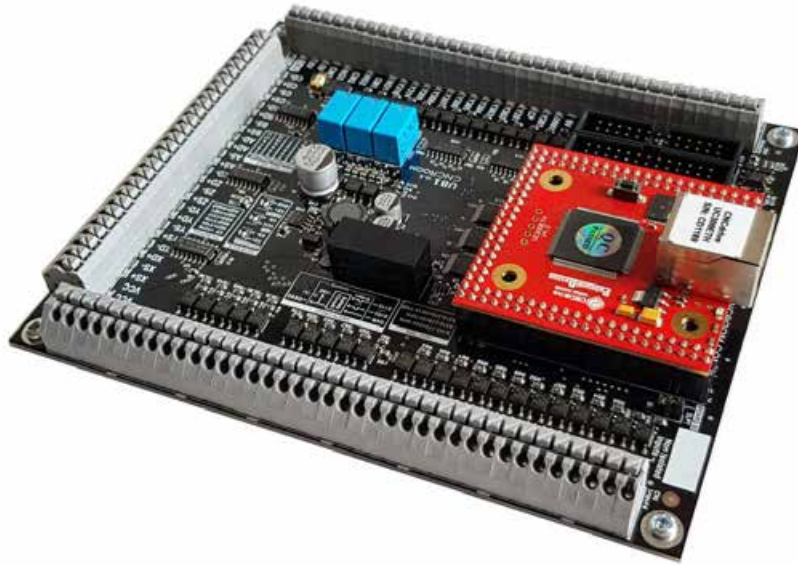


UB1

Owner's manual



Doc E1.5Rev0 (8/23/2017)
for PCB ver 1.5

Introduction

It is perhaps well understood that in an industrial environment, personal computers, motion control boards and logic signals can face a large amount of interference from things such as power cables, motors, welding machines, magnetic contactors etc.

We can help to minimize the effects of this interference by having any susceptible electronics enclosed in a metal control cabinet and using the correct safety and best practice techniques, which include, but are not limited to the installation of noise reduction such as an isolated transformer and noise filters.

While these things will help us achieve a better result, using a control board designed for industrial applications can be more important.

UB1 (UCCNC Breakout board) is designed for industrial applications and specifically to work with the UC300ETH which is an excellent motion control board designed to be used with UCCNC and Mach3 software.

Specification and Features

- By using an Ethernet connection, the UC300ETH is far more noise resistant than when using a USB motion board or parallel Port connection and therefore helps to protect the logic signal when the controller and drives are located a large distance from the computer.
- Can be used in conjunction with UCCNC or Mach3 Windows XP, Win7, Win8 and Windows 10 both 32 and 64 bit, on both desktop and notebook computers.
- Generates motion command signals from 25 kHz to 400 kHz
- New! Utilizes All 5 ports and is compatible with the UC300ETH-5LPT pin out.
- New! Differential line driver for motion signals, allowing for longer wiring with more resistance to interference when compared to TTL open end. Also can be used as single end both source and sink connection.
- New! A single 24Vdc Power Supply is needed. There is a 5Vdc isolated and a non-isolated dc2dc converter on board, thus saving installation space and wiring.
- New! OSSD (Output Signal Switching Device) outputs and hardware safety circuit are implemented when a peripheral device such as a servo motor drive or a spindle VFD (Variable Frequency Drive) trigger an alarm condition, which causes the Safety Circuit to disengage the OSSD output. This method is used on large CNC machines to cut power from the drives.
- New! LED status for all inputs and outputs including motion control signals. Makes it much easier to diagnose and trouble shoot.
- Isolated power and ground between the PC, UC300ETH and I/O, which eliminates crossover noise and ground loop problems.
- New! Polarity and over voltage protection (in conjunction with a fuse) for the 24Vdc power supply.
- A charge-pump signal is provided. This helps the user to form a safety interlock condition between controller and devices.
- 2 non-isolated analog inputs for feed and speed control override.
- New! 2 isolated analog outputs. This circuit is totally isolated from the UB1 and forms a part of the VFD inverter, connected as potentiometer variable resistor (VR). High voltage noise from the inverter cannot cause interfere through this connection.

- 13 channels of 24vdc isolated NPN inputs, suitable for industrial sensors with an NPN type output.
- 5 channels of 5Vdc isolated NPN inputs, suitable for low voltage devices such as MPG, encoder.
- New! 5 channels of 24/5Vdc selectable isolated PNP inputs, suitable for industrial sensors with PNP type output.
- 2 non-isolated extended headers, LPT4 and LPT5 with compatible UC300ETH-5LPT pin out.
- 14 NPN isolated output terminals capable of sinking current up to 70mA for each channel.
- 3 onboard NO relays. (Contacts can easily be changed to NC by using the solder-bridge under the board). Off Delay Time provided for K1, K2. This allows the user to create a timing sequence for devices that need to power up or power down independently at different times. It can be used for such application as “Z axis Drop Protection”. The K3 Relay can be controlled by a charge pump signal.
- Spring terminals for quicker connecting and disconnecting of cables. They are resistant to vibration, so no more screws which have rattled loose and no more forgetting to tighten.

Precaution



- Remember to static discharge before touching any part of UC300ETH/UB1. Ground your body by wearing a grounding strap or frequent touching an earthed metal chassis to release electrostatics.
- Make sure that there is no high voltage leak from your soldering iron when soldering the solder-bridge – the safest way is to unplug your soldering iron from the mains power when it has reached a high enough temperature to melt the solder. High voltage leakage from a cheap soldering iron can potentially damage the integrated circuit (IC) on the UB1 board.
- The UB1 board is **Fragile**, do not drop, as it could badly damage the electronics components.
- In certain circumstances, it could be possible for the UB1 board to build up excessive heat if many of the inputs and outputs are active at same time over an extended period. It is therefore advisable to install a good quality cooling fan to ventilate the cabinet.

Quick Reference

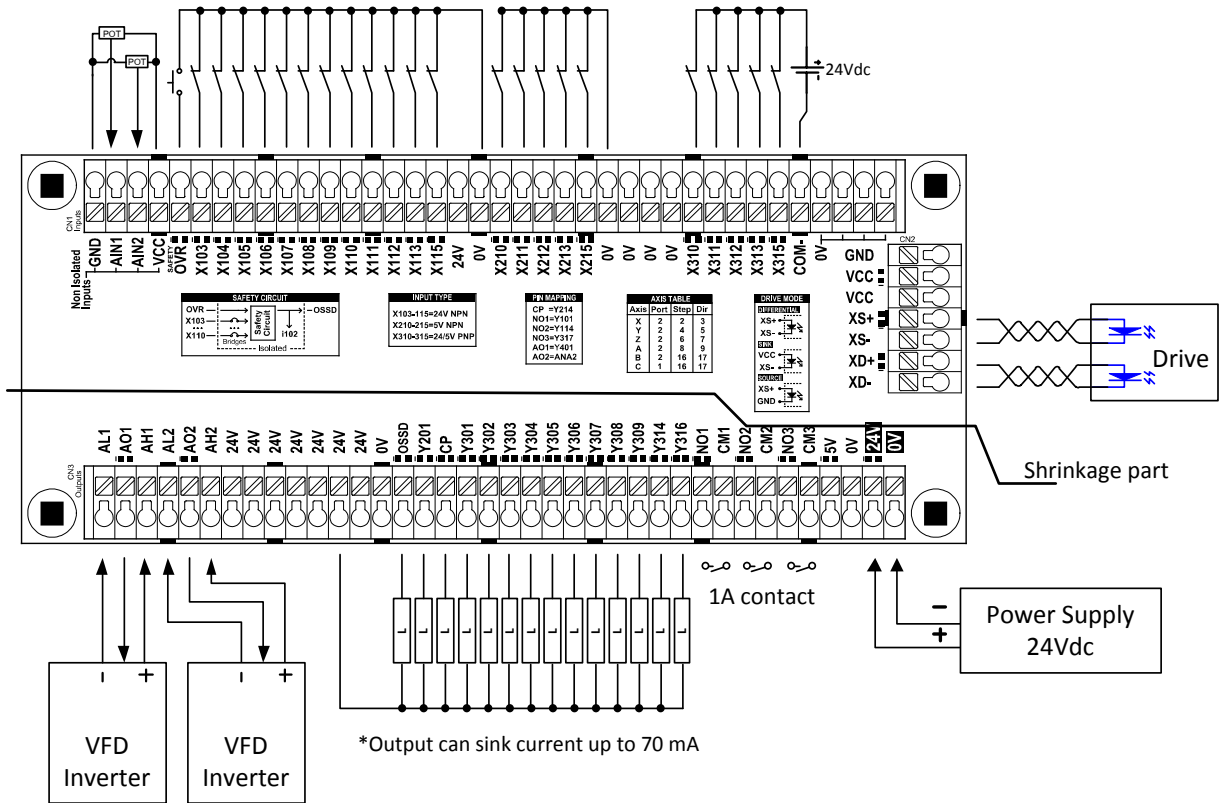


Figure 1, UB1 Overview Connection

Port1 (Pins 2-9 as input)				Port2 (output)				Port3 (Pins 2-9 as output)			
Pin	I/O	Term Name	Description	Pin	I/O	Term Name	Description	Pin	I/O	Term Name	Description
1	O	NO1	Relay Contact	1	O	SPD (Spindle)	Sink output	1	O	Y301	Sink output
2	I	-	OSSD feedback	2	O	XS (X step)	Line driver	2	O	Y302	Sink output
3	I	X103, Safety	NPN input	3	O	XD (X dir)	Line driver	3	O	Y303	Sink output
4	I	X104, Safety	NPN input	4	O	YS (Y step)	Line driver	4	O	Y304	Sink output
5	I	X105, Safety	NPN input	5	O	YD (Y dir)	Line driver	5	O	Y305	Sink output
6	I	X106, Safety	NPN input	6	O	ZS (Z step)	Line driver	6	O	Y306	Sink output
7	I	X107, Safety	NPN input	7	O	ZD (Z dir)	Line driver	7	O	Y307	Sink output
8	I	X108, Safety	NPN input	8	O	AS (A step)	Line driver	8	O	Y308	Sink output
9	I	X109, Safety	NPN input	9	O	AD (A dir)	Line driver	9	O	Y309	Sink output
10	I	X110, Safety	NPN input	10	I	X210	NPN input	10	I	X310	PNP input
11	I	X111	NPN input	11	I	X211	NPN input	11	I	X311	PNP input
12	I	X112	NPN input	12	I	X212	NPN input	12	I	X312	PNP input
13	I	X113	NPN input	13	I	X213	NPN input	13	I	X313	PNP input
14	O	NO2	Relay Contact	14	O	CP (ChargePump)	Sink output	14	O	Y314	Sink output
15	I	X115	NPN input	15	I	X215	NPN input	15	I	X315	PNP input
16	O	CS (C step)	Line driver	16	O	BS (B step)	Line driver	16	O	Y316	Sink output
17	O	CD (C dir)	Line driver	17	O	BD (B dir)	Line driver	17	O	NO3	Relay Contact

Analog Input1 = AIN1, **Analog Output1** = Y401 (Can be changed to PWM1 by solder bridge) X103-X110 are **Safety** inputs
Analog Input2 = AIN2, **Analog Output2** = PWM2, **NO3 Contact** = Y317 (Can be changed to ChargePump by solder bridge)

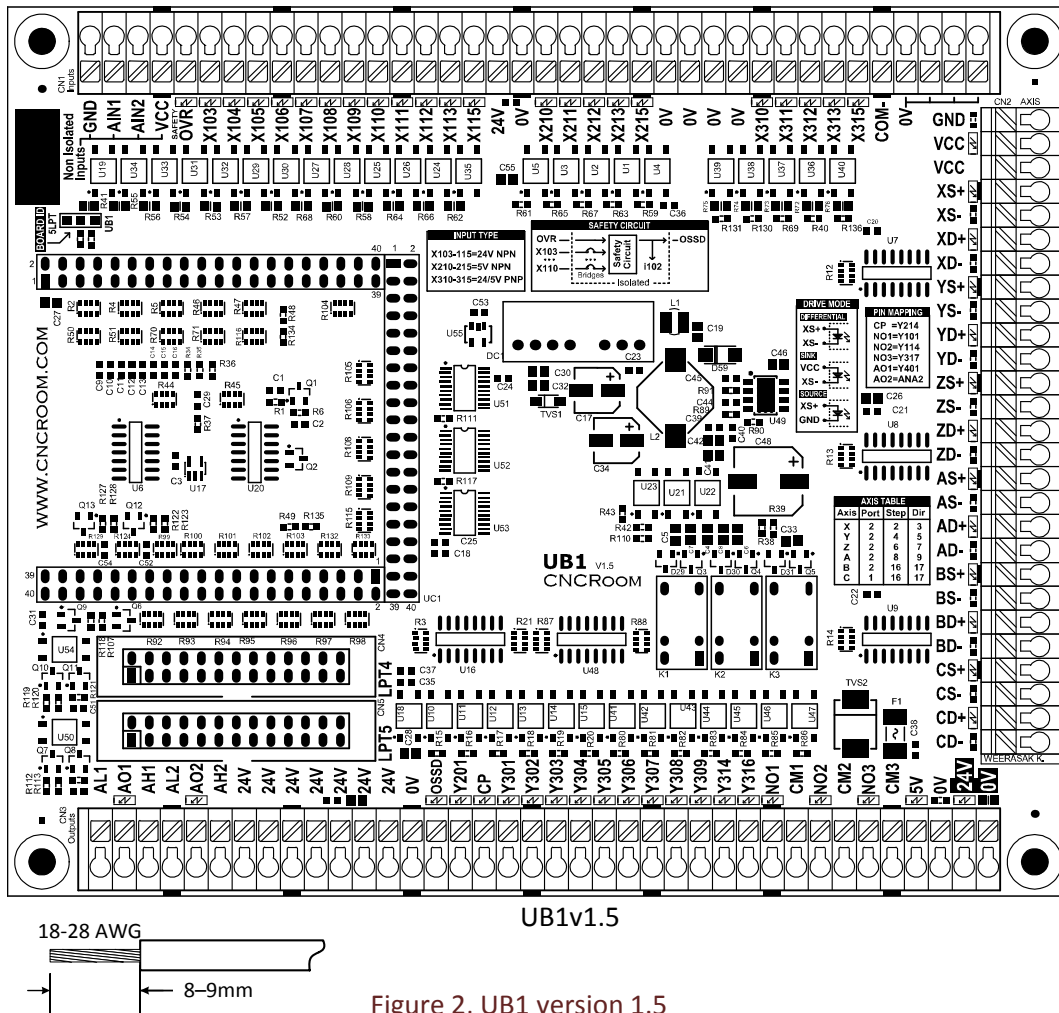
Table 1, Ports and Pins Reference Tables

Quick Reference is a summary for the experienced user.

Figure 1 is a partial view of the UB1 board. It shows the connection of inputs & outputs, power supply, analog output for the VFD and differential axis signals. These line drivers can also be connected as source and sink single end. It is suggested that you first try the differential connection.

Table 1 is a summary of the Ports and Pins and their corresponding reference numbers. All pin numbers preceded by an “X” are inputs and those preceded by a “Y” are outputs. Using X110 as an example. The “X” means it is an input. The first digit “1” is the port number, the last 2 digits “10” are the pin number.

UB1 Layout



- Input (CN1) – Input terminals, consisting of 2 channels of non-isolated analog inputs, 18 channels of NPN type and 5 channels of PNP type
- Axis (CN2) – Axis signal terminals, consisting of 6 axes, which are; X, Y, Z, A, B, C
- Output (CN3) – Output terminals, consisting of 14 isolated NPN sink outputs, 2 isolated analog output signals, 3 Relay’s NO (Contacts can easily be changed to NC by using the solder-bridge under the board) and an inlet for the 24Vdc power supply
- LPT4,5 (CN4,5) – 2 non-isolated inputs headers. It is compatible with PC parallel port input mode.
- Board ID – 5LPT / UB1 Identifier jumper

UC300ETH and UB1 piggyback

The UC300ETH is easily plugged into the header socket on UB1 board, without the need for ribbon cables. It draws power from the isolated dc2cd converter on the UB1 board.

Figure 4 shows how to remove the UC300ETH from the UB1 board. Gentle levering by a metal plate or a blank PCB will prevent UC300ETH pins from bending.

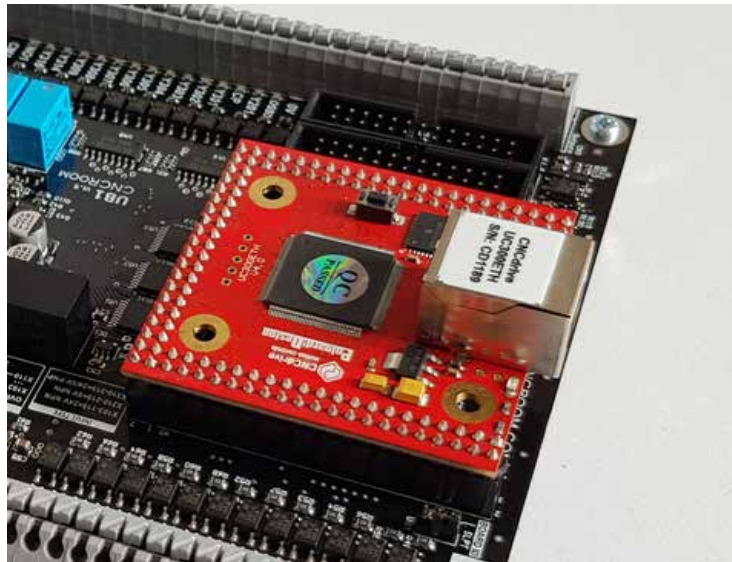


Figure 3, UC300ETH stack on UB1 breakout board.

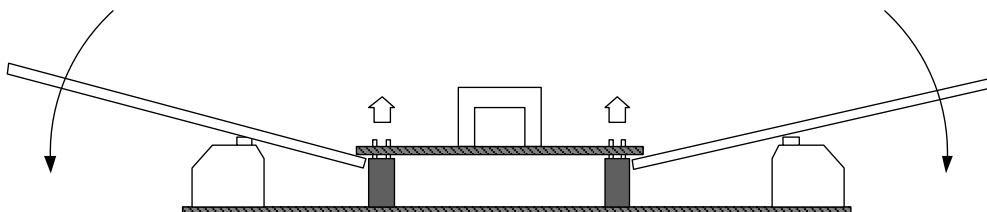


Figure 4, UC300ETH board removal.

UB1 Connection Diagram

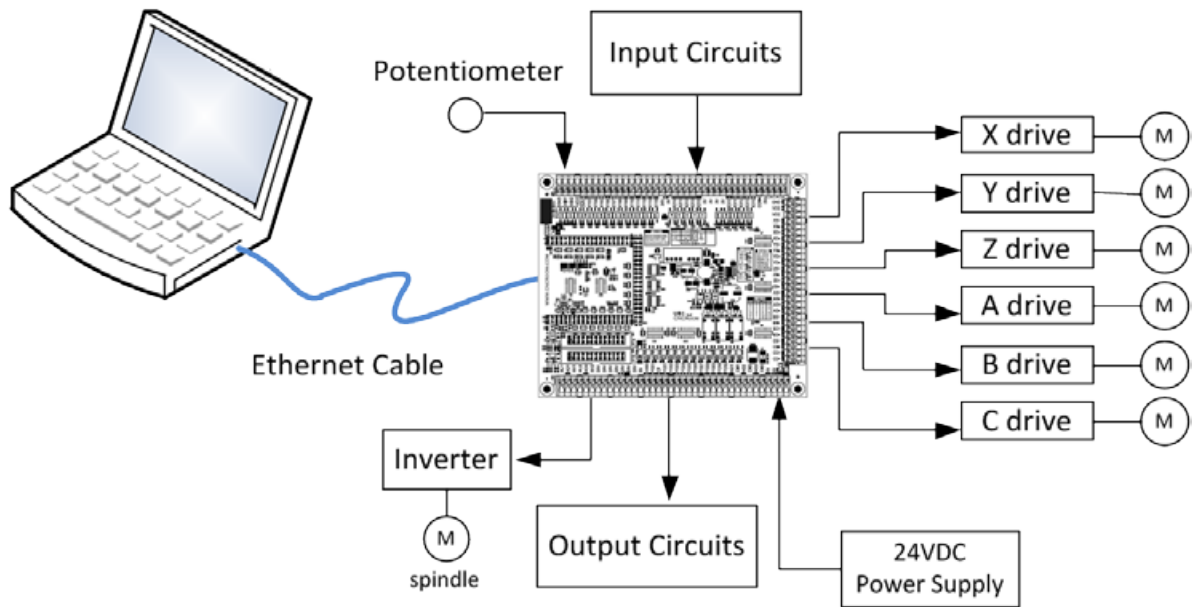


Figure 5, Connection Diagram

Hardware

Power Supply

The UB1 requires only a single 24Vdc 500mA power supply to power the board. However, a 24Vdc 3Amp power supply is recommended for general usage. **Figure 6** shows the input terminals for 24V and 0V with highlighted label on the lower right hand side terminal.

There is a step-down switching regulator that converts 24V (18-28Vdc) down to 5V to supply most parts of the circuit, including the inputs and outputs.

There is also a special isolated DC2DC converter that generates VCC (5Vdc), this is used solely to power the UC300ETH board and it's surrounding buffer circuits for UC300ETH MCU.

There are several pairs of power terminals, which are labelled as 5V-0V, 24V-0V. The user can use these to power external devices and circuits.

The 5V-0V point can supply up to 500mA and the 24V-0V can supply up to 1000mA. It is recommend setting up an external terminal for power distribution if a large amount of power is required.

On board there is also a small fuse for protection against over voltage and polarity reversal.

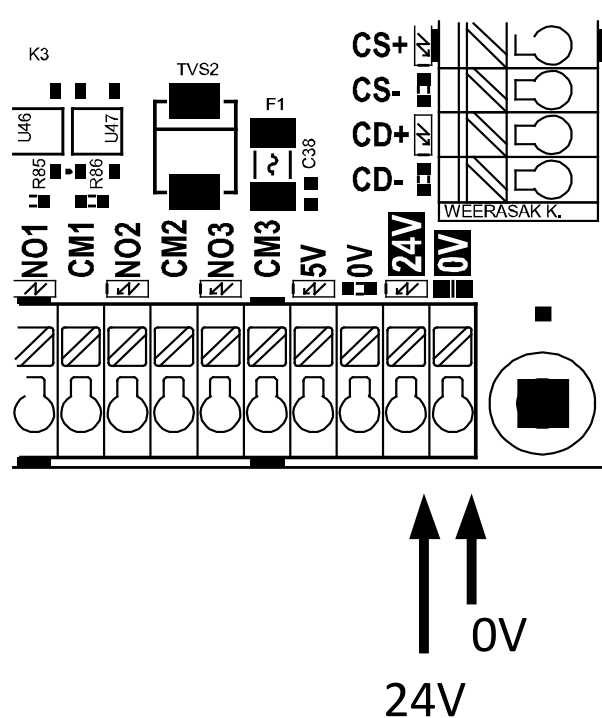


Figure 6, Power supply connection

Board Identifier

The UB1 was developed by following UC300ETH_5LPT Motherboard pin out. Choosing the 5LPT jumper will get 100% pin to pin compatible, except analog channel output 2 which will not function properly. Choosing the UB1 jumper the user will get 100% pin to pin compatible and the analog output will function properly.

The reason for this is that the UB1 isolated analog circuit uses a frequency of 1 kHz while the 5LPT board uses a frequency of 48 kHz.

Axis Motion signals

AXIS CN2 terminal supplies motion command signal for drives.

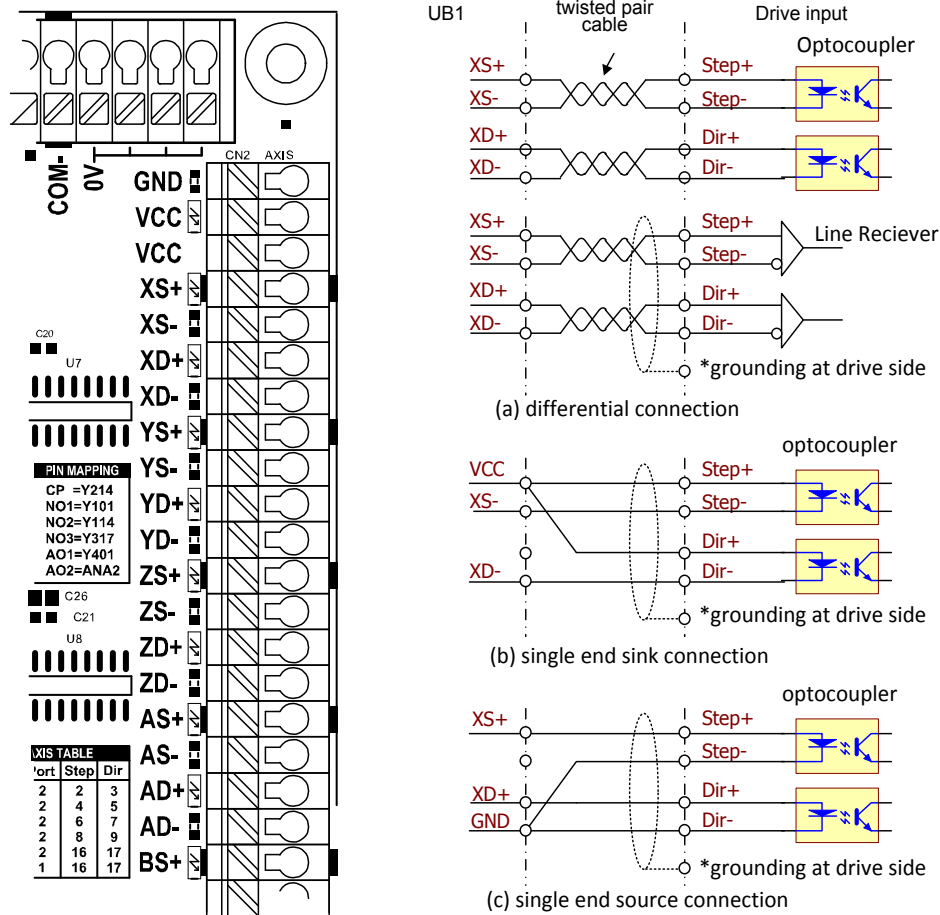


Figure 7, Axis command terminal and various connection modes

There are three different methods of connecting your drives to CN2.

Figure 7 (a) Differential connection has the best noise immunity. It is recommended to use differential mode if possible.

Figure 7 (b) Single end sink connection is used if the exist connection system follows this fashion.

Figure 7 (c) Single end source connection is used if the exist connection system follows this fashion. This connection is similar to computer parallel port.

Inputs

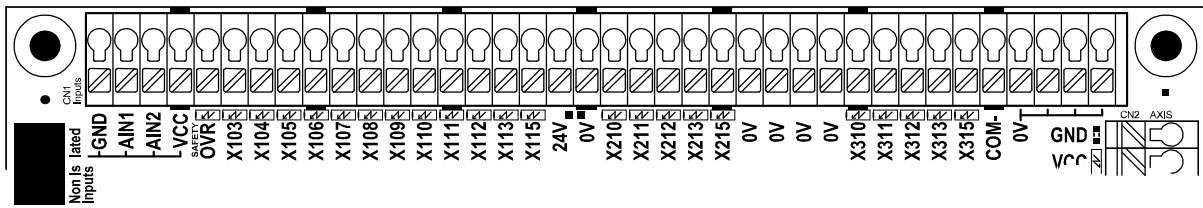


Figure 8, Input terminals

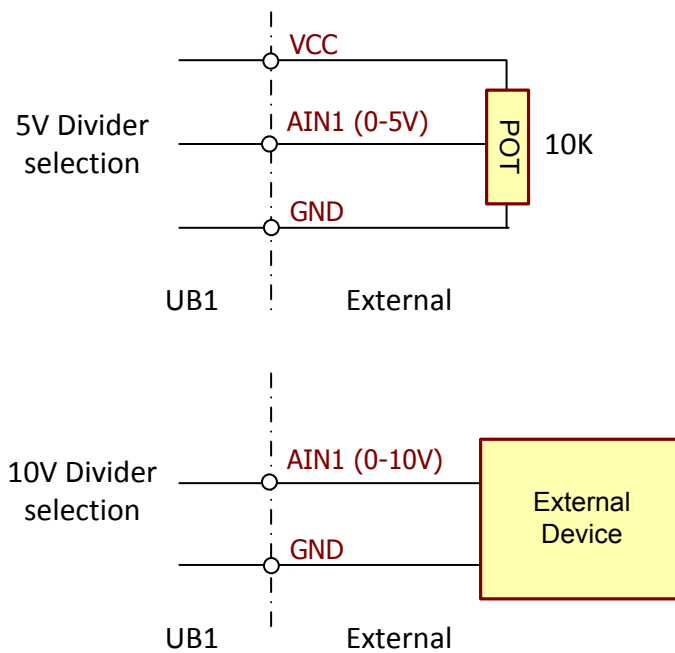
Figure 8 shows input terminal. It consists of following inputs.

- 2 non-isolated 5V analog inputs including AIN1 and AIN2. The user can change it to 10V by change solder-bridge.
- 13 channels of 24vdc isolated NPN inputs including OVR, X103-X115.
- 5 channels of 5Vdc isolated NPN inputs including X210-X215 which is suitable for low voltage devices such as MPG, encoder.
- 5 channels of 24/5Vdc selectable isolated PNP inputs including X310-315, which is suitable for industrial sensors with PNP type output.

Analog Inputs

The UB1's two analog inputs use two sets of circuits which include a voltage divider and a filter and voltage clamp circuit to handle the analog signals before passing them through to the UC300ETH's MCU analog input pins. To select the voltage level, please see the detailed information at the [modification](#) section of this manual..

Warning, these two inputs are not isolated, therefore connecting voltage higher than 5v, 10v (depending on which one is selected) could permanently damage the MCU of UC300ETH. Please make sure that you don't induce interference noise to disturb the operation of MCU.



Digital Inputs

There are 23 digital total inputs on CN1 or top terminal, The primarily function of these inputs is to feed the state of logic 'on' and 'off', 'true' and 'false' from the outside world to the UC300ETH controller. A secondary function of X103-X110 are inputs for the safety circuit.

There are solder-bridges on the bottom of the UB1 board for the user to bridge the input status of inputs X103 – X110 to safety circuit (see page 18). Use the “OVR” input as the override signal for the OSSD safety circuit.

The safety circuit forms an “AND” logic for all of its input signals. This eliminates the need to build a separate safety circuit, hopefully saving the user time and money

This safety circuit is a standalone circuit that works without any control from UC300ETH and software. Therefore it will disengage the OSSD output regardless of whether the software crashes or malfunctions.

Switches Connection

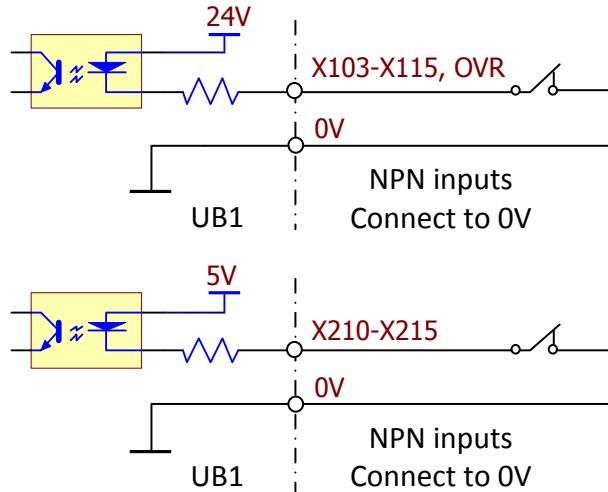


Figure 9, Connection of the NPN inputs, it references to 0V

Figure 9, shows the conventional way to connect a switch to an NPN input with 0V

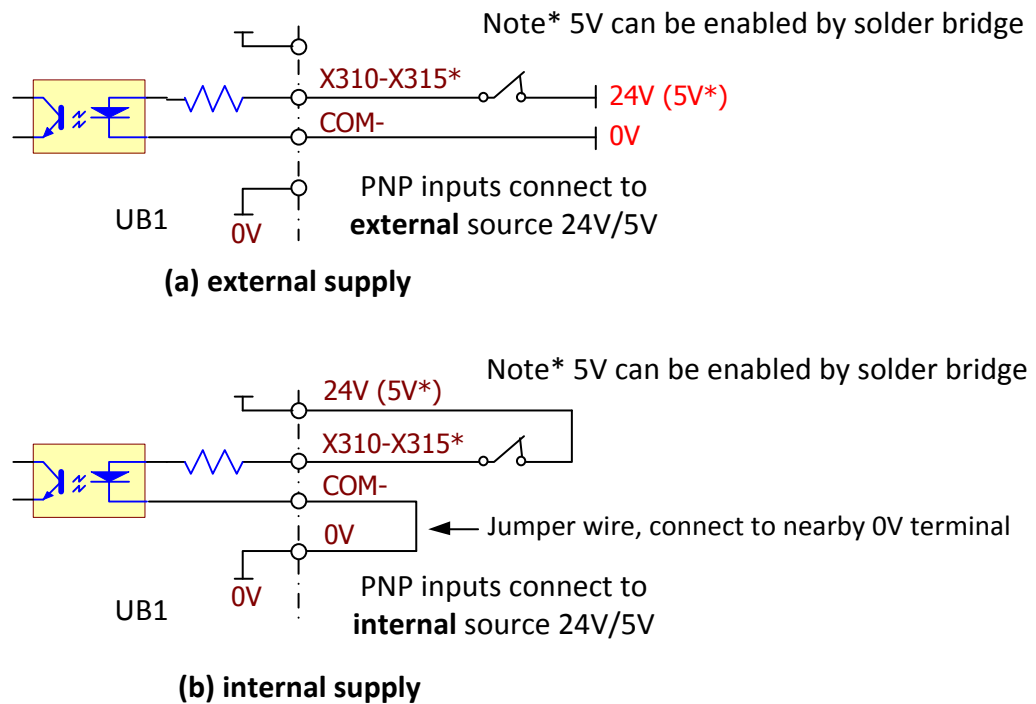


Figure 10, Connection of PNP inputs

Figure 10, (a) shows a PNP input connected to an external power source. This connection is totally isolated from any part of the UB1 circuit. This external circuit, for instance, could be the fault output of a VFD drive or servo drive.

Figure 10, (b) shows a PNP input connected to the internal power source.

Sensors Connection

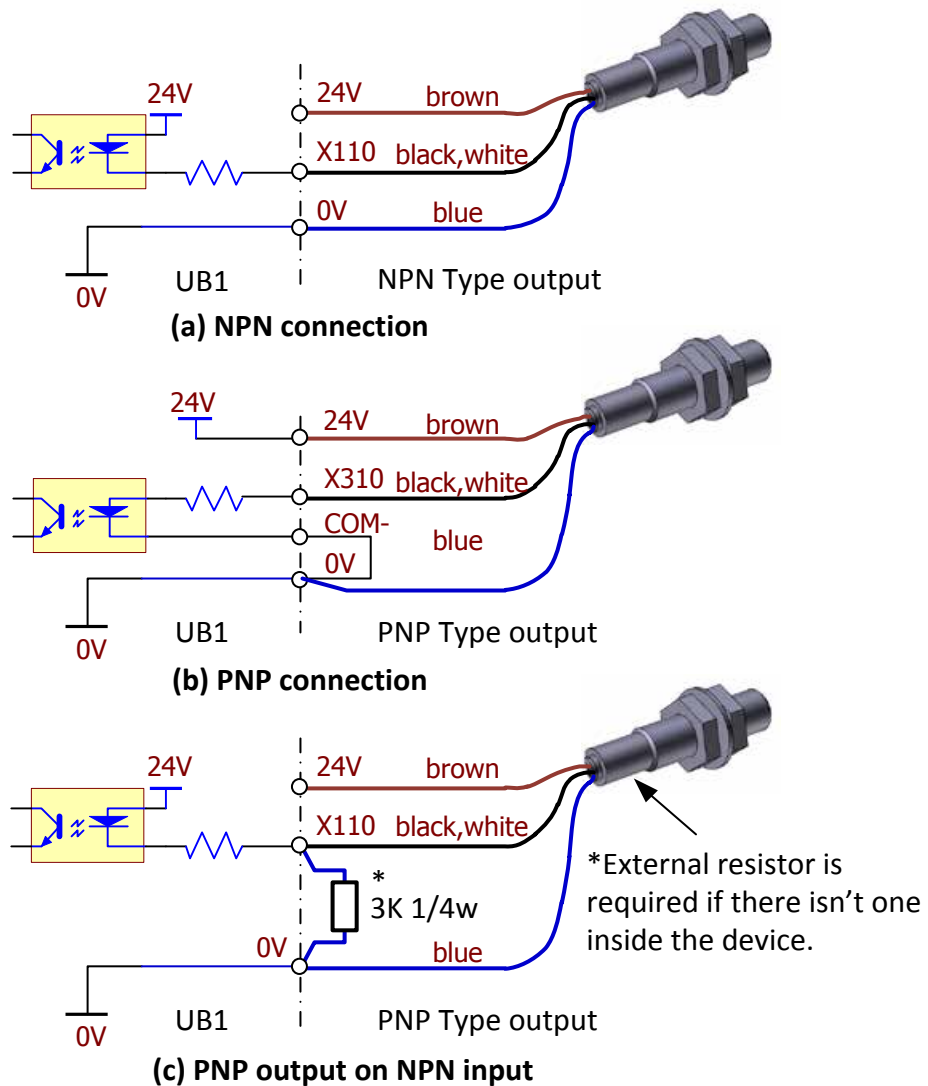


Figure 11, Sensor connections

Figure 11, (a) shows the connection of NPN type sensors. This connection is applicable for input terminals X103 – X115 and X210 – X215 only.

Figure 11, (b) shows the connection of PNP type of sensors. This connection is applicable for input terminals X310 - X315 only.

Figure 11, (c) this connection gives an alternative for PNP sensors to connect to NPN inputs. However, the logic is **inverse**, so you must also change the logic in the corresponding setting within Mach or UCCNC to also be inverse.

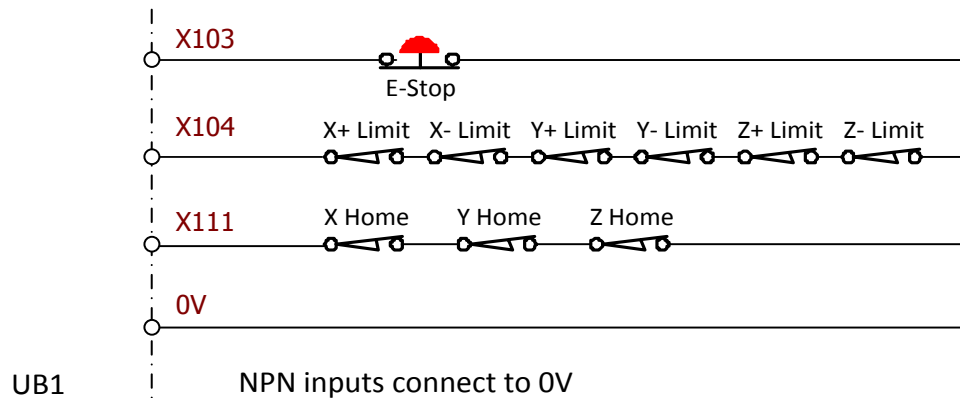


Figure 12, is an example of E-STOP, LIMIT and HOME switch connections

Figure 12 shows the conventional way to connect the Estop, Limit and Home switches. This will form an “AND” circuit. Notice that all use NC contacts (normally closed).

Outputs

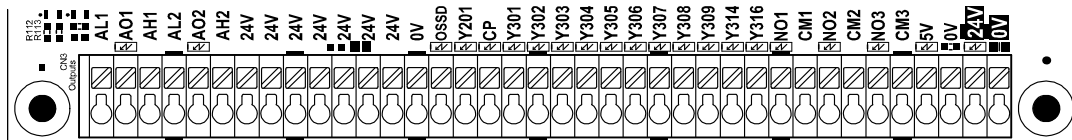


Figure 13, Output terminals

Figure 13 shows the UB1 output terminals. It consists of the following outputs:

- 2 isolated analog output including AO1 and AO2
- 14 digital output, can sink current up to a maximum of 70 mA
- 3 Relays

Analog Output

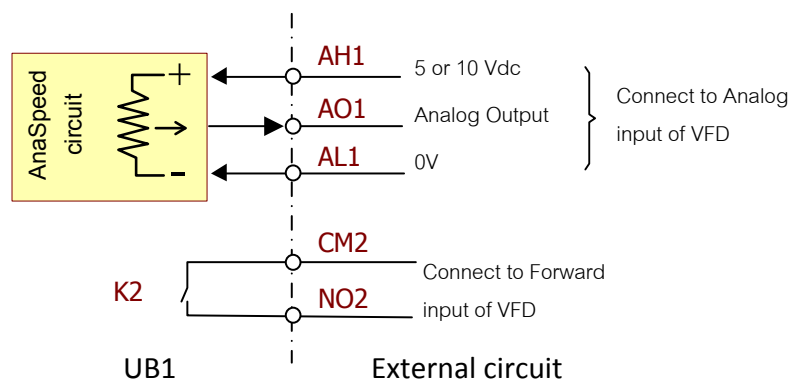


Figure 14, VFD connection

The “AnaSpeed” circuit converts PWM signal into an analog signal. The maximum voltage level is dependent upon the external power supply. For example, if the circuit is connected to a 0-10V analog input of the VFD, it will demand 10Vdc from the VFD as well.

The “AnaSpeed” has a tolerance margin of about $\pm 0.2V$ with light load. It is able to generate a voltage up to 9.8V only (10V-0.2V) when supplied with external power of 10V.

There are two way to make VFD run at full range of frequency. First is the compensation is made by the VFD’s parameters. Second, provide an adequate voltage power source to AH1 or AH2.

Normally, a VFD needs a forward command to rotate the motor. Thus, any NO contact of K1 or K2 can be used for this purpose.

Transistor Sink Output

General Load Connection

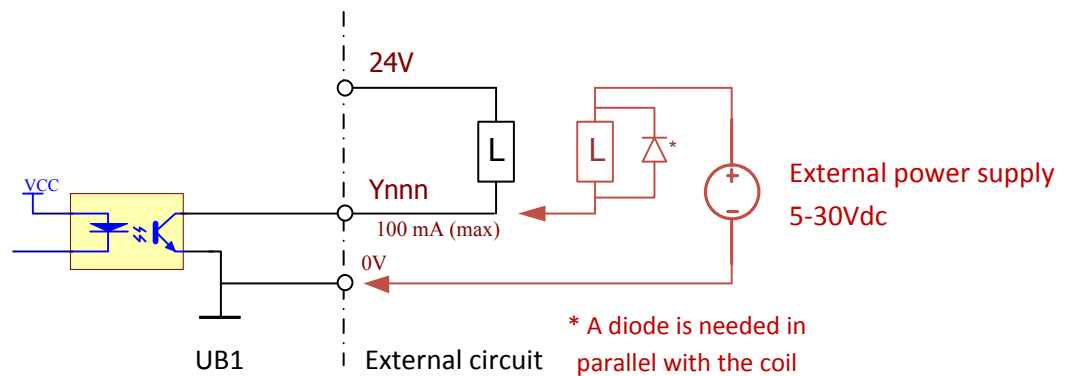
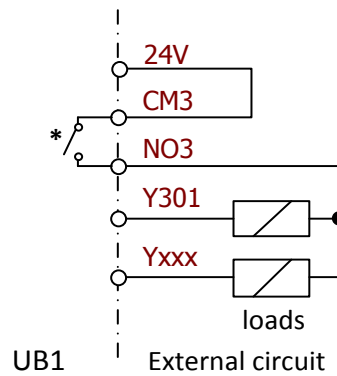


Figure 15, connecting various loads to a “Y” output

Charge Pump

The charge pump is a pulse frequency signal from UCCNC/Mach3 indicating that software control is present and ready to run. UB1 has special circuit to capture this pulse frequency and output to the CP (Charge Pump) terminal. Normally an external relay would be connected to this CP terminal for cutting the power source from any attached loads. However, with the UB1, the user can choose to select relay K3 as an output for the CP signal. To choose this option, please see **Figure 19**, the bottom side layout of the UB1. There is an appropriate solder-bridge [*8].



Note* Solder bridge [*8] CP is selected

Figure 16, Charge pump interlock with other relays

OSSD Output and Safety Circuit

The UB1 has an OSSD (Output Signal Switching Device) output for the user to form a simple safety circuit in their system. When the system is error free, the UB1 energizes the OSSD output and it will de-energize the OSSD output if an error has occurred.

Most drives will give an OK signal or “Servo Ready” or similar, by energizing its appropriate output and connected external devices will receive this status. The UB1 collects all OK signals from various devices through terminal inputs X103 – X110 and then sends out an OK signal to the next device.

However, if there is an error feeding in, UB1 will send out a “Not OK” signal by de-energizing the OSSD output and the external safety circuit will cut power and stop the hazard.

Using a magnetic contactor as an external device is a simple way to disconnect the power supply from the drives or the VFD. The “OVR”(Override) input is provided for temporarily energizing the magnetic contactor, which lets the machine operator recover from the error.

To activate this function, the user needs to select one or more inputs from X103 to X110. Then by creating a solder-bridge across the appropriate corresponding solder pads, i103 to i110, which are shown in **Figure 18 on page 18**, the chosen inputs will become part of the safety circuit.

Figure 17 shows the safety circuit block and relevant I/O including, inputs, solder-bridge, and override input and outputs.

Warning. The UB1 utilises only a simple safety circuit. There is no guarantee it will protect against a serious external failure. It is therefore advised that the user **MUST ALWAYS** check the functionality of any external circuit that is connected to the UB1.

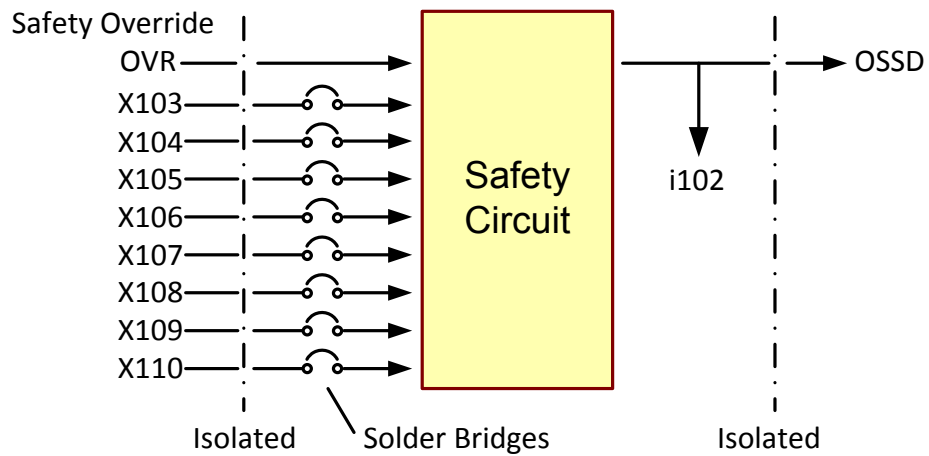


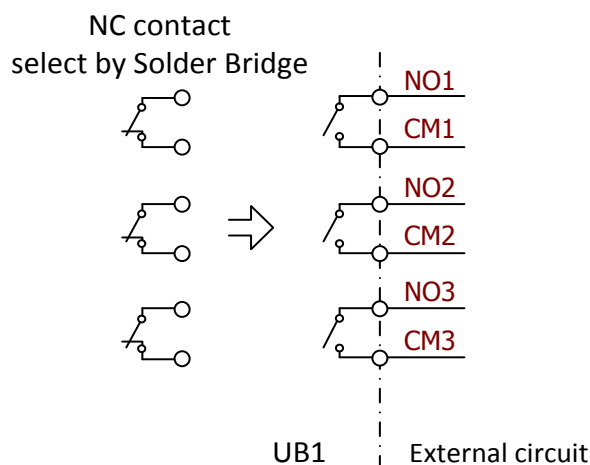
Figure 17, On board safety circuit

Relays

The UB1 comes with 3 on-board relays, K1, K2 and K3. NO contacts are selected by default. But they can easily be changed to NC by soldering the solder-bridge under the board.

Off delay time is provided for K1, K2. This allows the user to create a timing sequence for devices that need to power up or power down independently at different times. It can be used for such application as “Z axis Drop Protection”. The K3 Relay can be controlled by a charge pump signal

These 3 relays are signal relays and should never be used as power relays. They are intended to convey signals such as forward and reverse to a VFD (Variable Frequency Drive) to control motor rotation of a spindle or similar. They can be used for other purposes as well, and the user needs to map them in software accordingly. However, please take care, as the contacts of these relays can carry a maximum current of only 0.5 Amps at 120VAC, or 1 Amp at 24Vdc. The user must use an external relay if the load requirements of the device will exceed the aforementioned current rating.



Modification

Solder-Bridges

The UB1 has a number of places where the user can conduct modifications. Instead of using pin jumpers, solder-bridges have been implemented to save cost and space. The user needs to solder or de-solder these bridges to achieve their purpose.

(Note: the below sub heading numbers, *1 to *12 relate to the printed numbers on the under-side of the UB1 board.)

*1. DC Converter

There is an option to not use the default onboard 5V isolated DC2DC converter. Because this on-board converter can only supply a limited current, in some cases it may be necessary to use an external 5V power supply. The existing bridge has to be de-soldered, and then the user can connect an external 5V power supply to the VCC channel at the Axis CN2 terminal.

*2. Safety Circuit Inputs

X103 – X110 primarily function the same as the other normal inputs. However, there is the option to use these inputs as part of the safety circuit by soldering a bridge across one or more pairs of the solder pads, which are shown in the image below. The i103 bridge is already soldered by default.

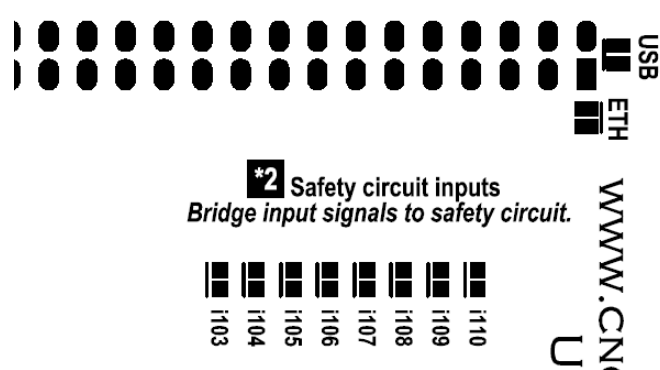


Figure 18 Bridges for safety inputs

*3. CP override

This allows the user disable charge pump function. Soldering solder-bridge makes CP signal always on

*4 Analog Input Tolerance

This allows the user to select the tolerance for the analog inputs, and can be set to either 5V or 10V range.

*5. Analog1 (A01) pin select

The pin for AnaSpeed Analog circuit channel 1, lets the user chose between ANA1*, the UC300 dedicate pin and Y401. The default setting is Y401.

*Note. UB1 identifier needs to be selected for Board ID jumper.

*6. 5V input tolerance

By default, X310-X315 accept 24V logic from external devices. However, the user can make these inputs to accept 5V logic level from external devices as well.

*7 Outputs Disable with CP

In safety concern environment, disengage hazardous energy sources is one of keys. This feature may help to reduce the complexity of safety circuit. The user can decide which group of output will be together with CP signal.

*8 K3 Relay pin select

Normally, K3 is associated with output Y317. However, you can select K3 as an output relay of CP (charge pump) signal. (See Figure 19, the bottom layout of the UB1)

*9. Off Time Relay

This feature can be used where an off time delay is required, such as in “Z-Drop” protection, which allows a mechanical brake to engage before the motor loses its holding torque. This can happen after the control signal or the main power is cut from its drive. Solder the bridge at K1 to enable an off delay of 220 ms, or at K2 for 440 ms. The delay time can be extended by adding more capacitors to the provided pads underneath the board.

*10. NO/NC contacts

As a result of squeezing so many features into a small board size. the NC relay contacts were eliminated. However, the NO contacts can be switched to NC by selecting the NC solder-bridge.

*11. Free Terminals

In some circumstances, the user may need a few extra terminals for their work. This can be achieved by cutting or de-soldering one or more of the bridges at the respective terminals. These free terminals are only meant for use with low voltage, nothing over 24V.

*12. Board ID solder-bridge or Board ID jumper on top side

This lets the user to choose between UB1 or 5LPT compatible mode.

The UB1 was developed by following UC300ETH_5LPT Motherboard pin out. Choosing the 5LPT jumper will get 100% pin to pin compatible, except analog channel output 2 which will not function properly. Choosing the UB1 jumper the user will get 100% pin to pin compatible and the analog output will function properly.

The reason for this is that the UB1 isolated analog circuit uses a frequency of 1 kHz while the 5LPT board uses a frequency of 48 kHz.

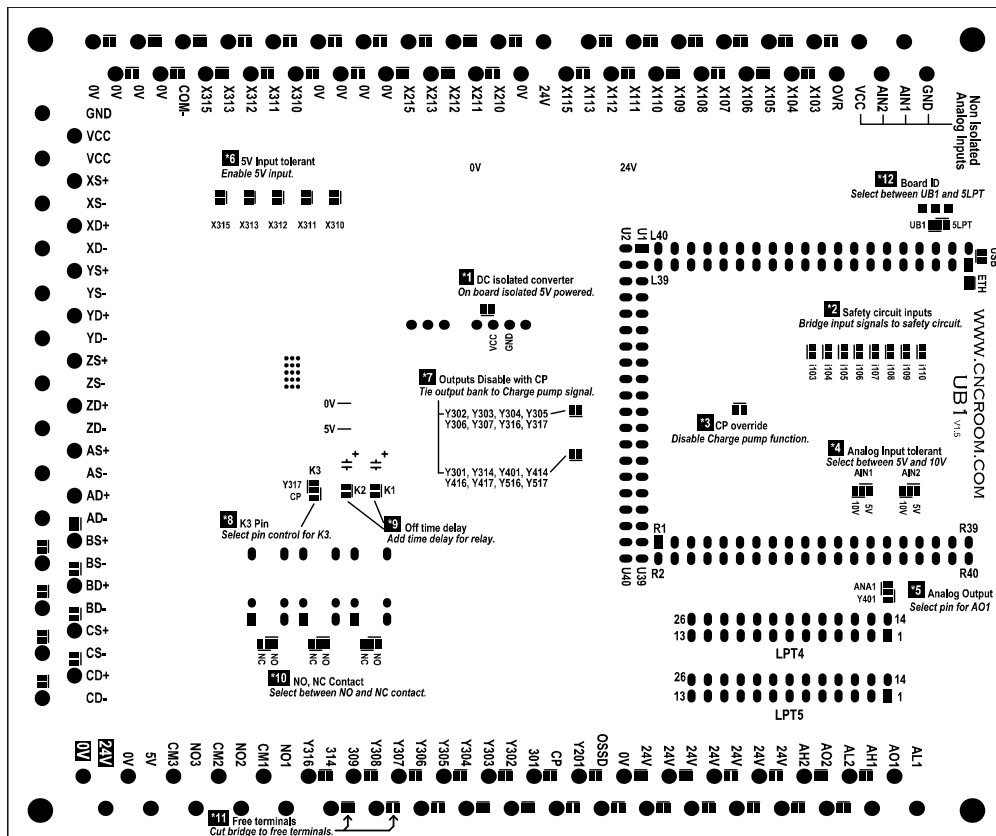


Figure 19, the bottom layout of the UB1

Software

UCCNC Configuration

UB1 has some certain hardware functions such as charge pump, analog outputs, etc. that need their ports and pins to be specified before the user can operate the board.

However, there are also some others ports and pins such as inputs and outputs that the user needs to specify depending on their application.

Axis Setup

RUN TOOLPATH OFFSETS TOOLS CONFIGURATION DIAGNOSTICS CAM HELP
AXIS SETUP I/O SETUP I/O TRIGGER GENERAL SETTINGS APPEARANCE PROFILES
X-AXIS Y-AXIS Z-AXIS A-AXIS B-AXIS C-AXIS SPINDLE AUX ENC.

Axis enabled

Step pin: 2 port: 2 Active low
Dir pin: 3 port: 2 Active low

Enable pin: 0 port: 0 Active low
Limit - pin: 0 port: 0 Active low
Limit + pin: 0 port: 0 Active low
Home pin: 0 port: 0 Active low Direction positive

Homing speed up (Units/min): 600
Homing speed down (Units/min): 300
Write offset on homing (Units): 0 Auto set
Steps per Unit: 200 [Calibrate](#)
Velocity (Units/min): 2000
Acceleration (Units/s²): 200
Softlimit - (Units): 0
Softlimit + (Units): 0
Comp. Acceleration (Units/s²): 360
Backlash distance (Units): 0 Enable backlash
Slave axis: None

[Apply settings](#) [Save settings](#)

Figure 20 X-Axis port and pin

RUN TOOLPATH OFFSETS TOOLS CONFIGURATION DIAGNOSTICS CAM HELP
AXIS SETUP I/O SETUP I/O TRIGGER GENERAL SETTINGS APPEARANCE PROFILES
X-AXIS Y-AXIS Z-AXIS A-AXIS B-AXIS C-AXIS SPINDLE AUX ENC.

Axis enabled

Step pin: 4 port: 2 Active low
Dir pin: 5 port: 2 Active low

Enable pin: 0 port: 0 Active low
Limit - pin: 0 port: 0 Active low
Limit + pin: 0 port: 0 Active low
Home pin: 0 port: 0 Active low Direction positive

Homing speed up (Units/min): 600
Homing speed down (Units/min): 300
Write offset on homing (Units): 0 Auto set
Steps per Unit: 200 [Calibrate](#)
Velocity (Units/min): 2000
Acceleration (Units/s²): 200
Softlimit - (Units): 0
Softlimit + (Units): 0
Comp. Acceleration (Units/s²): 360
Backlash distance (Units): 0 Enable backlash
Slave axis: None

[Apply settings](#) [Save settings](#)

Figure 21 Y-Axis port and pin

RUN	TOOLPATH	OFFSETS	TOOLS	CONFIGURATION	DIAGNOSTICS	CAM	HELP
AXIS SETUP	I/O SETUP	I/O TRIGGER	GENERAL SETTINGS	APPEARANCE	PROFILES		
X-AXIS	Y-AXIS	Z-AXIS	A-AXIS	B-AXIS	C-AXIS	SPINDLE	AUX ENC.

Axis enabled

Step pin: 6 port: 2 Active low

Dir pin: 7 port: 2 Active low

Enable pin: 0 port: 0 Active low

Limit - pin: 0 port: 0 Active low

Limit + pin: 0 port: 0 Active low

Home pin: 0 port: 0 Active low Direction positive

Homing speed up (Units/min): 600

Homing speed down (Units/min): 300

Write offset on homing (Units): 0 Auto set

Steps per Unit: 200

Velocity (Units/min): 2000

Acceleration (Units/s²): 200

Softlimit - (Units): 0

Softlimit + (Units): 0

Comp. Acceleration (Units/s²): 360

Backlash distance (Units): 0 Enable backlash

Slave axis: None

Figure 22 Z-Axis port and pin

RUN	TOOLPATH	OFFSETS	TOOLS	CONFIGURATION	DIAGNOSTICS	CAM	HELP
AXIS SETUP	I/O SETUP	I/O TRIGGER	GENERAL SETTINGS	APPEARANCE	PROFILES		
X-AXIS	Y-AXIS	Z-AXIS	A-AXIS	B-AXIS	C-AXIS	SPINDLE	AUX ENC.

Axis enabled

Step pin: 8 port: 2 Active low

Dir pin: 9 port: 2 Active low

Enable pin: 0 port: 0 Active low

Limit - pin: 0 port: 0 Active low

Limit + pin: 0 port: 0 Active low

Home pin: 0 port: 0 Active low Direction positive

Homing speed up (Units/min): 600

Homing speed down (Units/min): 300

Write offset on homing (Units): 0 Auto set

Steps per Unit: 200

Velocity (Units/min): 2000

Acceleration (Units/s²): 200

Softlimit - (Units): 0

Softlimit + (Units): 0

Comp. Acceleration (Units/s²): 360

Backlash distance (Units): 0 Enable backlash

Slave axis:

Figure 23 A-Axis port and pin

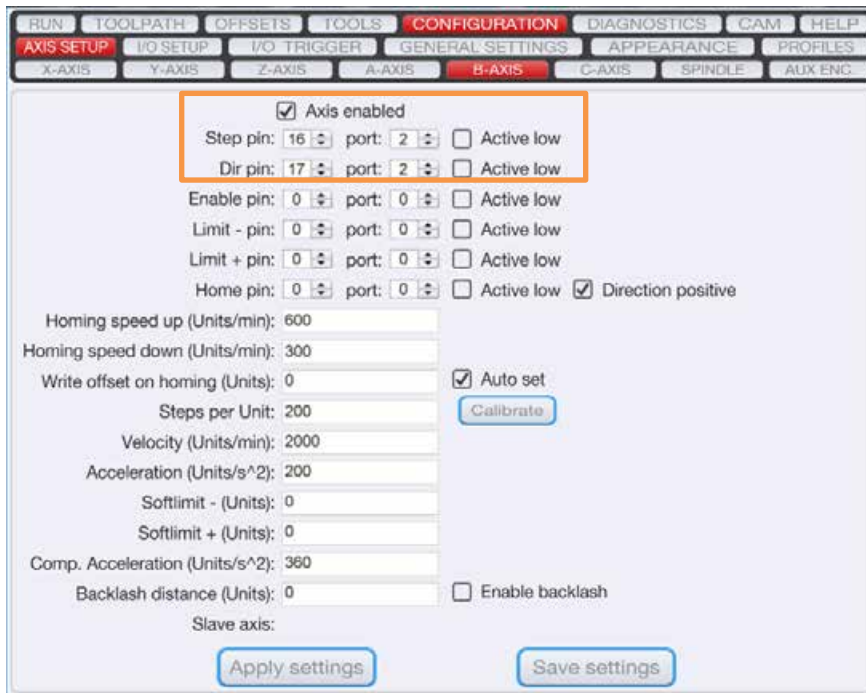


Figure 24 B-Axis port and pin

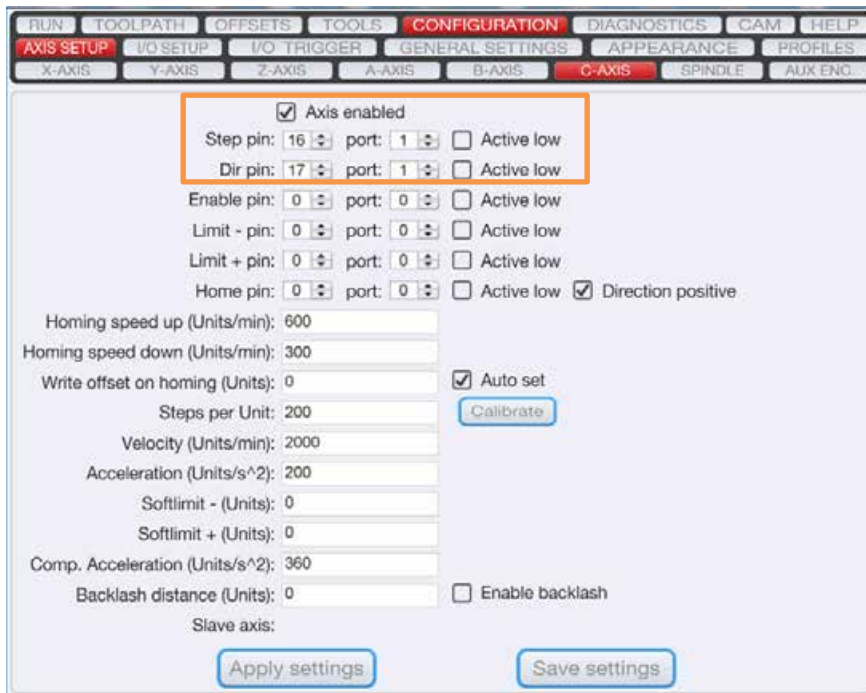


Figure 25 C-Axis port and pin

Spindle

PWM spindle
 PWM pin: 1 port: 4 Active low
 Dir pin: 0 port: 0 Active low
 PWM frequency (Hz): 1524
 PWM min duty (%): 0 max (%): 100

Step/direction spindle
 Step pin: 0 port: 0 Active low
 Dir pin: 0 port: 0 Active low
 Step per rotation: 500
 Acceleration (step/s²): 200

Spindle PID control:
 Index pin: 0 port: 0
 Index prescaler: 1

Encoder PPR: 400 Reverse Enc. dir.
 Encoder A pin: 0 port: 0
 Encoder B pin: 0 port: 0

Spindle velocity (1/min): Min. 10 Max. 24000 Use pulleys Pulley no.: 1

Spindle relay output enabled
 M3 relay pin: 1 port: 1 Active low
 M4 relay pin: 0 port: 0 Active low
 M3 delay after on (ms): 0
 M3 delay after off (ms): 0
 M4 delay after on (ms): 0
 M4 delay after off (ms): 0

Flood/Mist relay outputs enabled
 M7 relay pin: 14 port: 1 Active low
 M8 relay pin: 17 port: 3 Active low
 M7 delay after on (ms): 0
 M8 delay after off (ms): 0
 M9 delay (ms): 0

Figure 26 Spindle ports & pins, Including PWM Analog channel 1

I/O Setup

E-stop pin: 0 port: 0 Active low
 Probe1 pin: 0 port: 0 Active low
 Probe2 pin: 0 port: 0 Active low
 Charge1 p. pin: 14 port: 2 Active low
 Charge2 p. pin: 0 port: 0 Active low
 Charge pump always on
 Current hi/low: 0 port: 0 Active low
 Laser output: 0 port: 0 Active low

Analog input 1 -> var#: 0
 Analog input 2 -> var#: 0
 FRO ana. ch.: 0 min% 0 max% 0
 SRO ana. ch.: 0 min% 0 max% 0
 JRO ana. ch.: 0 min% 0 max% 0
 Var# -> analog out 1: 0
 Var# -> analog out 2: 0
 Spindle PWM -> analog ch.: 2

MPG A pin: 0 port: 0
 MPG B pin: 0 port: 0
 MPG prescaler: 1 MPG filter const.: 10
 MPG speed multiplier: 10
 Attach JRO to MPG

Enable THC control
 Arc on pin: 0 port: 0 Active low
 THC up pin: 0 port: 0 Active low
 THC down pin: 0 port: 0 Active low
 Min. height: 0.2 Max. height: 1
 THC feedrate (Units/min): 600
 Control THC even if the THC on signal is not active
 Enable THC Delay Delay (sec): 0
 Enable THC anti dive Threshold (%): 0
 Enable THC anti down
 THC en. out pin: 0 port: 0 Active low
 An. dive out pin: 0 port: 0 Active low
 An. down out pin: 0 port: 0 Active low

Figure 27 Ports & Pins for Charge Pump and PWM Analog channel2

General Settings

RUN	TOOLPATH	OFFSETS	TOOLS	CONFIGURATION	DIAGNOSTICS	CAM	HELP
AXIS SETUP	I/O SETUP	I/O TRIGGER	GENERAL SETTINGS	APPEARANCE	PROFILES		

Comm. buffer size (sec): 0.1

Interpolation mode selection:

Exact stop mode

Constant velocity mode

Stop at angle degrees > 89

Look ahead lines count: 300

Linear error max. 0.03

Linear addition length max. 1

Linear unify length max. 2

Corner error max. 0.03

Arc radius tolerance 0.1

Enable softlimits Softlimits file precheck

Unknow g-codes action:

Ignore Warning Don't run

Reset on file load: G68 G51

Kernel frequency:

25kHz 200kHz

50kHz 400kHz

100kHz

Position DROs digits: 4

On tool change code (M6) do the following:

Ignore tool change code (M6)

Stop spindle and wait for Cycle Start

Run the tool change macro (M6)

Safe Z height (Units) 25

G73 back off (Units) 0.4

Measure dwell in seconds instead of msec

Precompile all macros on startup

Homing sequence:

1.) Z axis 2.) X axis 3.) Y axis

4.) None 5.) None 6.) None

Configure plugins Config macroloops Edit screen

Apply settings Save settings

Figure 28 General settings

Mach3 Configuration

At the current time, the user need to select the 5LPT identifier for UB1 breakout board, otherwise the UC300ETH plugin will not detect the board.

The user can obtain the pre configuration XML file and copy it to their system. However, there are some values that need to be set to suit individual applications.

After downloading and extracting the pre configuration profile. You will find UB1.xml that needs to be copied and pasted into C:\Mach3 which is shown in picture below. Run Mach3 Loader and choose UB1 profile.

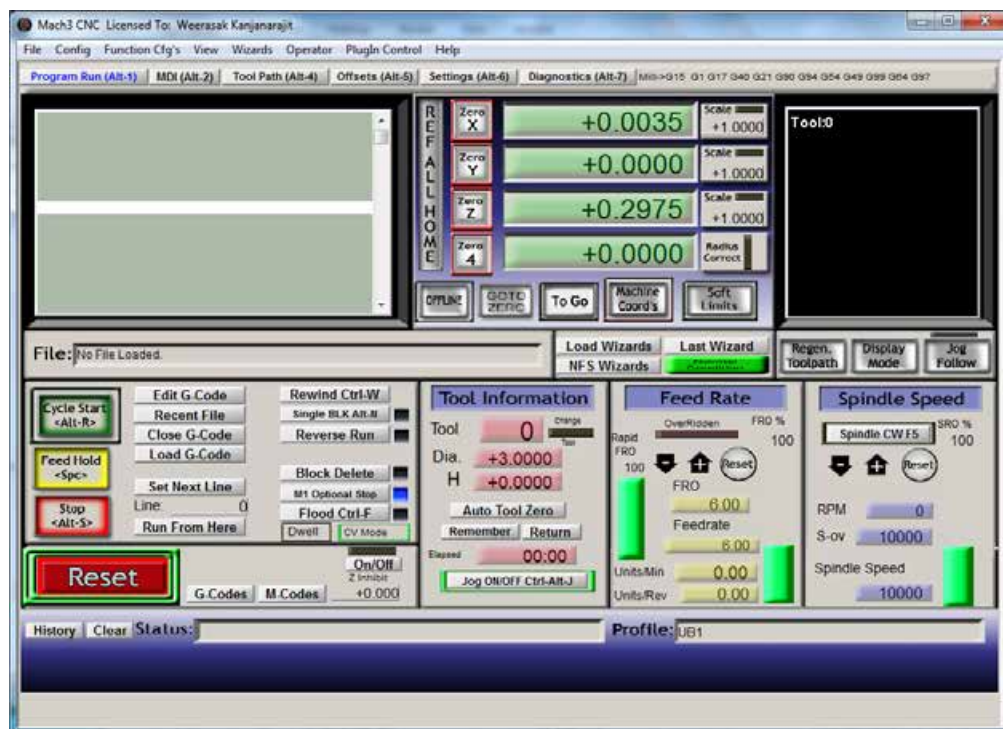


Figure 29, Mach3's first screen

Menu Config > Ports and Pins

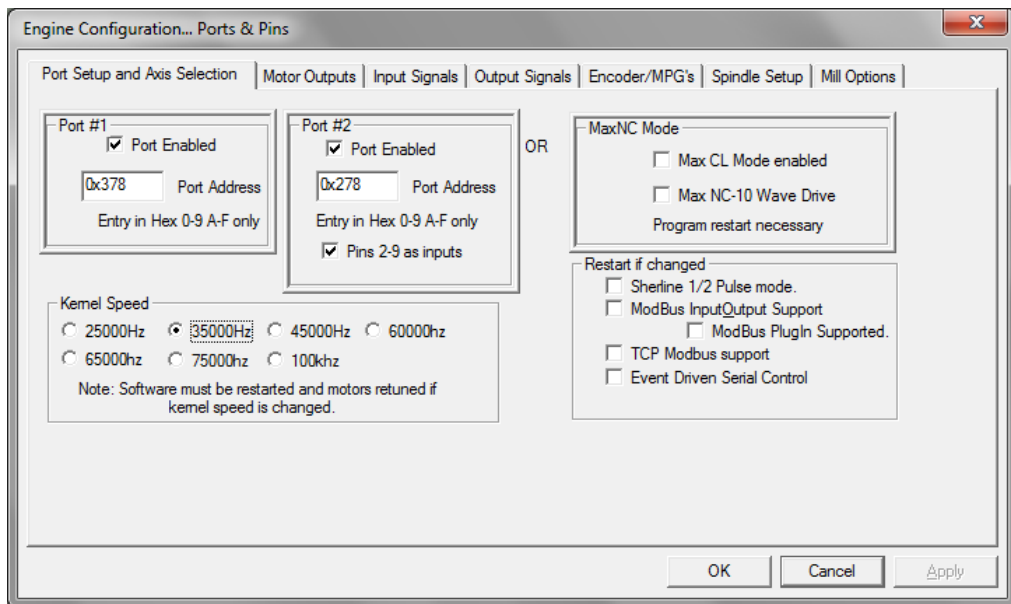


Figure 30, Mach3 Ports and Pins dialog

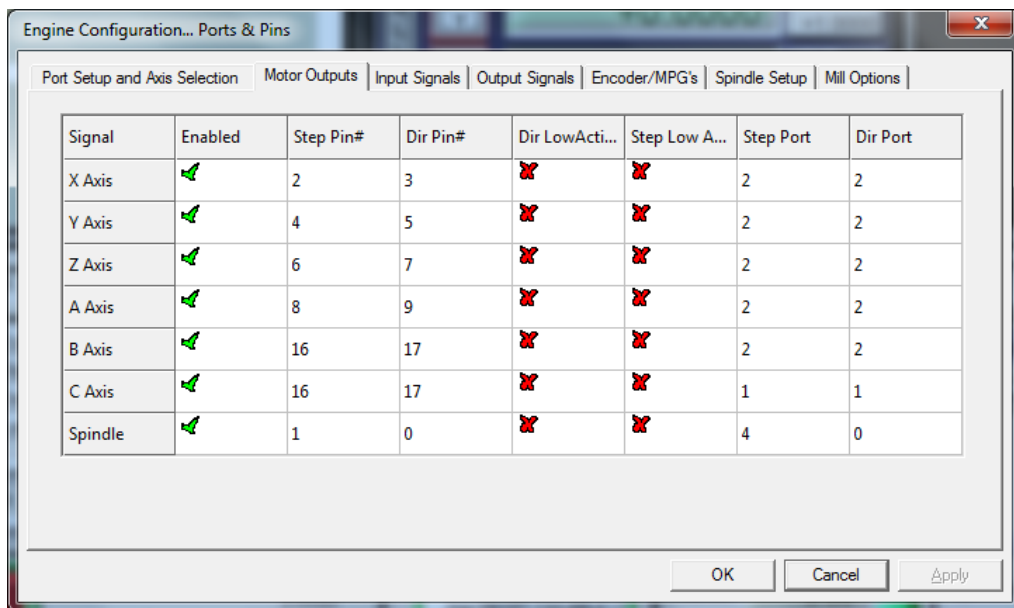


Figure 31, Motor output tab

Specify values as shown in the picture.

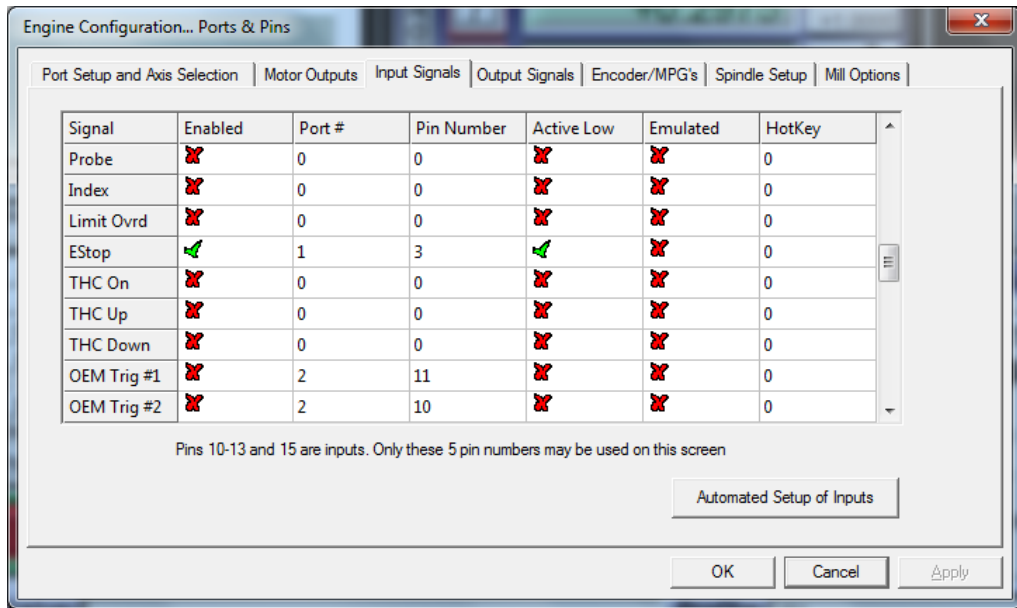


Figure 32, Mach3 Input Signals

The user needs to set suitable values by themselves

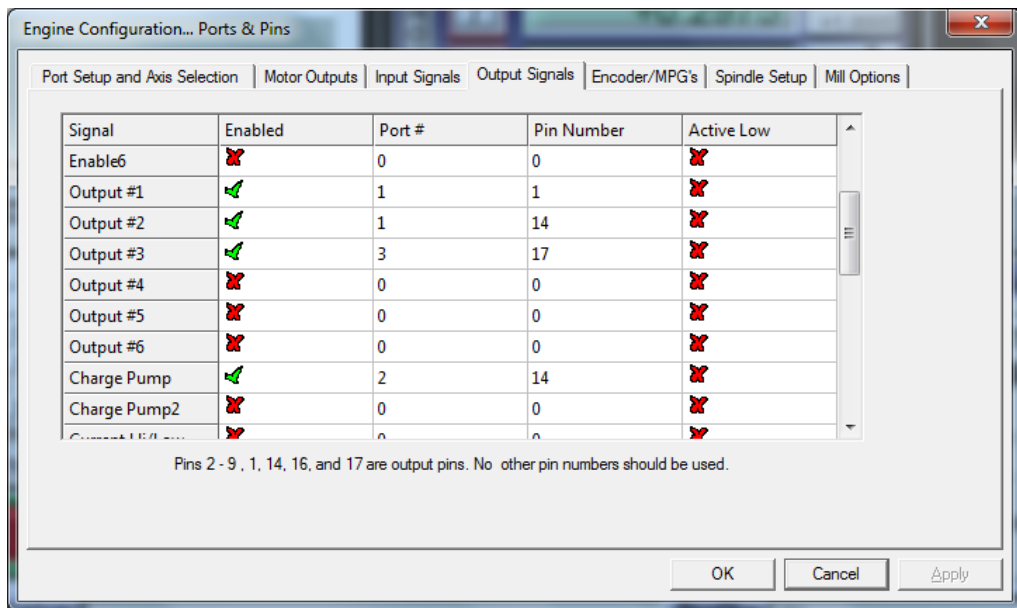


Figure 33, Mach3 Output Signals (1/2)

The user needs to set suitable values by themselves

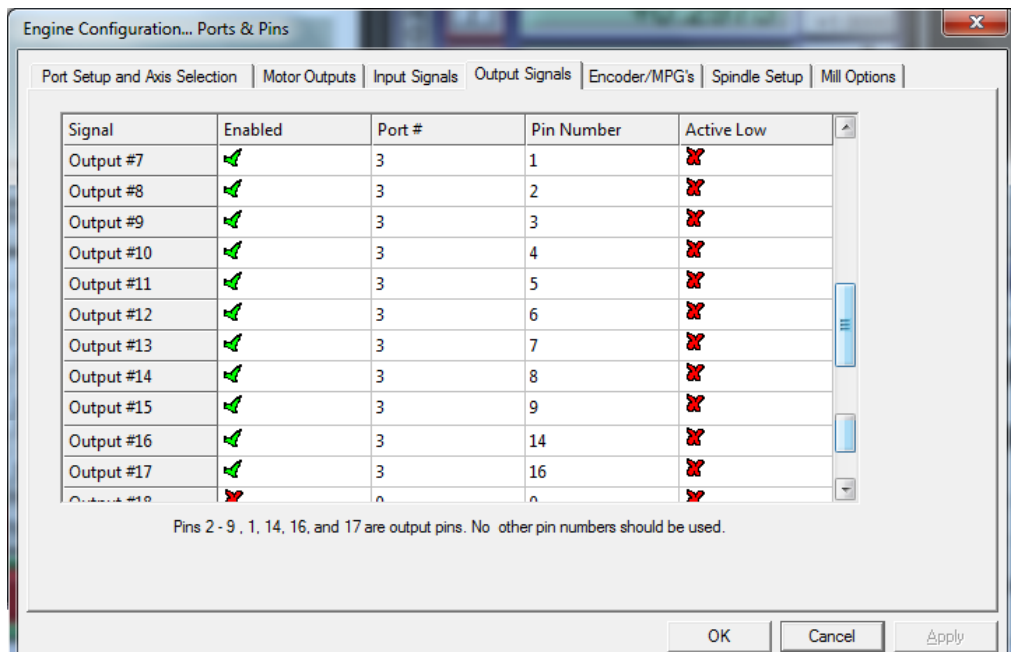


Figure 34, Mach3 Output tab (2/2)

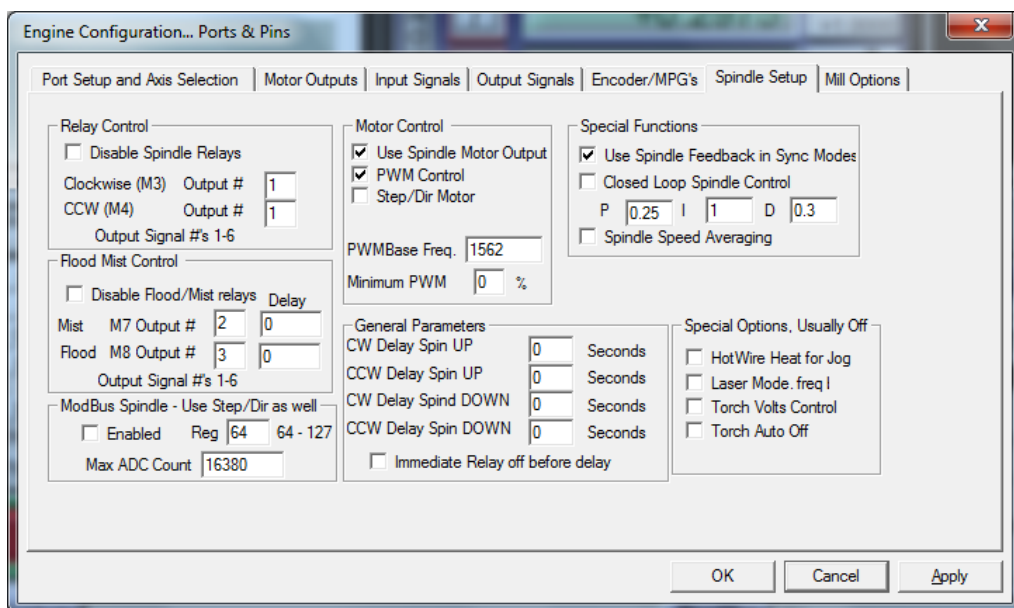


Figure 35, Mach3 Spindle Setup

Menu Config > Motor Tuning

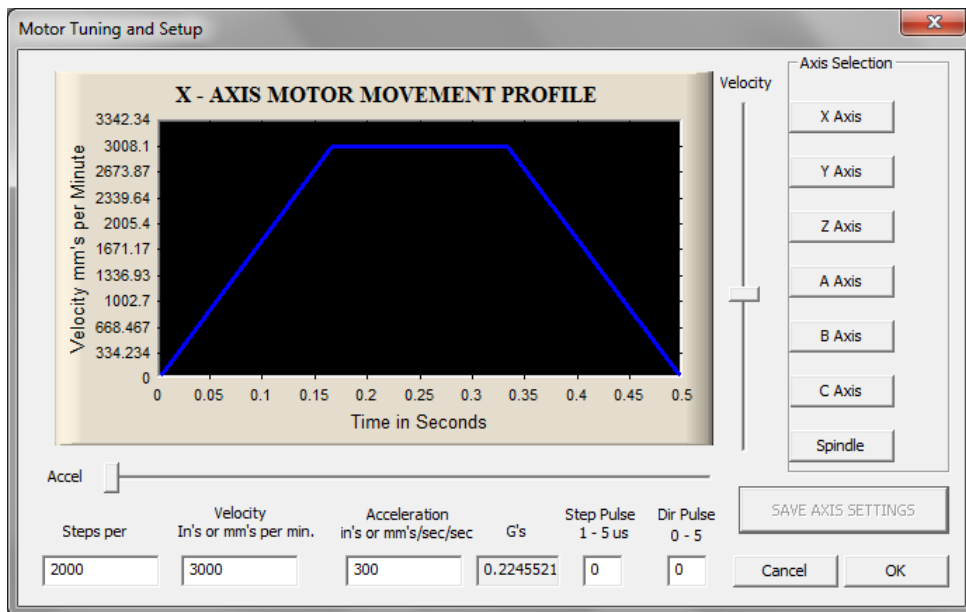


Figure 36 Mach3 Motor tuning dialog

Motor Tuning and Setup, The user needs to set suitable values by themselves

Menu PlugIn Control > UC300ETH In/Out Monitor

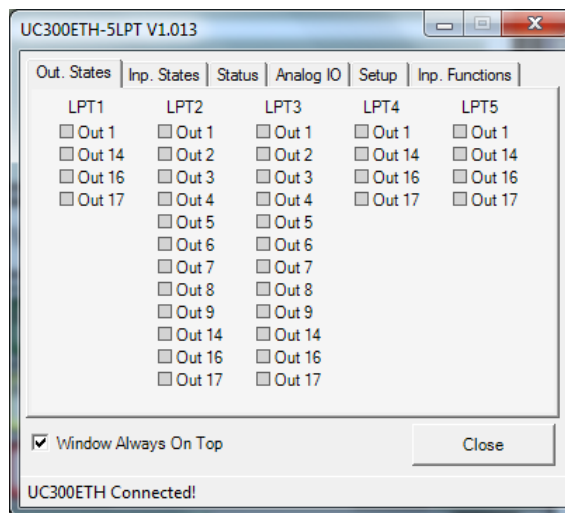


Figure 37, UC300ETH Outputs states

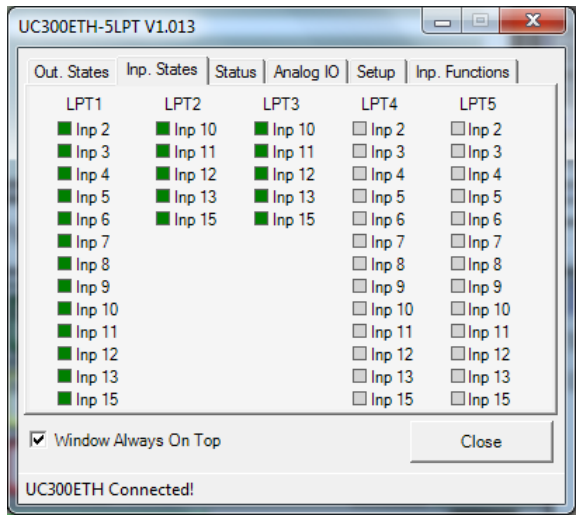


Figure 38, Inputs States

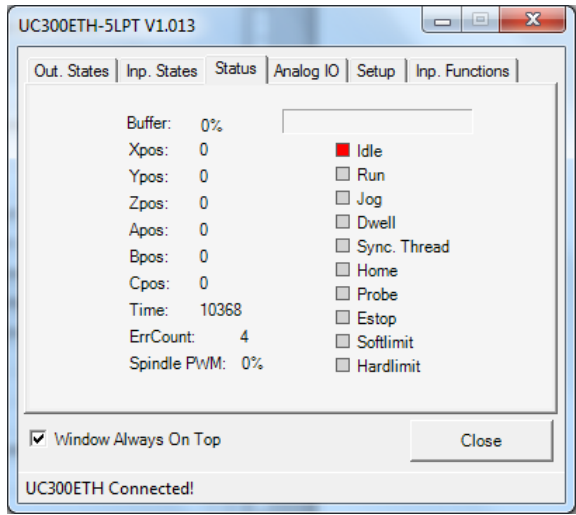


Figure 39, Status

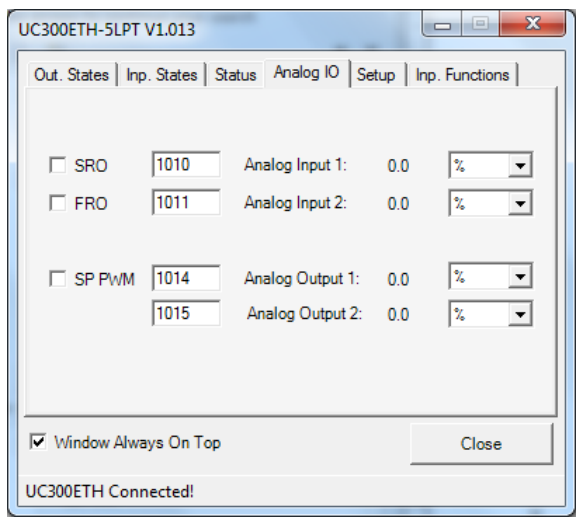


Figure 40, Analog Input and Output

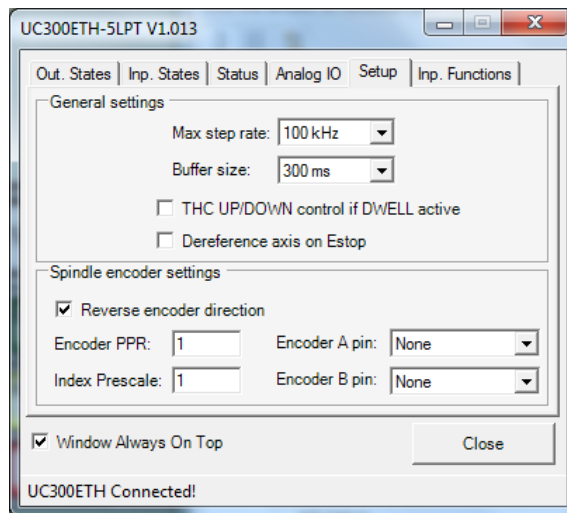


Figure 41, Setup Kernel speed

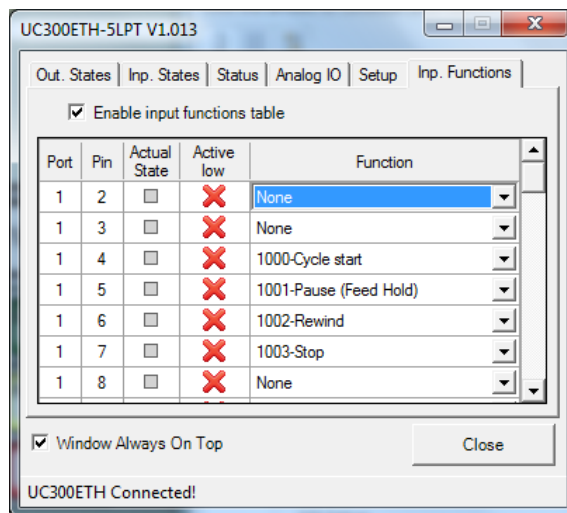
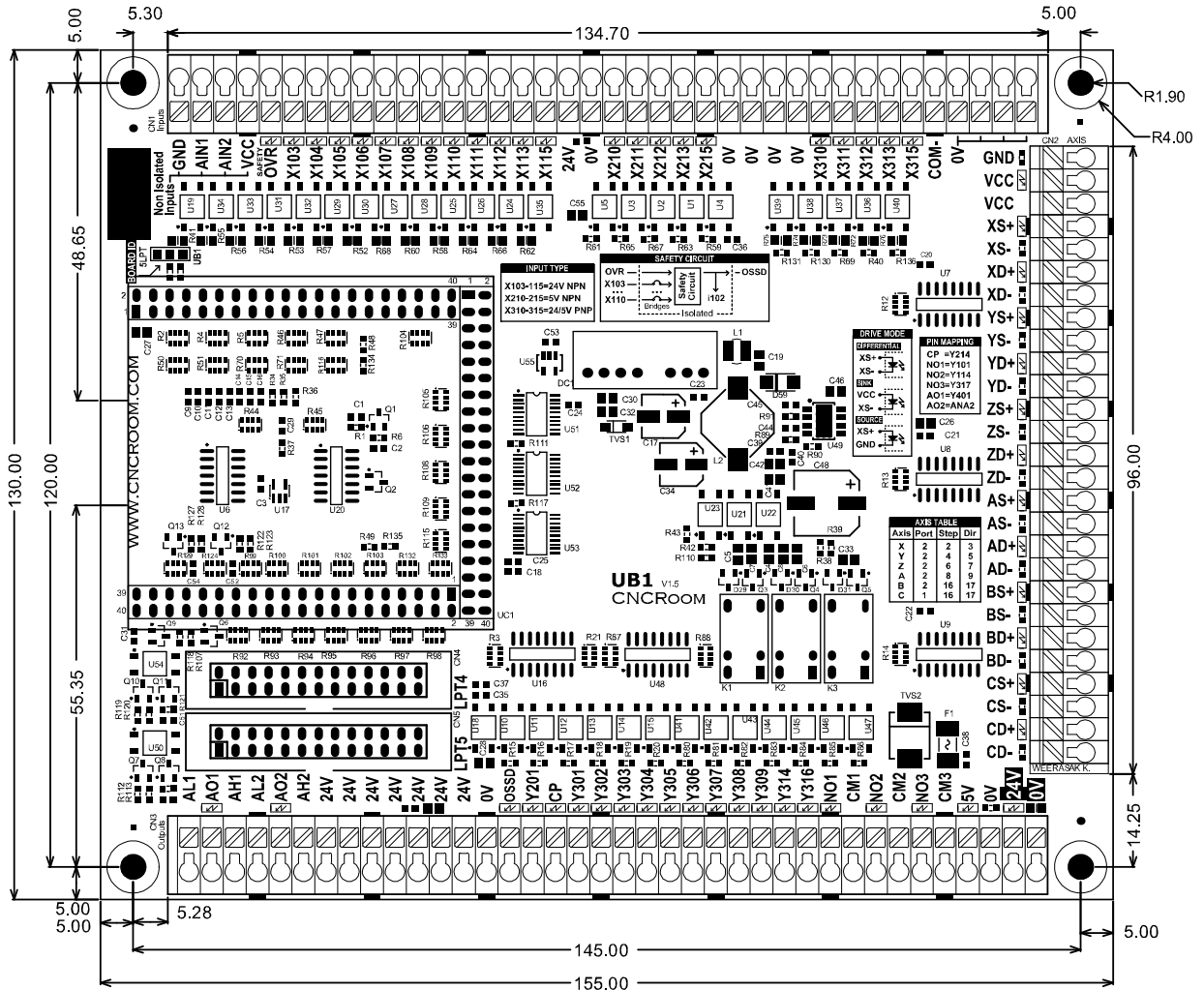


Figure 42, Input Functions, The users can map function to any input

Appendix I UB1 Specifications

Dimensions	130 x 155 mm (height x width)
Supply voltage	24V 500mA (18-28Vdc), recommended 3A for general usage.
Supply voltage ripple	≤ 5%
Outputs	NPN, Sink 5-24Vdc, 70mA Max
Relay contact	0.5A 120Vac, 1A 24Vdc
Analog output range	(0V + 200mV) ~ (Vin – 200mV)
Inputs	NPN, PNP, 24/5Vdc
Ambient operating temperature	0-40°C

Appendix II UB1 Board Dimensions



UNIT = MM

Appendix III Safety circuit options

The circuits shown below are only examples and adhere to no particular country's safety standard. Please always seek professional advice from a qualified electrician or electrical engineer in your country of residence before implementing any circuit that is presented in this manual. CNCRoom cannot be held responsible for any adverse outcome, which came about as a result of copying anything from this manual.

Safety Circuit 1

Safety circuit 1 is simple but effective. It has fewer components and less wiring and relies mainly on good and consistent function of the computer and electronic components to disengage the drive's power through a "servo on" signal or similar.

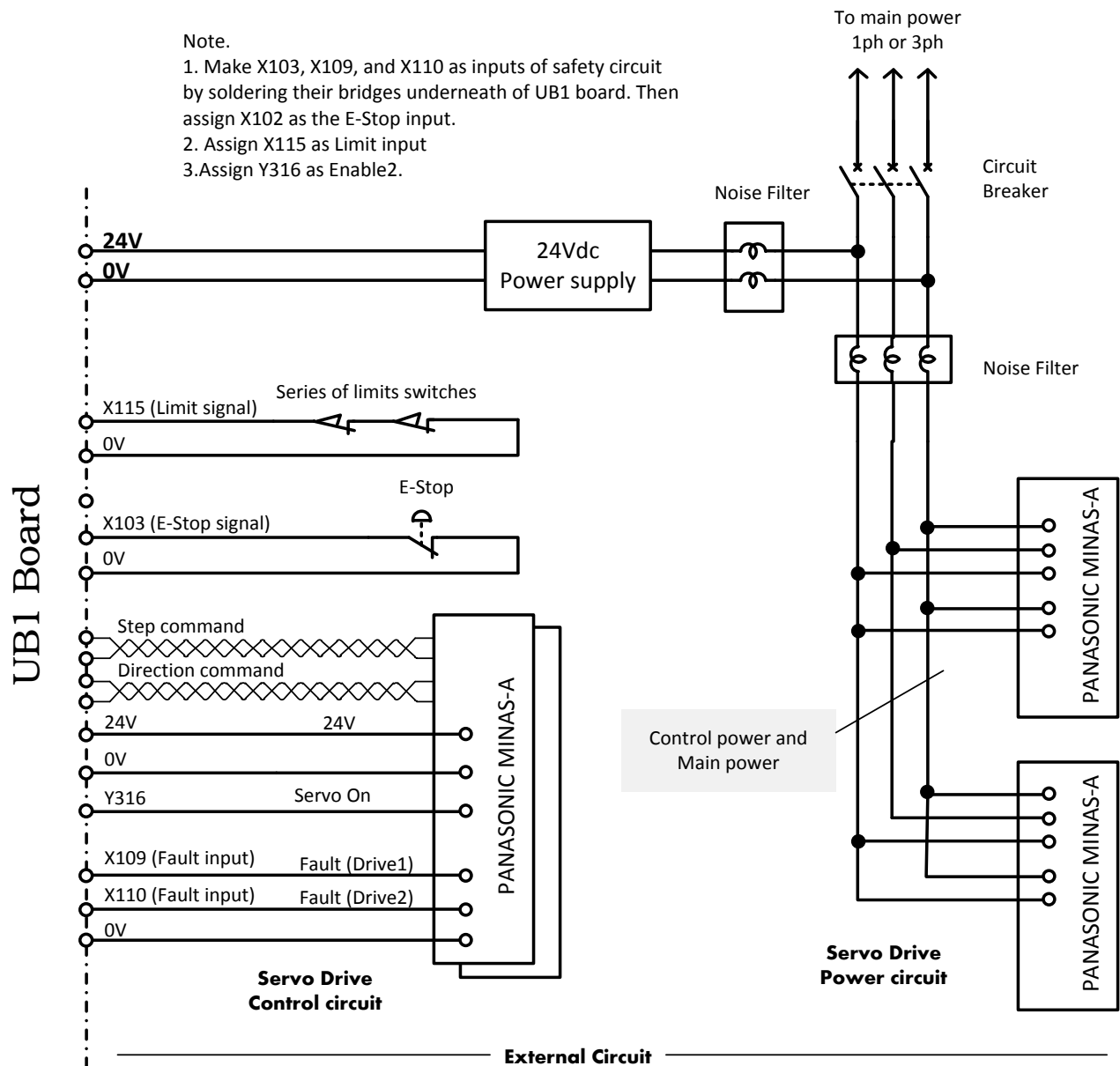


Figure 43, Safety Circuit 1

Safety Circuit 2

Safety circuit 2 is more for the user who prefers not to rely on electronics for safety and would prefer the option of disengaging power from the drives or hazardous devices by the use of unintelligent components, such as limit switches, the E-stop button or a magnetic contactor.

In a situation where a motor runs out of control, being caused either by electromagnetic interference or even human error, a well-designed system should be able to halt the machine by the use of limit switches alone or by hitting the E-stop button.

However, in normal circumstance, the UB1 with an external circuit and connection to a computer should work well together. In some drive connections you may need to implement the use of timer relays to handle an "Under Voltage" error.

Note.

1. Make X103, X109, and X110 as inputs of safety circuit by soldering their bridges underneath of UB1 board. Then assign X102 as the E-Stop input.
2. Assign X115 as Limit input
3. Assign X110 as OEM Trigger, Then assign "Reset OEM code" or 1021 to System hotkey > External button.
4. Assign Y114, Y316 as Enable1, Enable2 respectively.

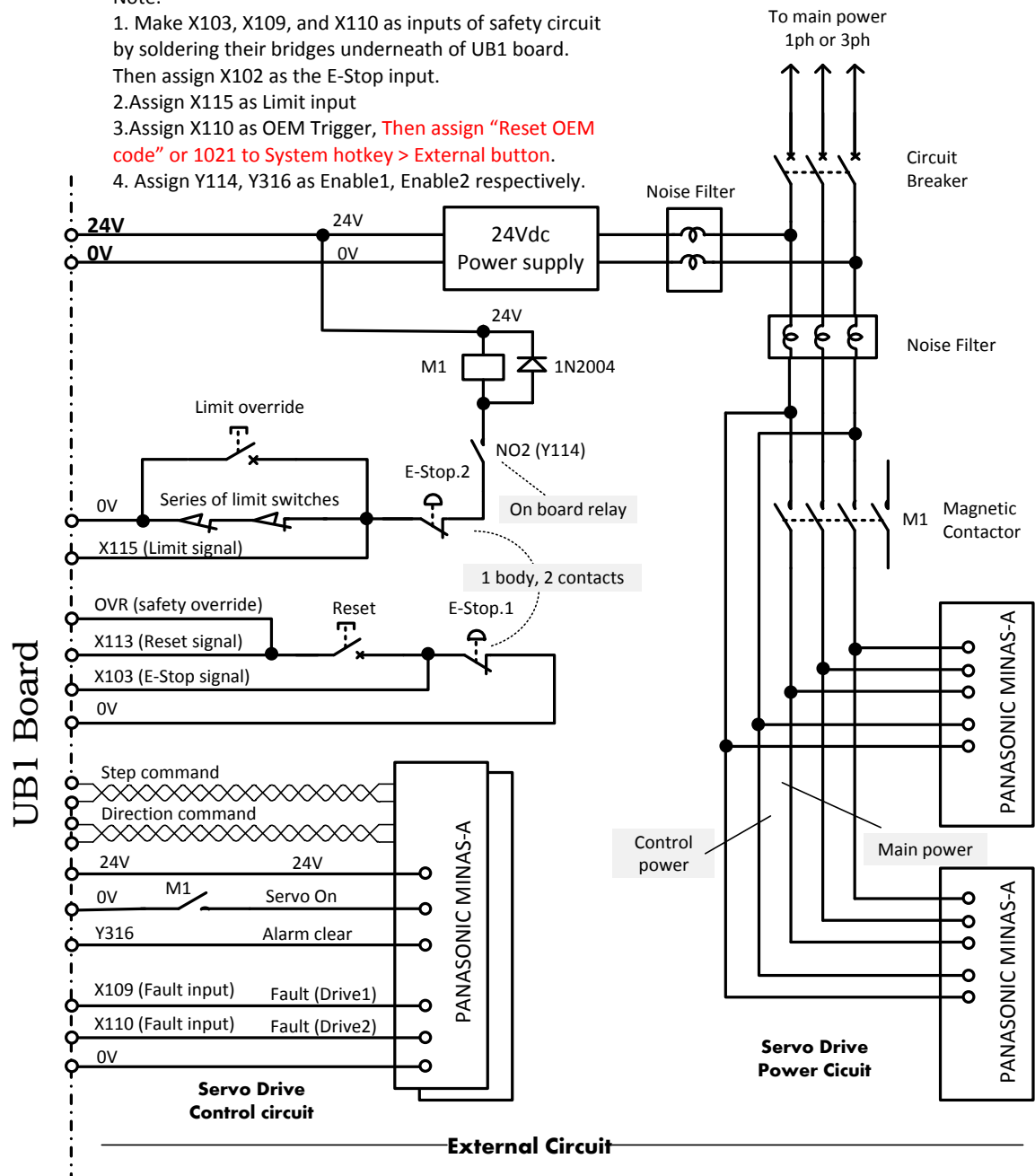


Figure 44, Safety Circuit 2

Safety Circuit 3

Since the UB1 board supports an “Off-Delay” function for relay K1 and K2, it allows the user to create a timing sequence for devices that need to power up or power down independently at different times.

In this circuit an AC line monitor for recognising a “Power-Out” or “Black-Out” condition has also been introduced. This circuit will halt the machine in an orderly fashion before it loses power completely. A UPS is needed to power AC drives for few seconds after the power has failed. For DC drives a lower cost, slow charging capacitor is all that is necessary.

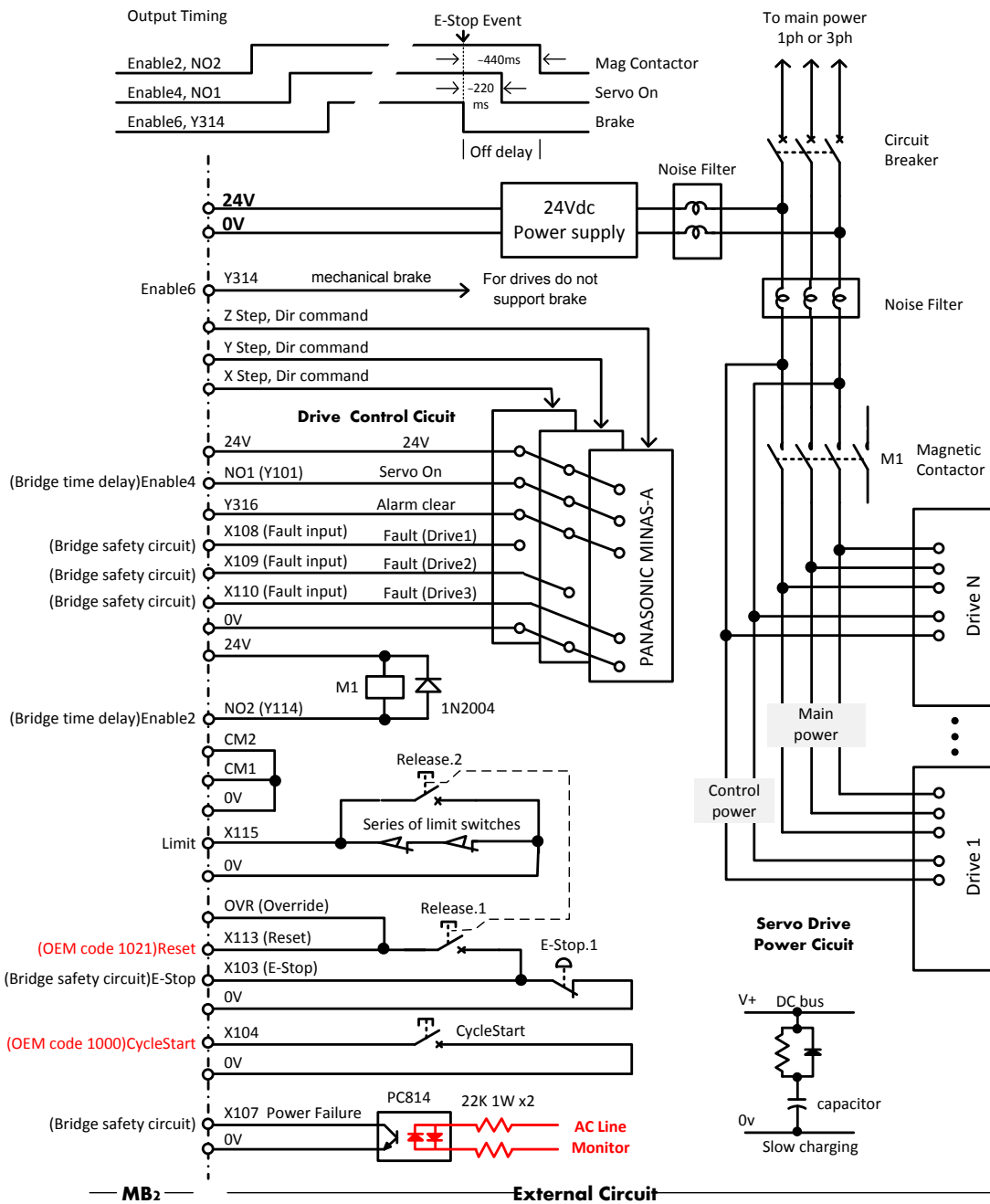


Figure 45, Safety Circuit 3

Appendix IV Figure and Table references

Figures

Figure Number	Page Number
Figure 1, UB1 Overview Connection.....	4
Figure 2, UB1 version 1.5.....	5
Figure 3, UC300ETH stack on UB1 breakout board.....	6
Figure 4, UC300ETH Removal.....	6
Figure 5, Connection Diagram.....	7
Figure 6, Power supply connection.....	8
Figure 7, Axis command terminal and various connection modes.....	9
Figure 8, Input terminals.....	10
Figure 9, Connection of the NPN inputs, it references to 0V.....	12
Figure 10, Connection of PNP inputs.....	12
Figure 11, Sensor connections.....	13
Figure 12, is an example of E-STOP, LIMIT and HOME switch connections.....	14
Figure 13, Output terminals.....	14
Figure 14, VFD connection.....	15
Figure 15, connecting various loads to a “Y” output.....	15
Figure 16, Charge pump interlock with other relays.....	16
Figure 17, On board safety circuit.....	17
Figure 18 Bridges for safety inputs.....	18
Figure 19, the underneath layout of the UB1.....	20
Figure 20 X-Axis port and pin.....	21
Figure 21 Y-Axis port and pin.....	21
Figure 22 Z-Axis port and pin.....	22

Figure 23 A-Axis port and pin	22
Figure 24 B-Axis port and pin	23
Figure 25 C-Axis port and pin	23
Figure 26 Spindle ports & pins, Including PWM Analog channel 1	24
Figure 27 Ports & Pins for Charge Pump and PWM Analog channel2.....	24
Figure 28 General settings.....	25
Figure 29, Mach3's first screen	26
Figure 30, Mach3 Ports and Pins dialog	27
Figure 31, Motor output tab.....	27
Figure 32, Mach3 Input Signals	28
Figure 33, Mach3 Output Signals (1/2).....	28
Figure 34, Mach3 Output tab (2/2)	29
Figure 35, Mach3 Spindle Setup.....	29
Figure 36 Mach3 Motor tuning dialog.....	30
Figure 37, UC300ETH Outputs states	30
Figure 38, Inputs States	31
Figure 39, Status	31
Figure 40, Analog Input and Output.....	31
Figure 41, Setup Kernel speed.....	32
Figure 42, Input Functions, The users can map function to any input.....	32
Figure 43, Safety Circuit 1.....	34
Figure 44, Safety Circuit 2.....	36
Figure 45, Safety Circuit 3.....	36

Table

Table 1, Ports and Pins Reference Tables..... 4