'tinned' (put solder) the ends of the wire before I screwed them in. Remember that this is arranged for a 12v pump if I was going to use a 240V pump then I would turn the heater socket 90 deg and squeeze the pump socket in next to it.

On the IEC power sockets they are marked L E N, the L stands for line which is active, the E stands for Earth and the N stands for Neutral, make sure you connect up the right way because between the AC input (IEC male connector) and the heat output(IEC female connector) the active and neutral swaps sides.

Also the AC in must be a male type fitting (the connector has prongs) and all the AC output must be female type (the connector has holes) that is because if put a male type in the output you will have exposed AC. With a multimeter measure the resistance of all the exposed metal parts to the earth pin on the AC input connection it must be a very low resistance almost as low as putting the 2 probes together. That completes the AC wiring.


Cut out and drill the front of the box
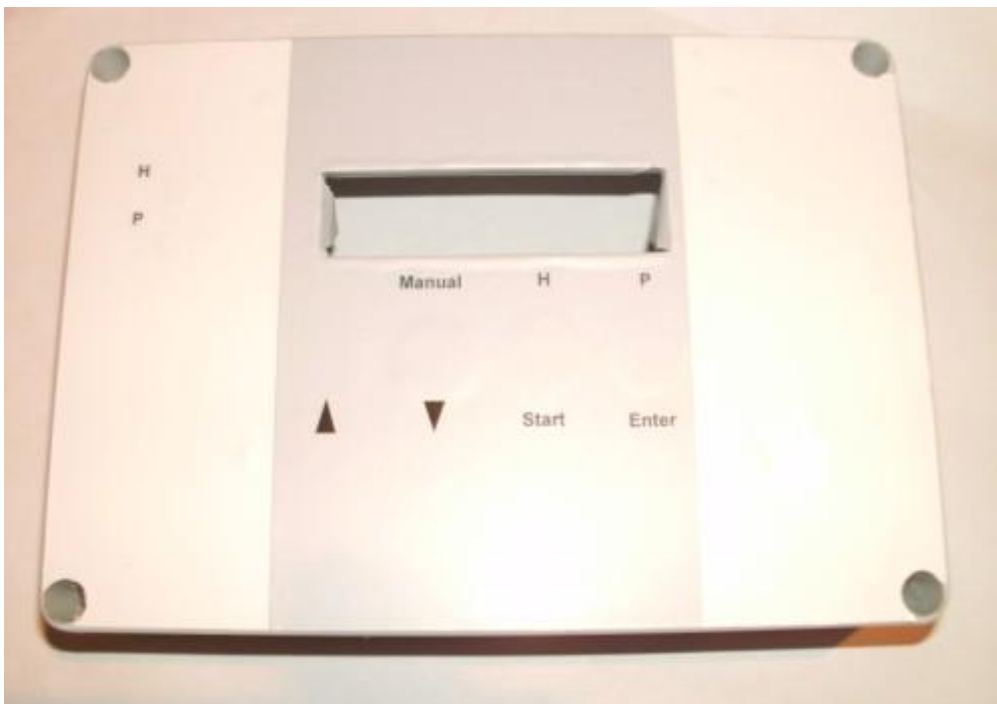
The front label applied

I printed the label out using AVERY durable heavy duty labels (re order code 936067), before I applied it to the box I gave it a coat of clear acrylic car paint and waited for it to dry. I then roughly trimmed it to size and put it on the box, then with a sharp razor I trimmed it up and cut out the holes, when I finished trimming it up I applied another 2 coats of clear acrylic. This is what I did on the original braumiser and it has served me well.
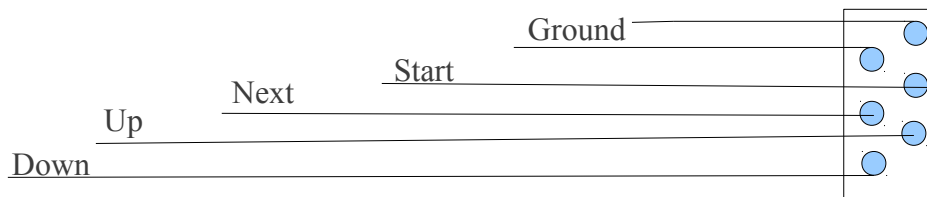
Mount the pushbuttons and solder the Ground loops in place

Enter   Start   Down   Up
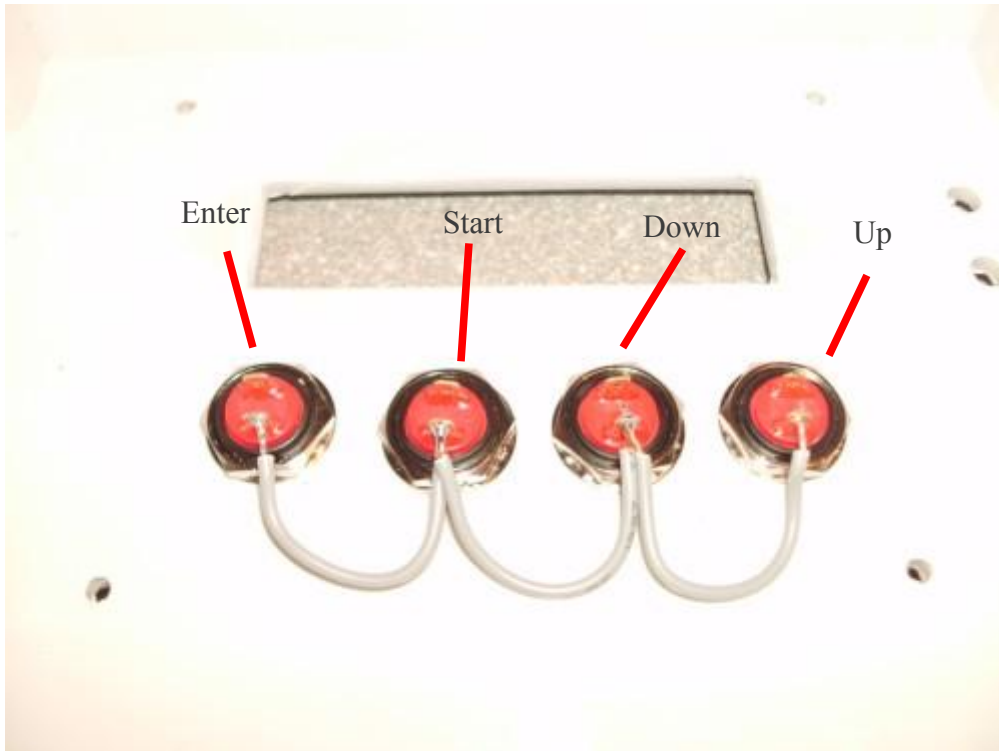
Now solder on the 2 Ground wires from the ribbon cable to the Ground loops

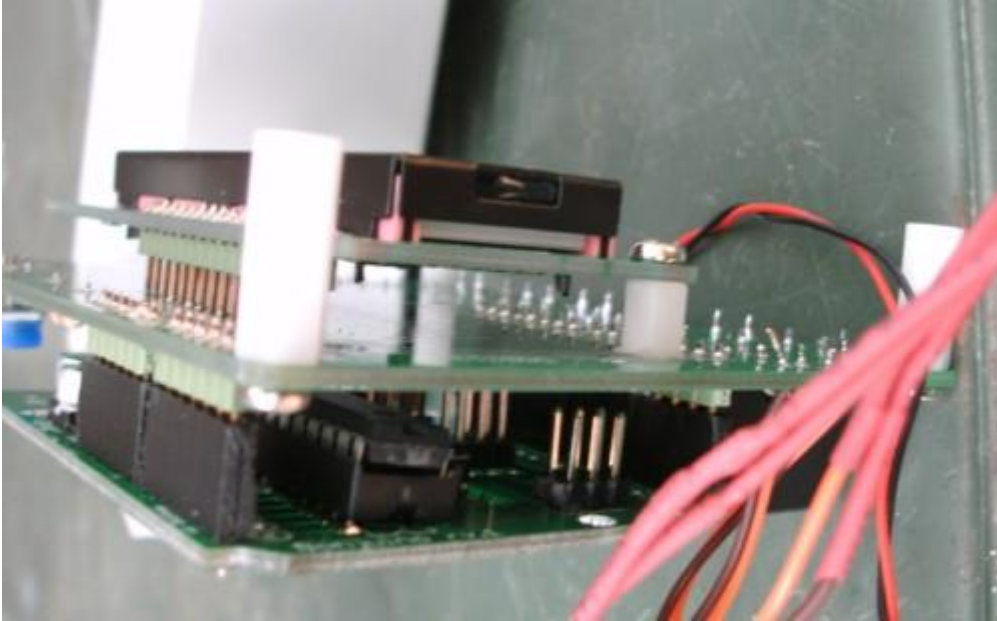Now solder the other four wires to the other side of the push buttons

To reduce the chance of water getting in to the box I cut out a bit of silicone sheet

get 4 15mm nylon standoffs (jaycar HP0926) and screw them to the brauduino PCB in the four

mounting holes in the corners.

And then mount the board to the box, I have chosen to use the nylon standoffs because they insulate the mounting screws that are on the front of the box, which means they don't need to be earthed saving a lot of headaches.
Drill a 3mm hole in the side of the box and glue the buzzer over it

also apply glue to the back of the LED's to hold them in place. Now would be the best time to adjust the LCD contrast (the blue POT up the top of the picture), Power up the Bonjuino(or arduino) but either plugging in the program cable or applying 5 – 12 V DC to the input terminals, **be safe** and don't take risks with exposed 240v, that means don't use the 12v power supply mounted in the back of the box unless
1. the wiring has been checked by a qualified person
2. you put a cover over the box to stop any accidental contact with 240V
get a phillips head screwdriver and adjust the contrast to get the best look, remembering what angle you are most likely to be viewing it from.

Now it is time to connect the back to the front
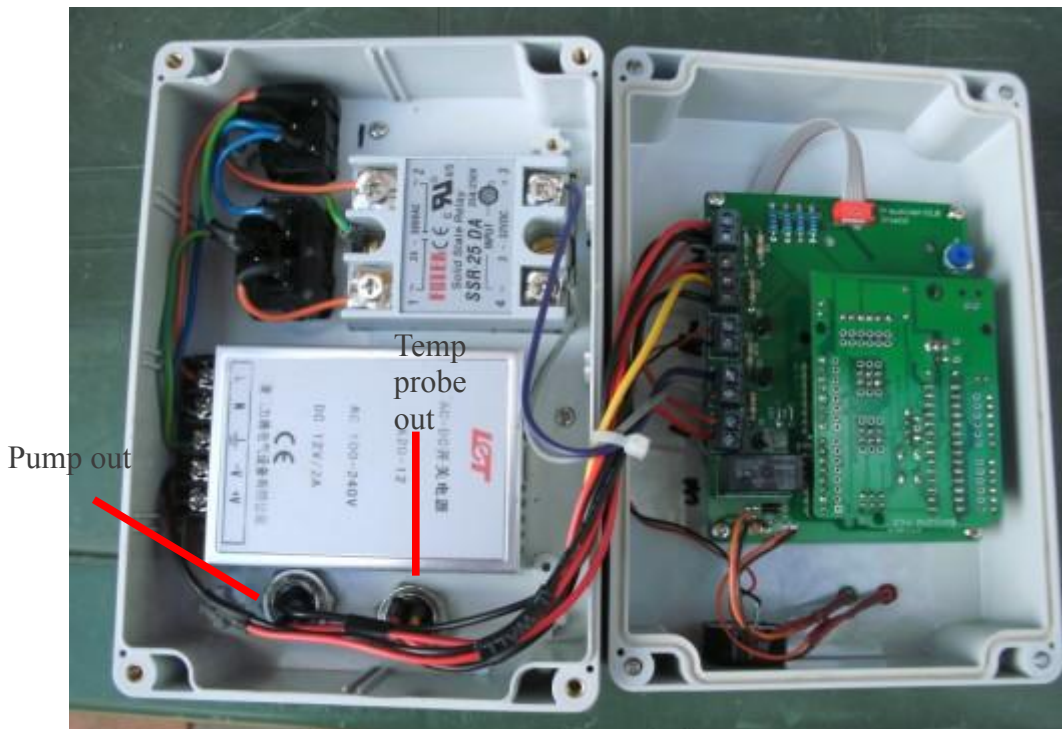
First thing to do is to solder the 2 wires to the pump out and 3 wires the temp probe out connectors, then connect the 12v DC wiring to the power supply. Get a bit of wire long enough to go between the +12v and one of the 'pump' screw terminals on the board, connect it to the pump screw terminal and then put the other end in the +12v terminal along with the +12v wire from the power supply. Next put the -12v wire from the power supply and the – wire from the pump into the -12v screw terminal. Take the + wire from the pump and put it in the other 'pump' screw terminal on the board.

The temperature probe has 3 wires VDD (+) , D and GND(-) connect the three wires from the connector to the board.
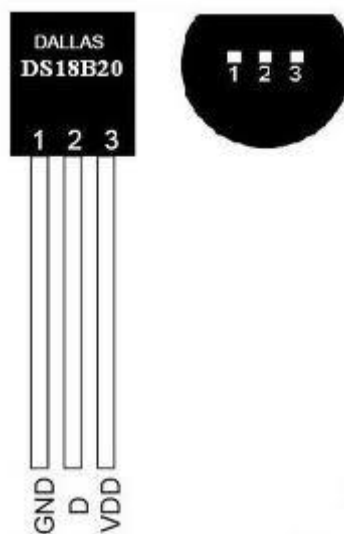

The last thing to do is to connect up the SSR control wiring, run 2 wires from the HEATER screw terminals to the SSR terminals 3 and 4 making sure to connect + to + and – to -.

Take note of how the pump socket and temperature probe socket is wired up so that you can wire up the plugs for them when the box is screwed together.

Next thing to do is to solder a 3 core cable to the DS18b20 to make the temperature probe (I used a 4 core alarm cable from jaycar) after I soldered the 3 wire I encased them in epoxy I did this by slipping a drinking straw over the sensor and the cable and filling it up with epoxy slowly moving it back up towards the top of the sensor filling as I went, two things to make sure off

1. don't cover the top of the sensor with epoxy
2. Make sure that none of the 3 wires are touching each other.

You will need to put this sensor in a thermowell to protect it.
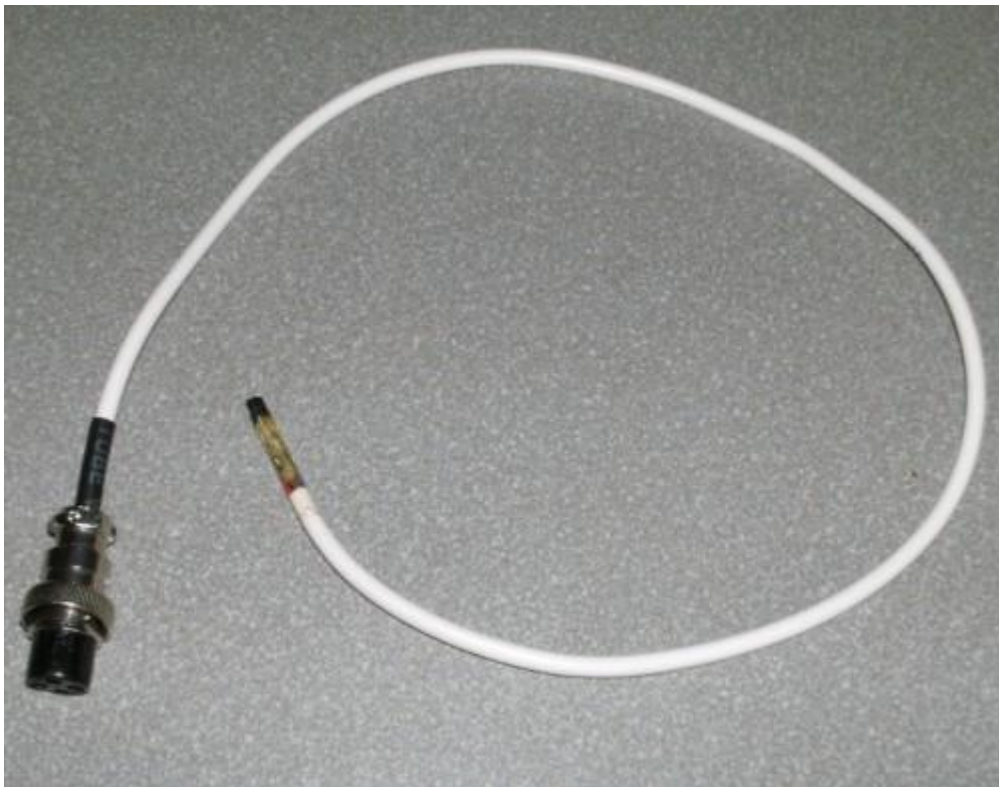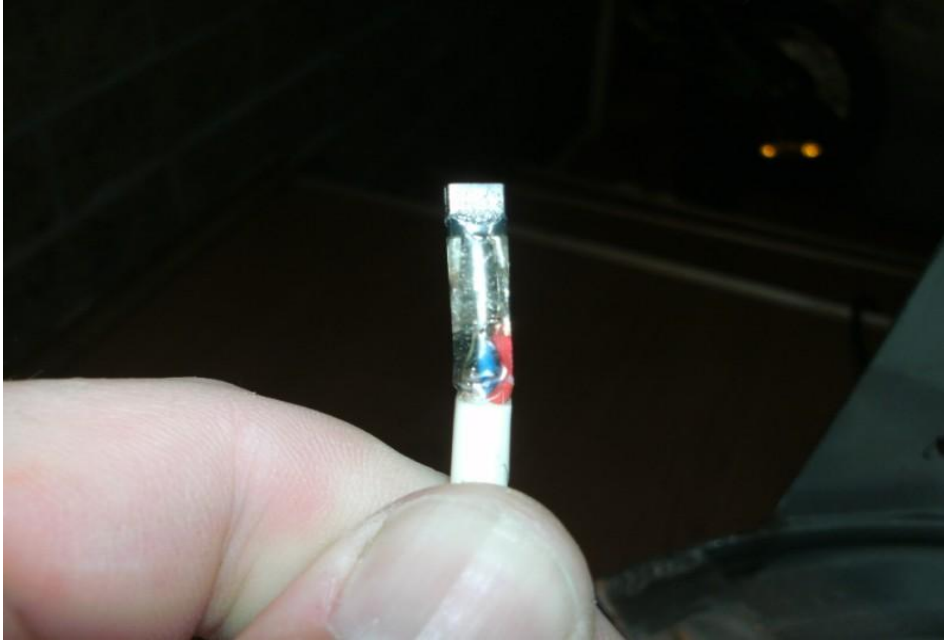
   That completes the build of the controller box.

Note: I have not included any instructions on wiring up a 240v pump but I have included a wiring diagram, I would suggest using a double insulated twin wire to wire from the pump screw terminals and pump outlet.
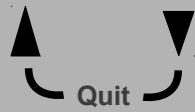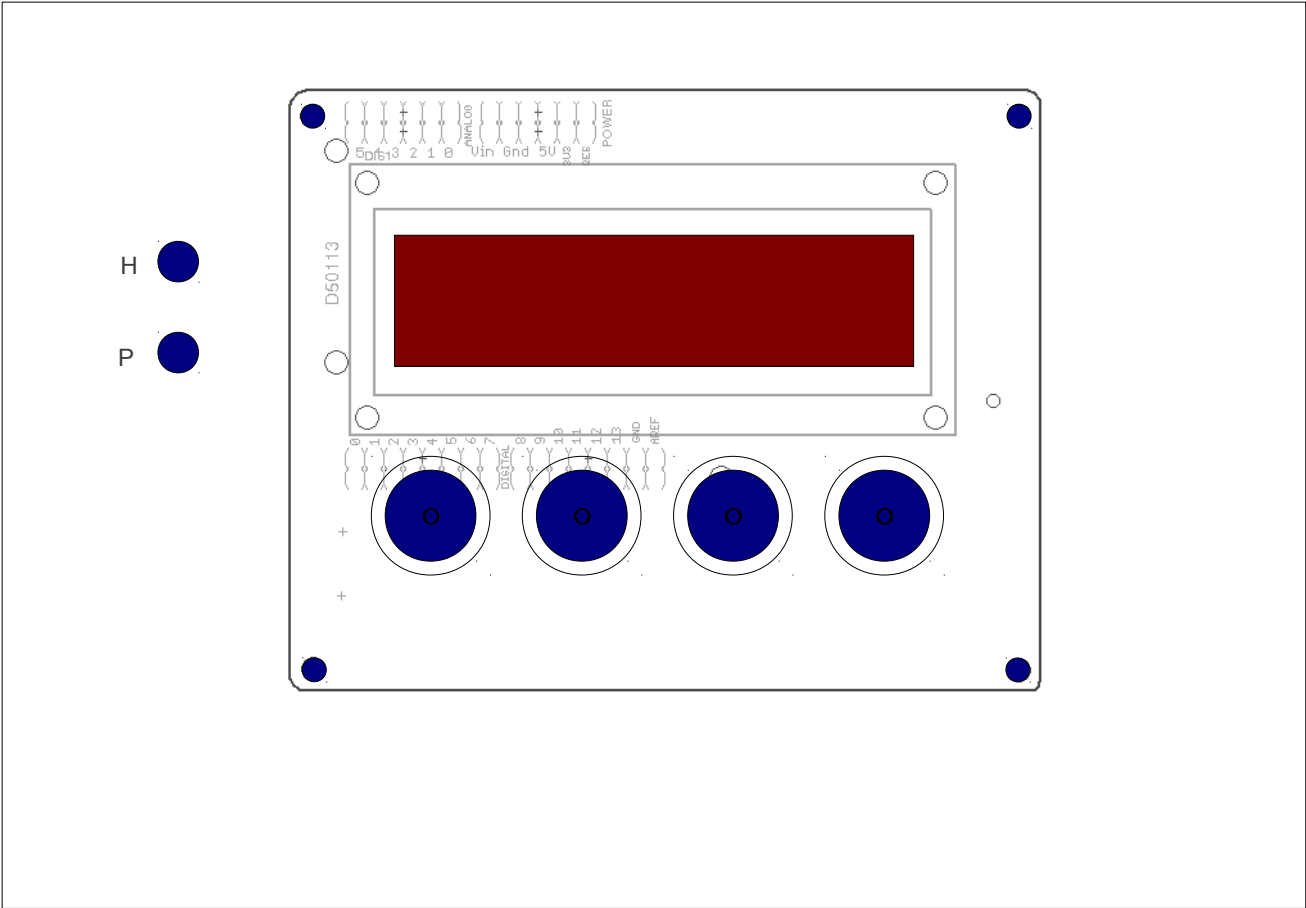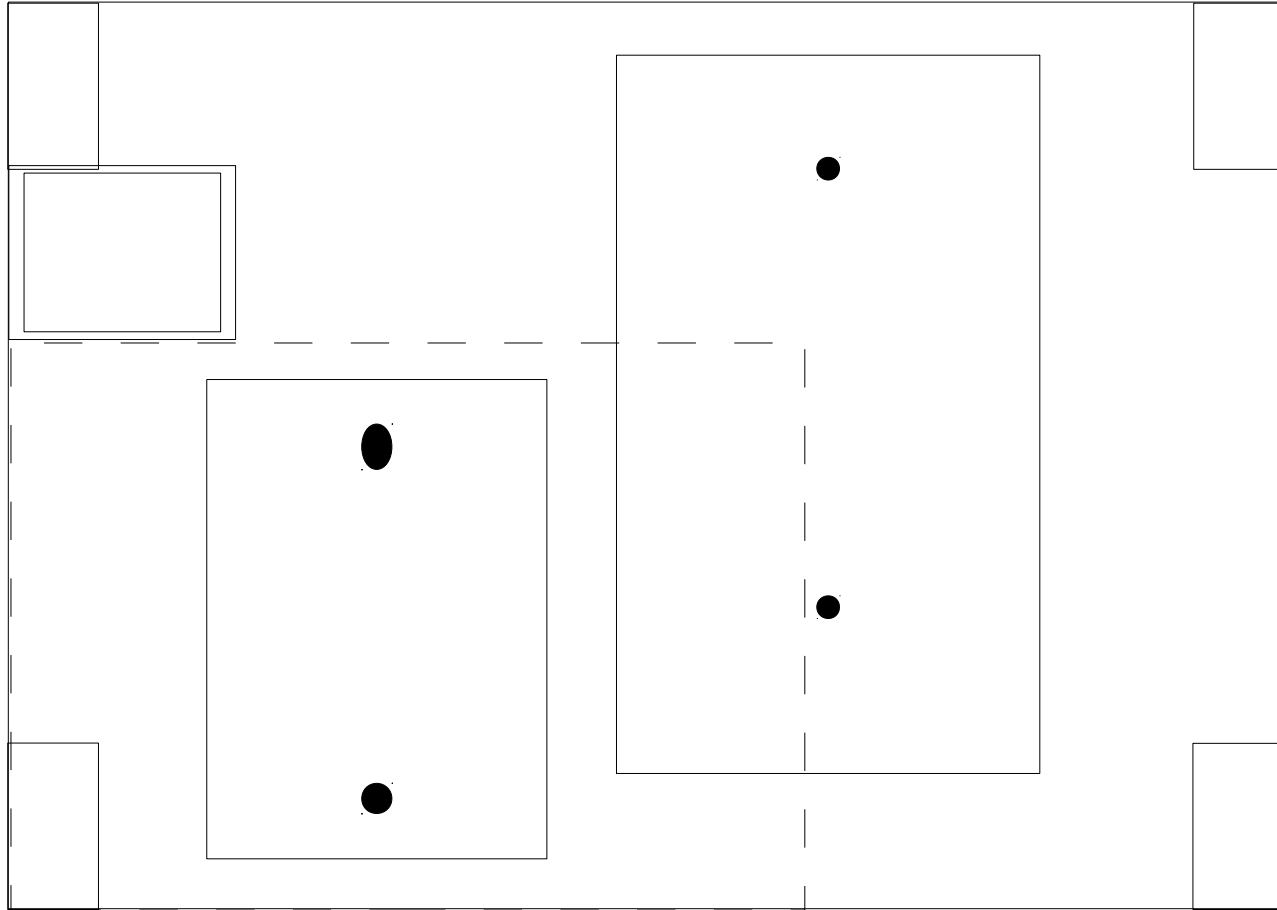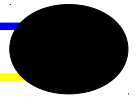
H

P

Manual   H   P

Start   Enter

Quit

Cut Out

Drill out

H

P

D50113

ANALOG POWER

5 13 2 1 0   Vin Gnd 5V

DIGITAL

GND AREF

O   O   O   O

+

+

AC 240V

12v Power Supply

− +

load

D50113

1N4004

K1 G5SB

PUMP

R7 470

+ HEATER −

R10 470

+ BUZZER −

R11 470

D

+

JU1 4.7K

R8

+12

5V 12V

Q1

Q2

Q3

R5 5K

R6 120

X6

R1 10K
R2 10K
R3 10K
R4 10K

BraumiserV2.0 Shield

DALLAS 18B20
1 2 3

40A 240VAC
LOAD
1 2

HANDOUK
SJ-D24Z40
SOLID STATE RELAY
INPUT
3 - 32VDC
−4 3+