Widrow-Hoff ‘Adaline’ Demonstrator Design Instructions

This document is a complete set of design instructions to enable users to recreate the Widrow-Hoff ‘Adaline’ demonstrator device (as originally conceived by Bernard Widrow and Ted Hoff) in 1960.

The design is modernised using digital peripherals and an Arduino Uno microcontroller to make the design as inexpensive as possible (total cost is approximately $62) The aim of the project is to encourage educators to build their own devices to help explore the concept of the Least Mean Square algorithm and disseminate the concepts more widely perhaps among Schools and Colleges.

Here is a video demonstrating how to train the device once it has been constructed: https://youtu.be/PBz0Q8OuVuk

Here is a link to a video (from 2012) which inspired this project. It features Prof Bernard Widrow himself demonstrating his Adaline device Part 1: https://youtu.be/hc2Zj55j1zU and Part 2: https://youtu.be/skfNlwEbqck

Tools:

- Laser cutting machine (preferred but not essential)
- Hand drill
- Drill bits
- Small Philips screwdriver
- Small flat blade screwdriver
- Snipe nose pliers
- Blade
- Small file
- Safety glasses

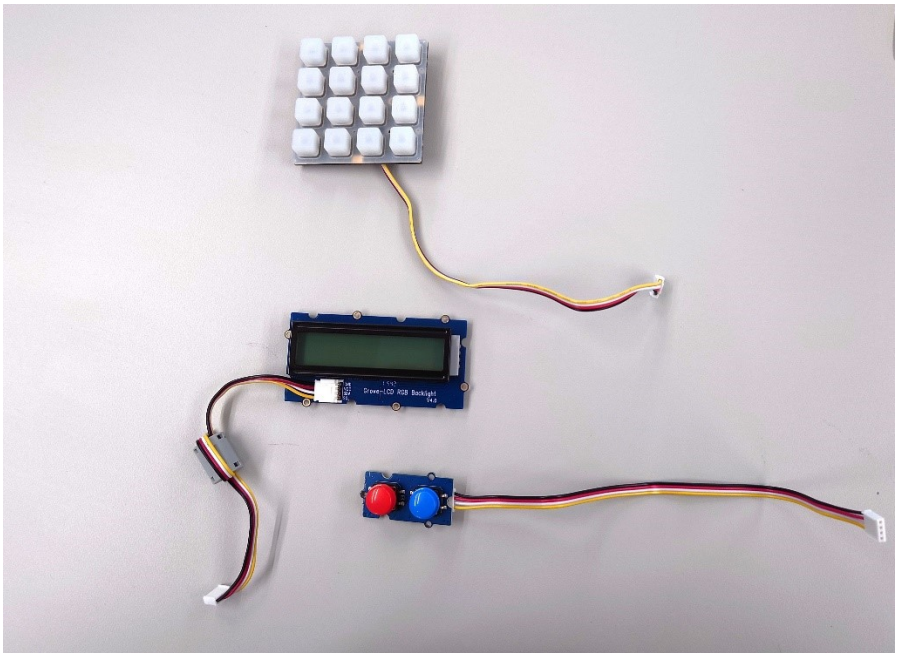
Components:

- ABS Enclosure https://www.ebay.co.uk/itm/195228858248?hash=item2d748bf788:g:twkAAOSwRGBZd5t3
- Acrylic Perspex sheet 3mm thick (.dxf design file download for top panel laser cutting)
- Arduino Uno (or clone equivalent)
- Seeed Studio Base Shield v2.1
- Grove - LCD RGB Backlight v4.0
- Grove - Dual Button v1.0
- Adafruit Neo Trellis 4x4
- 4x M2x10mm machine screw
- 4x M2x12mm machine screw
- 4x M2x16mm machine screw
- 4x M2x6mm spacer
- 3x M2x8mm spacer
- 11x M2 nut
- 4x M2 fibre/nylon washer
- 1x Momentary push button (panel mount)
- 4x M3x6mm nylon stand-off
- 4x M3 nylon nut
- 4x M3x10mm slotted screw

Build Instruction:

Begin by using the downloaded .dxf file to cut/engrave the top panel with laser cutting machine. The top panel dimensions are 226x148mm and we are using 3mm thick Perspex/Acrylic. If there is no access to a laser cutter, other materials may be used, such as wood, aluminium, or soft type acrylic (non-shatter) sheet. A hand drill and files may be used to cut and shape all the holes.

Next, we can populate the top panel with the Grove LCD RGB backlight, Adafruit Neo Trellis 4x4 Button matrix and the Grove Dual Button components shown below.

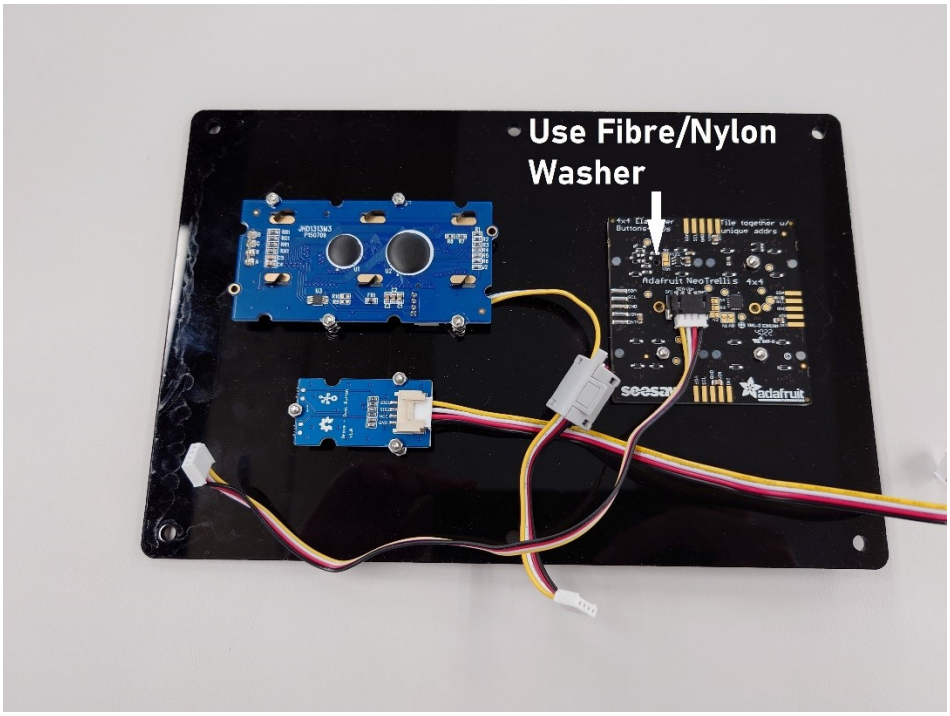


Using the M2x12mm machine screws, M2x6mm Spacers and M2 nuts (4 of each in total) mount the Grove LCD display into the panel.

Using the M2x10mm machine screws, M2 nut and fibre/nylon washers (4 of each in total) mount the Adafruit Neo Trellis 4x4 matrix into the panel.

Using the M2x16mm machine screws, M2x8mm spacers and M2 Nuts (3 of each in total) mount the Grove Dual button.

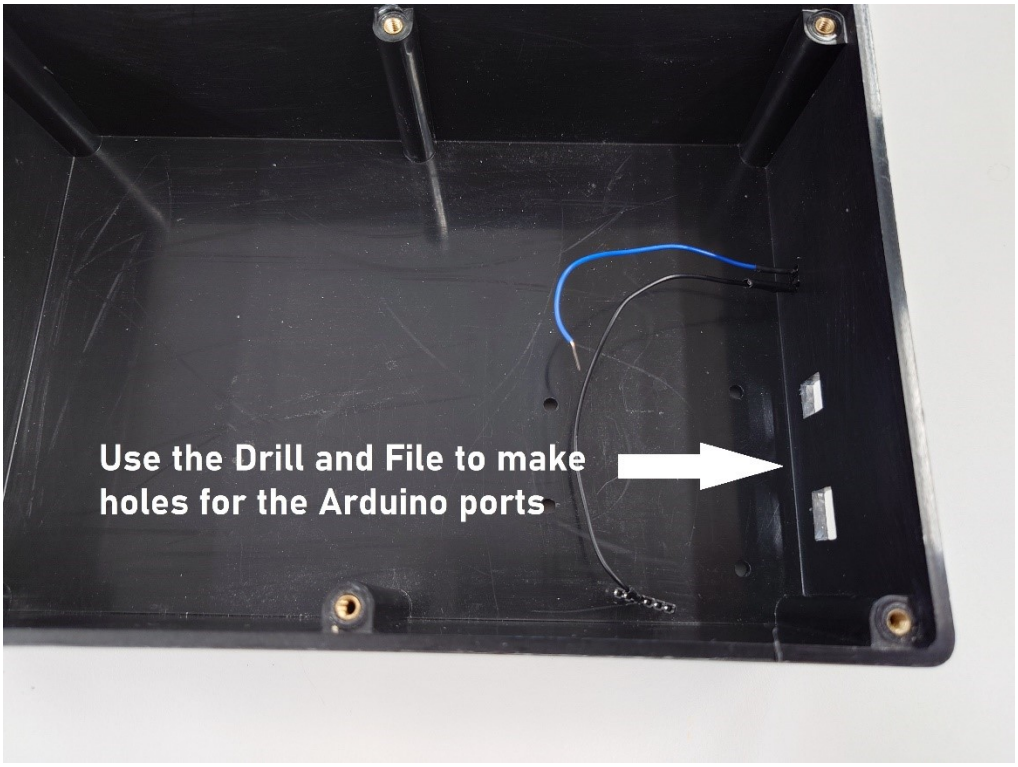
See front and rear view of complete populated top panel:



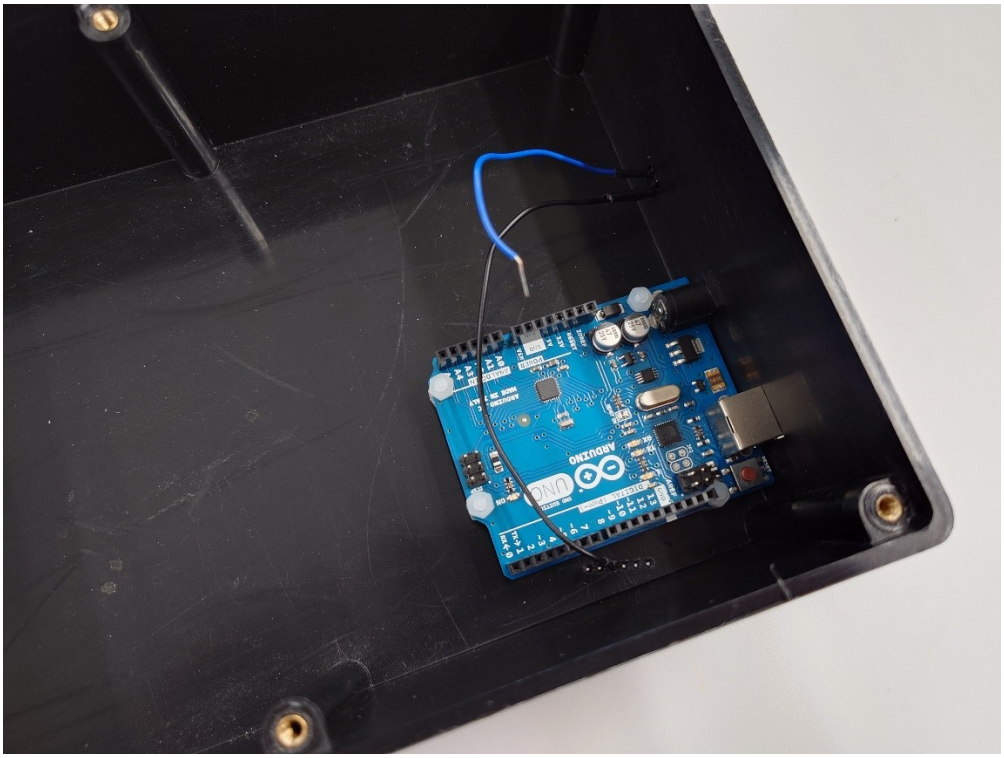
Mark out and drill 4x 3mm holes for mounting the Arduino in the ABS case.

Use the M3x6mm stand offs and M3 Nylon Nuts in the Arduino mounting holes.

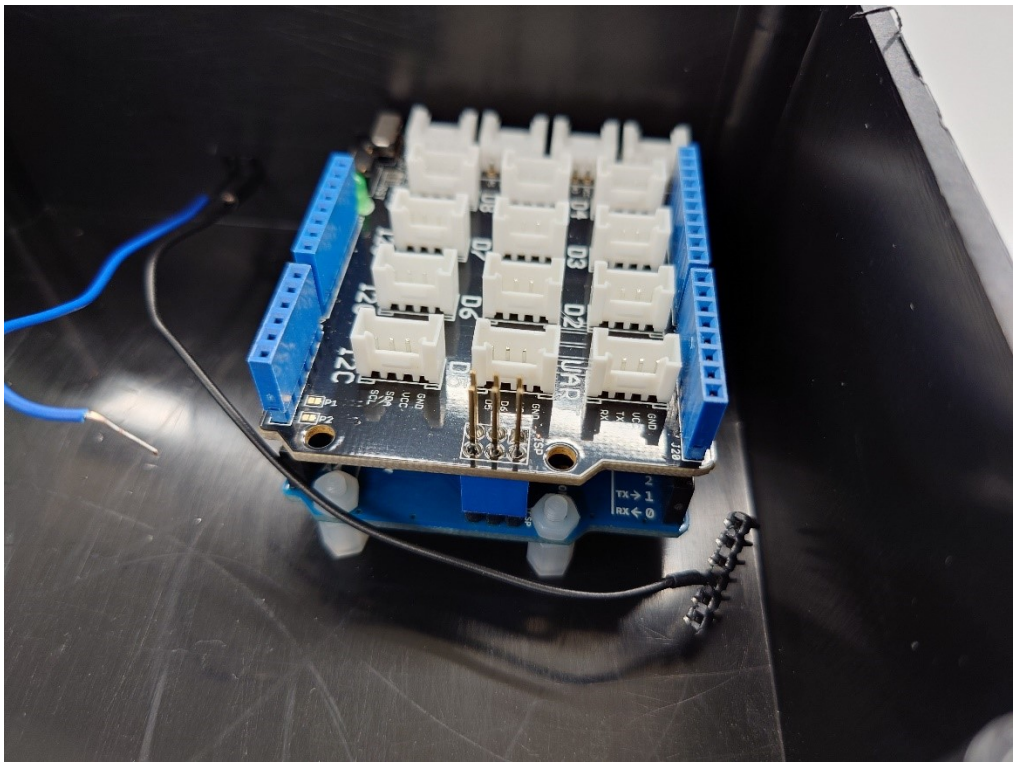
Use the Drill and File to make holes in the case for Arduino ports. In this example we have made ports for USB, DC power and Reset button but once the Arduino is programmed a DC socket and Reset is all that is required, and this can be mounted however you wish.



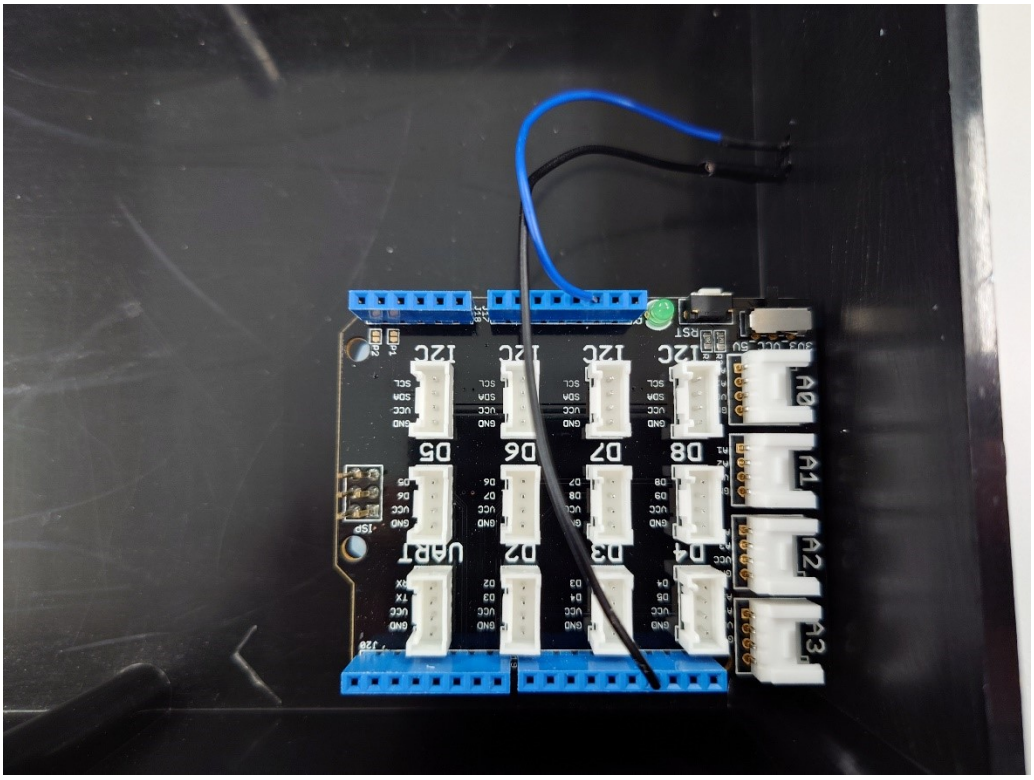
Mount the Arduino in the case using the M3x10mm slotted Screws



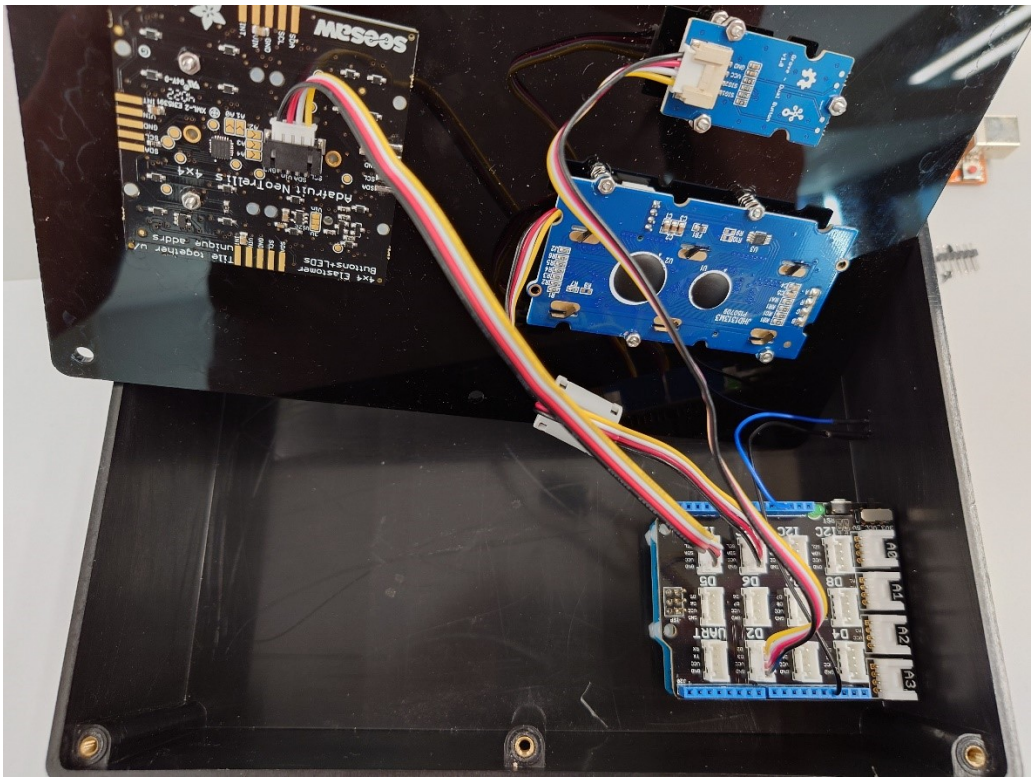
Connect the Base Shield to the Arduino



Connect the Reset button as shown.



Now connect the top panel components. The Neo Trellis 4x4 Matrix and Grove LCD display connects to any connector on the I2C bus. The grove Dual button connects to D2 connector.



Using the 6 screws that came with the ABS case, screw the top panel on.

Download the .ino code and program the Arduino Uno. Finally, power up the unit by your chosen method (we are using the USB port)

Now please refer to the document on how to train your Adaline here.