

myFocuserPro2

Let's make a L298N Minimal myFocuserPro2 Controller

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v1.09 (Jan 2018)

This document describes how to build a myFocuserPro2 L298N Minimal Focus Controller

Note: there may be slight differences in layout, parts and schematics show here compared to other documents. This is due to different revisions as the myFocuserPro has been developed over 4 years as well as different available options. It is unreasonable to expect the author to keep every single document up to date when a change is made. It is also unreasonable to assume that when looking at a specific schematic or PCB that it covers all available options. There are different schematics and PCB's for each option so please do not assume that one schematic or PCB will show all of these.

The documents reflect what was in use at the time of creation.

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1. You cannot sell kitsets or assembled units to others
2. You cannot copy the design and code and make your own version to sell to others, even if you make some code changes or change pin designations
2. You cannot use these designs and code ideas to make your own focuser and sell versions of those to others

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In other words, the author accepts no responsibility to damage caused to any equipment or goods or self by using the ideas, schematics and code associated with this project, or loss of income or all other losses that may be incurred.

IMPORTANT LINKS

[MAIN PDF WHICH YOU SHOULD READ FIRST!](#)

Part1a Working Out Your Hardware Requirements

https://youtu.be/J6vh_iS2JsE

Part1b Assembling your focuser

<https://youtu.be/aB0vM2evxEM>

Part1c Testing your focuser

https://youtu.be/Kye_BaU67Aw

Part1d Adjusting the stepper motor current of the myFocuserPro2 controller

<https://youtu.be/u2Z0dFaiiyM>

Part2a Get The Software

https://youtu.be/KwAxsUjq_i_o

Part2b Load ASCOM and Arduino IDE and Libraries

<https://youtu.be/m1BJGCBR-nU>

Part2c Programming the Firmware

<https://youtu.be/2f4X6omc2NI>

Part3a Initial setup of Focuser settings

https://youtu.be/mZmWG_vQ1uM

Part3b Overview of Focuser settings

<https://youtu.be/yuXUDxkdAgU>

Part3c Overview of Windows App Menu Options

https://youtu.be/jsq7kXDv3_Y

Part3d Overview of ASCOM Driver Settings

<https://youtu.be/Gh4dpqDFouQ>

Part3e Upgrading the Controller Firmware

<https://youtu.be/cSvOVw8Djsw>

Part3f Controlling more than one myFocuserPro2 controller

<https://youtu.be/sEvvWYNMCFs>

Part4 myFocuserPro2 Home Position Switch

<https://youtu.be/ADi2W0nsypl>

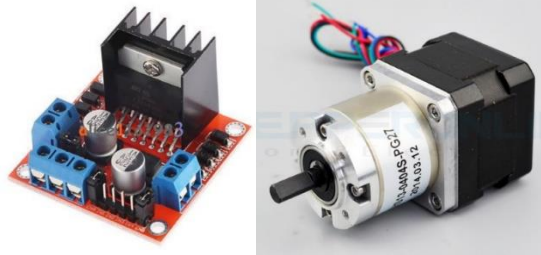
Part5a myFocuserPro2 Temperature Compensation

<https://youtu.be/YXRqP-V1fcM>

Part5b Understanding temperature compensation in myFocuserPro2

<https://youtu.be/ulEgBXL9Cks>

The L298N driver board supports Full and Half Steps (firmware v251 upwards), so is best used with a geared stepper motor such as the [Nema17-PG5](#) or [NEMA17-PG27](#) (recommended)



PARTS LIST

L293DMINI CORE COMPONENTS (M VERSION)	Quantity	Supplier	Cost
Arduino Header Pins 40, Breakable 2.54mm 1pc of 40 pins	1	Robothome	3.07
470uf 16V Electrolytic Capacitor (power on reset circuit)	1	runber2012	1.25
L293D Mini Driver Board	1	czb6721960	1.67
Nano v3 ATmega328P 1KB EEPROM 2KB SRAM	1	gowin_electronic	3.80
Ceramic Capacitor 0.33uf	1		
Ceramic Capacitor 0.1uf	1		
LM7808 Voltage Regulator TO-220 package	1	shieldsfans	1.15
LED Blue 3mm Blue 5V Pre-wired 20cm lead	1	colorfulplace	0.60
LED Green 3mm Blue 5V Pre-wired 20cm lead	1	colorfulplace	0.60
LED Bezel Holder 3mm	3	tayda2009	0.40
LED Red 3mm 12V Pre-wired 20cmm lead	1	bestshop2008hk	0.43
1N5408 3A Diode (or 1N5401) (Replaces 10A10)	1	shieldsfans	1.12
PTC resettable fuse 3A	1		
Buzzer Continuous 5V	1	moncss8	0.20
HER208 Diode	1		
1N4732A 4.7V Zener diode	1		
10K 1/4 Watt Resistor	1		
TEMPERATURE PROBE COMPONENTS (MT VERSION)	Quantity	Supplier	Cost
4.7KΩ Resistor 1/4 watt	1		0.10
Thermometer probe DS18B20	1	alice1101983	1.84
FULL COMPONENTS (F VERSION)	Quantity	Supplier	Cost
Green 12mm Mini Round Waterproof Lockless Momentary Push Button Switch (for PB switches)	1	chip_partner	1.68
Red 12mm Mini Round Waterproof Lockless Momentary Push Button Switch (for PB switches)	1	chip_partner	1.60
1.2KΩ resistor (for push buttons)	3		0.30
1MΩ resistor (for push buttons)	1		0.10
470KΩ resistor (for Home Position Switch)	1		0.10
LCD 1602 I2C Module	1	hkseller2014	2.98
LCD 1602 Module	1	seemmy	1.95
or replace LCD1602 with OLED I2C Display	1	huasharenmin2013	3.48
EXTERIOR COMPONENTS (NON PCB)	Quantity	Supplier	Cost
Stereo Female Jack 3.5mm Chassis Mount	1	Mouser Electronics	0.93
Stereo Plug Male 3.5mm	1	louisliu2009	0.99
TDK 5mm Clip On EMI RFI Filter Snap Around Ferrite	1	janeH2100	0.40
NEMA17-PG27 Stepper Motor	1	omc-onlinestepper	48.00

Flexible Shaft Coupler 6-6mm	1	forever-esoft	2.30
RS232 DB9 male connector	1	chipworld	0.30
RS232 DB9 female panel mount connector	1	chipworld	0.30
Power Socket Female Panel Mount 12V 2.5mm x 5mm	1	dailyappliance2010	0.99
Power Plug Male 2.5mm x 5.5mm x 14mm	1	dailyappliance2010	0.99
Toggle switch mini ON-OFF SPDT 3pin (power)	1	ymvon	0.32
Mini toggle ON OFF switch (power on reset circuit)	1	aushop	0.56
XH2.54-2P 24AWG Plug Connector 30CM (solder to Power Socket, Toggle ON/OFF switch and Mini Toggle switch)	3	superiorbuy2014	1.34
XH2.54-3P 24AWG Plug Connector 30CM (solder to 3p Audio socket)	1		1.09

WHAT YOU WILL NEED

Solder Iron

Solder

Cutting Hobby Knife/Scalpel

Magnifying Glass

Print outs of the schematic and layout

WHY USE A MINIMAL FOCUSER?

- control of the focuser is using a computer
- no requirement for temperature readings or temperature compensation
- no need to manually focus
- cheapest build option

RECOMMENDED STEPPER MOTORS

NEMA17-PG5 or NMEA17-PG27. The Nema17-PG27 provides the highest torque and the most number of steps per revolution and is suitable for very heavy imaging trains.

CONCERNED ABOUT STEPPER MOTOR SIZE AND WEIGHT



An alternative is the NMEA14 which is much lighter, but uses 0.9 degree step movement with 400 steps per revolution. Using microstepping, this gives 800 steps at half-stepping. This stepper is best used with the DRV8825 driver board.

This stepper motor is ideal for the majority of focusing solutions.

STRIPBOARD OR PCB?

- for DIY projects a stripboard is a good choice if you know how to solder, read circuits and have some trouble-shooting skills. Stripboards are NOT updated when new features are added.
- a PCB can look professional; less mistakes should be made; but costs more than a stripboard. Fritzing PCB's can be ordered online. PCB's contain the latest features and are updated when new features are added.

The stripboard is the easier to make. However, the PCB gives a nice clean layout and minimizes mistakes and has the latest features.

AISLER PCB L298N-M-MT-F-BT

The PCB can be ordered online at

<https://aisler.net/p/QWESFIOS>

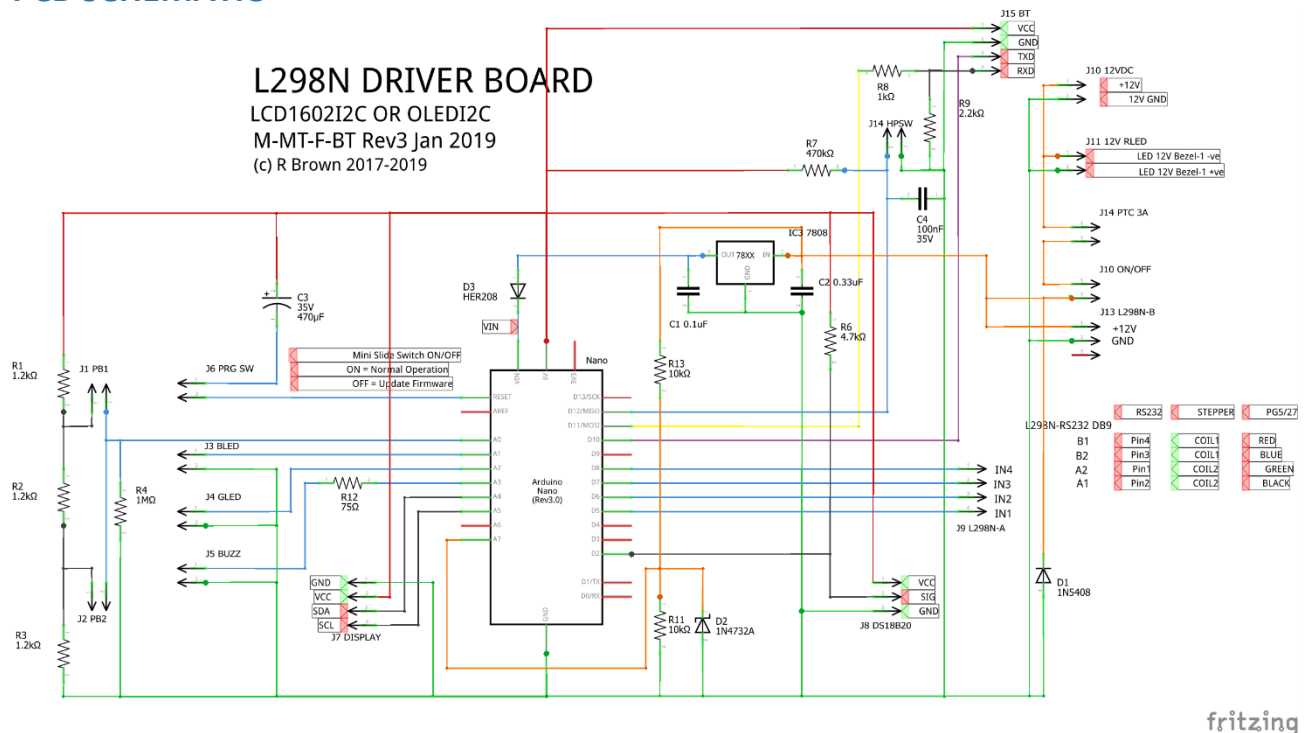
https://aisler.net/brown_rb/my-project-repository/myfocuser-l298n-mmtfbt

The PCB is high quality and all component placements are clearly marked. A PCB can be built and working in a couple of hours. It is a simple matter of soldering the components to the PCB.

Please watch this video on youtube to see how easy this is.

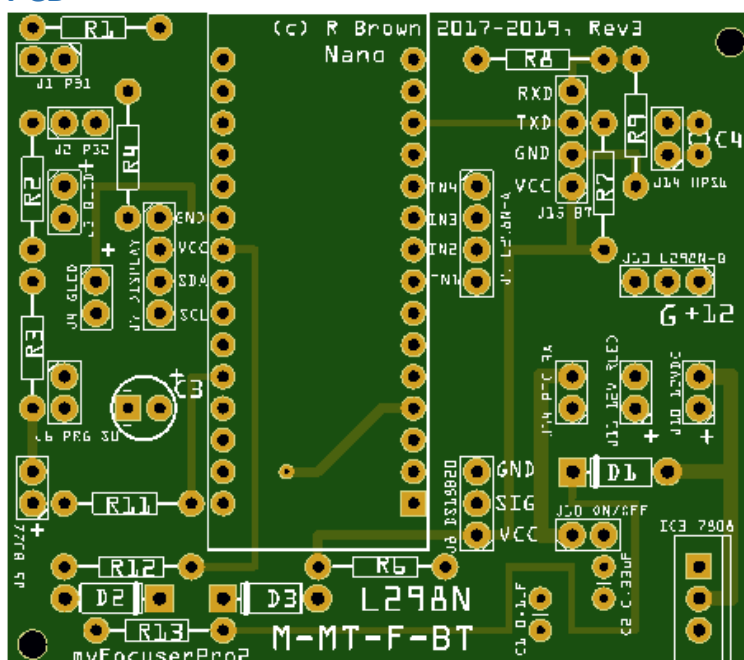
<https://www.youtube.com/watch?v=aB0vM2evxEM>

PCB SCHEMATIC



fritzing

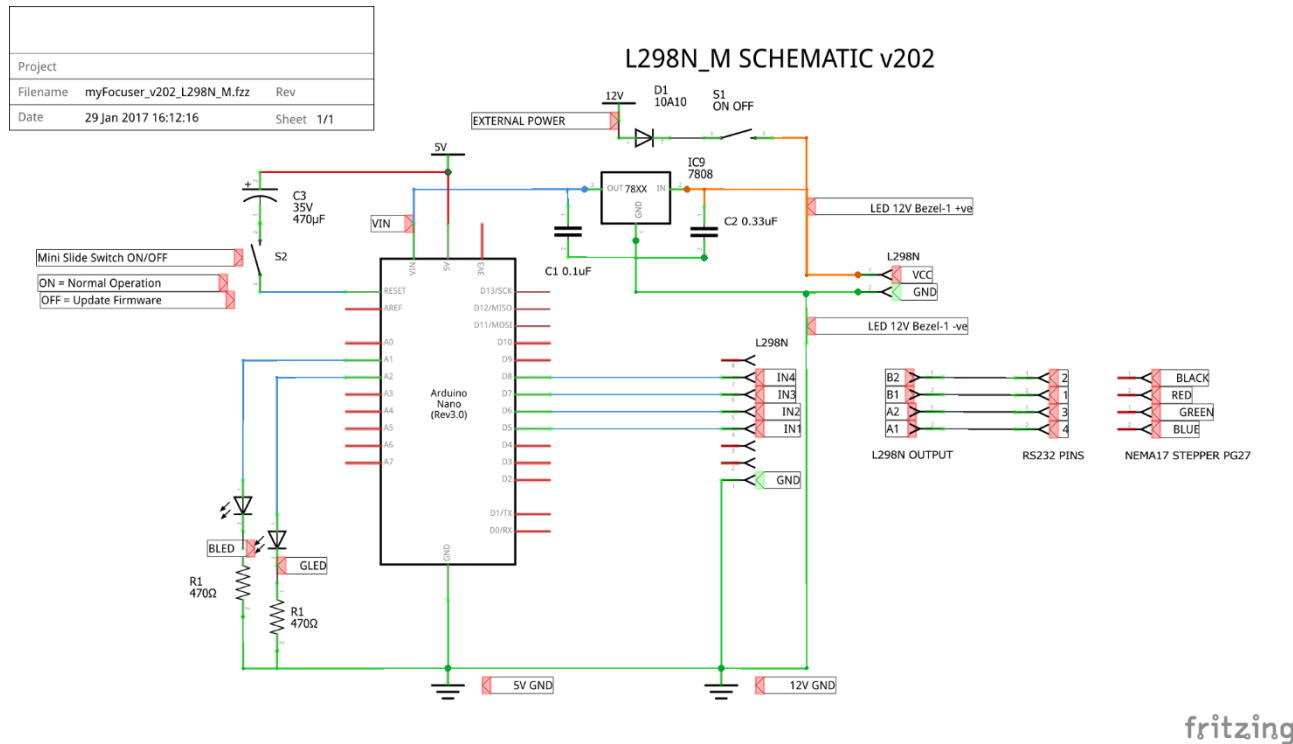
PCB



DIY STRIPBOARD L298N MINIMAL

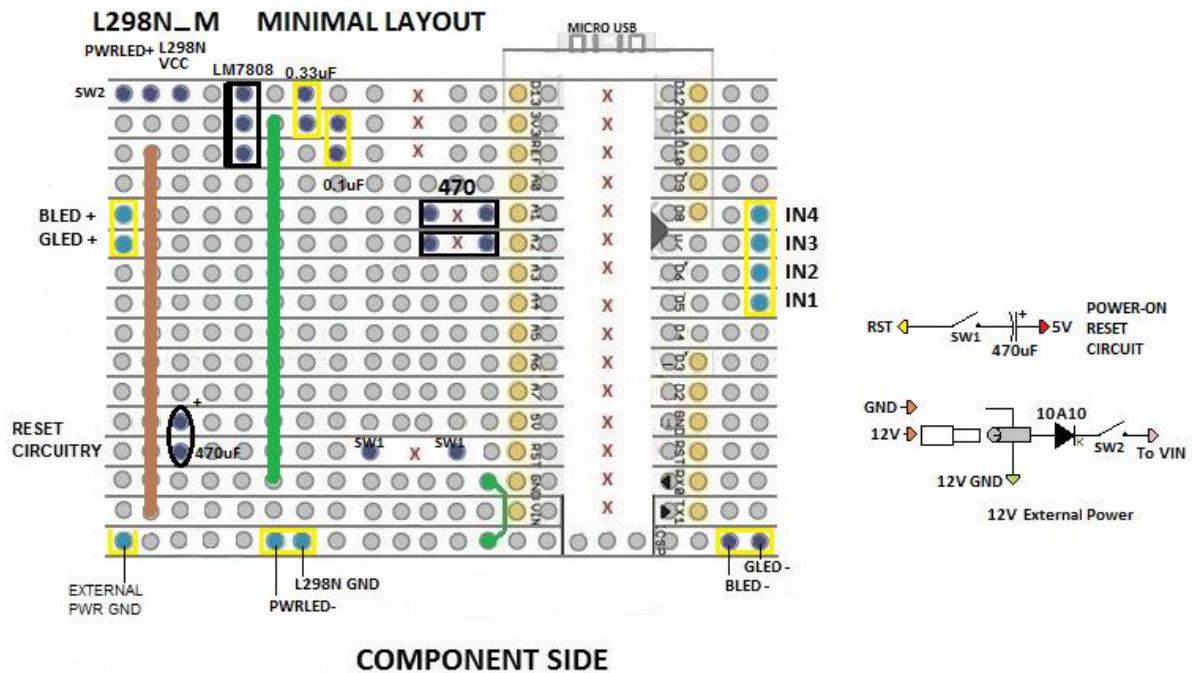
Stripboards do not get updated when new features are added. But they do provide a good low-cost solution for a budget DIY controller. Assembly time is considerably longer than a PCB solution, typically taking several days to complete.

STRIPBOARD SCHEMATIC



DIY STRIPBOARD LAYOUT

The stripboard layout looking from the top component side is as follows. The red X indicates the copper track must be cut. We are looking **down** onto the board and looking through it to see the tracks underneath.



It is best to work in a designated order. A suggested order is

1. Cut the tracks on the underside of the board
2. Install and solder all the required links first (shown above as green and brown)
3. Install and solder all resistors and capacitors and diode
4. Install and solder all the Header Pins
5. Install and solder the 15P headers for the Nano
6. Wire up the ON/OFF switch and connect it to the stripboard
7. Wire up the Power on reset circuit and switch and connect it to the stripboard
8. Solder the LM7808 voltage regulator on the stripboard (ensure it is the right way round)
9. Install and solder wires from the L298N PWR and GND leads to the stripboard
10. Wire and solder the LED's to the stripboard
11. Wire and solder the Buzzer to the stripboard
12. Insert the Nano carefully into the 15p headers (ensure it is the right way round)
13. Move onto testing

FIRMWARE FILE TO USE

_L298N

STEPPER MOTOR CONNECTIONS

The L298N driver board has four outputs for driving a bipolar stepper motor.

Connect wires from Stripboard to the L298N driver board

Stripboard	L298N Driver Board Input
D5-IN1	IN1
D6-IN2	IN2
D7-IN3	IN3
D8-IN4	IN4

Note: Easy to use a 4P 2.54mm female to female header cable



Connect wires from the L298N driver board to the RS232 female connector

L298N Driver Board	RS232 Female Connector
A1	4
A2	3
B1	1
B2	2

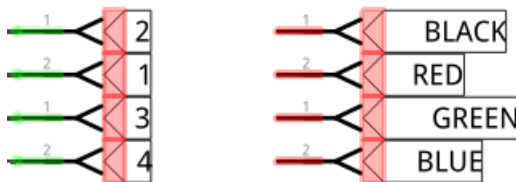


L298N OUTPUT

RS232 PINS

Connect wires from NEMA17-PG27 to RS232 male connector

NEMA17-PG27	RS232 Male Connector
BLACK	2
RED	1
GREEN	3
BLUE	4

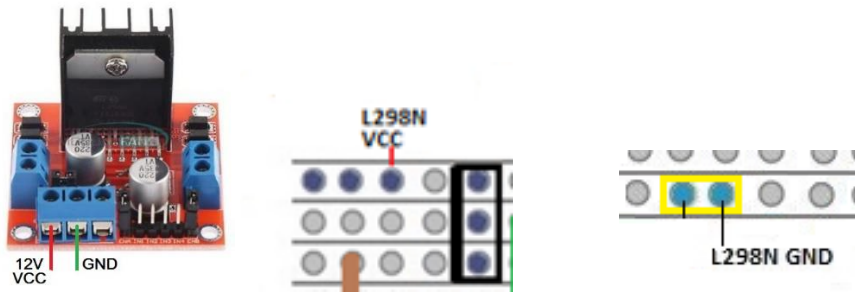


RS232 PINS

NEMA17 STEPPER PG27

Connect the GND of the L298N driver board to the Arduino GND on the stripboard

Connect the 12V PWR INOUT of the L298N driver board to the Arduino 12V power on the stripboard



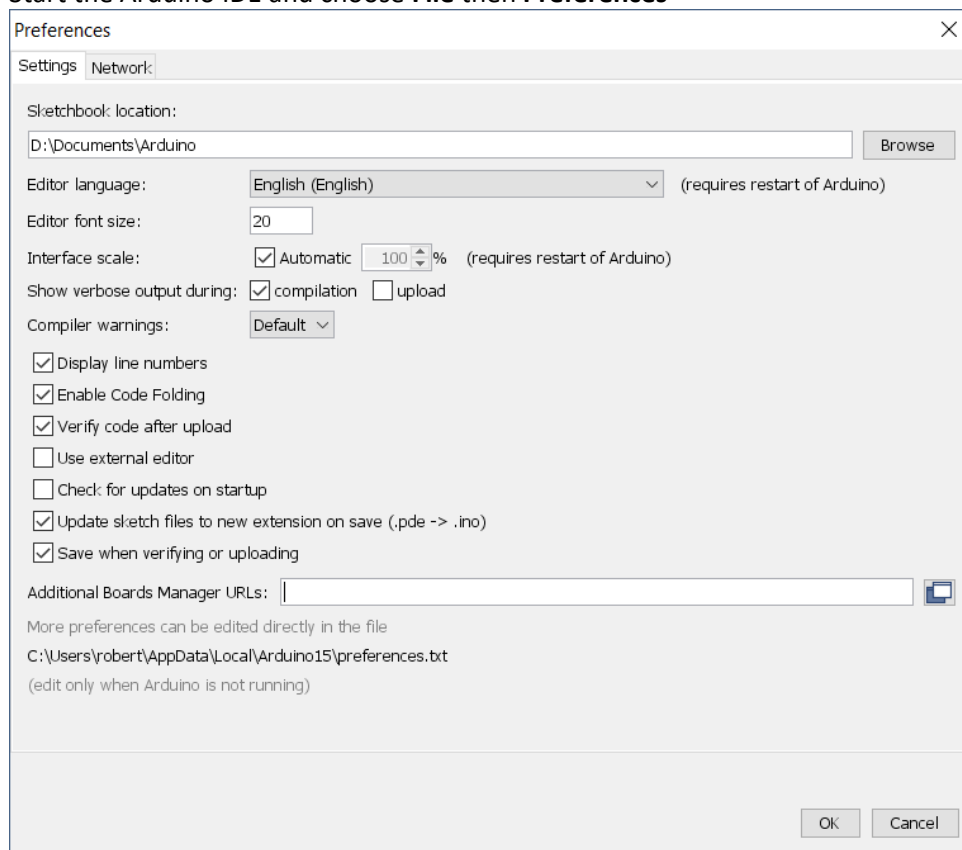
Mount the stripboard, power socket, ON/OFF switch, Power on reset switch, RS232 female connector and LED's to a case.

DOWNLOAD AND INSTALL THE ARDUINO IDE

I recommend v1.6.8 which is [here](#). Run the installer and remember to install the drivers for the Arduino at installation of the IDE.

CONFIGURE ARDUINO IDE

Start the Arduino IDE and choose **File** then **Preferences**



The important things are

- Display Line Numbers
- Save when verifying or uploading
- Show verbose output during Compilation

Set these settings as indicated then click OK. You will need to close and then restart the Arduino IDE application for these settings to take effect.

DOWNLOAD THE LATEST FIRMWARE FOR MYFOCUSER PRO

<https://sourceforge.net/projects/arduinoascomfocuserpro2diy/files/CODE%20ARDUINO%20FIRMWARE/>

UNZIP the file and you will end up with the firmware folders, a test folder containing the test programs, and a libraries folder holding the required libraries. Follow the instructions in that folder for installing the libraries.


HOW TO TEST THE BOARD

One step at a time!!

If you have successfully powered the board and there is no smoke, congratulations.

Connect the controller to the computer using a USB cable


If ambitious, you can navigate to the Focuserv2xx_L298N folder and double click on the Focuserv2xx_L298N.ino file. This will start the Arduino IDE and load the focuser code into the IDE.

1. Select the Board type by selecting from the menu bar, **Tools** then **Board** then **Arduino Nano**
2. Select the correct COM Port by selecting from the menu bar, **Tools** then **Port** then the com port associated with the Nano board
3. To test compile the code, click on 
4. You will see a lot of messages in the bottom window of the IDE
5. If successful you will see a **Done compiling** message as well as

Sketch uses 15,844 bytes (51%) of program storage space. Maximum is 30,720 bytes.

Global variables use 559 bytes (27%) of dynamic memory, leaving 1,489 bytes for local variables. Maximum is 2,048 bytes.

This means there was no errors. If there are errors they will be displayed and please do not hesitate to ask for help in finding out what those errors are and their cause by posting a message on the site or emailing me direct.

6. If you have a successful compilation then you can attempt to program the controller by clicking on the  button. This will compile the code and send it to the Nano controller.
7. When the upload to the controller is complete, you will see the message **Done Uploading**
8. If you get this message **Problem Uploading to Board** then you have selected the wrong comport
9. If you get this message **Uploading** and is displayed for a long time (minutes) then you have selected the wrong board type. Uploading should take less than 60s. Eventually the upload will time out and you will get a **Problem Uploading to Board** message

If the upload is successful, the controller will reboot at the end of the upload.

1. For this, it is not necessary to have the stepper motor connected and not necessary to have 9V external power.
2. Start the Windows Application and connect to the controller.
3. Take time to get familiar with the various options and settings of the Windows application.

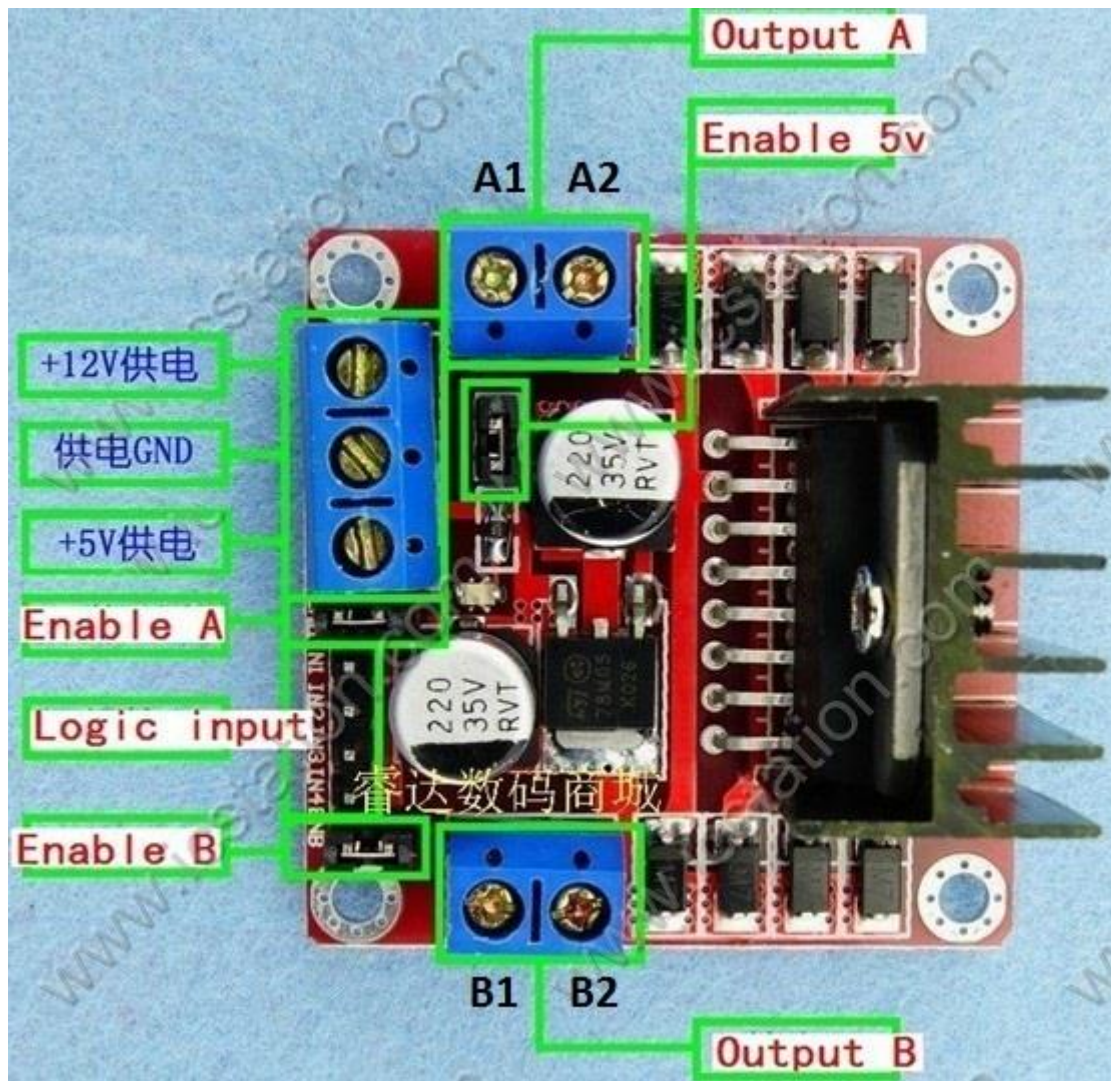
The last step involves the stepper motor. Please read the [FAQ](#) before continuing.

1. Make sure the Power ON Reset Circuit is disabled
2. Connect the stepper motor as per instructions
3. Connect the external 9V power supply but leave the switch off
4. Turn the switch ON
5. The Nano should now be powered from the external 9V supply
6. If the Nano does not power up there is an issue and you will need to check all the 9V external wiring, ON/OFF switch before continuing. I can provide further instructions on how to do this but will involve the use of a multi-meter
7. If the Nano is powered, then connect the Nano to the computer using the USB cable
8. Now start the Windows Application and Connect to the correct COM PORT at 9600bps.
9. When connecting, you should see the Nano reboot (the buzzer should give a brief beep and both LEDs should briefly come ON). If it does not, disable the Power ON Reset Circuit before continuing
10. Once connected the Windows application should display the current settings and Ready message in the Status bar
11. Now attempt a move by clicking on +100 or -100
12. If the motor moves – Success

And that is about it. Now you can think about

1. Reconnect the Power On reset circuit
2. Put everything in a case
3. Mount the stepper motor on your focuser

Now go back to the main PDF and read all about CFZ and READ the section on the initial setup of your focuser.



Note: DO NOT WIRE THE +5V OF THE L298N DRIVER BOARD TO THE ARDUINO NANO +5V

Note: THE GND OF THE L298N BOARD MUST BE CONNECTED TO THE EXTERNAL BATTERY GND AS WELL AS THE GND OF THE ARDUINO NANO