

Minos
Turntable
Motor Speed
Controller /
Tachometer

1	Product Overview	3
2	Installing and connecting the controller.....	3
2.1	Safety	3
2.2	Overview.....	4
2.2.1	Setting the input voltage v3.7 or later PCB	4
2.2.2	Connecting the FFC ribbon cables.....	5
2.2.3	Red/Geen LED square switch mounting method.....	5
2.2.4	Power Switch sequence.....	6
2.2.5	Basic installation overview – LP12	7
2.2.6	Configuration menu and tuning software	10
2.2.7	Setup Menu - item entry	11
2.2.8	Final installation note.....	11
3	Configuration menus and parameters	12
3.1.1	Setup Menu - item entry	12
3.1.2	System Parameters	12
3.1.3	Motor Parameters	14
3.1.4	Write to eeprom	14
3.1.5	Motor ON/OFF	15
4	Upgrade to Zeus.....	16
5	Appendix – Drivers/MAC.....	16
5.1	Windows Users	16
5.2	Mac Users	17
6	Specifications.....	19
7	Manufacturer Details	20

1 Product Overview

The Minos motor controller is a sub assembly intended for incorporation into an audio HiFi turntable to provide necessary drive signals to the originally installed turntable 24 pole AC 115v synchronous motor. The Minos provides two independent AC signals for each phase of the AC synchronous motor. The following parameters may be adjusted using configuration values defined and stored in the on-board microprocessor: phase drive voltage, frequency and phase delay. Adjustable values mean the user may adjust the parameters to achieve minimum motor vibration and noise in their turntable which is highly desirable.

The Minos may be upgraded to a Zeus in future. The Zeus microprocessor also incorporates a Proportional, integral and Derivative (PID) control algorithm. By utilising an optical sensor to read the turntable platter rotation speed and using the PID algorithm adjustment of the AC signals fed to the motor is possible. The feedback loop created by the sensor and PID result in accurate speed control and low WOW values and compensate for turntable wear and tear, also stylus drag. In addition, the Zeus is supplied with an OLED display for rpm readouts.

2 Installing and connecting the controller

2.1 Safety



WARNING: The Minos motor controller **MUST** be installed inside a turntable plinth that does not allow any physical contact with the Minos printed circuit board. Hazardous voltages exist on the printed circuit board that may result in injury or death. If in doubt consult your dealer who will be happy to install the controller board for you.



WARNING: Only ever connect a Laptop/PC USB connection via USB cable routed out of your turntable plinth – do not operate the board with the plinth baseboard removed as hazardous voltages exist within the Minos board.



INFORMATION: It is usual for the heatsinks/PCB to get hot during normal operation typically 70-80 degrees centigrade.

2.2 Overview

The Minos board may be mounted inside the LP12 turntable on a Linn (or compatible) cross brace. The minimum connections are mains power and motor wiring and on-33-45-off switch.

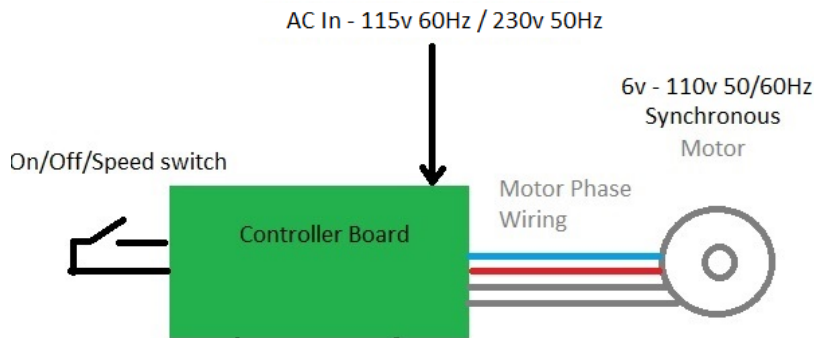


Figure 1 - Pictorial wiring for a 2 phase synchronous motor

The on/off/speed switch is a standby switch and does not isolate the PCB from the mains supply. The board may be configured to go into a low power sleep state after a period of inactivity. The default sleep timer is 60 minutes.

2.2.1 Setting the input voltage v3.7 or later PCB

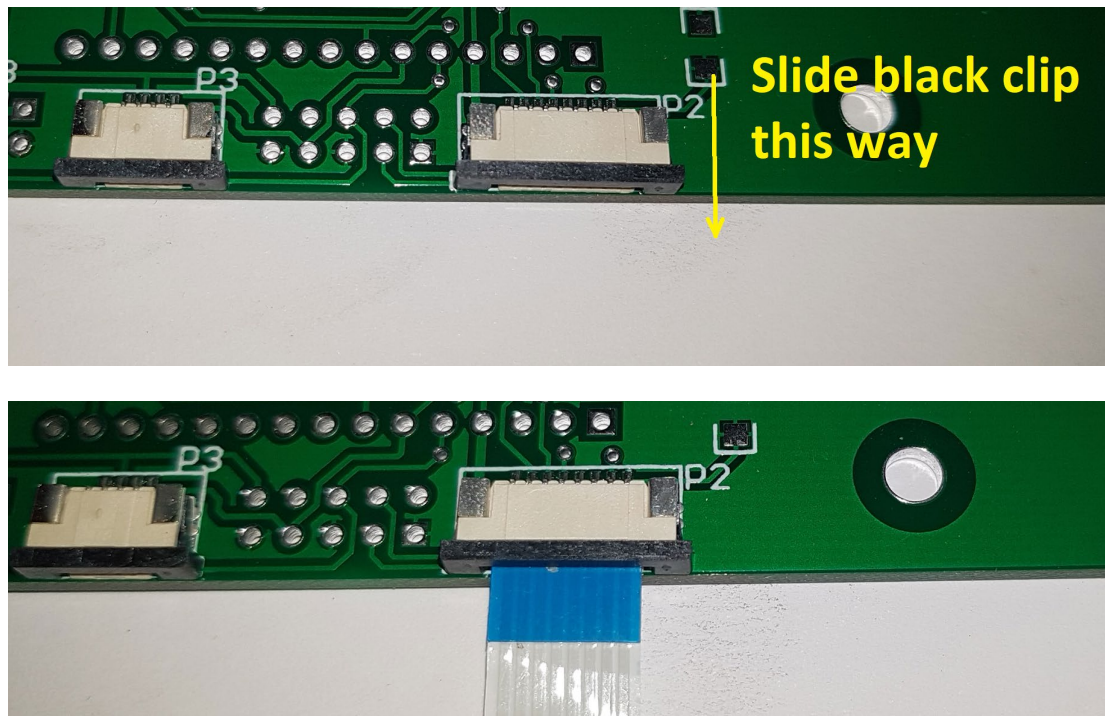
Important: Before installing the Minos check that the input voltage selector link is in the correct position for your region. Make the wire link on J3 for 115v operation. DO NOT CONNECT YOUR SUPPLY TO J3:



The Live input is the left-top terminal on the J1 mains block. The Neutral is the left-bottom terminal.

2.2.2 Connecting the FFC ribbon cables

Slide the black retaining clip forward about 1.5mm away from the connector – this will release the latch. When connecting the cable back the contacts face towards the PCB. Slide the blue tab in and push the black retaining latch back so it clicks into place. This will lock the FFC cable in place. When inserting the FFC cables the contacts on the FFC cables always face the PCB.



2.2.3 Red/Geen LED square switch mounting method

Remove the existing Valhalla/Other switch from your top plate. The square Linn style RED/GREEN LED switch has four plastic barbs to lock behind the top plate. Simply angle the switch into the square hole and push into place as per the sequence in the pictures below:



2.2.4 Power Switch sequence

Either the OLED or the square Linn Style Red/Green led switch work the same way. In standard Zeus switch action mode (default):

1. Press the power switch briefly for around 0.5 second to switch on to 33. The OLED indicates 33 or red LED illuminates.
2. To change speed up to 45 from 33 hold the power switch for >4 seconds until the OLED speed badge or green LED flashes – release the button. The same action switches down from 45 to 33 – the green LED is extinguished. Speed changed may be repeated as desired.
3. To switch off, hold the button for slightly longer than 1 second but less than 3 seconds. The speed badge or both LEDs go off.

Note that you need to wait around 5 seconds between the steps above for the speed change to stabilise before making a further speed/off selection. You can find a YouTube video of the Zeus/Minos switch action to help you get the timing.

Alternatively, if you are used to the way the Lingo/Axis switching works you can change to this by setting the “Use Lingo/Axis switch action” setting to Y in the System Parameters. (See section 3.1.2). This is not as flexible as the default Zeus switch action as you can only go 33-off or 33->45-off but some users may find it more familiar when transitioning from either a Lingo or an Axis.

2.2.5 USA/60Hz region motor variations

Over the years Linn have shipped a variety of motor configurations and solutions to the USA/60Hz markets. Extra steps will be needed to identify which kind of motor/pulley you have. During the installation of the Minos, inspect your motor identification plate (on rear of motor) and take a note of the frequency specification. It will be either 50Hz or 60Hz.

For 50Hz supply countries e.g. UK, Europe, Australia you will have a 50Hz motor. Your Minos is set by default for a 50Hz motor.

For 60Hz supply countries e.g. USA:

If you have been using a Lingo or later Valhalla and your motor says 50Hz then you have a UK/50Hz motor (even though you may be in USA or another 60Hz supply country). Your Minos is set by default for a 50Hz motor.

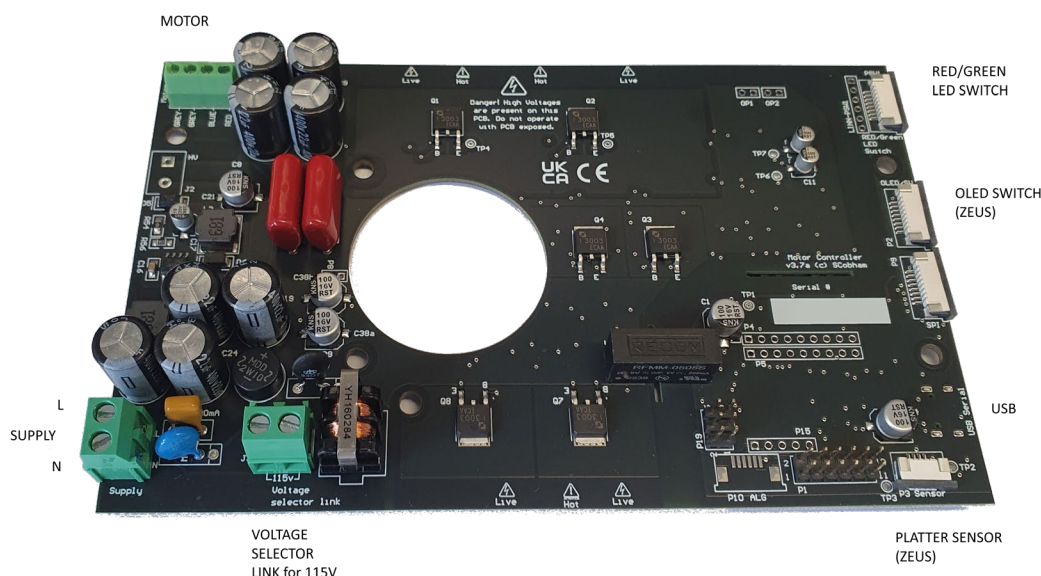
If your motor has 50Hz written on the label and you have not been using a Lingo or Valhalla, then you will have a small pulley fitted. You will need to set the Minos up to output 60Hz and 81Hz for 33 and 45 rpm respectively. Details of how to do this can be found later in the manual in Section 3 Configuration menus and parameters.

If you have difficulty identifying the motor it can be determined by trial and error.

If after initial setup, if the Minos only manages to achieve 27-28 rpm then it's likely you have a 60 Hz motor or small pulley.

If you Minos runs slow with either 50Hz or 60Hz/small pulley settings, then check you have wired up the motor correctly and all four wires are connected securely. If you are still experiencing issues, please contact us for support.

2.2.6 Basic installation overview – LP12



1. Remove the turntable power cord from the mains supply, inner & outer platter, arm counterweight and secure your tonearm with its retaining clip or use masking tape to secure. To prevent oil leaking out the bearing, ensure you tape over the top of bearing or use a bung
2. Remove the platter base board.
3. Mount the Linn internal cross-brace using plastic stand-off clips. The Linn bearing should be central in the large circular cut out on the Minos PCB.
4. Connect the motor to the controller board using the Motor connector block. The board has legends that should match RED, BLUE and GREY standard motor colours. If your platter runs backwards the colour coding on your motor does not match the Linn/Airpax standard so reverse the BLUE & RED wires.
5. Remove the existing square LINN switch and replace with the new Minos rectangular switch/PCB assembly.
6. Connect the mains supply cord to the Minos to the power terminals and check that the right supply voltage is selected on J3. The mains/supply cord earth should be connected (already) to the Linn cross brace or other metal parts of the plinth. Do not disconnect the mains safety earth from the plinth chassis. If necessary, dress any spare earth connection so it cannot touch the Minos PCB accidentally.
7. Connect the supplied USB cable to the board Serial connector and route outside the plinth using the mains power cable cut-out. The final cabling should look like the picture below:

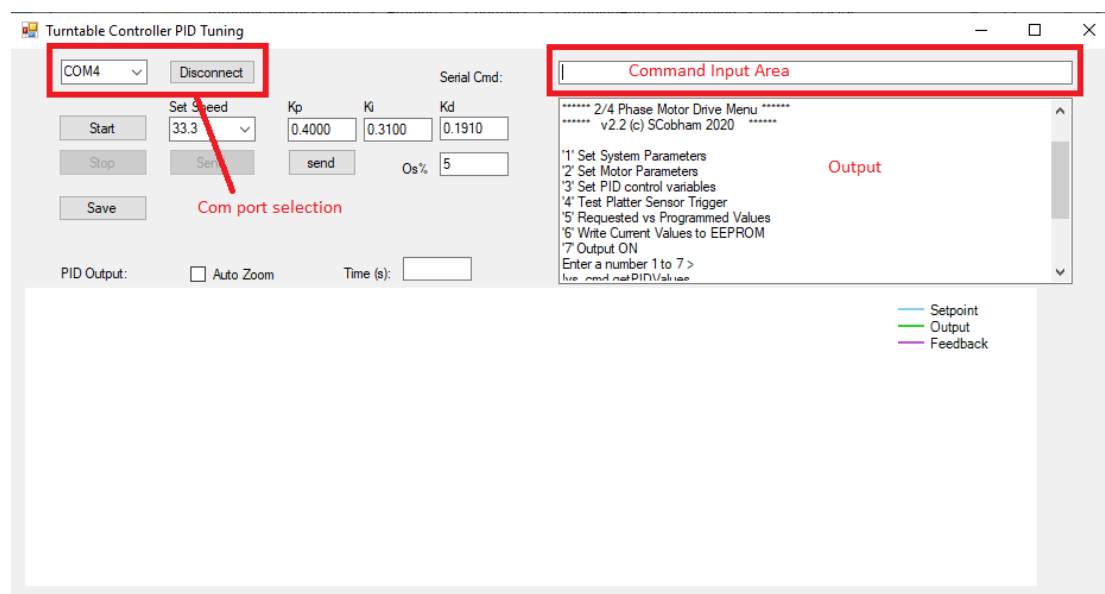


8. Replace the platter base board.
9. Connect the turntable to the mains supply.
10. Switch on depress the start switch briefly < 0.5 second. The platter should turn now at 33.3 rpm. If all is fine test 45 rpm by depressing the switch until the LED flashes. (Approx. 3 seconds). You can switch back to 33.3 by depressing the switch until the LED flashes.
11. To switch off, depress the switch for approx. 1 second. (After being idle the Minos will go into a low power sleep mode).

2.2.7 Configuration menu and tuning software

The motor controller is pre-configured with a set of defaults that assume you are using a 110v synchronous 2 phase motor.

To configure the board for basic testing use the Controller Setup (PIDTuning) application (or a serial console application set to 9600,N,8,1). Interaction with the controller firmware is via the serial command input and output area:



A configuration menu should be displayed upon initial connection. You can always get the menu to print by inputting the “M” character (not case sensitive) in the Serial Cmd: Input area and pressing Enter/Return (CR) when not in a sub-menu. Any values that you input will remain in place until power is removed unless you use the Write Current Values to EEPROM option. On controller power up the EEPROM saved configuration values are read back and used.

Your Anti-Virus (AV) program may block the ControllerSetup.exe (PIDTuning.exe) program or show a warning – this is normal as the program is not digitally signed. You may need to create an exception in your AV software.

The Controller Setup app is only available on Windows. Although this program makes it easier to change the board parameters, a standard serial console application may be used on other platforms (e.g. Mac/Linux) for board configuration. Mac users may need to install drivers to interface correctly with the Minos – consult section 5

A full list of all the menu options and the default values has been provided later in this section.

2.2.8 Setup Menu - item entry

When in each of the menu items you will be asked to respond to a question. For example: “Enter 33.3 rpm frequency, Hz: (45 – 65): 50.0”. The question will be followed by the units, the range of acceptable values in between the brackets (45 - 65), and finally the current value: 50.0. Either provide a new value within the range specified or press the Return key (CR) to accept the current value. The section questions will repeat until the Q key is pressed. The Q key can be pressed at any time, not just at the end of a section to exit the current setup menu. You must be back at the main menu to save any settings to the EEPROM.

2.2.9 Final installation note

Congratulations you have installed the controller. There are many configuration options and items in the controller that you can tweak and adjust to your specific turntable. Please feel free to read through section 3 for a full explanation of all of the parameters. You may find that through experimentation of the motor drive voltages and slight adjustment of phase angles you can significantly reduce motor vibration and hence audible noise. Some of the parameters require a re-boot of the controller to take effect – remember to write to the EEPROM before a re-boot otherwise changes will be lost. Each time you connect to the controller using the Controller Setup (PIDTuning) application or a serial console utility the controller will re-boot.

Further instructional videos can be found on our YouTube channel.

3 Configuration menus and parameters

3.1.1 Setup Menu - item entry

When in each of the menu items you will be asked to respond to a question. For example: “Enter 33.3 rpm frequency, Hz: (45 – 65): 50.0”. The question will be followed by the units, the range of acceptable values in between the brackets (45 - 65), and finally the current value: 50.0. Either provide a new value within the range specified or press the Return key (CR) to accept the current value. The section questions will repeat until the Q key is pressed. The Q key can be pre pressed at any time, not just at the end of a section to exit the current setup menu. You must be back at the main menu to save any settings to the EEPROM.

3.1.2 System Parameters

Configuration items in this menu relate to general behaviour of the overall controller. If you live in the UK and are using a 110v synchronous motor, then the default values should work fine. Worldwide users on 60Hz motors without smaller Linn pulleys may need to set the 33.3 & 45 rpm frequencies as follows 33.3 would be 60Hz and 45 would be 81Hz.

Parameter / Description	Units	Range	Default value
Enter 33.3 rpm frequency, Hz: The frequency that needs to be supplied to the motor to achieve 33.3 rpm rotation	Hz	30-65	50
Enter 45 rpm frequency, Hz: The frequency that needs to be supplied to the motor to achieve 45 rpm rotation	Hz	65-90	67.5
Soft start frequency delta, Hz: The difference from the 33.3 rpm starting frequency when first powered on.	Hz	0-30	10
How many phases on motor: The number of windings on the motor you are controlling. Most synchronous motors are 2 phase. Three and four phase motors require an additional expansion board that contains additional DDS generators and motor amplifiers.	#	1-4	2
Power standby sleep time, min: If the motor drive is idle (not spinning) for longer than the specified period, the board switches to low power/sleep mode. It is woken by pressing the power switch.	Min	1-360	60
Display blank time, min: Time for the display to blank after starting or changing speed. 0 disables feature.	Min	0-360	0
Automatically start platter on application of		Y / N	N

power? The board can automatically start the platter on the application of power rather than having to press a start switch.			
Use Lingo/Axis power switch action? Changes the Zeus to emulate a Lingo/Axis power switch action. 33->Off, 33->45->Off rather than the Zeus standard action. The Zeus action offers greater flexibility of switching back and forth between 33 and 45.		Y / N	N

3.1.3 Motor Parameters

Configuration items in this menu relate to the motor and turntable. n=1 to 4 – i.e. each motor winding. The motor setup questions will step through n=1 to n=maximum number of motor phases (windings, 4 max) configured in System Parameters.

Parameter / Description	Units	Range	Default value
Winding 1 phase is always starts at 0 degrees. This is a statement. Subsequent windings probably require 90, 180, 270 degree phase angles respectively depending if you are using 2,3,4 phase motors.	-	-	-
Enter winding %d, phase angle in deg Windings probably require 90, 180, 270-degree phase angles respectively depending if you are using 2,3,4 phase motors. Slight adjustment of phase angles can reduce motor vibration. Start with the defaults and adjust on test. If you can hold the motor in your hand this is the best way to determine vibration. Listening to the motor noise is also a good indication.	degrees	45 – 300	90, 180, 270 for each phase 2, 3, 4 respectively
Enter winding n, drive voltage for 33 rpm (rms) The voltage that should be applied to each winding. For 110v synchronous motors 85v rms is a good starting point. Slight adjustment of phase voltages can reduce motor vibration. Start with the defaults and adjust on test. If you can hold the motor in your hand this is the best way to determine vibration. Listening to the motor noise is also a good indication.	Volts (rms)	5-100	85
Enter winding n, drive voltage for 45 (V rms) The voltage that should be applied to each winding. For 110v synchronous motors 85v rms is a good starting point. Slight adjustment of phase voltages can reduce motor vibration. Start with the defaults and adjust on test. If you can hold the motor in your hand this is the best way to determine vibration. Listening to the motor noise is also a good indication.	Volts (rms)	5-100	90

3.1.4 Write to eeprom

Use this option to save configuration parameters to the internal EEPROM so they are used when the board is powered up,

3.1.5 Motor ON/OFF

Turns the platter on or off instead of the manual power switch,

4 Upgrade to Zeus

Upgrading to a Zeus provides a significant improvement from the Minos with actual speed measurement and correction of the platter. This provides for tighter pitch and musicality. In addition, there are more options to reduce motor vibrations and noise. Lower noise floor is possible leading to enhanced sound quality and separation.

See website for current pricing. The conversion from a Minos to Zeus is easy to perform and consists of several parts that are attached to your Minos and a software activation key to unlock additional software features. We need to know the serial number and software version of your existing Minos. This can be located on the physical board or you can use the PIDTuning/ControllerSetup software.

To locate the serial number from the physical board it will either be written on the white panel or available to scan from your phone with a QR code scanner. When using the QR code you must scan to get the full 8 digits.

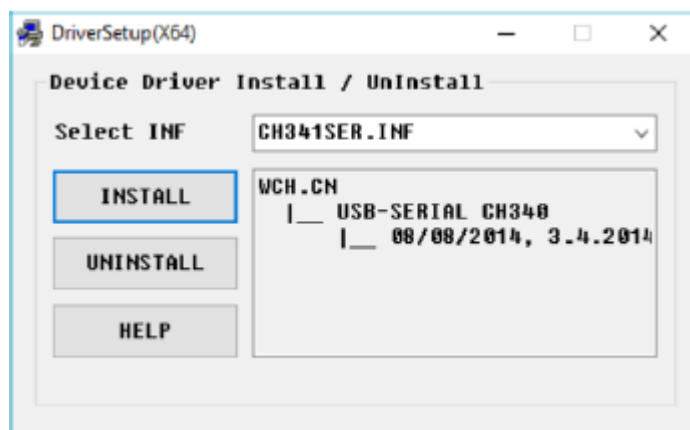
To use software, at the input prompt issue the command: **!vs_get_SN** and press enter. An 8 digit serial number will be returned. The software version number can be found at the top of the main menu. Paste this SN code and version number into the notes field of your shop order. You will receive a physical upgrade kit containing: OLED/Switch, Sensor, Software licence activation key, upgrade instructions and a download link to the Zeus user manual.

5 Appendix – Drivers/MAC

5.1 Windows Users

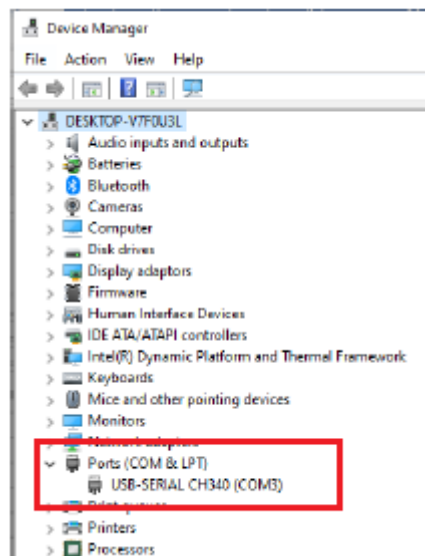
Windows PC's should automatically install drivers for the Zeus/Minos but sometimes Windows can have issues. The driver is a CH340 obtained here:

https://www.valhallaelectronics.com/wp-content/uploads/2021/08/CH341SER_WIN.zip



Click the Uninstall button first to remove any old version then Install

If the drivers do not appear to install correctly disconnect the Zeus USB connection, reboot your Windows installation and try again. If everything is working correctly, you should see a serial port in Windows Device Manager (although it may not be COM3):



5.2 Mac Users

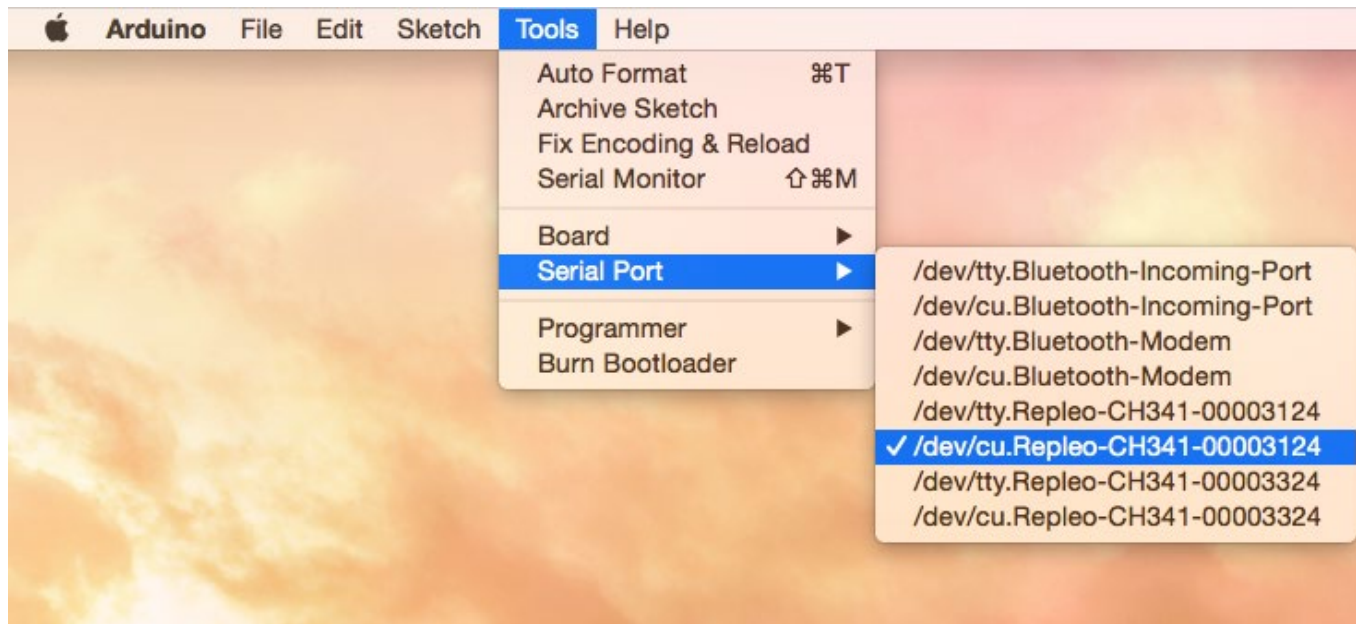
Mac users will need to install USB drivers to connect to the Minos motor controller. You can download and install from here:

https://www.valhallaelectronics.com/wp-content/uploads/2021/08/CH341SER_MAC.zip

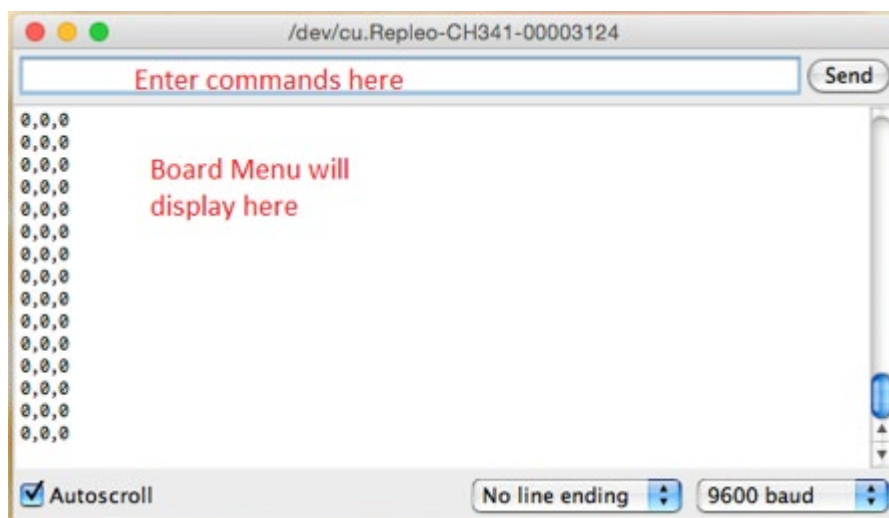
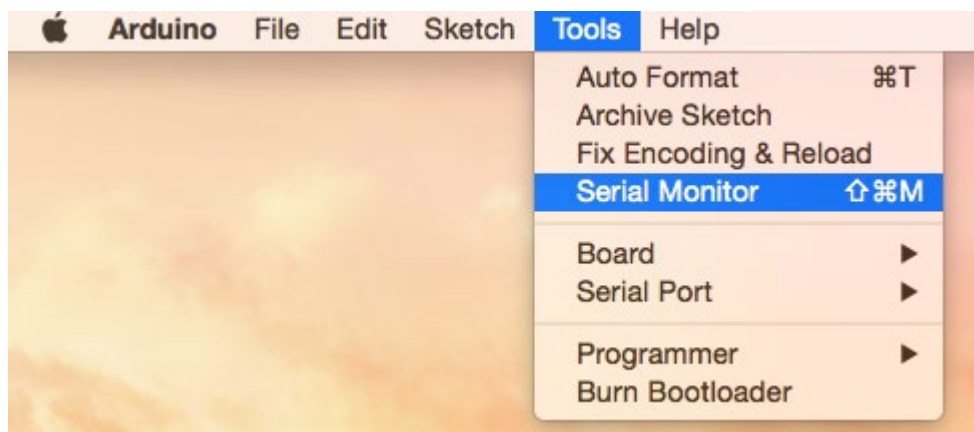
If you do not have a serial monitor program use the one build into the Arduino IDE. Follow the instructions at this link:

<https://www.arduino.cc/en/Guide/MacOSX#toc1>



Once the program is installed use connect to the Minos USB port and use the Tool>serial port menu to select the serial port.



The use the Tools>Serial Monitor to access the Terminal utility.



6 Specifications

Supply voltage	115-230V AC
Supply frequency	50-60Hz
Altitude	<2000m
Supply current	200mA at initial switch on, 20mA steady state at 230V
Replacement Fuse	<p>If fitted, 20mm 500mA timed.</p> <p>For v3.6c boards (or later) a cartridge fuse is not needed as a thermal fuse is fitted. If you have a fault on your Minos the thermal fuse will trip. Remove mains supply for 1 hour and see if it resets. If the board fails to power on, please return to us for service.</p>
Dimensions	20 x 165 x 100mm (HxWxD)
Motor Output drive voltage	12v to 110v AC
Motor Output drive current	20mA
Frequency resolution	0.001Hz
WOW	<1%
Approvals	
EU Representative	 <p>Euverify Ltd Unit 3D North Point House, North Point Business Park, Old Mallow Road Cork, T23 AT2P, Ireland info@euverify.com</p>

7 Manufacturer Details

S.Cobham T/A Valhalla Electronics
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Liverpool
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United Kingdom