Altair-Duino version 1.4 to Pro Upgrade

I would strongly suggest comparing the parts you received with the list below. Let me know if you are missing anything and I will send a replacement. (It will not be unusual to have a few extra minor parts, like resistors/LEDs/transistors.)

PARTS LIST

- 1 x Circuit Board
- 1 x 16 pin DIP socket
- 1 x 28 pin DIP socket
- 1 x VGA connector
- 1 x DB9 connector
- 1 x 3.5mm audio jack
- 1 x Micro SD module
- 1 x DC power jack
- 1 x USB-A connector
- 4 x Rubber feet
- 1 x MAX3232 IC
- 1 x PIC32 IC
- 2 x 4.7kΩ resistors
- 1 x 220Ω resistor
- 2 x 150Ω resistor
- 1 x 100kΩ resistor

- 1 x 470Ω resistor
- 2 x 27pF capacitors
- 7 x 100nF capacitors
- 3 x 10uF capacitors
- 1 x 5mm LED
- 1 x 8Mhz crystal
- 1 x MCP-1700 regulator
- 1 x Dual Pin Header
- 1 x Single Pin Header
- 8 x Jumpers
- 8 x 8mm M-F standoffs
- 8 x Nylon nuts
- 4 x 6mm bolts
- 11 x 14mm steel bolts
- 11 x Square steel nuts
- 19 x 10mm steel bolts
- 19 x Hex steel nuts
- 1 x 14 pin IDC cable
- Laser-cut rear panel
- 12 x acrylic pieces (blue & gray)

OTHER PARTS YOU MAY NEED

- Soldering Iron with a nice fine tip
- Good Solder (I recommend Alpha Fry Rosin Core 0.032")
- De-soldering Iron (optional)
- Phillips Screwdriver
- Needle-nose Pliers
- Side Cutters (Nippers)
- Computer

A word about soldering: Do not underestimate the need for good solder and a good soldering iron. Most problems I've seen people have with this kit are caused by cold joints or insufficient wetting. That does not necessarily mean you have to spend a lot of money. I have had good luck with $8 soldering kits from eBay (however, I do throw away the solder that comes with those…) Just make sure it has an adjustable temperature and comes with an assortment of tips. Right now, I'm using a $55 soldering station and it works great. I strongly advise you to get quality 60/40 Rosin core .032" diameter solder (I use Alpha Fry or Kester). The spools I buy are only $10 and well worth it. I set my iron to 400 degrees and use the fine point tip.

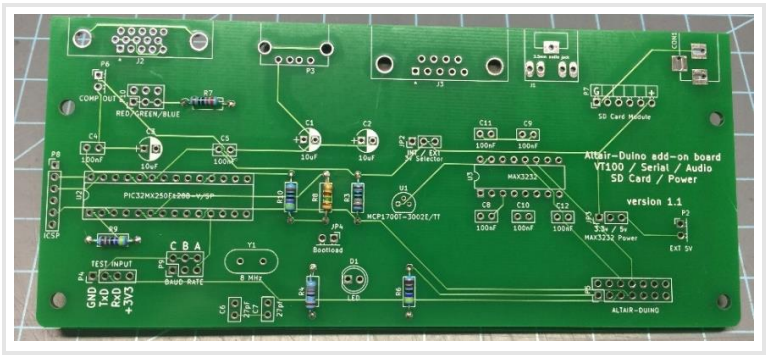
A note about assembling acrylic pieces: Some people may want to glue the case together. This is fine, and will add some strength to the project, but I would suggest not using "super glue" or similar plastic cement. The fumes can adhere to the acrylic causing

undesirable marks. I have had luck with "Loctite Plastics Bonding System" or other types of adhesives with activators. Assemble first to be sure everything fits, then disassemble and use adhesive.

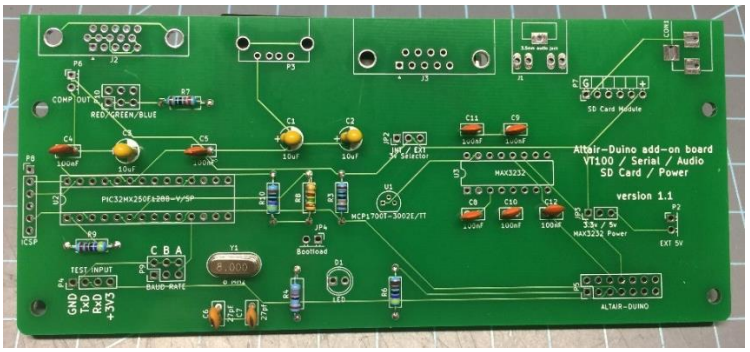
In your kit, you will find a bag with smaller circuit board and bags of miscellaneous parts.

There are seven resistors to install with six different values. You will need to identify your resistors with a multimeter, or with the color codes (see resistor-calculator.com for a handy tool.) The locations for the resistors are clearly marked on the circuit board.

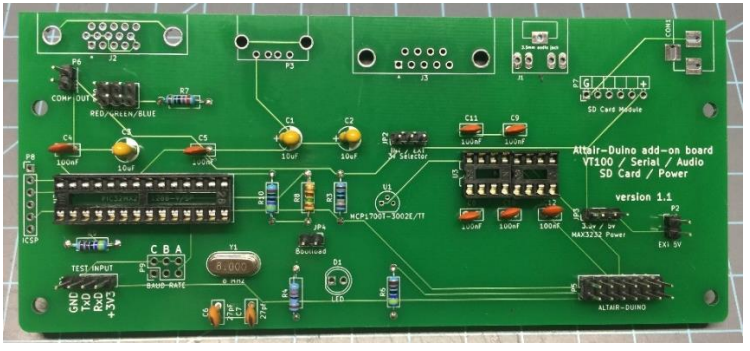
2 x 4.7kΩ	(Yellow – Violet – Black – Brown)
1 x 470Ω	(Yellow – Violet – Black – Black)
2 x 150Ω	(Brown – Green – Black – Black)
1 x 220Ω	(Red – Red – Black – Black)
1 x 100kΩ	(Brown – Black – Black – Orange



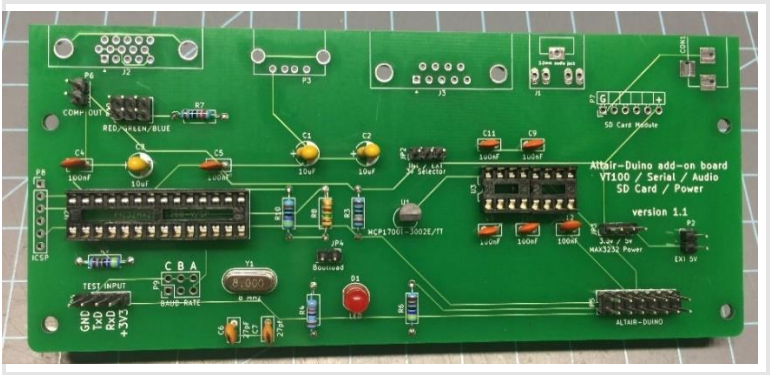
Add the capacitors and 8MHz crystal where marked.
7 x 100nF (marked "104")
2 x 27pF (marked "27")
3 x 10uF (Important: insert long lead in + hole) **(see addendum!)**



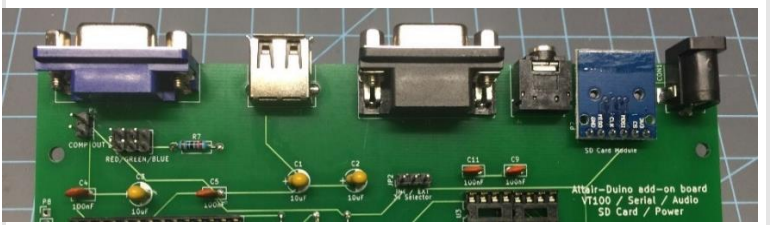
Next add the IC sockets (with the notch oriented to the left) and the single pin and double pin headers.



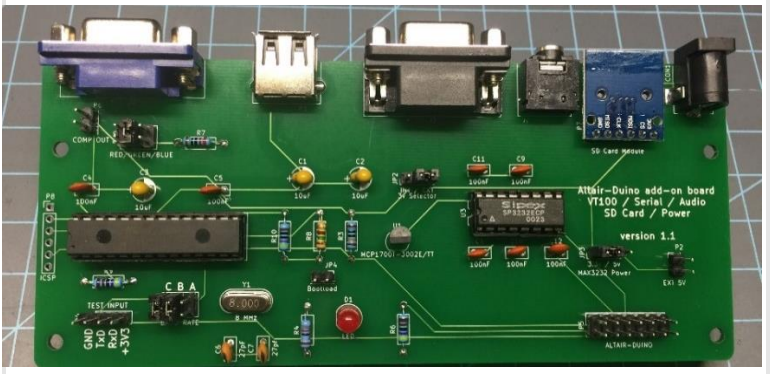
Add the LED *with long lead to the right and flat side to the left) and the MCP1700 voltage regulator with the flat side down. **(see addendum!)**



Add the jacks and connectors.



Finally, insert the MAX3232 IC and PIC32 IC with the notch facing left.



Add the required jumpers to the I/O expansion. The following are the "default" jumpers. Later you can read more about the jumper options on the website.

From upper left to lower right:
Red/Green/Blue: Your choice of text color on VGA monitor, you must jumper at least one.

3v Selector: Set to EXT.

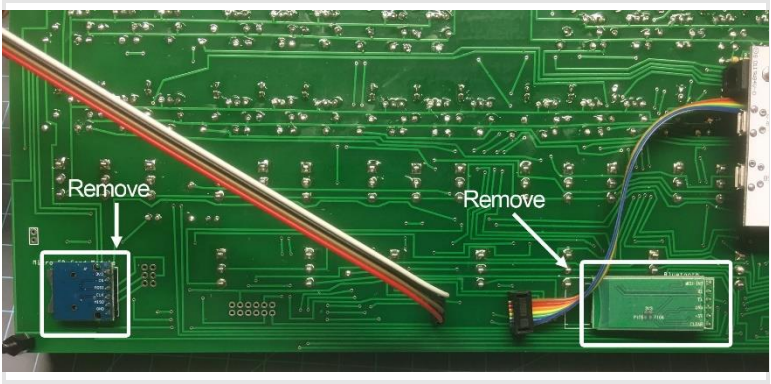
Baud Rate: Jumper C and B for 9600 baud.

Bootload: No jumper.

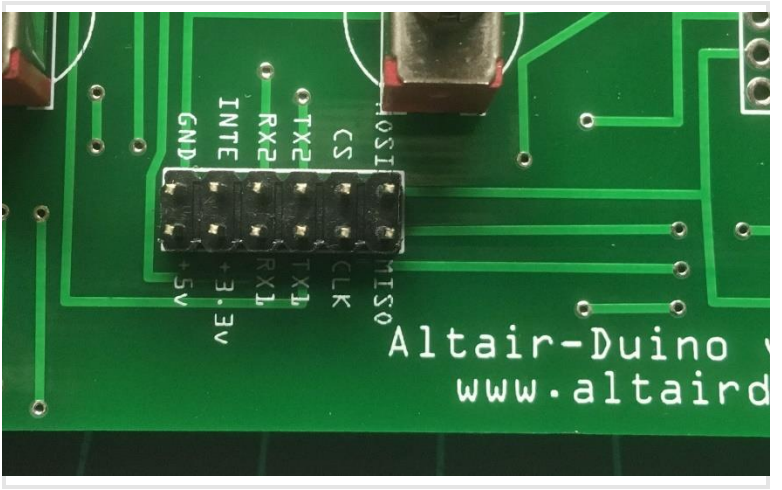
MAX3232 Power: Set to 3.3v.

Prepare the version 1.4 circuit board to connect to the I/O expansion. Remove the four-pin cable that is connecting the RS232 module to the circuit board. You will also need to desolder the Micro SD card module and Bluetooth module (or clip the leads with a side clipper). **Leave the six-pin cable that is soldered into the circuit board.**

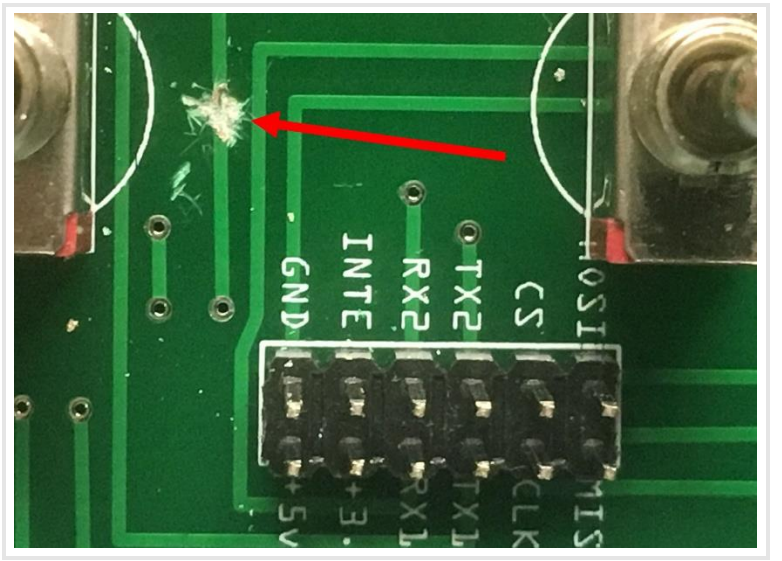
If you want to keep the Bluetooth serial module, see the instructions at the end of the document.



Add a 12 pin dual male header to the expansion connector on the lower right side of the circuit board.



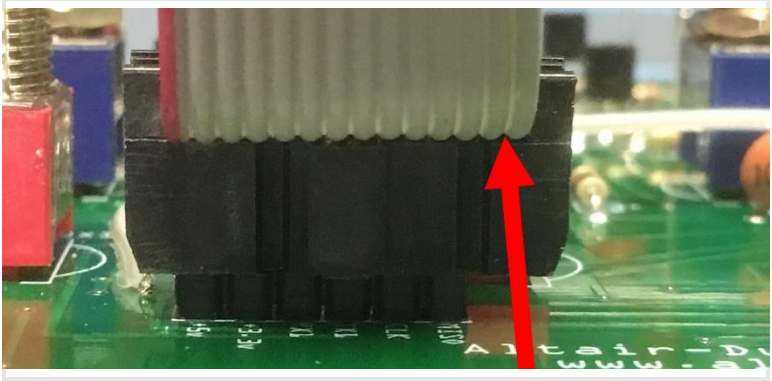
You will need to use a razor or x-acto knife to cut the indicated trace on the main circuit board. Use a continuity tester to verify the trace has been disabled.



Add a wire to connect the "Ring/Tip" audio connector to the via located in the lower part of the trace you just cut.

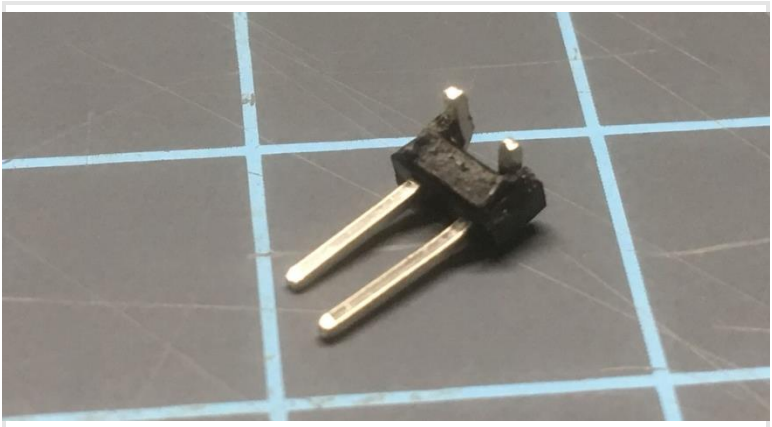
You'll notice the ribbon cable has 14 pins, while the connector on the main circuit board has 12 pins. The right-most pins provide power. These pins need to be connected to the "+Vin/GND" connectors on the left side.

There are two ways you can do this. You can cut the right-most two wires (carefully!) on the ribbon cable, and connect those to the "+Vin/GND" connector (the inside wire is GND, the outside wire is +V.)



Another way is to use a two-pin male header, bend the ends to insert into the right side of the ribbon connector, and solder a wire to the pins that connect to the "+Vin/GND" connector.

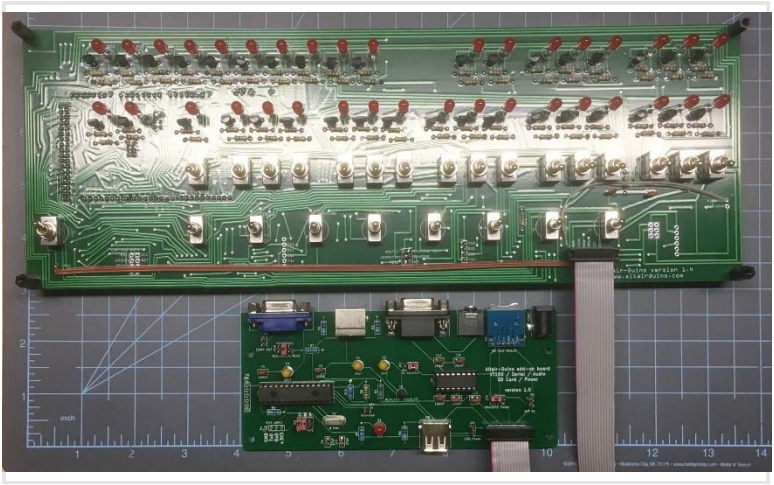
The power connectors on the ribbon cable are in the same orientation as the power connectors on the left side of the board, with +Vin on the top, and GND on the bottom.



Run the wire along the bottom of the board to the ribbon cable connector.

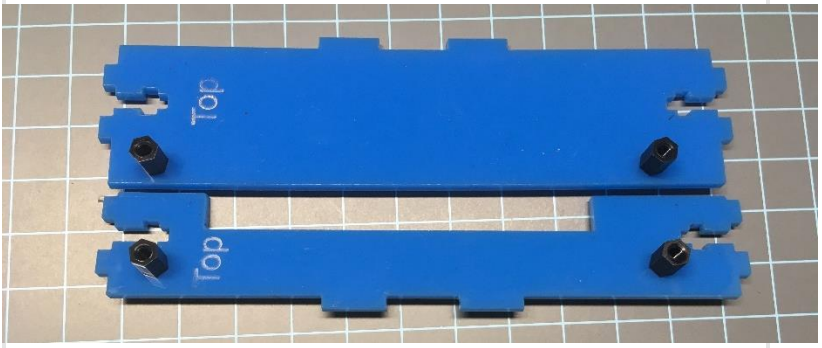
Connect the I/O expansion board to the main circuit board and test it.

If everything works, you can assemble the acrylic case, and you're ready to put it all together.

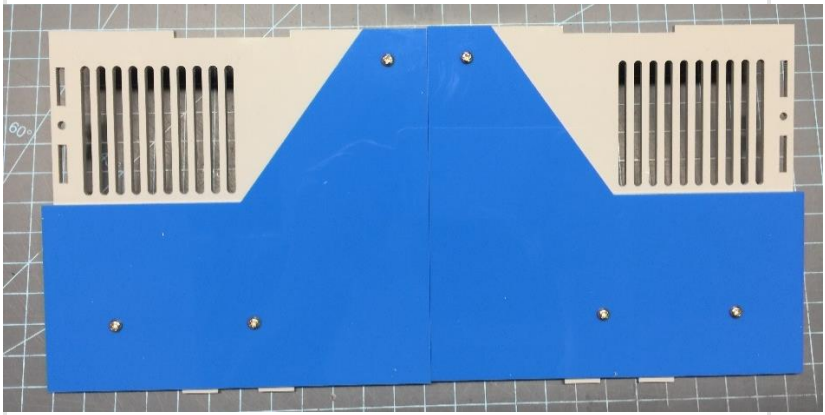


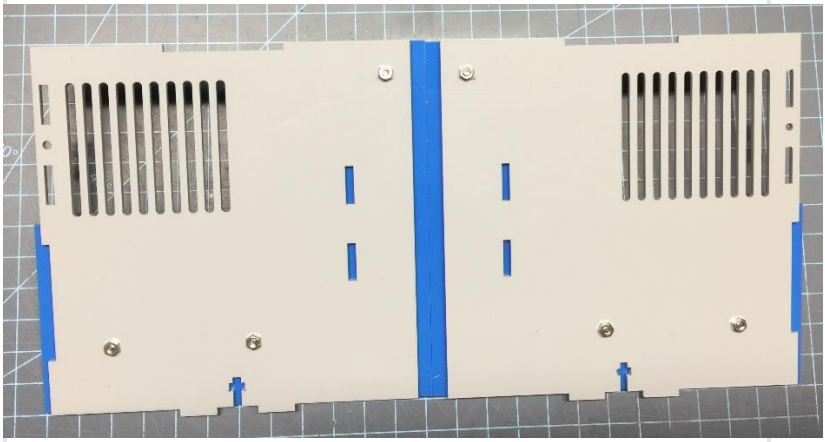
Get the acrylic pieces and start removing the masking paper.

Take the two smaller acrylic pieces with the word "Top" engraved. Add four 8mm nylon standoffs to the side that says "Top" and secure each with a nylon nut. (These pieces may be blue or gray.)



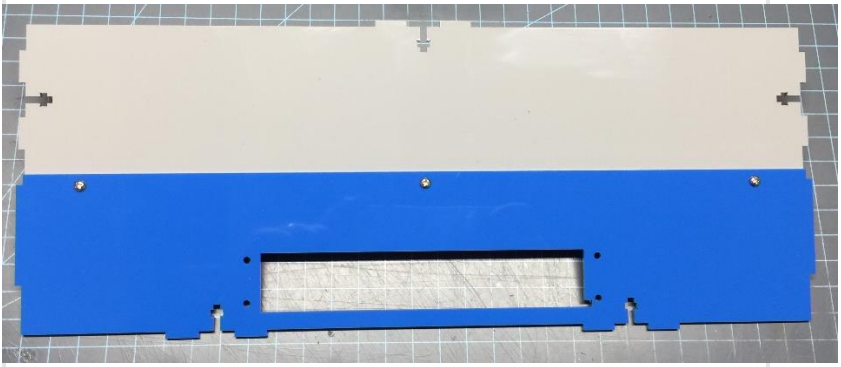
Next take the two gray side pieces (with "ventilation holes" and attach the blue side pieces with three 8mm bolts each.





Attach the blue top piece to the gray top piece as shown with 8mm bolts. Make sure the blue piece extends 6mm over each side (turn it over if it doesn't.)

Attach the two back pieces together with 8mm bolts. Note the position of the notch in the lower right.

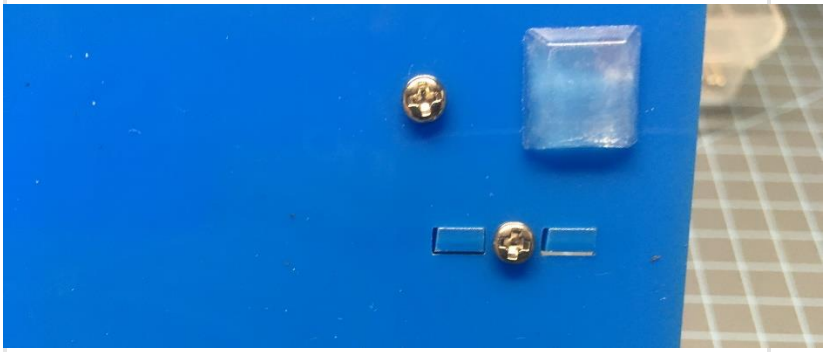


Attach the I/O circuit board to the blue bottom piece with four 8mm standoffs, nylon nuts and nylon bolts.

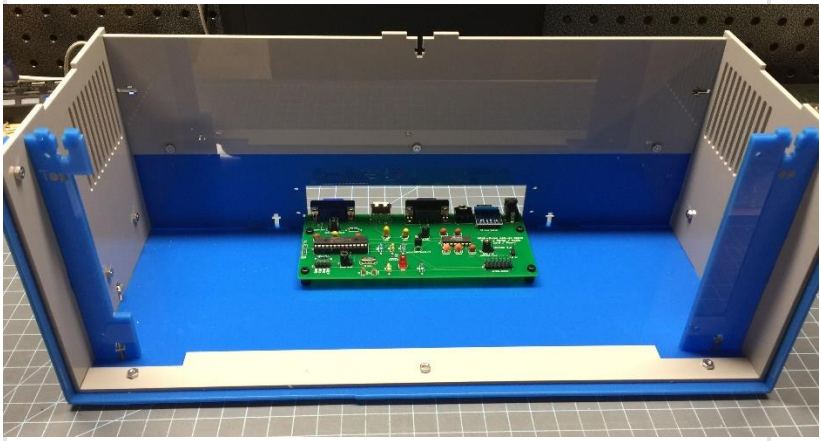
Attach the gray piece (as shown) to the bottom with 8mm bolts.

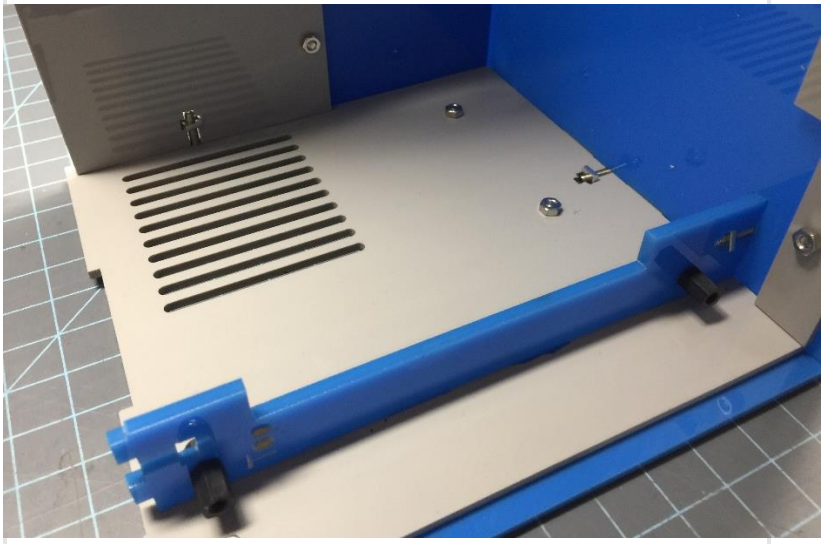
This would also be a good time to apply the rubber feet to the bottom piece.

Next we're going to start joining acrylic pieces with a t-slot joint. Start with the uprights where we will eventually mount the main circuit board. Attach them to the bottom piece with 14mm bolts and square nuts. Tighten firmly, but not too tight – acrylic can crack.

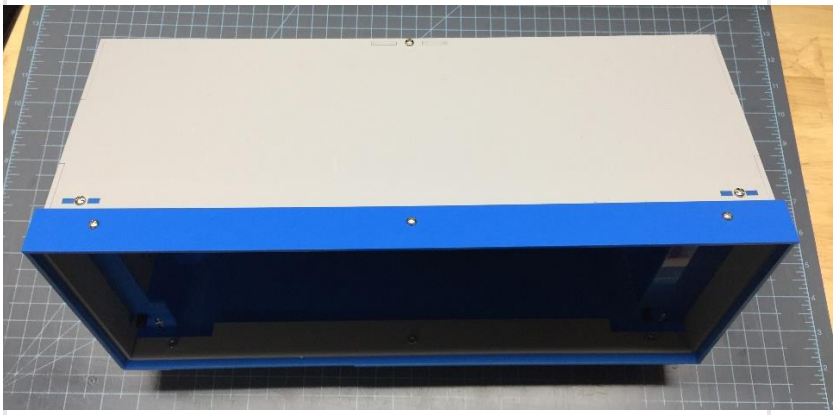


Add the back piece and side pieces and bolt in place with four 14mm bolts.



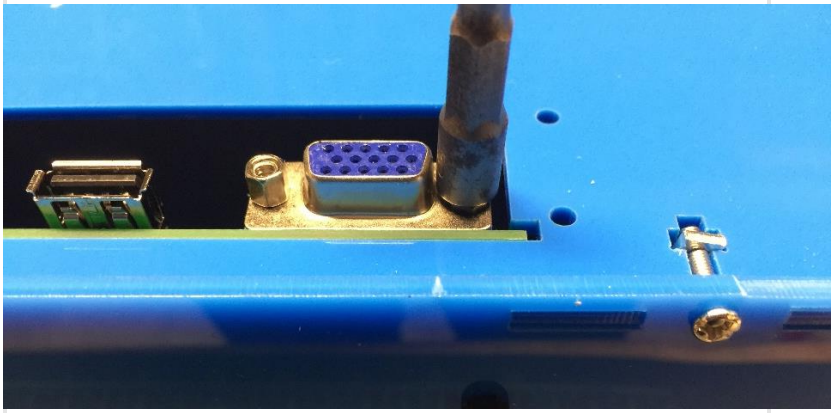


Add the top piece as shown and secure with three 14mm bolts.



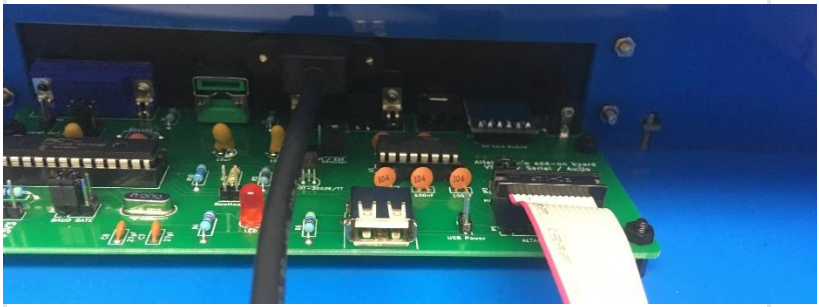
Get the small rear panel (for the ports) and add the USB extension with two 8mm bolts.

Remove the jack screws from the VGA and Serial connectors with a needle-nose pliers, or a 3/16" or 5mm socket.

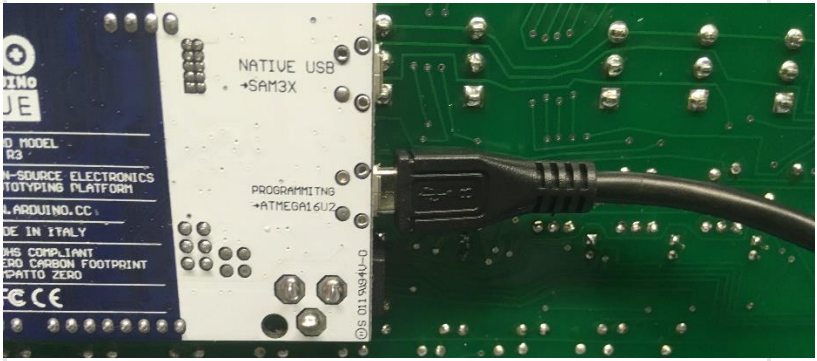


Place the rear panel in place and secure it with the jack screws and four 8mm bolts.

Connect the fourteen pin IDC cable to the I/O board, with the red stripe to the left.



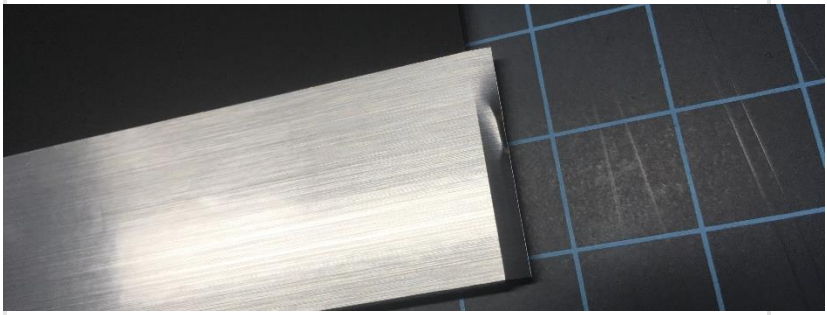
Connect the USB connection cable to the Programming port on the Arduino Due.



Attach the main circuit board to the case with 15mm M-F nylon standoffs.

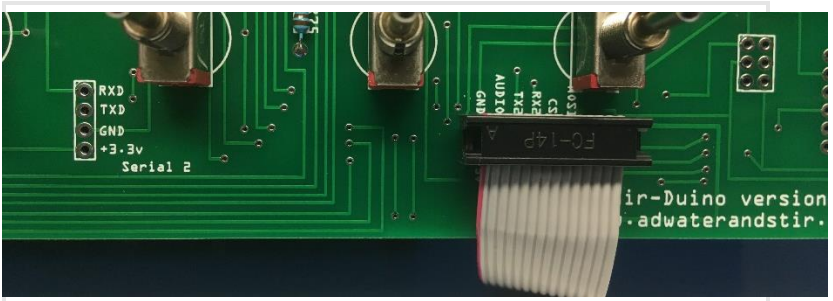
Apply the Altair 8800 sticker to the front panel. The adhesive is forgiving, so if you place it wrong, you can pull it up and put it in place again. Use a small Phillips screwdriver or awl to poke holes where the bolts will go.

Your label will be a little bit longer than the front panel.

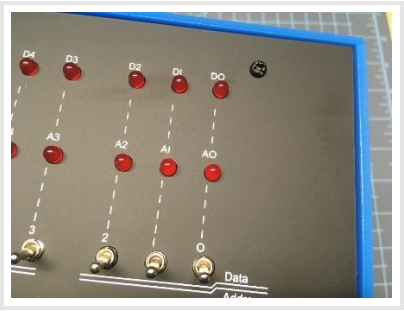


You may wrap the excess around the edge of the panel or trim it with a sharp razor.

Plug the fourteen pin IDC cable onto the front of the circuit board with the red stripe on the left.



Add the front panel to the main circuit board, push down around the toggle switches, and secure it with four nylon bolts.



CONGRATULATIONS! YOUR ALTAIR 8800 IS COMPLETE!

Depending on the age of your Arduino, you will probably want to update the software. You can find the instructions at adwaterandstir.com/install#update.

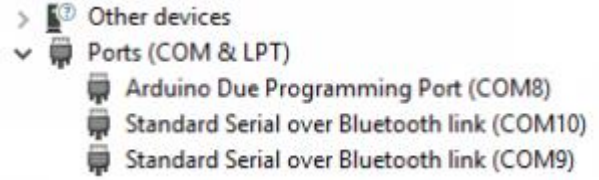
You should install the latest disk images and settings profiles to your SD card. You can download those from the link on this page: adwaterandstir.com /version-1-4-kit-upgrade.

See the web page www.adwaterandstir.com/operation for full documentation and easy step-by-step things to do.

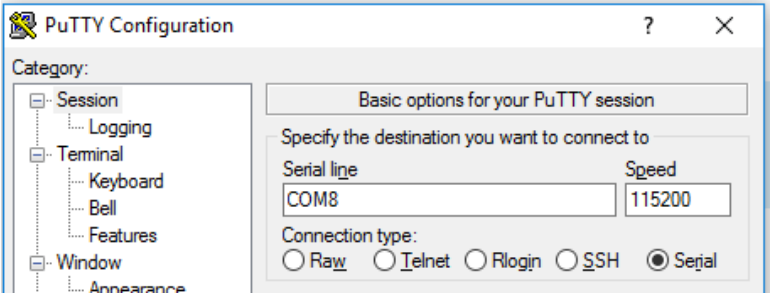
Here are a few easy things to try:

By default, your Altair-Duino is set up to communicate through the USB port.

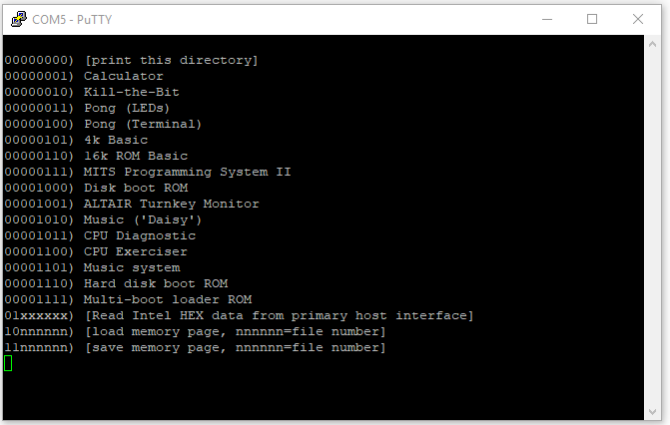
1. Plug USB cable into computer and the other end to your Altair-Duino.
2. Windows 10 should automatically recognize a new serial port. To check, launch "Device Manager".
3. Expand "Ports (COM & LPT)" in Device Manager



4. Your port should be identified as "Arduino Due Programming Port".
5. Launch PuTTY (or another terminal program if you choose.)
6. Connect to the indicated COM port at baud rate 115200.



7. The front panel lights will flash briefly while it connects.
8. With all switches down, press AUX1 down.
9. On the terminal, you should see a directory of options for front panel switches.



If you have a serial device (such as a dumb terminal):

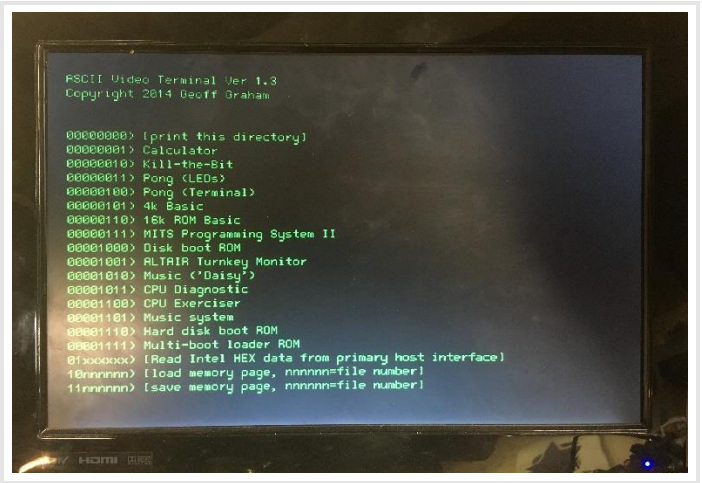
1. Plug a serial cable from the Altair-Duino to your serial device.
2. Connect a power supply to the Altair-Duino.
3. Set front panel data switches to "2" (switch 1 up, all other switches down).
4. Raise (and hold) DEPOSIT up.
5. Turn on Altair-Duino.

This will cause the Altair-Duino to load configuration 2 on power up. This configuration has been saved to communicate on serial port 2 at 9600 baud.

If you have Geoff Graham's VT-100 emulator on serial port 1 (using the I/O expansion board):

1. Plug a VGA monitor and PS2 keyboard into the Altair-Duino. Power on the monitor.
2. Connect a power supply to the Altair-Duino.
3. **Make sure the SD card is inserted.**
4. Set front panel data switches to "1" (switch 0 up, all other switches down).
5. Raise (and hold) DEPOSIT up.
6. Turn on Altair-Duino.

You should see "ASCII Video Terminal Version 1.3 Copyright 2013 Geoff Graham" on the VGA monitor. With all switches down, press AUX1 down. On the monitor, you should see a directory of options for front panel switches.



Please see the website (adwaterandstir.com) for many other examples and walk-throughs for common functions. Also visit the online forum to discuss the Altair-Duino with other enthusiasts, or to ask questions (adwaterandstir.com/forum).

USB Keyboard Compatibility:

Any standard wired USB keyboard should work, but you need to avoid using a keyboard with a USB hub. Some keyboards have built-in USB hubs and those will not work either. If your keyboard has one or more USB sockets on it (to connect a mouse for example), or is wireless, then it likely contains a USB hub and will not work. Also, back-lit keyboards most likely will not work. It is

best to use a "plain-Jane" wired USB keyboard.

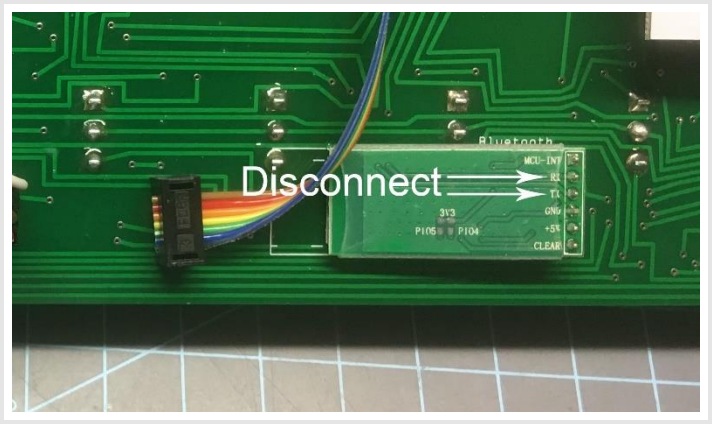
But I don't want to lose my Bluetooth!

You can keep your Blutooth module, but it will require you to flex your DIY muscles!

This procedure is completely optional and is only required if you want Bluetooth and the VT100 emulator.

You will need to disconnect the RX and TX pins from the main circuit board. It may be easier to completely desolder and remove the modules, clip (or desolder) the RX and TX pins, then resolder the Bluetooth module.

You can then connect the RX and TX pins directly to the Arduino.

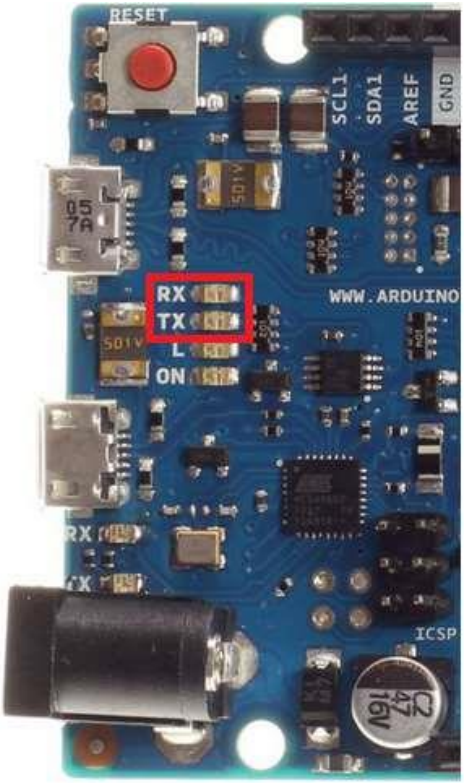


(These instructions are directly from David Hansel's documentation.)

This port is disabled by default since it uses two I/O pins that are not connected to headers on the Arduino Due: the pins controlling the RX and TX LEDs next to the Native USB port (framed in red in the image on the right). These pins are accessible as digital pins 72 (RX) and 73 (TX) on the Arduino Due. Despite their location next to the Native USB port they have no connection to the port and can be freely controlled by software. To add a serial interface using these pins do the following:

(Optional but recommended): remove the RX/TX LEDs. I did try leaving the LEDs in place and just soldered onto the LEDs themselves and serial communication did work. However, the LEDs go to +3.3V through a 1k resistor which could possibly interfere with the serial signals. Your mileage may vary.

Solder wires to the pads on the left side of the LEDs (the side closer to the "RX" and "TX" labels). These will be the RX and TX wires for the serial connection.



In file host_due.h, change

```
#define USE_SERIAL_ON_RXLTXL 0
```

to

```
#define USE_SERIAL_ON_RXLTXL 1
```

and upload the sketch to the Arduino.

Connect the RX LED to the TX pin on the Bluetooth module, and TX LED to the RX pin.