Eding CNC

driving creation

Hardware Manual

CNC310

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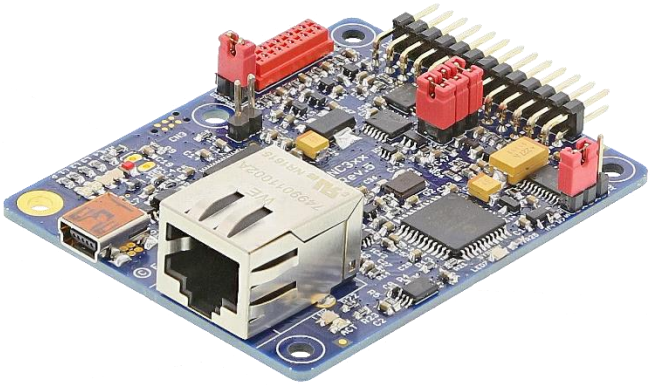
Released



History:

Revision	Date	Author
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Revision overview:

Revision	Remarks
1	Initial version

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1 Introduction

1.1 Purpose

This manual describes the hardware of the CNC310.

The CNC310 is a basic 3-axis CNC controller the specification is:

3x Axis controller interface (optional 4th axis)	Puls/Direction	5V ($f_{step,max}$ = 125Khz)
	Enable	5V
1x digital HOME inputs (optional 2nd input)	Max. 5V	
1x cooling output	5V	
1x toolsetter/tool length input	Max. 5V	
Interface	USB (optional Ethernet)	
Power Supply	Via USB or externally 5VDC	
Dimension	54.5x67.5mm	
Others	- Firmware upgradable through USB connection - Connector pitch 2.54mm/0.1”	

The starter software has basic operations and is able to operate 2.5D.

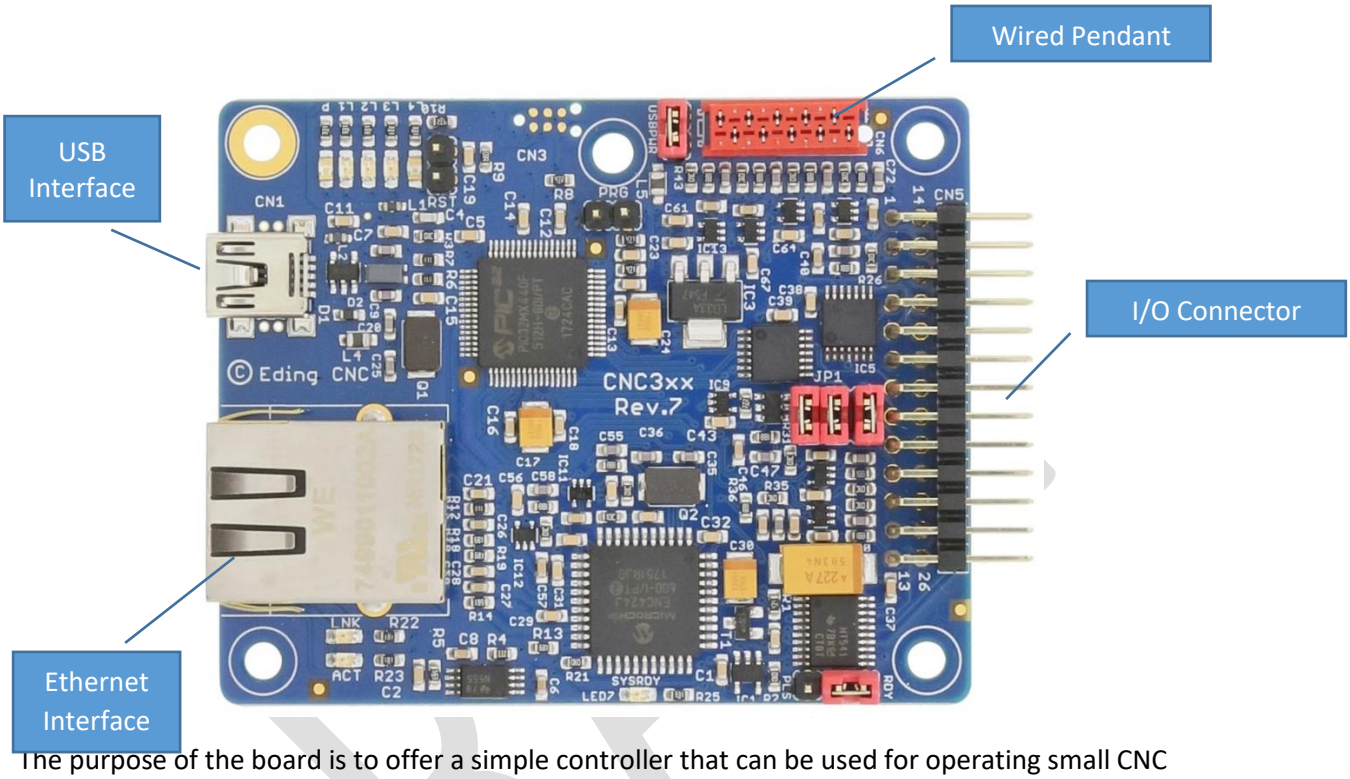
SW upgradable features:

- 4th Axis + home input
- Ethernet interface
- Full software support (full 3D)

2 Board overview

The CNC310 is a CNC controller with USB interface, and is intended for 3 axes. However, the user can upgrade the board through separate licenses with a 4th axis and activate the ethernet interface.

The image below shows an overview of the CNC310.



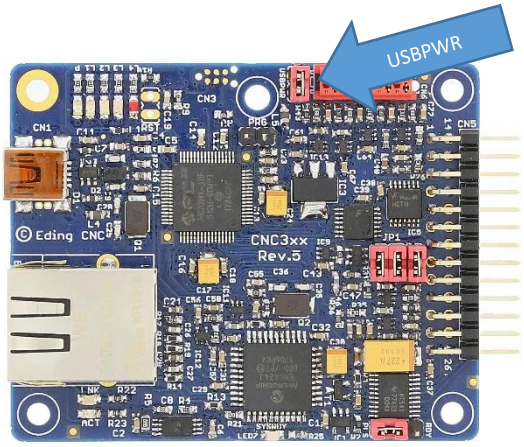
The purpose of the board is to offer a simple controller that can be used for operating small CNC machines that need only limited I/O.

This document focusses on the hardware interface of this board, and how to use it to get a simple CNC set up, up and running. This manual will only focus on the hardware part. For more information about the software please check the software manual that can be downloaded from the website.

3 Board jumpers and indicators

This chapter describes the jumpers and indicators that are present on the controller board.

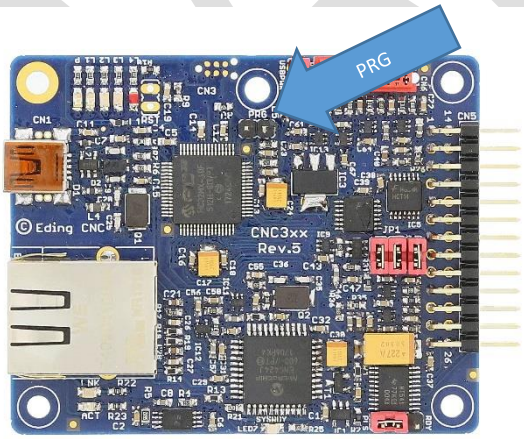
3.1 Jumper USBPWR



This jumper is used to power the board via the USB interface. The board can also be powered through an external pin.

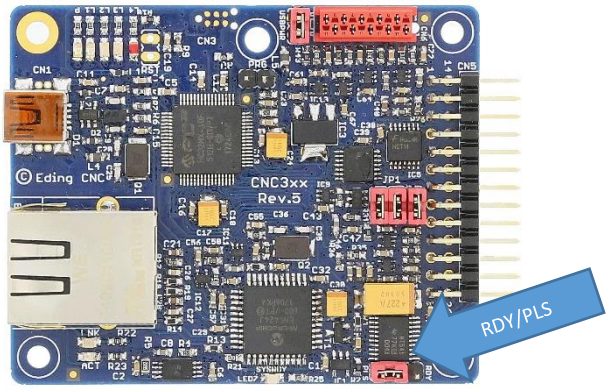
WARNING: If the board is powered externally make sure that the USBPWR jumper is removed because else the USB interface will get externally powered which can damage the USB port.

3.2 Jumper PRG



If this jumper is place the board will skip the bootloader mode and will go directly to starting the firmware.

3.3 Jumper RDY/PLS

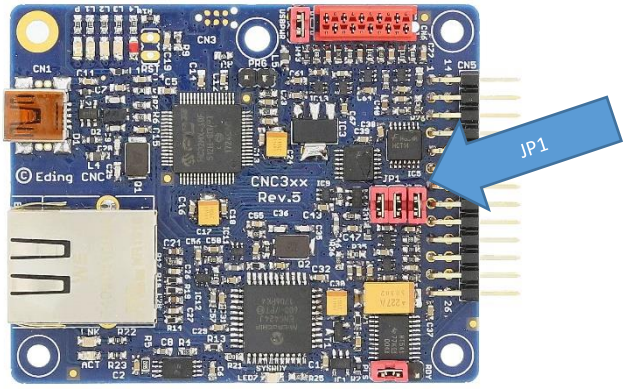


This jumper is used to set the output signal that is present on the I/O pin 'WATCHDOG/SYSRDY'.

For more info see chapter 5.5 WATCHDOG/SYSRDY output

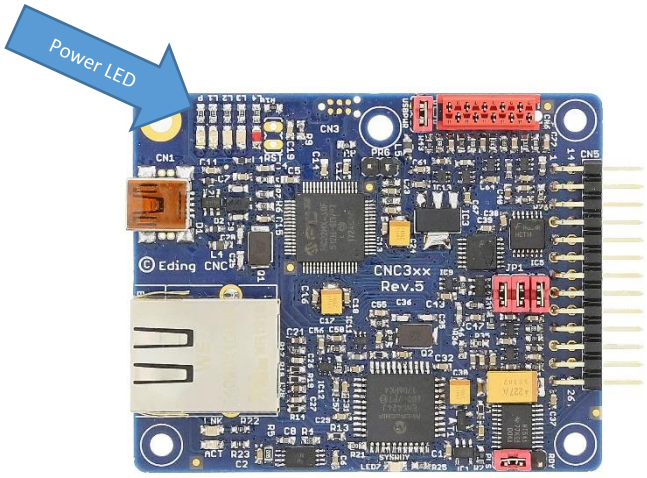
WATCHDOG/SYSRDY output.

3.4 Jumper JP1



This jumper can be used to deactivate the signals on some I/O pins. Currently make sure that all jumpers are mounted.

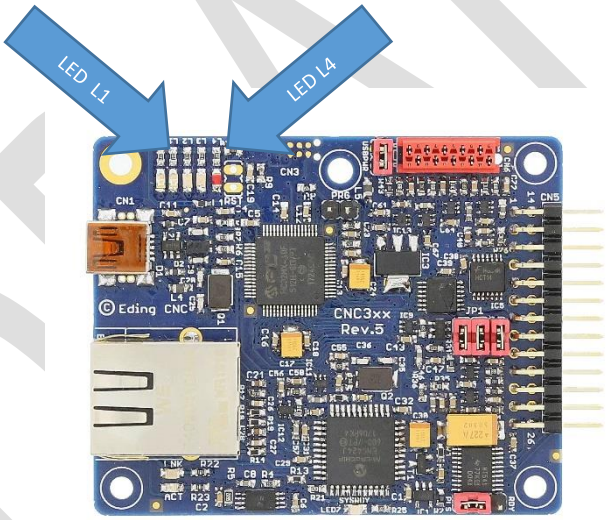
3.5 Power LED



This blue power led indicates when power is applied to the board.

3.6 Status LED 1-4

The status LEDs indicate the current mode of the controller. The status LEDs are indicated by L1 through L4.

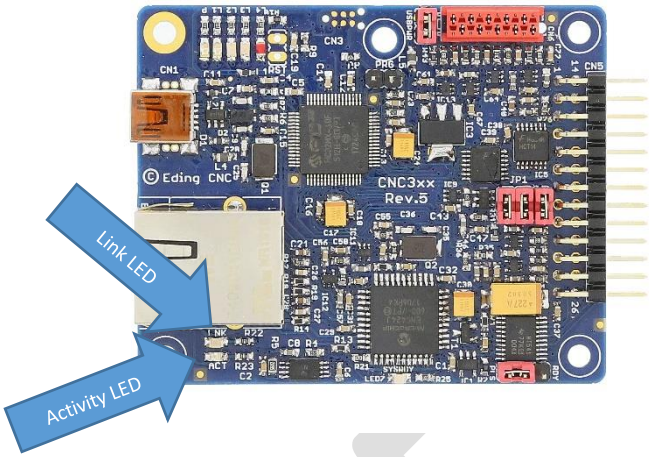


L1	ORANGE	BLINKING = Board is starting	
L2	GREEN	ON = System is active	OFF = System if inactive
L3	GREEN	BLINKING = Board is active	
L4	RED	BLINKING = Watchdog is active	

Please note, when in bootloader mode L2 and L3 will toggle to indicate this.

3.7 Network LEDs (optional)

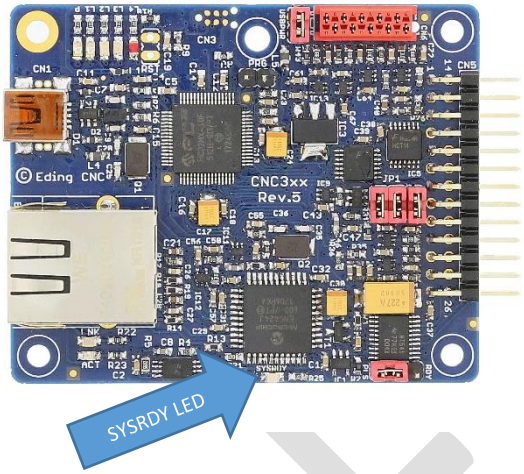
The network LEDs will only be active if the license has been activated for the network and new firmware has been downloaded.



The LINK LED indicates if a network cable is connected. The ACTIVITY LED will blink if there is network communication.

3.8 SYSRDY led

The LED indicates that status of the SYSRDY output. If it is ON, it indicates that the signal on the WATCHDOG/SYSRDY output also is active.



4 I/O pinning

4.1 Pinning functions overview

The board can be connected through a 26-pole header. The pitch of the connector is 2.54mm or 0.1”. The images below show the pin numbering and the functions on each pin.

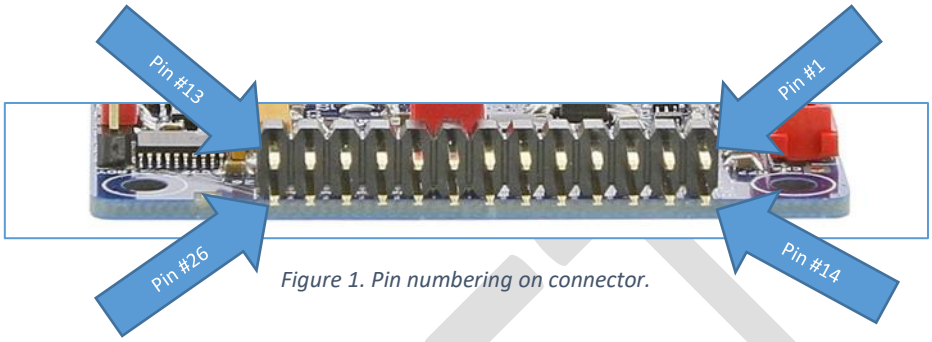


Figure 1. Pin numbering on connector.

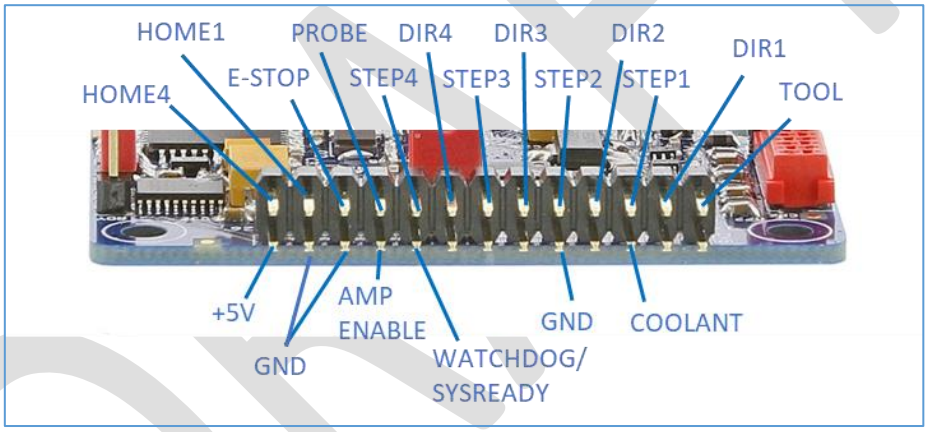


Figure 2. Functions on connector overview.

In “Figure 3. Overview of functions.” all signals that are present are discussed in more detail.

Pin #	Name	Direction	Type	Function	Electrical Spec.	Remarks
1	TOOL	OUT	DIGITAL	Switching of tool	TTL 5V/20mA	
2	DIR1	OUT	DIGITAL	Direction signal X axis	TTL 5V/20mA	
3	STEP1	OUT	DIGITAL	Step signal X axis	TTL 5V/20mA	Max. 125kHz
4	DIR2	OUT	DIGITAL	Direction signal Y axis	TTL 5V/20mA	
5	STEP2	OUT	DIGITAL	Step signal Y axis	TTL 5V/20mA	Max. 125kHz
6	DIR3	OUT	DIGITAL	Direction signal Z axis	TTL 5V/20mA	
7	STEP3	OUT	DIGITAL	Step signal Z axis	TTL 5V/20mA	Max. 125kHz
8	DIR4[*1]	OUT	DIGITAL	Optional: Direction signal A axis	TTL 5V/20mA	
9	STEP4[*1]	OUT	DIGITAL	Optional: Step signal A axis	TTL 5V/20mA	Max. 125kHz
10	PROBE	IN	DIGITAL	Probe input	Max. 5V	
11	E-STOP	IN	DIGITAL	Emergency stop signal input	Max. 5V	
12	HOME1	IN	DIGITAL	Input for homing switches	Max. 5V	
13	HOME4[*1]	IN	DIGITAL	Optional: input home switch A axis	Max. 5V	
14	reserved					Do not connect
15	reserved					Do not connect
16	COOLANT	OUT	DIGITAL	Controlling the coolant.	TTL 5V/20mA	
17	reserved					Do not connect
18	GND		GROUND			
19	reserved					Do not connect
20	reserved					Do not connect
21	reserved					Do not connect
22	WATCHDOG/SYSRDY	OUT	DIGITAL	Indication if system is active	TTL 5V/20mA	
23	AMP-ENABLE	OUT	DIGITAL	Enabling motor drivers	TTL 5V/150mA	
24	GND		GROUND			
25	GND		GROUND			
26	+5V[*2]	IN/OUT	POWER	Power supply, can be in and output.	Max. 5V	

Figure 3. Overview of functions.

Make sure that the maximum in or output limitations are not exceeded.

5 OUTPUTS

5.1 TOOL output

The TOOL output is used for switching ON and OFF the tool of your machine. The TOOL output is not cable of switching large loads. Therefor it will need a relay to switch large loads.

Standard relays cause a lot of EMI noise. EMI noise can disturb the USB communication.

We therefor recommend using a solid-state relay.

Figure 4. Example of solid-state relay.

A solid-state relay can be often connected directly to the TOOL output. Please check the current that the solid-state relay input needs do not exceed the maximum current that the port can supply.

The biggest difference between a 'normal' relay and a solid-state relay is that the lather does not have moving parts and in and output are also separated through a optocoupler. It should cause much less EMI problems.

Connecting a solid-state relay is shown in the image below:

Figure 5. Connecting a solid-state relay.

If you want to use a 'normal' relay it's important to check the current that a relay needs to switch. This can be improved by adding a transistor to the output of the board as shown in the image below.

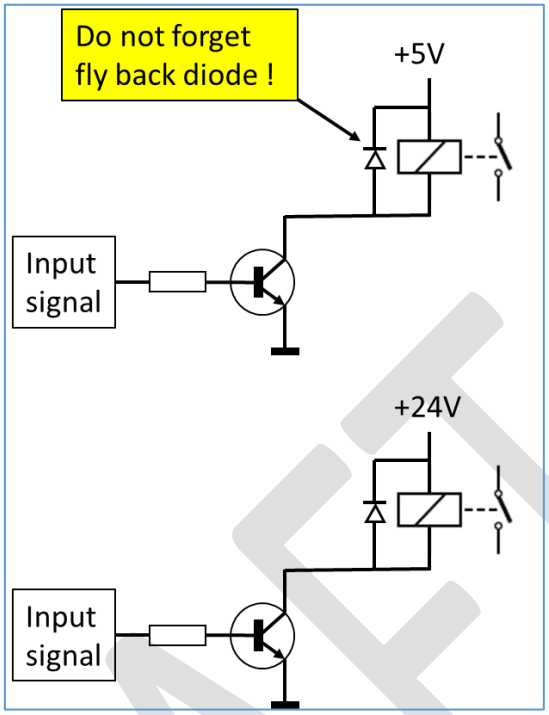


Figure 6. How to switch a power relay.

This image shows how you can control a 5V or 24V (or almost any) relay with the output of the CNC310. It might be easier to find a board that has all logic already included on one board, and which can readily be found in the internet. Some will even include optocouplers.

Figure 7. Example of finished relay interface.

We recommended to use standard relays only for low power.

Please note to always use an anti-parallel diode of 100-200v / 1-2 Amp. Without this diode the controller may be damaged.

<u>However, our advices remains to use solid state relay.</u>

5.2 COOLANT output

The coolant output can be used to control any form of coolant that might be used during the operation of the machine. Its output is electrically identical to the TOOL output. For information about how to use this please refer to that part of the document.

5.3 STEP/DIRx output

The controller board features 3, optional 4, outputs for controlling the driver of a stepper motor. The signals generated are the common signals STEP and DIRECTION, as used by many drivers.

The DIRECTION signal indicates to the driver whether it has the move clockwise (CW) of counter-clockwise (CCW). The STEP signal indicates when a step is to be made. Figure 8 illustrates this.

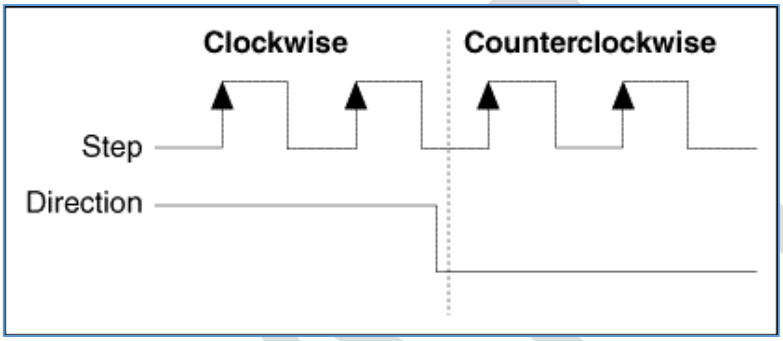


Figure 8. Example of STEP/DIRECTION signal.

Whether the DIRECTION signal means CW or CCW depends on the stepper driver and how you wire it or configure it. Also, whether the low/high or high/low signal indicates a step depends on the way it is connected and used by the driver.

Please refer to you motor driver's manual to find more information about how to connect the controller to it.

5.4 AMP-ENABLE output

The AMP-ENABLE output is used for enabling the motor drivers. This output can supply more output current than the other digital outputs.

See also chapter 9 Example of connecting CNC310 to Leadshine DM422C.

5.5 WATCHDOG/SYSRDY output

The WATCHDOG/SYSRDY can be used to indicate when the system is active. This can be either with a HIGH (active) / LOW (not active) signal or by outputting a square wave of 12 kHz. Often that signal is used as a kind of watchdog signal by for example stepper drivers.

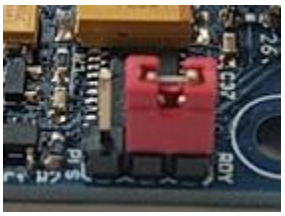


Figure 9. Output is HIGH if SYSREADY is active

Figure 10. Output is square wave if SYSREADY is active.

This HIGH/LOW signal is selected by setting the jumper on the 'RDY' position, the square wave is selected by selecting the 'PLS' position.

6 Inputs

This chapter describes how to use the inputs of the controller board. Make sure that the input signals do not exceed the maximum values of the input.

6.1 PROBE input

The PROBE input has multiple functions, it can be used for:

- Determining the height of the material
- Determining the length of a tool

The figure below, it shows how the input circuit is designed.

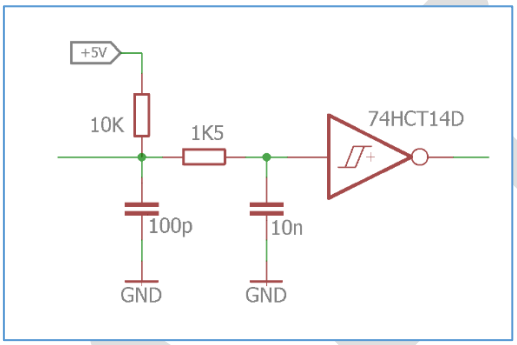


Figure 11. Probe input circuit.

This image shows that on the input a 10k resistor is used as a pull-up. This means that IF you would measure on this input you will measure 5V. Please note, that this is not the 'real' 5V but just a pull-upped value. The image also shows, in order to activate this input you need to connect it to ground. In the image below this is illustrated.

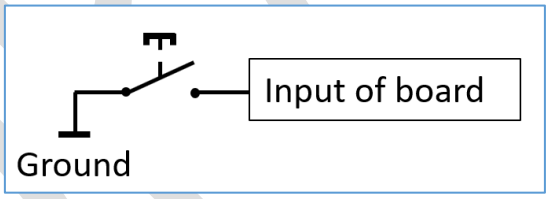


Figure 12. Connecting switch to probe input.

If you need to connect multiple devices to this input, you can simply connect them in parallel, as shown in the image below. The system will know when to consider this an actual probe or when it is a toolsetter.

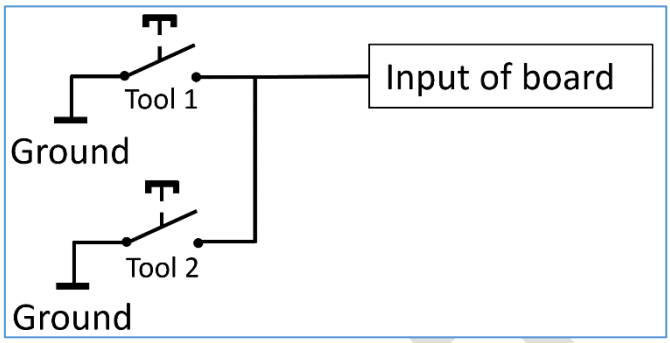


Figure 13. Connecting multiple tools to probe input.

6.2 E-STOP input

The E-STOP input signals that the systems needs to stop immediately.

Warning: The E-STOP does not replace a proper external E-STOP switch, the user is responsible for having an external hardware E-STOP switch to switch off the machine in case of emergency.

The figure below shows how the input circuit is designed.

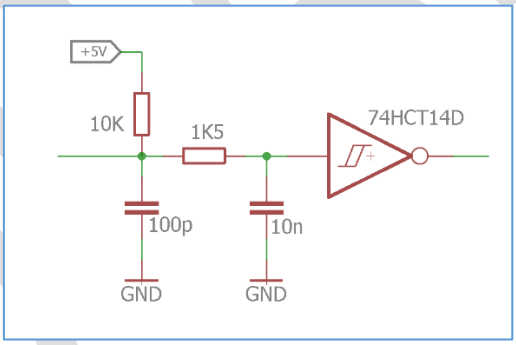


Figure 14.E-STOP input circuit.

This image shows that on the input a 10k resistor is used as a pull-up. This means that IF you would measure on this input you will measure 5V. Please note, that this is not the 'real' 5V but just a pull-upped value. The image also shows that in order to activate this input you need to connect it to ground. In the image below this is illustrated for a Normal-Open and Normal-Closed switch.

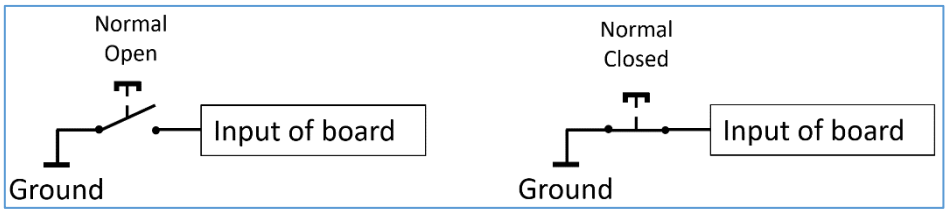


Figure 15. Connecting switch to E-STOP input.

In the software it must be indicated whether a switch is either Normal-Open (NO) or Normal-Closed (NC). This is set via 'Homing and E-Stop' part of the setup screen. A message will appear onscreen to show that an E-STOP condition has occurred.

Please note, by default the E-STOP input is disabled.

6.3 HOME1 input

The HOME1 input is used for connecting the X, Y and Z home switches for the machine so it knows where it is.

The figure below shows how the input circuit is designed.

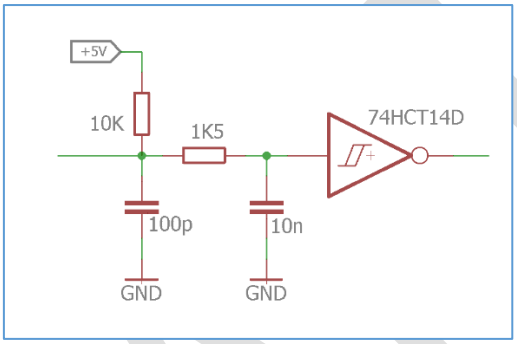


Figure 16. Home1 input circuit.

This image shows that on the input a 10k resistor is used as a pull-up. This means that IF you would measure on this input you will measure 5V. Please note, that this is not the 'real' 5V but just a pull-upped value. This input is used for the X, Y and Z axis. Depending on the type of switch, Normal Open or Normal Closed, the switched need to be connected differently.

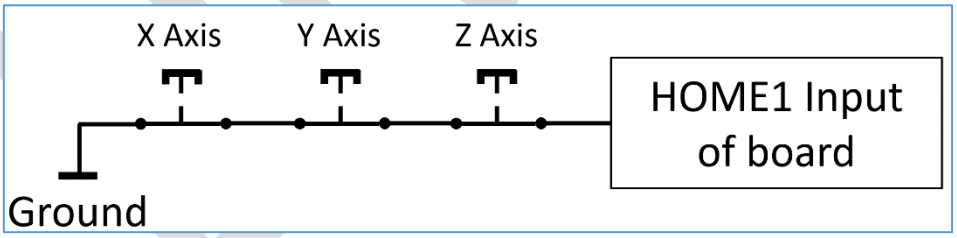


Figure 17. Connecting Normal-Closed home switches in series.

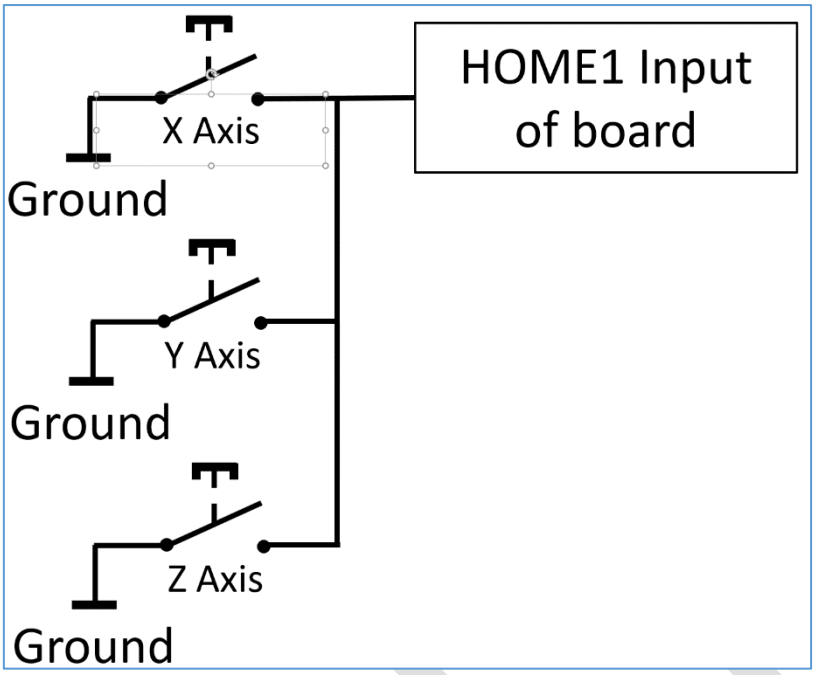


Figure 18. Connecting Normal-Open home switches in parallel.

In the software it must be indicated whether a switch is either Normal-Open (NO) or Normal-Closed (NC). This is set via 'Homing and E-Stop' part of the setup screen.

6.4 HOME4 input

The HOME4 input is used if a 4th axis is activated. This input takes only a single home switch.

The figure below it shows how the input circuit is designed.

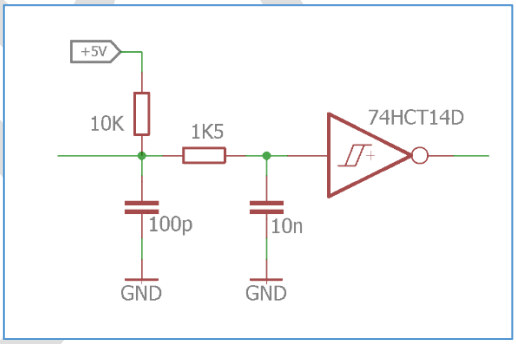


Figure 19. Home1 input circuit.

This image shows that on the input a 10k resistor is used as a pull-up. This means that IF you would measure on this input you will measure 5V. Please note, that this is not the 'real' 5V but just a pull-upped value.

Please note, that all home switches need to be the same with respect to Normal-Open or Normal-Close.

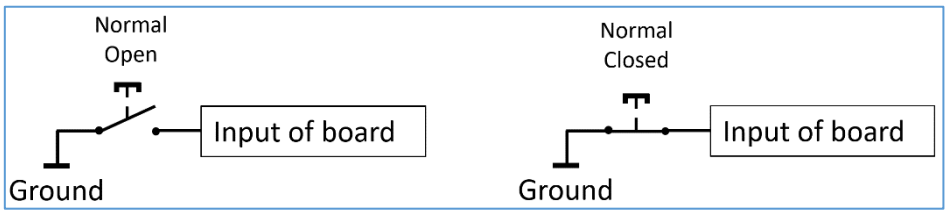


Figure 20. Connecting switch to HOME4 input.

In the software it must be indicated whether a switch is either Normal-Open (NO) or Normal-Closed (NC). This is set via 'Homing and E-Stop' part of the setup screen.

7 MPG/Pendant

The MPG connectors makes it possible to directly connect a pendant to the controller.

This option is only available if the full software is used.

<TO BE ADDED>

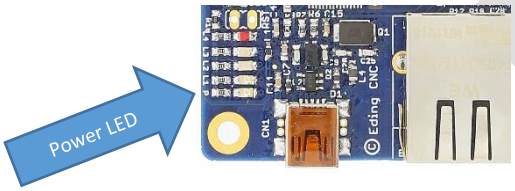
8 Getting started

Before installing the board it's a good idea to validate that the board is operational.

A. Validate the board is active

Step 1. The first step is to validate the board is operational. Connect the USB.

Step 2. As a result the blue power led should turn on. Also, observe that the status LEDs indicates that the board is active, indicated by the 'heart beat'. See also "3.6 Status LED 1-4".



Step 3. The board is now able to communicate with the application software. If you startup the software the board should be found. This is indicated by the controller type 'CNC310' appearing in the top-left of the window. If the board is not found it will show 'SIMULATION'.

B. Check for motion

Now the board is operational the next step is to check whether the machine and home switches work correctly. We start with the homing switches. Make sure that the power is off.

Step 1. Connect the home-switches

Step 2. Power up the board and connect with it with the software.

Step 3. By using the I/O screen of the application validate that the switches are correctly detected; make sure not to forget to setup the switches in the setup screen of the software. This is determined by the *HomeInputSenseLevel*, at default it is Normal Open.

Step 4. First, check there is no power connected. Next, connect the driver(s) to the board, you can choose to connect all motors at once or just one at a time. Please check the manual of the driver on how to connect it to the controllers, also check that the enable is correctly connected. Some drivers will automatically be enabled when this input is not connected, and they are powered up.

Step 5. DOUBLE check all connections.

Step 6. Power up the board and driver(s) and re-connect with it.

Step 7. Normally with the default settings of the software you should be able to get some motion. If not please check the following:

- Are all signals correctly connected?
- Do some signals need to be inverted (e.g. enable)?

TIP: By using the software I/O screen you can manually control enabling the drivers. When the drive is not enabled you will be able to move the axis by hand, if it is enabled this should not be possible.

If all checks went ok, your machine has now a basic setup. From here you can continue to connect more I/O (eg. E-STOP) to the board, please check all I/O via the software; also check whether inversion is necessary.

Please note that the system will need to be tuned to each specific machine. This means that machine parameters as speed/acceleration etc. will need to be changed to get optimum performance. Please make sure you know how to do this, and if not request support.

9 Example of connecting CNC310 to Leadshine DM422C.

In the image below is drawing of how to simple the CN310 can be connected to a DM422C.

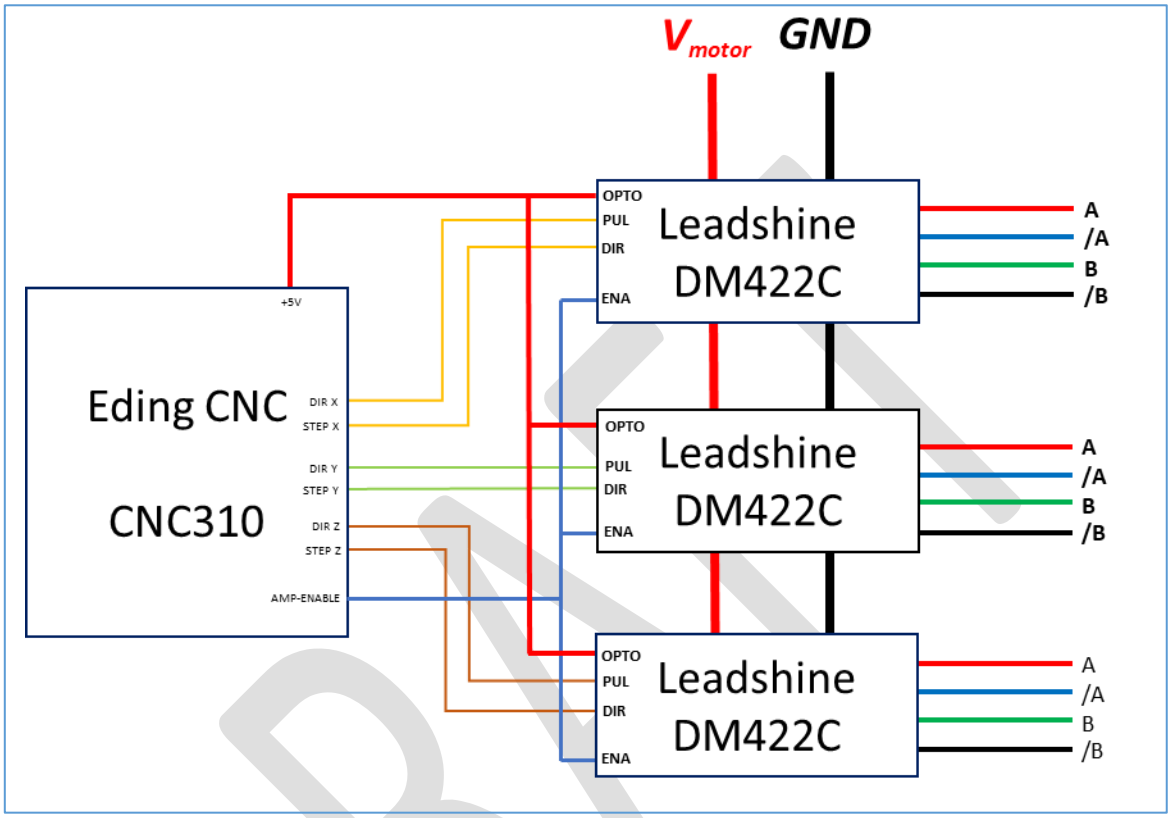
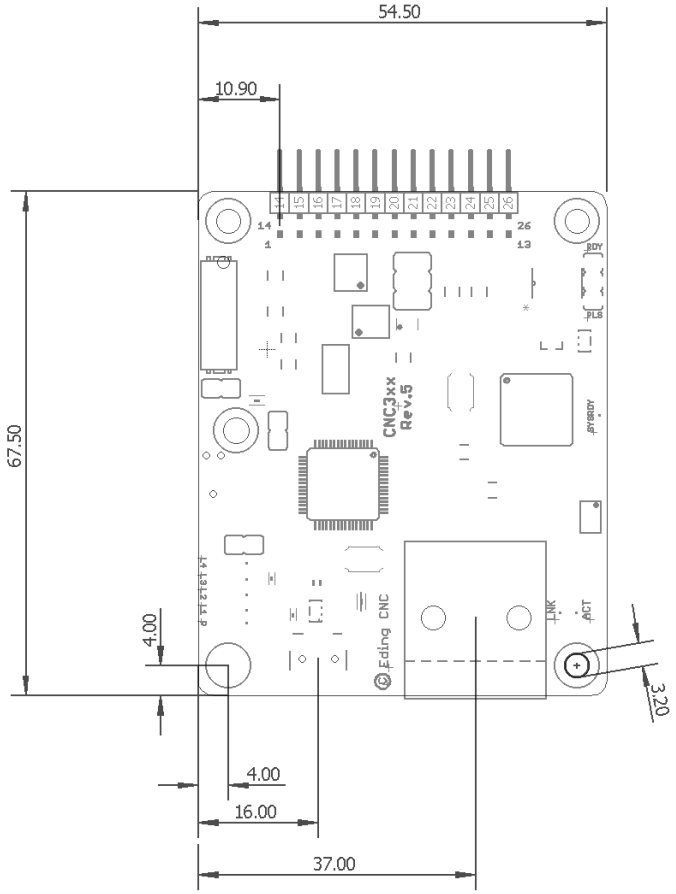
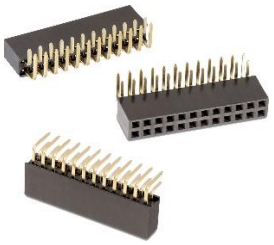


Figure 21. Connecting CNC310 to Leadshine DM422C.

10 Mechanical dimensions



The controller can simply be connected by using standard connector (2x13 pole), pitch 2.54mm/0.1”:



For example:

Wurth WR-PHD 613026243121