Centroid USB-BOB User Manual for use with CNC12 v5.30
USB-BOB USB Operators Control Panel
Updated: 4-21-25

Overview

The Centroid USB Operator Control Panel Interface Board (aka "USB-BOB") is a CNC machine tool operator control panel interface board that connects to the CNCPC via a USB port.

The Operator Control Panel Interface Board is an affordable, reliable, alternative to traditional methods of building CNC control operator control consoles and panels. The USB-BOB provides inputs for the most common operator controls in a package that installs quickly with minimal fuss—saving on wiring/installation labor and CNC controller inputs. It features inputs for three standard rotary encoders with integrated pushbutton, three MPG handwheel encoders, 12 optically isolated switch inputs, and 12 open collector LED outputs. The USB-BOB can be used in conjunction with Centroid's popular Virtual Control Panel or without.

Starting with Acorn, AcornSix and Hickory CNC12 v5.20 the USB-BOB Operator Control Panel Interface Board is plug and play with pre-programmed button and knob functionality using a Wizard setup menu. Many common functions like Cycle Cancel, Tool Check, Feed Hold and Cycle Start along with Rapid Override, Spindle Speed Override, and Feedrate Override preprogrammed and user selectable with easy drag and drop installation. Centroid Oak and Allin1DC CNC controller boards are also compatible but do not have a USB BOB configuration Wizard. USB-BOB setup for Oak and Allin1DC is done the old fashioned way with parameters and PLC program logic edits to add the functionality.

In addition to these pre-programmed canned operator control functions, all control functions are user-configurable using Centroid's CNC PLC language In situations where desired functionality is not present in the canned list, a user can customize both the button or knob functionality to suit their particular application and tastes while not being limited by the Centroid supplied canned functionality.

Common uses:

- Use physical buttons and knobs for core/common operator functions with custom CNC machine panels and consoles.
- Supplement Centroid's Virtual Control Panel with physical controls without using up any CNC control board inputs.
- Add a dedicated Rapid Override knob to Centroid Legacy control systems that did not have this feature.
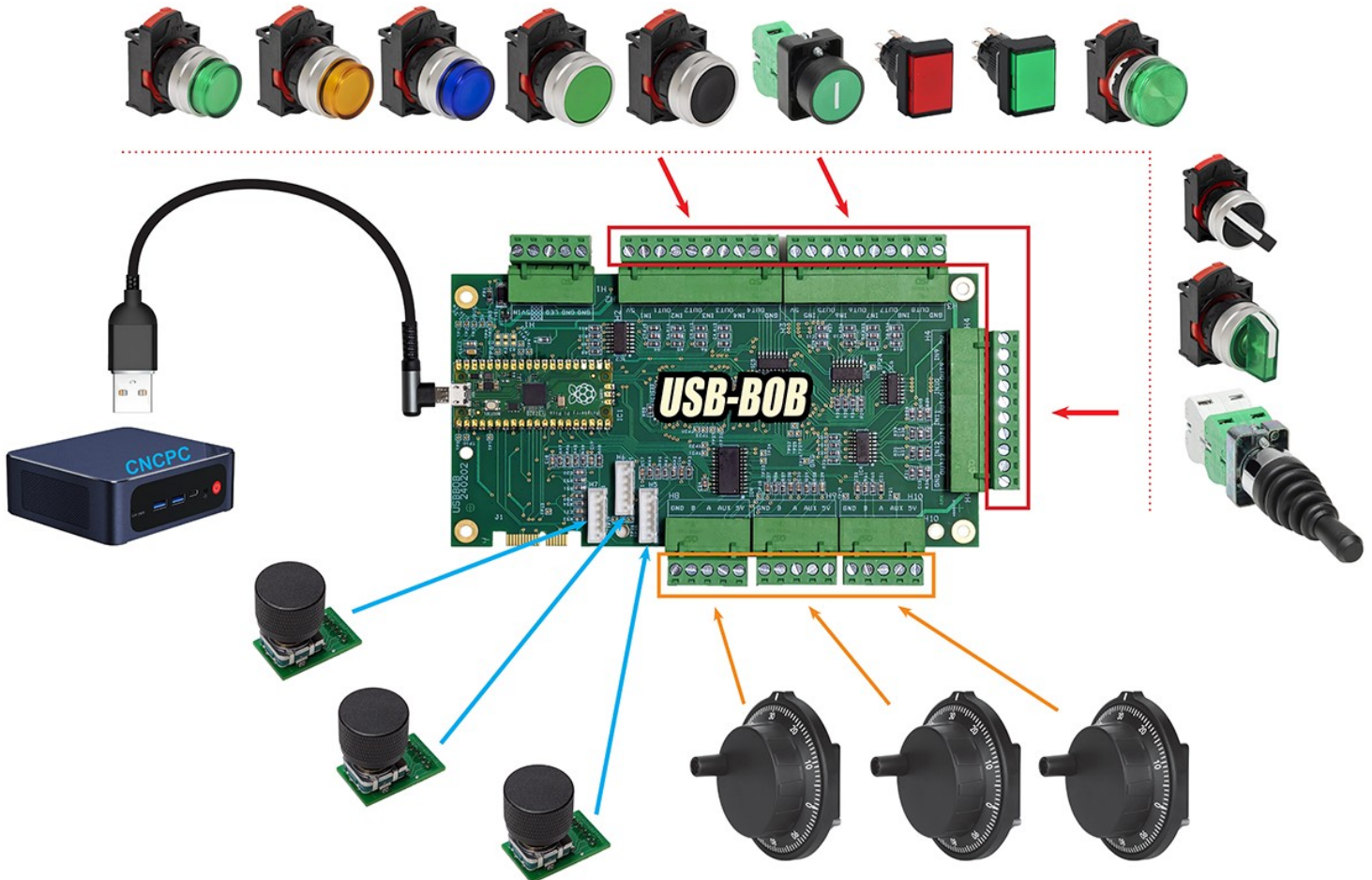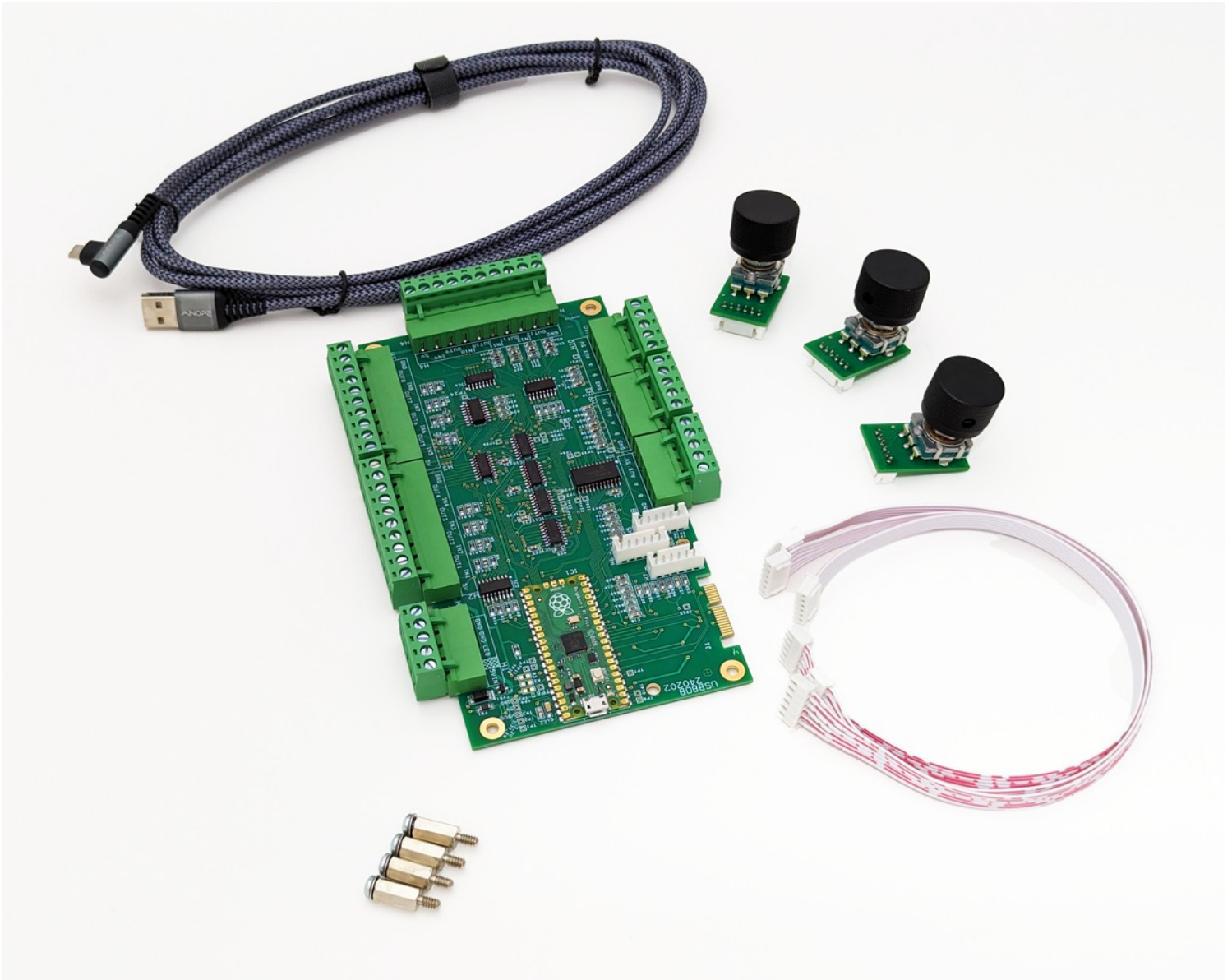
Table of Contents

USB-BOB kit

Kit (P/N: 15380) Contents

- Operator Control Panel Interface Board Assembly (P/N: 15398)
- Rotary Encoder Assembly (P/N: 15399) x 3
- Knob (P/N: 9964) x 3
- 6 Pin Ribbon Cable (P/N: 9967) x 3, 30cm long
- 5 Position Terminal Block Plug (P/N: 8857) x 4
- 10 Position Terminal Block Plug (P/N: 3904) x 3
- 6 ft. USB A to Micro B cable (P/N: 021) x 1
- ½" 6-32 stand offs and matching 6-32 screw and washer

USB-BOB Operator Control Panel Interface Board Specification Overview

Rotary Encoders:	3
MPG/Handwheel Encoders:	3
Switch Inputs:	12 screw terminal + 3 on the Rotary Encoders
LED Outputs:	12 programmable + 1 connection status
Default Encoder Functions:	Feed rate, spindle speed, and rapid rate overrides
Default Button Functions:	Cycle start and stop, feed hold, and tool check
Software Compatibility:	CNC12 V5.2+
# of Operator Control Panel Interface Board Supported by CNC12:	2 with Wizard, 4 with CNC12
Weight:	16 oz.
Dimensions (W*D*H):	7.19 * 4.40 * 1.41 inches

System Compatibility Notes

The USB-BOB Operator Control Panel Interface Board is compatible with all Centroid CNC controllers capable of running CNC12 V5.20 and newer. This includes Acorn, AcornSix, HICKORY, ALLIN1DC, OAK, and MPU11.

Acorn, AcornSix, and Hickory with CNC12 v5.20+ is plug and play using drag and drop Wizard menu for common operator panel input definitions.

ALLIN1DC, OAK, and MPU11 with v5.20 will need logic added to the PLC program for the USB-BOB Operator Control Panel Interface Board to function.
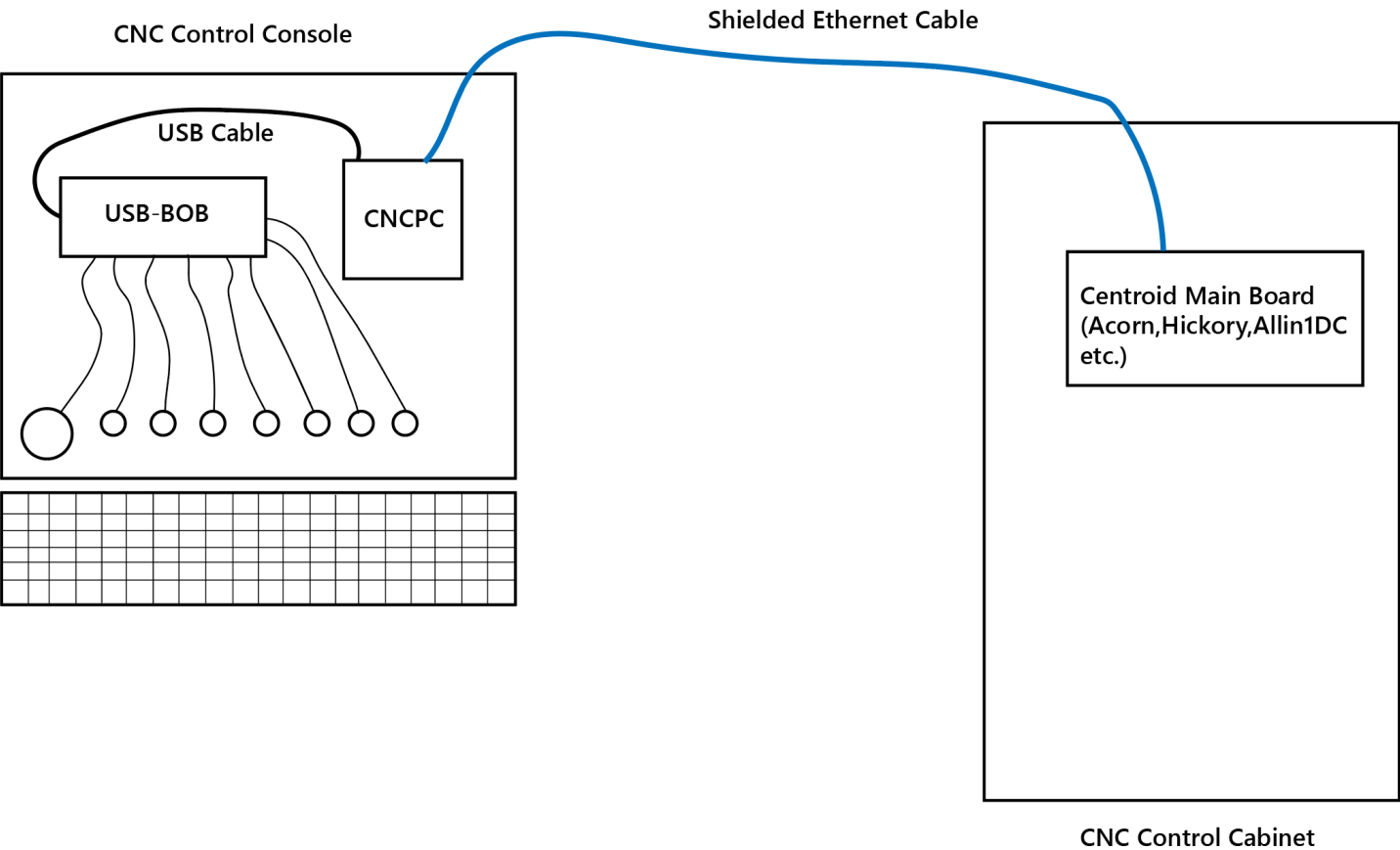
Up to two Operator Control Panel Interface Board boards may be connected to a system. Functionality can be assigned separately for each Operator Control Panel Interface Board.

Planning ahead: Mounting configurations for USB-BOB placement within the CNC Control system.

The preferred method is to install both the CNCPC and the USB-BOB inside the same CNC console.

This keeps the cables that are most vulnerable to EMI noise as short as possible, inside a metal box, and away from the main CNC control cabinet.

Centroid's ideal and recommended USB BOB and CNC PC mounting locations are as follows:

CNC Control Console

Shielded Ethernet Cable

USB Cable

USB-BOB

CNCPC

Centroid Main Board (Acorn,Hickory,Allin1DC etc.)

CNC Control Cabinet

Typically, when connecting devices to USB-BOB inputs inside an operator control panel or console, shielding is not necessary as long as the cables are short, inside a metal box (the CNC console itself), and are separate from the main CNC control cabinet.

General guidance on cable lengths.

A less-than-ideal but alternative mounting method uses a proven 33' USB extender cable, while maintaining good grounding and shielding practices to minimize EMI/noise issues.

CNC Control Console

Curated USB extension Cable

USB-BOB

CNCPC

Shielded Ethernet Cable

Centroid Main Board (Acorn,Hickory,Allin1DC etc.)
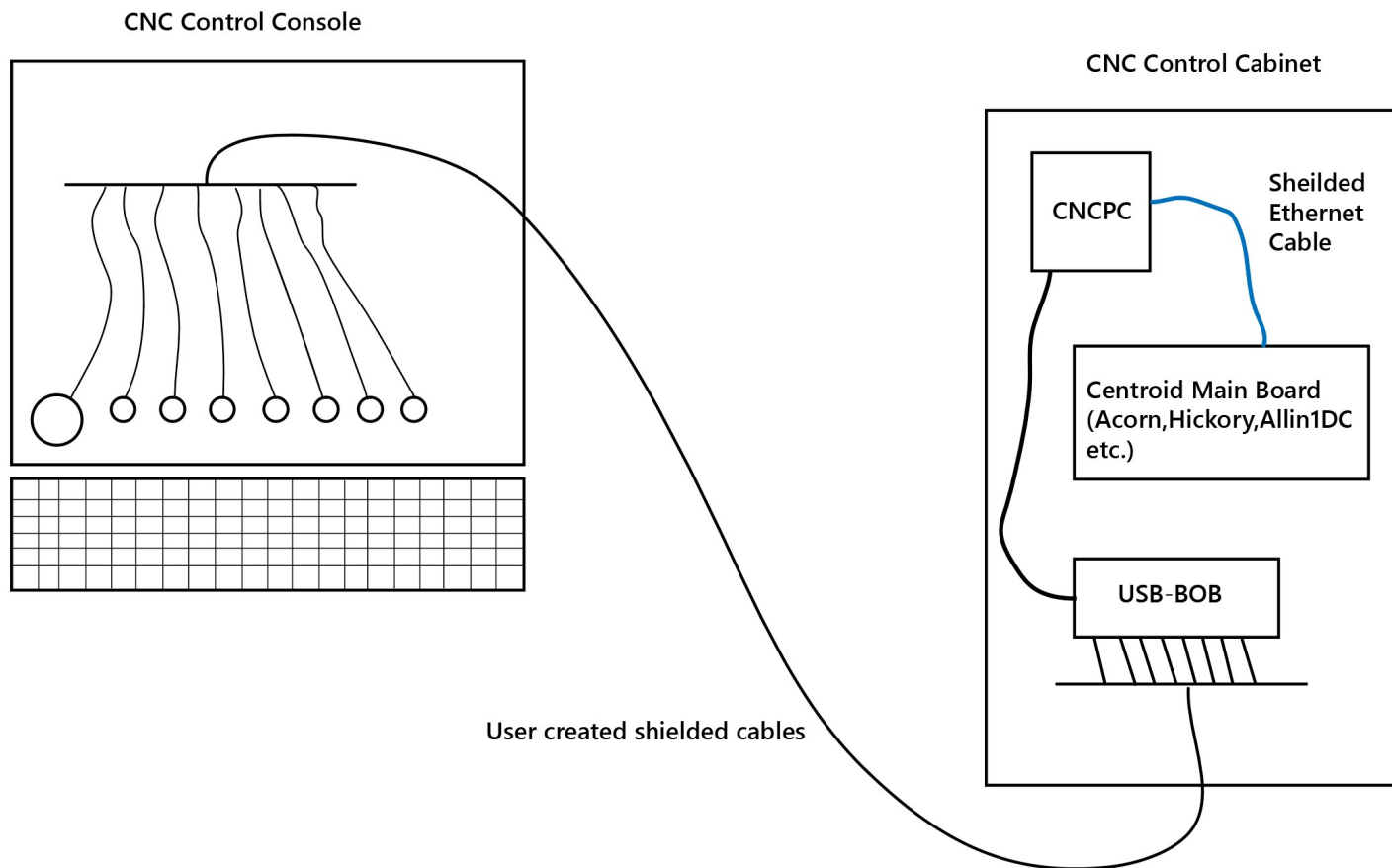
CNC Control Cabinet
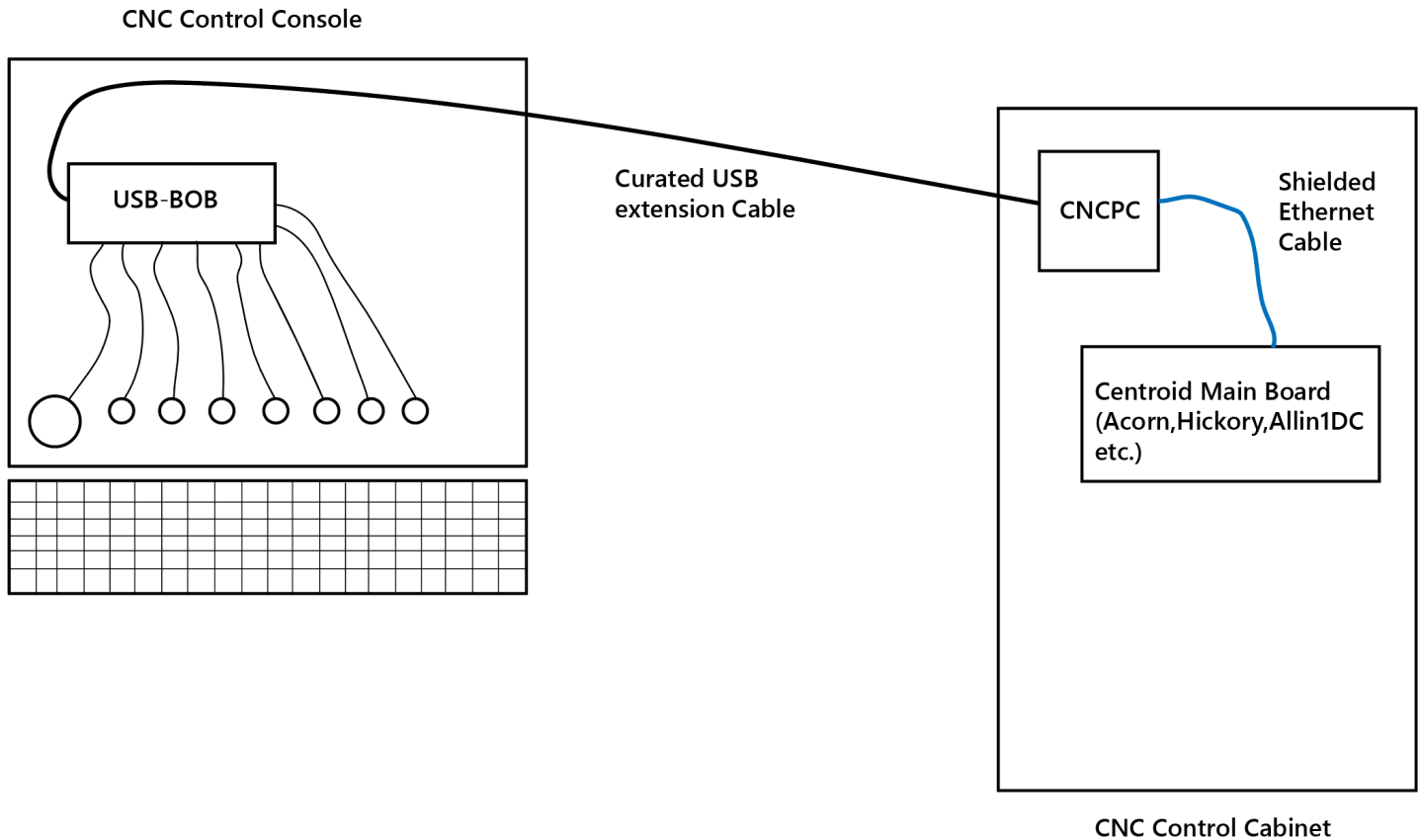
While certain types of USB Extender cables can be used we do not recommended this unless absolutely necessary.
The following USB extension cable has been successfully tested with Operator Control Panel Interface Board but your mileage may vary: https://amzn.to/48QtEOS

The least desirable mounting configuration. Not recommended and considered experimental. This configuration exposes the system to EMI related noise issues.

CNC Control Console

CNC Control Cabinet

CNCPC

Sheilded Ethernet Cable

Centroid Main Board (Acorn,Hickory,Allin1DC etc.)

USB-BOB

User created shielded cables

While not recommended this mounting configuration will likely work as long as proper attention to details on cable shielding, drain/ground connections, and wire gauge are used in both the CNC main electrical cabinet and inside the CNC console. If you are not experienced with proper grounding, shielding, and using twisted pair cabling, avoid this configuration.

If you must use or make longer cables for any of the inputs we advise using shielded cable of at least 24 gauge (heavier gauge wire is ok, just don't go smaller).

See information specific to lengthening the Rapid/Feed/Spindle Encoder cable in that section below.
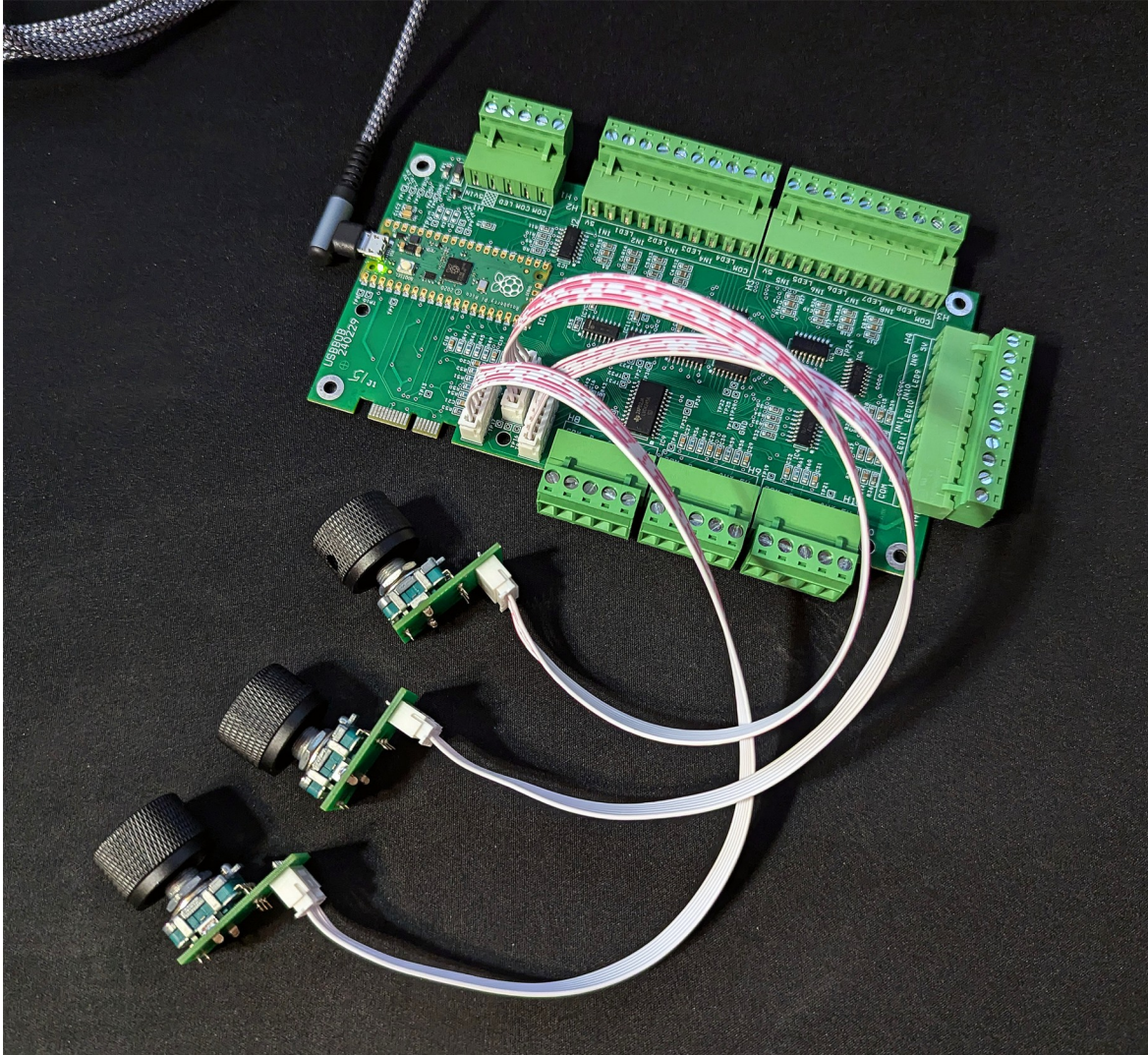
USB-BOB Bench Test

The USB-BOB is powered via the USB cable. No other power is needed in most cases.

Grounding to the chassis is achieved through the mounting stand off through holes. Use metal stand offs or connect a wire between chassis ground and the stand off through holes.

A supplemental 5 VDC power terminal is provided on the USB-BOB. This is provided for cases in which the total of the current draw of any connected LEDs approaches or exceeds the USB provided current limit of 500 mA. The USB-BOB input optocouplers draw up to 240 mA which leaves roughly 240 mA for any external LEDs powered from the on-board provided 5V DC. The USB-BOB LED outputs are open collector which can operate up to 24 VDC.

Bench Test the USB BOB with the CNCPC <u>before</u> mounting in the CNC Control cabinet.

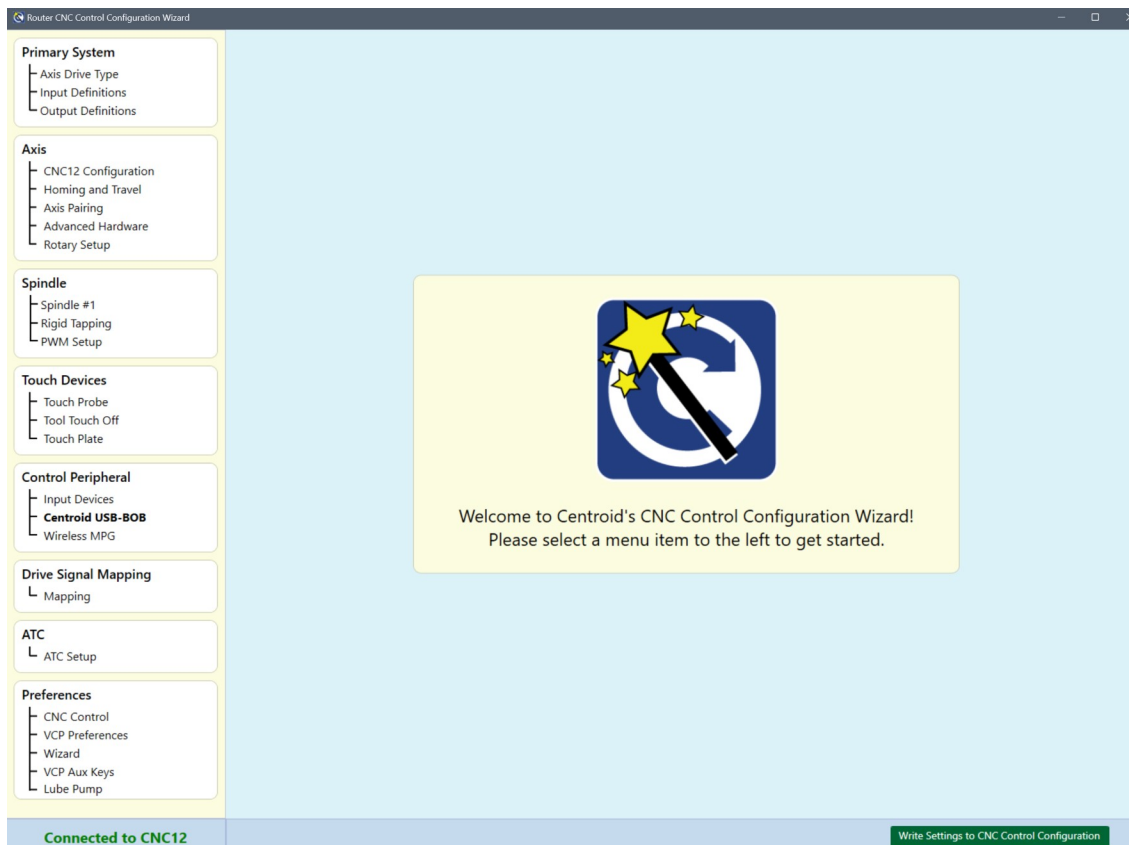Acorn/AcornSix/Hickory First Time Setup And Communications Bench Test

With the CNCPC Off, connect the USB-BOB to a USB port that is directly on the CNC PC.
DO NOT use a USB HUB or Extension cable for this first time connection.

Connect the 3 included Knobs (P/N: 9964) using the 3 included ribbon cables (P/N: 9967) to H5, H6, and H7.

Turn on the CNCPC. The green heartbeat LED on the USB-BOB will begin to blink once per second after it has booted up.

Start CNC12 v5.20+, and open the setup Wizard (**F7 Utility Menu → F10 Wizard**).

Open the USB-BOB configuration page in the Wizard.

Toggle the slider to "Yes".

Press the "Write Settings to CNC Control" button and follow the instructions on the screen.

Write Settings to CNC Control Configuration

Saving CNC Control Configuration

Please Wait...

CNC Control Configuration Wizard ✕

Settings Saved.
Be sure to close the Wizard and restart CNC12!
For all changes to take effect.

OK
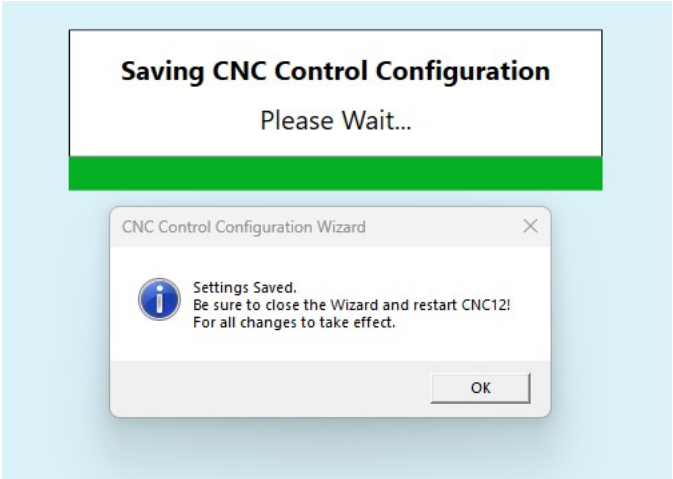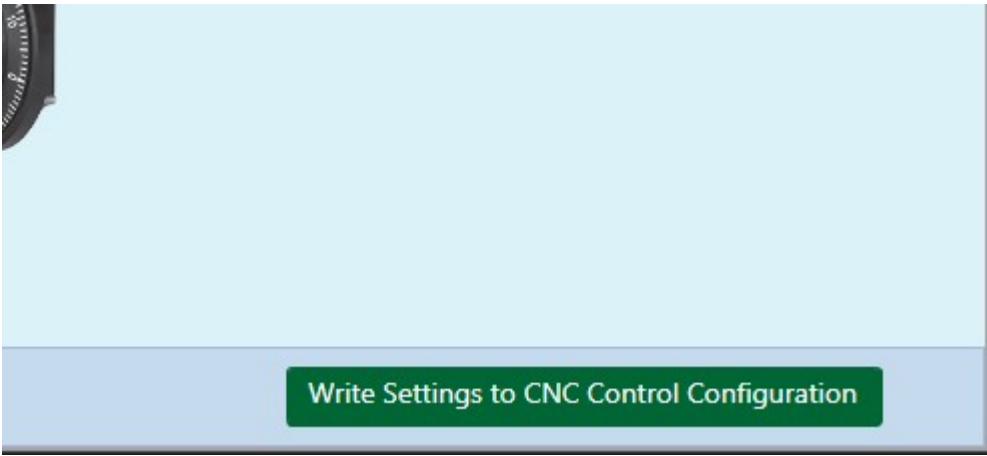
Click OK and Close the Wizard.

Then close CNC12, F10 Shut down menu.

Shut Down
Menu
F10

Then F9 Exit CNC12.

Exit
CNC12
F9

Re-start CNC12.

The USB-BOB LED will go **SOLID** when it has successfully connected to CNC12.

Note: The first time Auto Detect may take a minute or more.
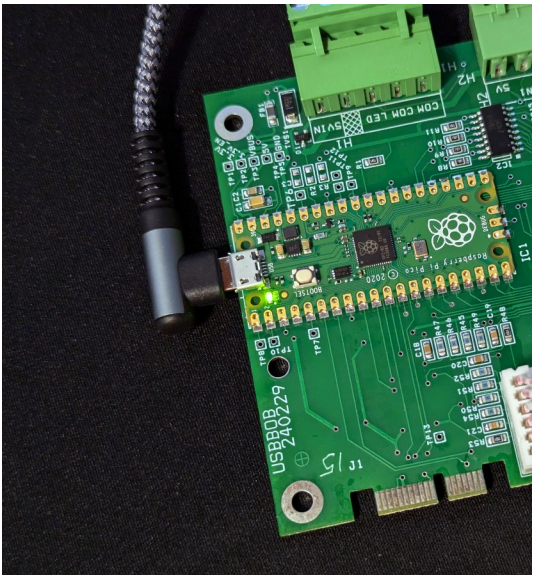
Open the Wizard and navigate to the USB-BOB setup page.

From the list on the left drag and drop the following canned functions:
- FeedRate 100% to Input 13
- Spindle Speed 100% to Input 14
- RapidRate 100% to Input 15
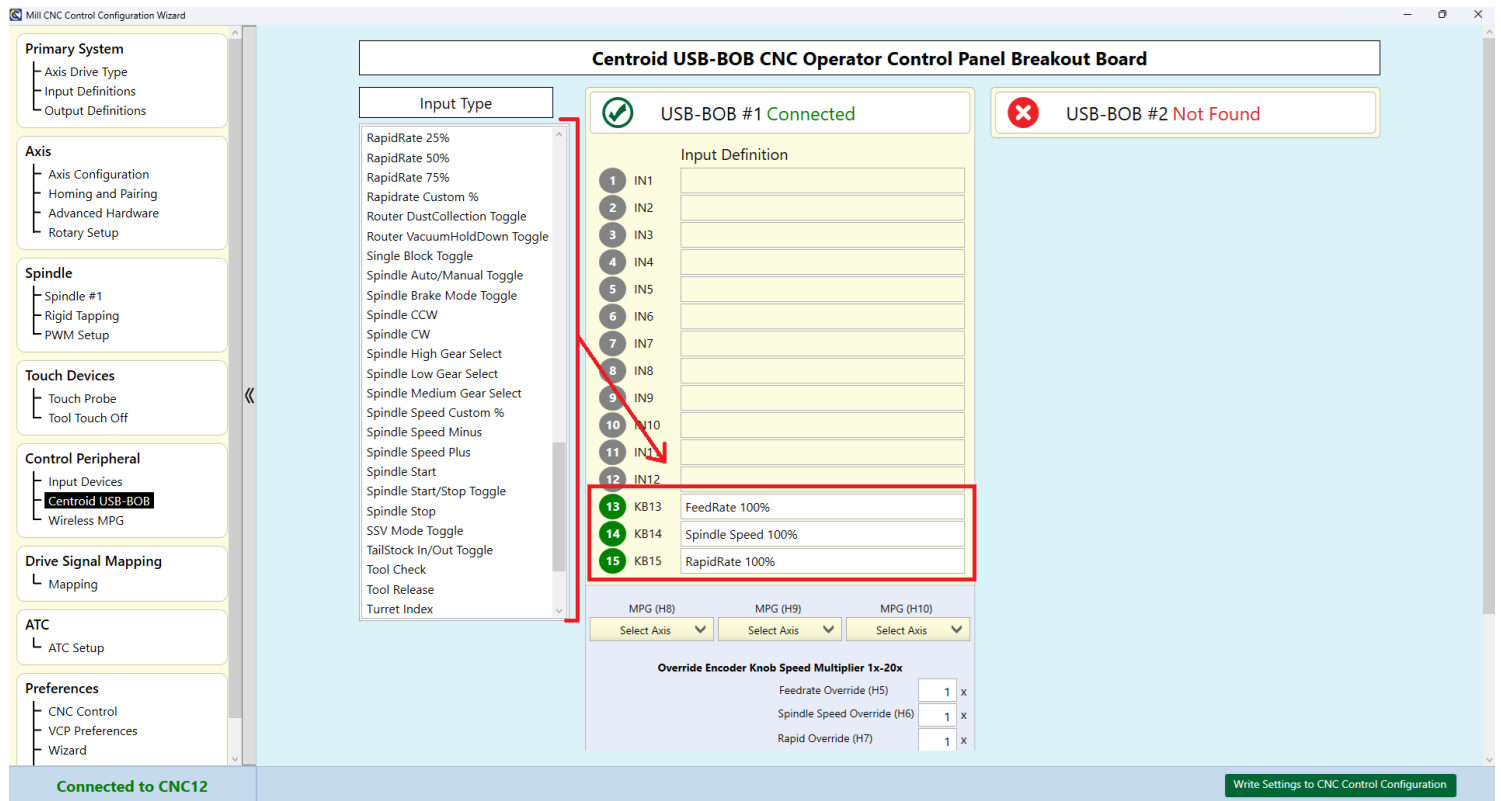
Press the "Write Settings to CNC Control" button and follow the instructions on the screen.
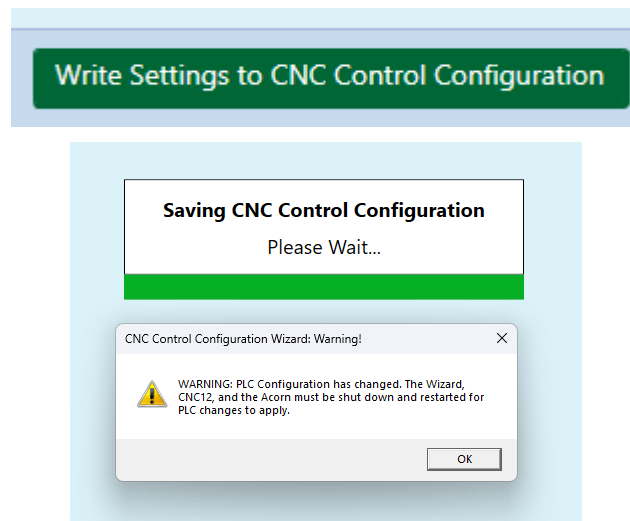
Power cycle your Acorn, AcornSix, or Hickory and then press the OK button.
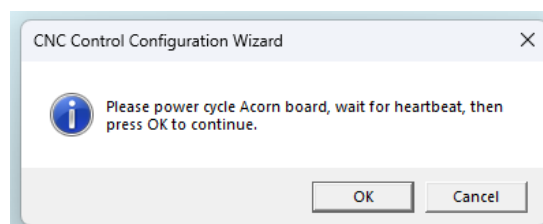
Once CNC12 comes back up, test each knob to be sure they work:

- The knob connected to H5 will control Feedrate
    - When turned it will raise or lower Feedrate
    - When pressed it will set Feedrate to 100%
- The knob connected to H6 controls Spindle speed
    - When turned it will raise or lower Spindle speed
    - When pressed it will set Spindle speed to 100%
- The knob connected to H7 controls Rapid rate
    - When turned it will raise or lower Rapid rate
    - When pressed it will set Rapid rate to 100%
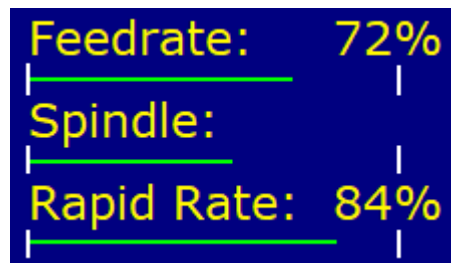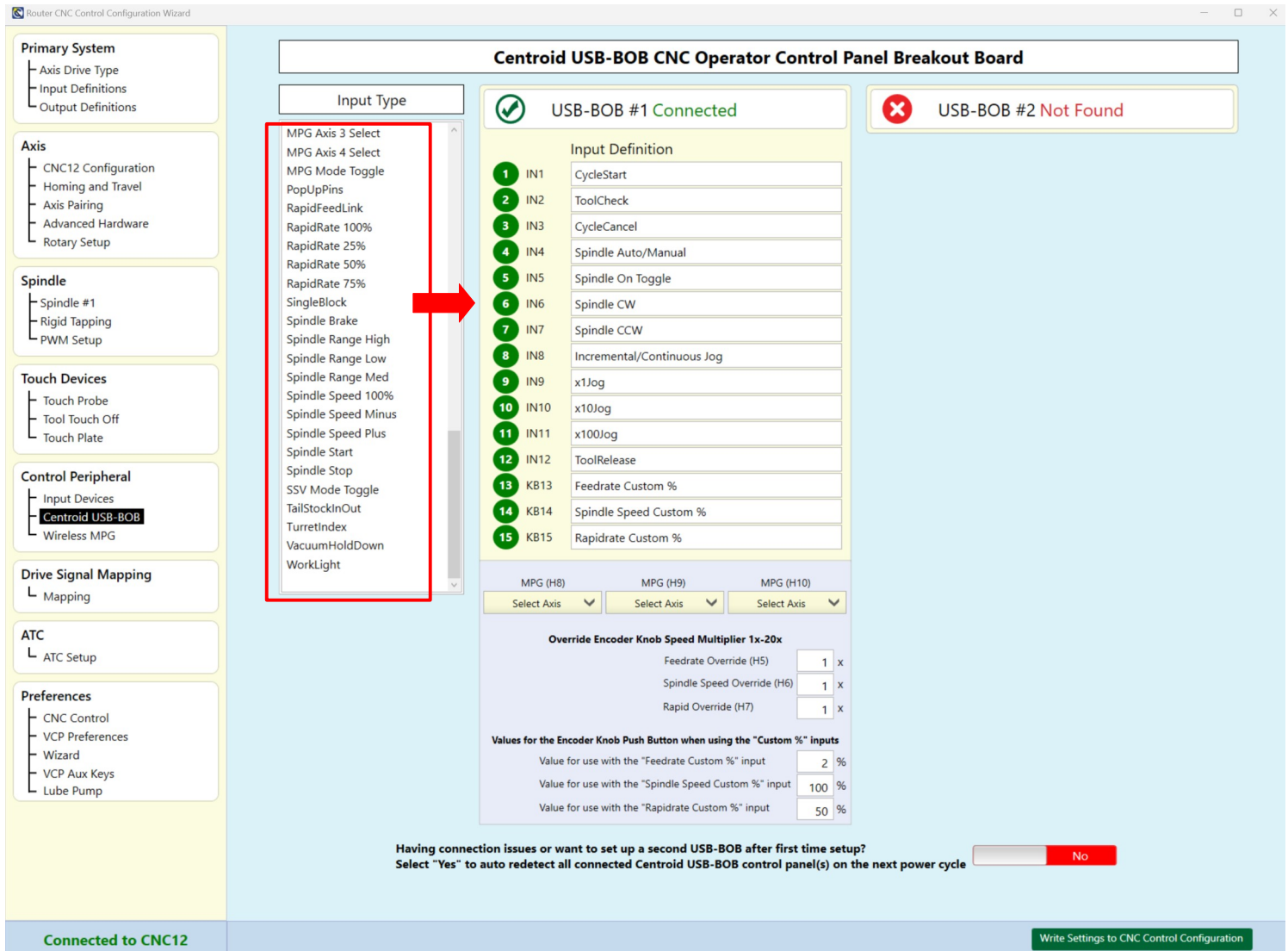
Basic bench test procedure is now complete.

Further configuration and setup continues on the following pages.
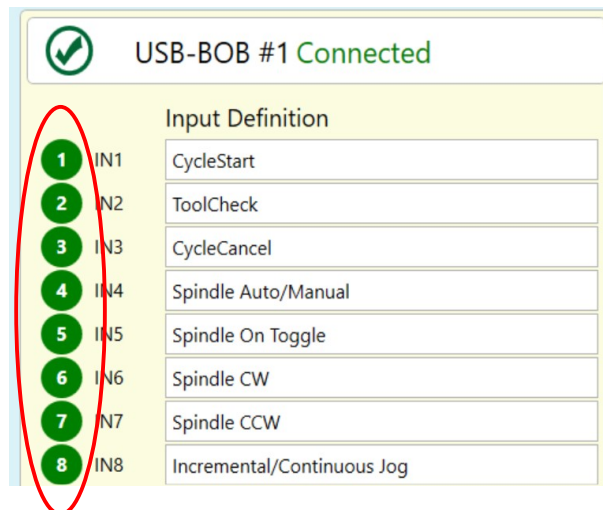
Configuration and setup

Select from any of the canned operator console functions and assign any function to any input number by drag and dropping the function name to the USB-BOB Input definitions table.

The circle indicating the input number is also a button, which provided a way to invert the expected input state for a given function.

For example, when wiring a cycle start button: if the button closes the input when pressed (continuity across the switch) the circle should be set to green.

If the button opens the input (no continuity across switch when pressed), the circle should be set to red by clicking on the input number in the Wizard.

In the example below, the buttons being used for Cycle Start, Cycle Cancel and Incremental/Continuous Jog, will OPEN the input when the button is pressed. Therefore the input circle is set to red.
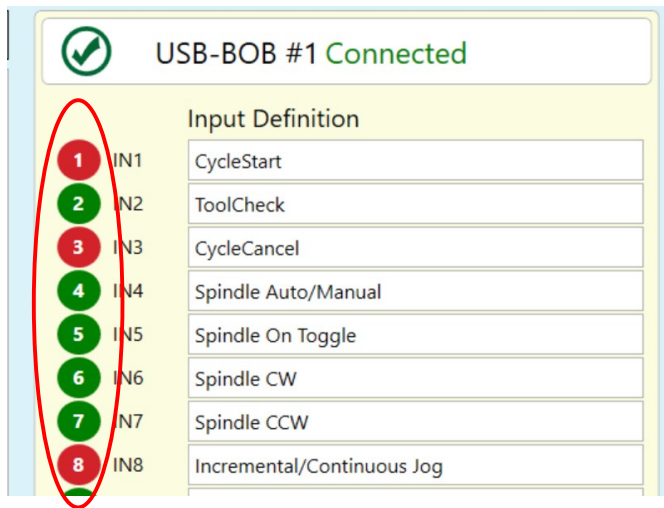
The current state of the USB-BOB inputs can be seen live in CNC12 using the PLC diagnostic tool. Press Alt-I from the main menu of CNC12 and the PLC diagnostic tool windows appears.
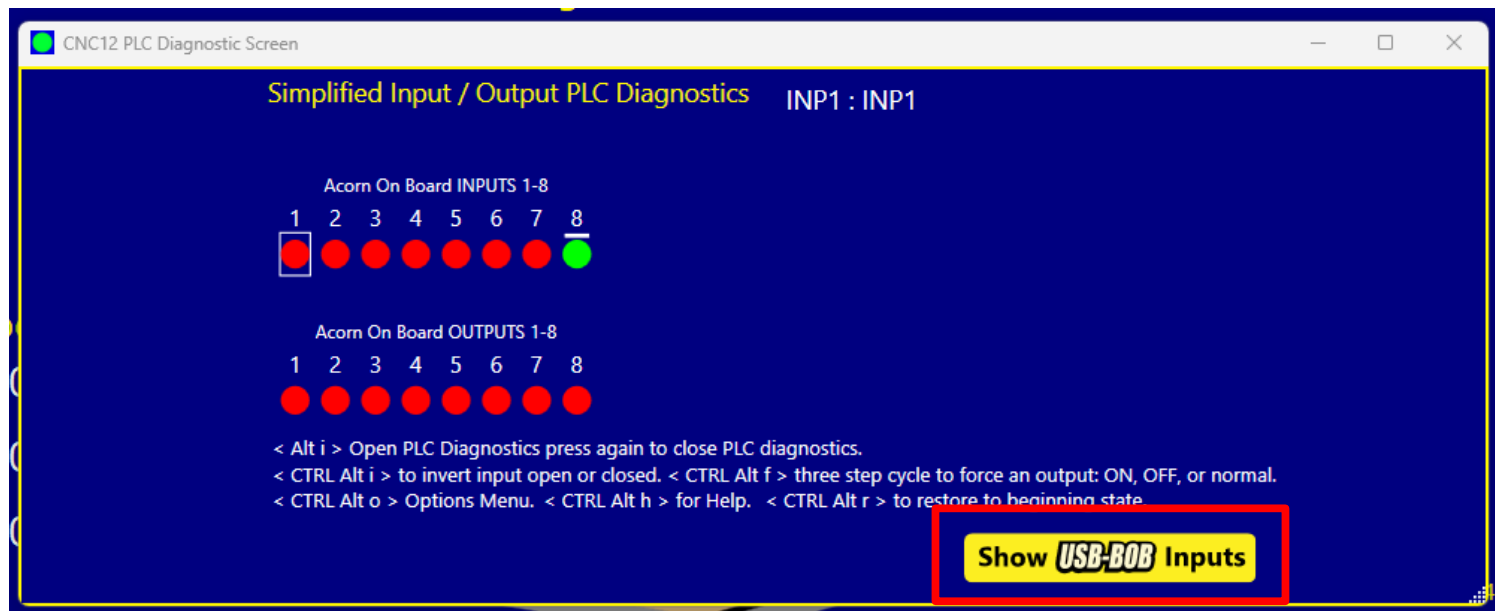
Click on "Show USB-BOB Inputs" at the bottom of the window.

Now you can exercise the buttons and knobs connected to USB-BOB inputs, observe their state in real-time, and test the function of the switches you have connected. The function assigned to each input number is also listed (use the mouse to click on the corresponding state indicator circle, or use the arrow keys to navigate).
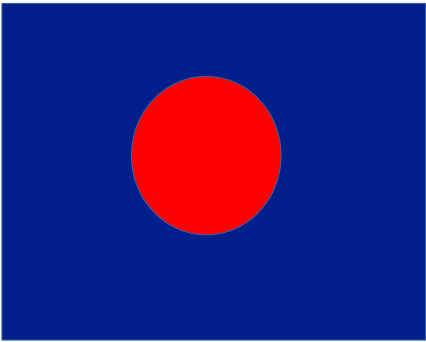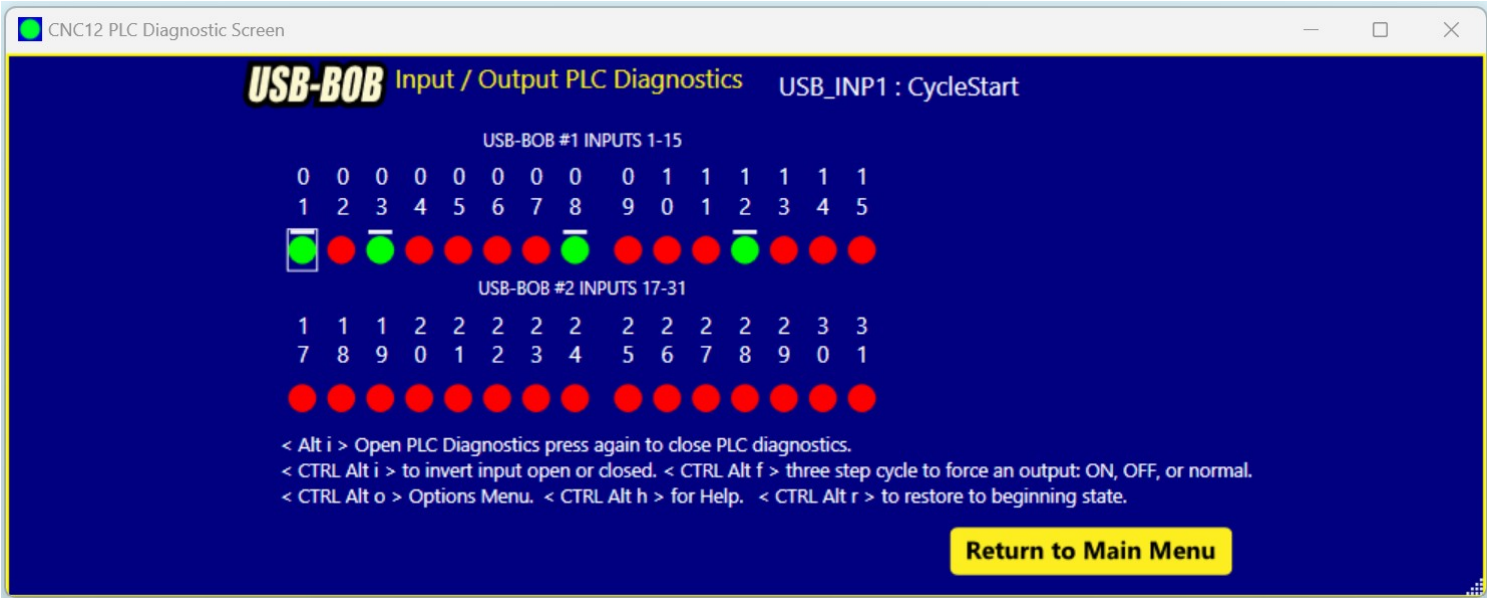
Button is NOT pressed, input is OPEN
No continuity across switch.
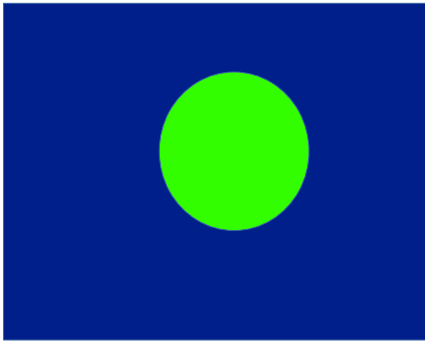
Button is pressed Closes the input
Continuity across switch.

A circle with line above it indicates that this USB BOB input has been inverted.

Input inversions are when you have set the USB BOB input number circle to red described above.

Input Inversion is simply letting CNC12 know that the button being used for this input is going OPEN the input when triggered.
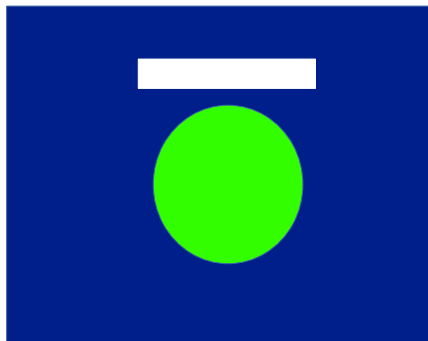
Example of Button not pressed
Input is inverted and closed
There is continuity across switch.
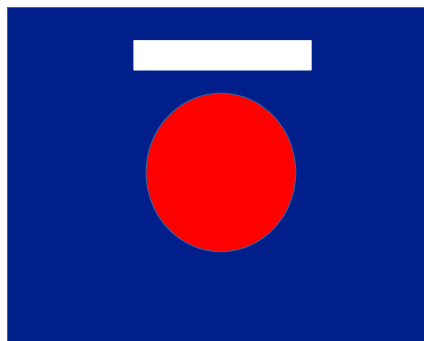
Example of Button is pressed
Input is inverted and OPEN
No continuity across switch.

Red circle with line above it indicates the USB BOB input is set to match a switch that closes the input.

MPG wheel input connections (H8, H9, H10) are assigned to command a particular axis using the drop down menu.

4-POSITION WIRING
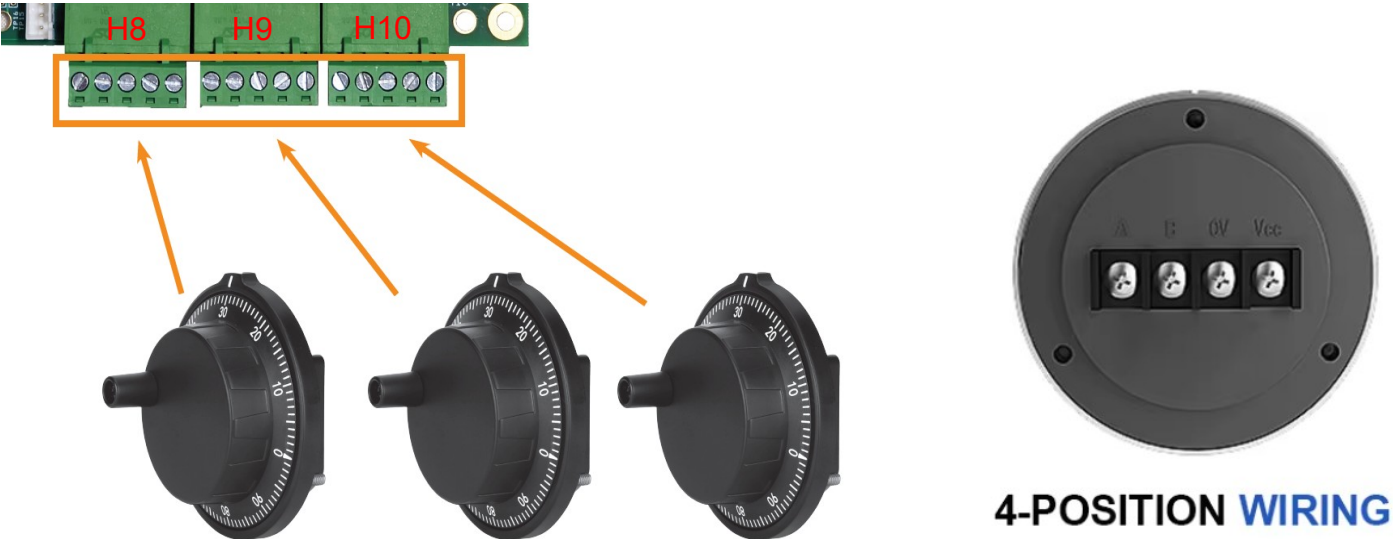
Use "4 Terminal" MPG wheels with A/ B / 0V / Vcc connections.   https://amzn.to/3WWCY0T
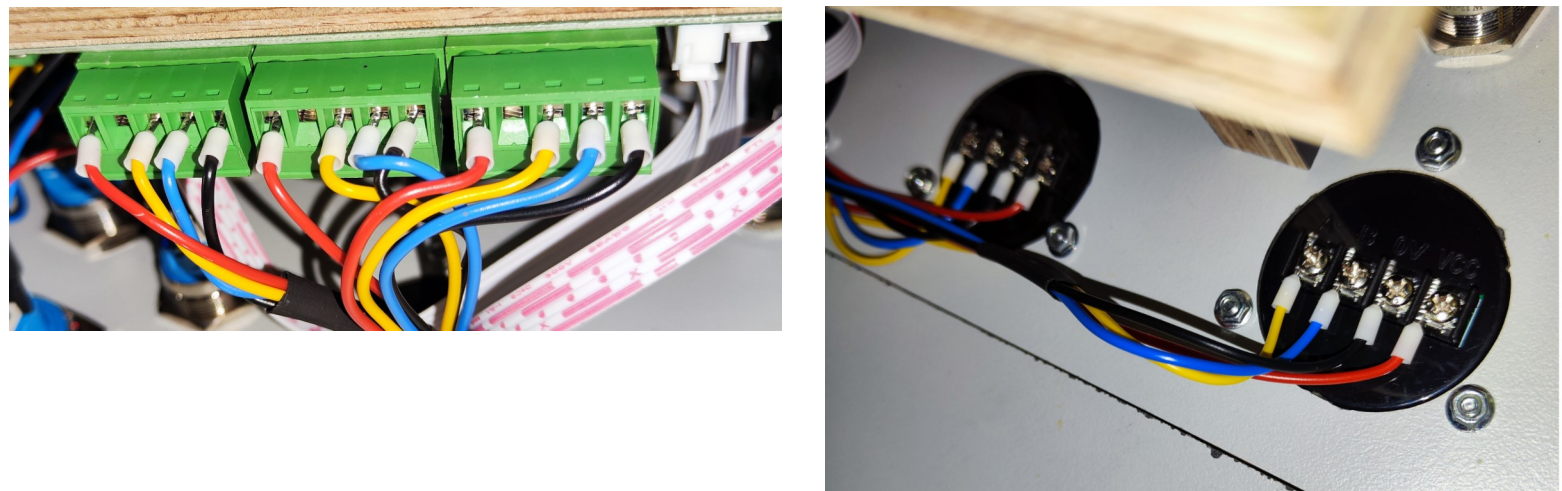
Choose an axis for each MPG connection to control. For example, H8 = Axis 1, H9= Axis 2, etc. when using a dedicated MPG wheel for each axis.

MPG (H8)	MPG (H9)	MPG (H10)
Select Axis ∨	Select Axis ∨	Select Axis ∨

Select Axis	
Use Selector Switch	coder Knob Speed Multiplier 1x-20x
Axis 1	Feedrate Override (H5) 1 x
Axis 2	Spindle Speed Override (H6) 1 x
Axis 3	Rapid Override (H7) 1 x
Axis 4	
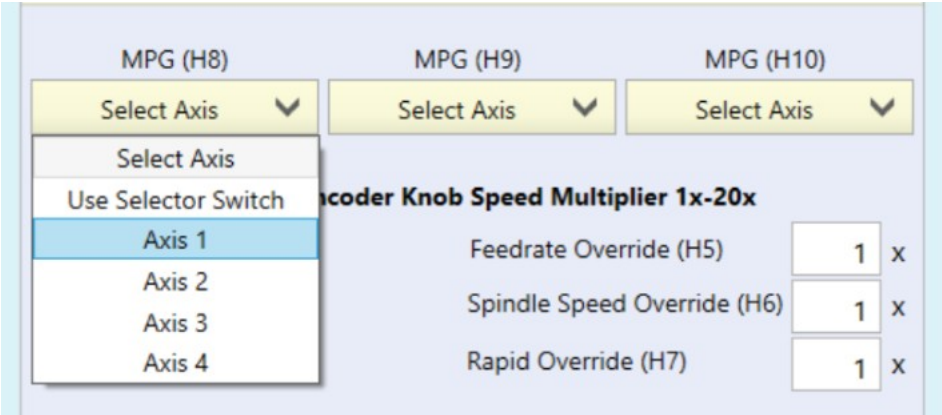
The example below shows three MPG wheels in use, one MPG wheel for each axis.

MPG (H8)	MPG (H9)	MPG (H10)
Axis 1	Axis 2	Axis 3

When using an MPG wheel with an Axis selector switch, choose "Use Selector Switch" from the drop-down menu.

Set the MPG axis selector switch inputs in the input definition table. These inputs determine which axis the MPG wheel will command.

For example: The following setup uses one MPG wheel with a FOUR position axis selector switch and assigning inputs 9,10 and 11 to axis selection 1,2, and 3 respectively. Note: the fourth position on the switch is MPG OFF and is not wired to anything!

Inputs KB 13,14, and 15 are momentary button inputs that are built into the Centroid supplied encoder knobs!

Push the knob in and you will feel a distinct detent click.
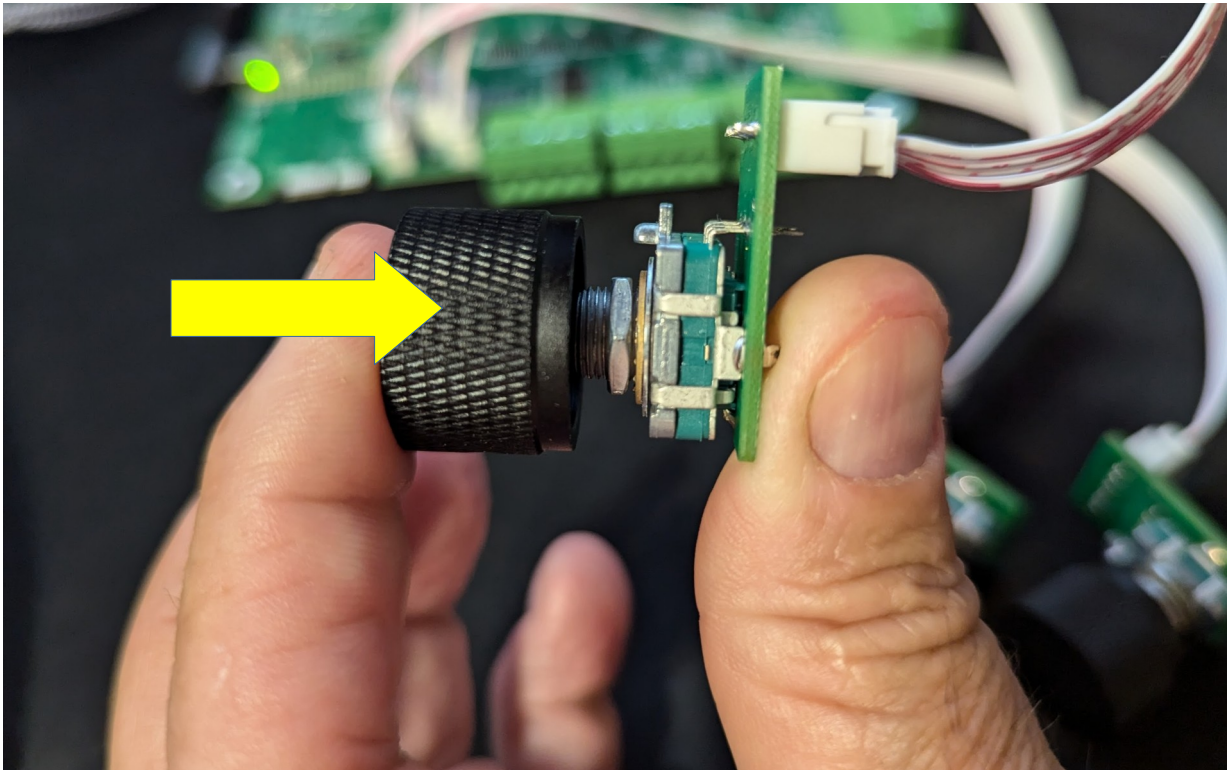
Header H5 on the USB-BOB is assigned to the Feedrate Override Knob, H6 to the Spindle Speed Override Knob, H7 to the Rapid Rate Override Knob
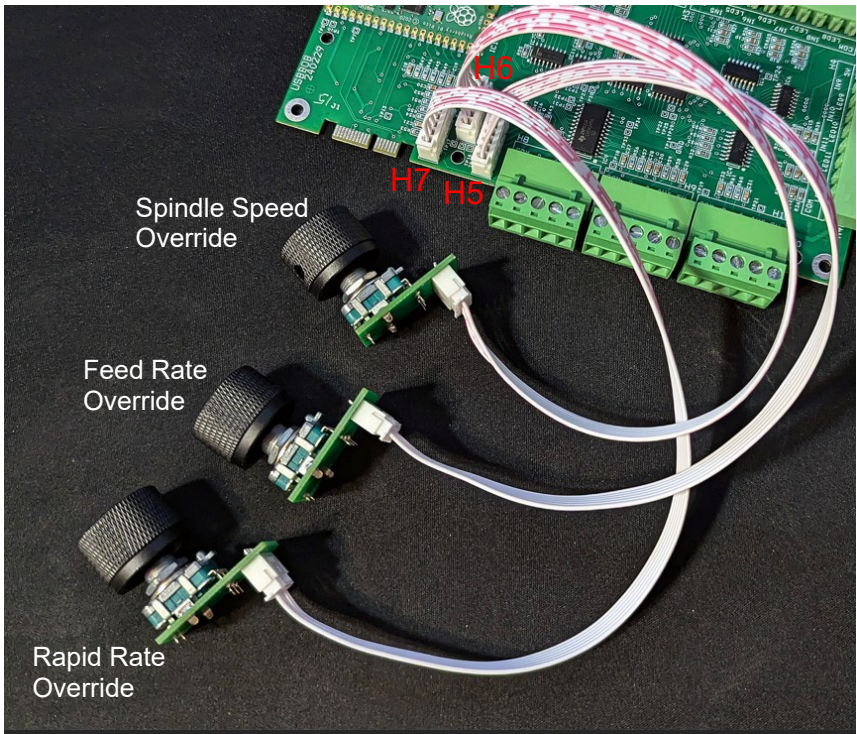
Header connection H5 Feed Rate Override Knob is also input KB13

Header connection H6 is Spindle Speed Override Knob is also input KB14

Header connection\H7 is Rapid Rate Override Knob is also input KB15

H5 Feed Rate Override knob button **13** KB13

H6 Spindle Speed Override knob button **14** KB14

H7 Rapid Rate Override knob button **15** KB15

Observe that the encoder knob button (Inputs 13,14,15) input changes from red to green in the USB BOB PLC diagnostic tool, when the knob is depressed.

USB-BOB Input / Output PLC Diagnostics   USB_INP13 : USB_INP13

USB-BOB #1 INPUTS 1-15

```
0 0 0 0 0 0 0 0  0 1 1 1 1 1 1
1 2 3 4 5 6 7 8  9 0 1 2 3 4 5
```

USB-BOB #2 INPUTS 17-31

```
1 1 1 2 2 2 2 2  2 2 2 2 2 3 3
7 8 9 0 1 2 3 4  5 6 7 8 9 0 1
```

< Alt i > Open PLC Diagnostics press again to close PLC diagnostics.
< CTRL Alt i > to invert input open or closed. < CTRL Alt f > three step cycle to force an output: ON, OFF, or normal.
< CTRL Alt o > Options Menu. < CTRL Alt h > for Help. < CTRL Alt r > to restore to beginning state.

Any input function can be assigned to the KB13 (Feed Rate Override knob), KB14 (Spindle Speed Override) and KB15 (Rapid Rate Override) knobs.

The most common input function assignment for these knob buttons are:

KB13 = "Feedrate Custom %"

KB14 = "Spindle Speed Custom %"

KB15 = "Rapidrate %"

These three functions allow their respective knob buttons to set the override back to 100% (or what ever value you specify) just by pushing the knob itself.

13	KB13	Feedrate Custom %
14	KB14	Spindle Speed Custom %
15	KB15	Rapidrate Custom %
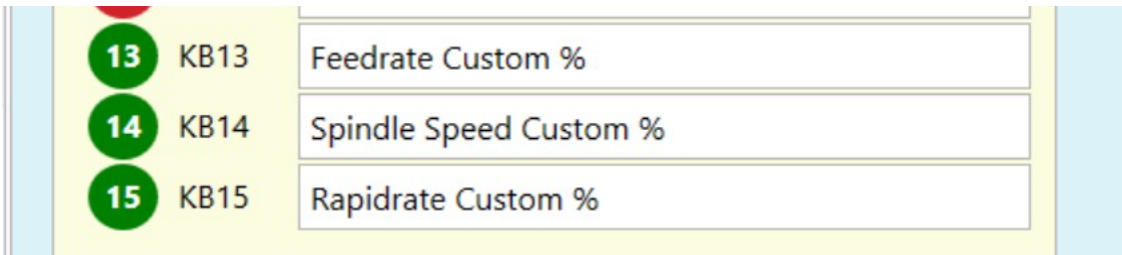
To set this up: Assign KB13 to "Feedrate Custom %", KB14 "Spindle Speed Custom %", and KB15 "Rapidrate Custom %" and then enter the override percentage value you'd like the knob button to "change to" when pressed.

In the example below we have set the Feed Rate Knob Button to use a custom value of 2% when the Feed Rate knob button is pressed. The Spindle Speed Knob Button will set the Spindle Speed Override to 100% and when the Rapid Rate Knob Button will set the Rapid Override to 50%.

Values for the Encoder Knob Push Button when using the "Custom %" inputs

Value for use with the "Feedrate Custom %" input	2 %
Value for use with the "Spindle Speed Custom %" input	100 %
Value for use with the "Rapidrate Custom %" input	50 %
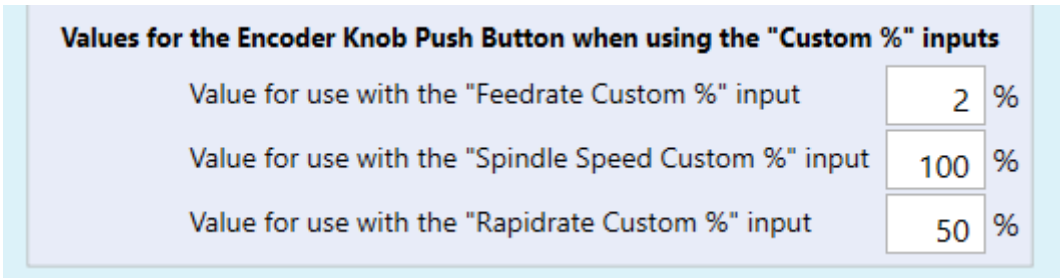
There are also multiplier values to control the responsiveness of the Encoder knobs.
1= slowest response, 20 = fastest response. Only whole number 1 though 20 are accepted.
Adjust to your application, Typical values are shown below.

Override Encoder Knob Speed Multiplier 1x-20x

Feedrate Override (H5)	4 x
Spindle Speed Override (H6)	2 x
Rapid Override (H7)	4 x
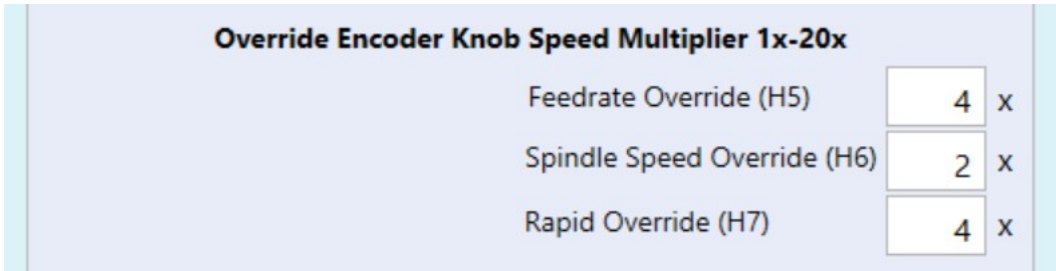
Once configured press the "Write Settings to CNC Control" button and follow the instructions on the screen.

USB-BOB canned functionality

Function Name	Description	Group	Platform
Cycle Start	Uses a momentary button (aka "One Shot") Starts a G code program or Macro.		All
Cycle Cancel	Uses a momentary button (aka "One Shot") Cancels a G code program or Macro.		All
Tool Check	Uses a momentary button (aka "One Shot"). Use Tool Check to stop a G code program and easily restart.		All
Feed Hold	One-Shot, Decelerates to a stop position during g code program. Press cycle start to resume job.		All
Fast/Slow Jog Toggle	Momentary button to Toggle between Fast Jogging Rate and Slow Jogging rate (user specifies).		All
Incremental/Continuous Jog Toggle	Momentary button to Toggle between Incremental jog mode and continuous jog mode.		All
Single Block Toggle	Momentary button to Toggle Single Block mode (must press cycle start for each line of g code program).		All
JogDisable Toggle	Momentary button to Toggle Jogging disabled and enabled.	A	Acorn, AcornSix
Ax#PlusJog (# = 1-8)	Ax1PlusJog = Momentary button to jog axis 1 in the positive direction.	A	All
Ax#MinusJog (# = 1-8)	Ax1MinusJog = Momentary button to jog axis 1 in the negative direction.	A	All
Ax1Ax2PlusJog	Diagonal Jog Momentary button to jog axis 1 and axis 2 in the positive direction.	A	All
Ax1Ax2MinusJog	Diagonal Jog Momentary button to jog axis 1 and axis 2 in the minus direction.	A	All
Ax1PlusAx2MinusJog	Diagonal Jog Momentary button to jog axis 1 in the positive and axis 2 in the minus direction.	A	All
Ax1MinusAx2PlusJog	Diagonal Jog Momentary button to jog axis 1 in the minus direction and axis 2 in the positive direction.	A	All
x1Jog Select	Momentary button that Latches x1 Jog speed until another speed is selected.	B	All
x10Jog Select	Momentary button that Latches x10 Jog speed until another speed is selected.	B	All
x100Jog Select	Momentary button that Latches x100 Jog speed until another speed is selected.	B	All
Rapid/Feed Link Toggle	Momentary button to Toggle the Link between the Rapid Rate Override Percentage and the Feedrate Override Percentage.	C	All
FeedRate 100%	Momentary button to select 100% Feedrate Override speed.	C	All
FeedRate 75%	Momentary button to select 75% Feedrate Override speed.	C	All
FeedRate 50%	Momentary button to select 50% Feedrate Override speed.	C	All
FeedRate 25%	Momentary button to select 25% Feedrate Override speed.	C	All
Feedrate Custom%	Momentary button to select a custom Feedrate Override speed value.	C	All
RapidRate 100%	Momentary button to select 100% Rapid rate override speed.	C	All

RapidRate 75%	Momentary button to select 75% Rapid Override speed.	C	All
RapidRate 50%	Momentary button to select 50% Rapid Override speed.	C	All
RapidRate 25%	Momentary button to select 25% Rapid Override speed.	C	All
Rapidrate Custom%	Momentary button to select a custom Rapid Override speed value.	C	All
Spindle Auto/Manual Toggle	Momentary button to Toggle spindle control from auto to manual and vice versa.	D	All
Spindle Start	Momentary button to start the spindle in manual mode.	D	All
Spindle Stop	Momentary button to start the spindle in manual mode.	D	All
Spindle Start/Stop Toggle	Momentary button to start the spindle in manual mode Toggle between Spindle Start and Spindle Stop in manual mode (saves from having to use two inputs to turn spindle on and off in manual mode).	D	All
Spindle CW	Momentary button to select Spindle CW direction in manual mode.	D	All
Spindle CCW	Momentary button to select Spindle CCW direction in manual mode.	D	All
Spindle Low Gear Select	Momentary button to select Low Gear Range (specified by user).	E	All
Spindle Medium Low Gear Select	Momentary button to select a Medium Low Gear Range (specified by user).	E	Hickory
Spindle Medium Gear Select	Momentary button to select a Medium Gear Range (specified by user).	E	All
Spindle High Gear Select	Momentary button to select High Gear Range (specified by user).	E	All
Spindle Brake Mode Toggle	Momentary button to Toggle Spindle Brake mode.		All
Spindle Speed 100%	Momentary button to select Spindle Speed 100% Override value.		All
Spindle Speed Custom %	Momentary button to select a Spindle Speed Custom % Override value.		All
Spindle Speed Plus	Momentary button to increase spindle speed in manual mode.		All
Spindle Speed Minus	Momentary button to decrease spindle speed in manual mode.		All
Coolant Auto/Manual Toggle	Momentary button to Toggle between Auto and Manual Coolant mode.	F	All
Flood Toggle	Momentary button to Toggle Flood on and off.	F	All
Router DustCollection Toggle	Momentary button to Toggle Router Dust Collection on and off.	F	All
Mist Toggle	Momentary button to Toggle mister on and off.	F	All
Router VacuumHoldDown Toggle	Momentary button to Toggle Router Vacuum Hold down on and off.	F	All
MPG Mode Toggle	Momentary button to Toggle ALL MPGs ON and OFF.	G	All
MPG Axis # Select (# = 1-8)	Momentary button to select which axis to move with a MPG for cases where one MPG wheel is used for multiple axes.	G	All
Aux # Key (# = 1-16)	Momentary button to select an operator control panel Auxiliary key. See VCP Users manual for more info on Aux keys.		All
Tool Release	Momentary button to release the tool from a pull stud spindle.		Acorn, AcornSix
Turret Index	Momentary button to Index a turret by one position with each press of the button.		Acorn, AcornSix

Chuck Open	Momentary button to Open the Chuck.		Acorn, AcornSix
Chuck Close	Momentary button to Close the Chuck.		Acorn, AcornSix
Collet Open/Close Toggle	Momentary button to Toggle a collet closer open or closed.		Acorn, AcornSix
SSV Mode Toggle	Momentary button to Toggle between Spindle Speed Variation mode ON or OFF.		Acorn, AcornSix
WorkLight Toggle	Momentary button to Toggle between worklight ON or OFF.		Acorn, AcornSix
TailStock In/Out Toggle	Momentary button to move the tailstock in or out.		Acorn, AcornSix
DryRun Toggle	Momentary button to Toggle Dry Run ON or OFF.		Acorn, AcornSix
PopUpPins Toggle	Momentary button to Toggle Pop Up Pins UP or DOWN.		Acorn, AcornSix
Air Blow Nozzle Toggle	Momentary button to Toggle an Air Blow Nozzle ON or OFF.		Acorn, AcornSix
Crosshair Laser Toggle	Momentary button to Toggle a Cross Hair Laser ON or OFF.		All
Limit Defeat	Momentary button to Defeat the Limit Tripped inputs for 5 seconds to give you a shot at jogging an axis off a limit.		Acorn, AcornSix

Groups = Inputs that are related and interact.

Platform = Which Centroid CNC Control System this feature is available on.

Permanent Installation

Mount the Operator Control Panel Interface Board to a suitable position using the provided #6-32 standoffs. Protect the PC board from chips, dust, coolant and oil.

A 6-foot USB A to Micro B cable is provided. There are several options if the provided cable is too short:

- Use a longer USB A to Micro B cable. Cables up to 15 feet long are readily available for USB 2.0.
- Use the provided cable and an unpowered or passive extension cable for runs up to 15 ft.
- You must use an externally powered or internally powered active extension cable for runs longer than 15 ft. The following USB extension cable has been successfully tested with Operator Control Panel Interface Board: https://amzn.to/48QtEOS

USB cable guidance: Keep USB cabling away from all sources of noise. Do not place USB cabling in the same tracks as VFD or axis motor wiring.

Pay particular attention to strain relief at the USB Micro B connector. An easy method is to ensure the plug is inserted straight and give a suitable amount of slack to keep the strain away from the connector then fix the cable in place several inches away from the connector.

Wiring Button Inputs

The Centroid Operator Control Panel Interface Board features twelve optically isolated inputs for switches, buttons, and joysticks. The inputs are internally pulled up to 5 volts DC and therefore source the current.
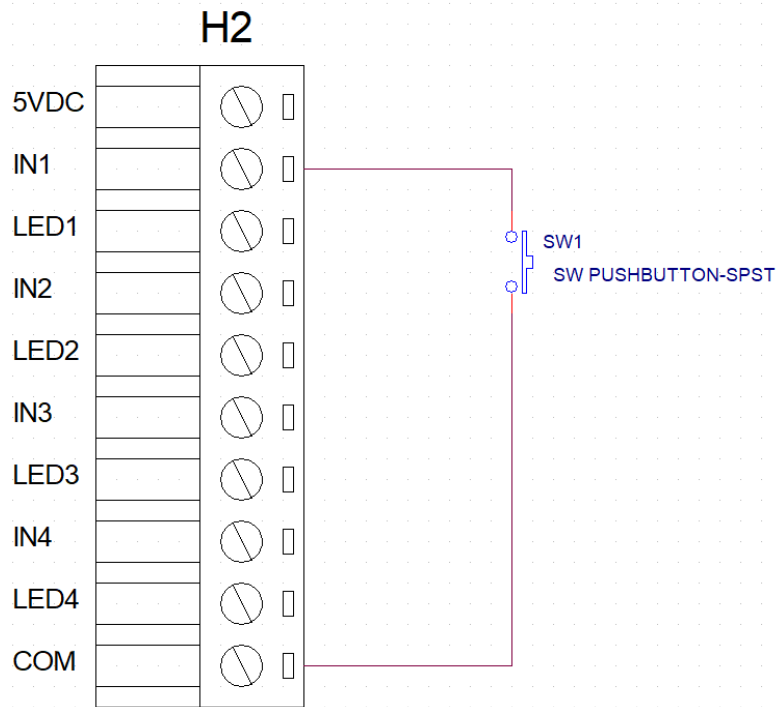
MPG Wheel Connections:
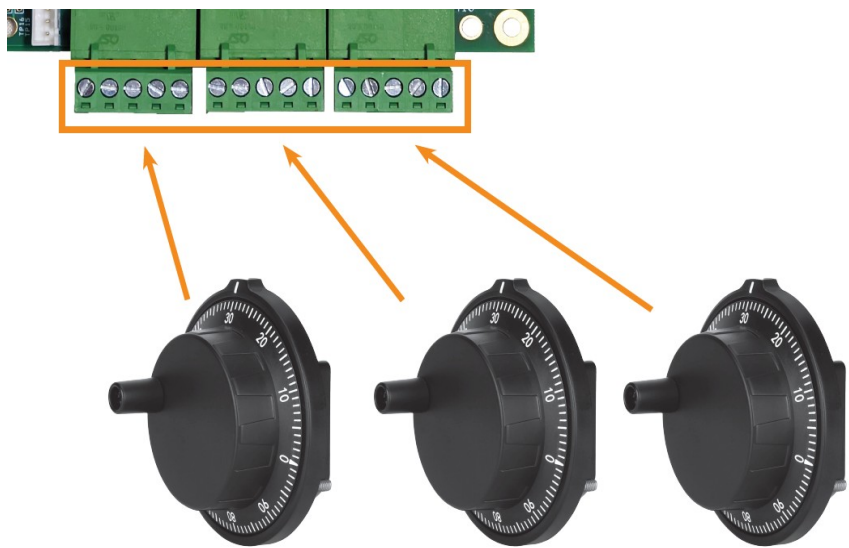
There are three connection headers for MPG handwheel style encoders on the USB-BOB.

USB-BOB is compatible with 5 volt MPG encoder wheels with single ended quadrature outputs.

Commonly referred to as "4 terminal MPG". Here is a link to the inexpensive MPG we verified will work properly:
https://amzn.to/49wMwCz

Typical connections are as follows:
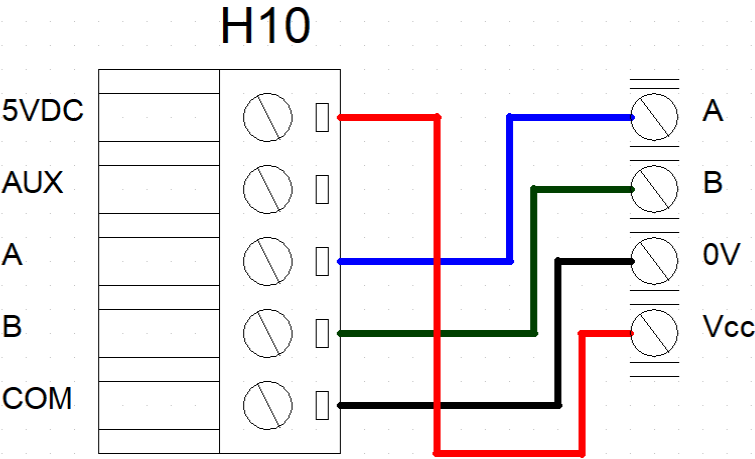
Rotary Encoder

30 cm ribbon cables are included with the kit that connect the rotary encoders for Rapid Override, Feedrate Override and Spindle Speed Override to the USB-BOB. The cables are keyed so they can only be installed in one way. Be sure to firmly seat both connector ends fully in the socket.
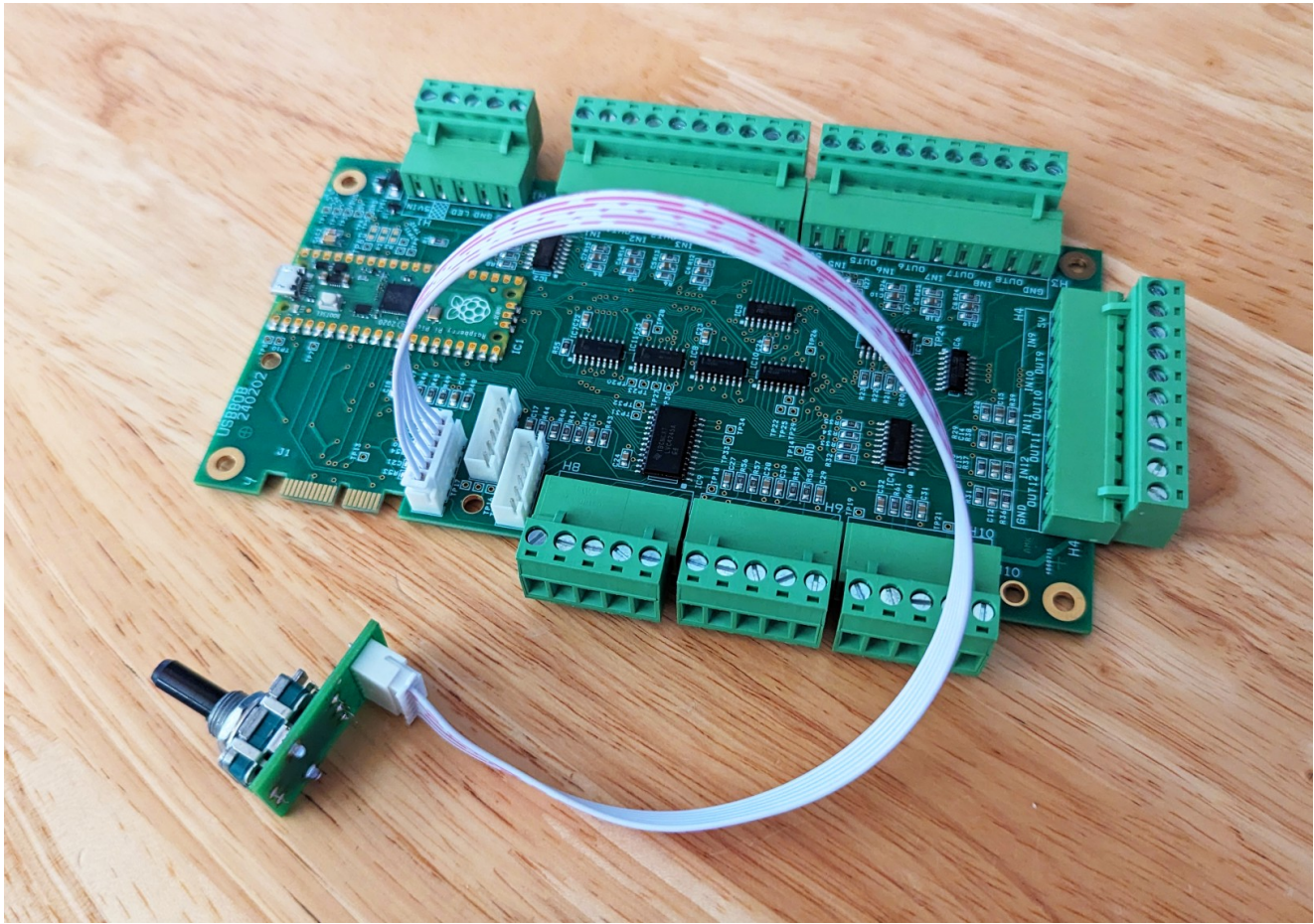
DO NOT pull on the ribbon cable to remove the connector from the socket. Use a stiff plastic tool to pry up on the lip edge of the connector in an upward direction to remove the cable from the socket.
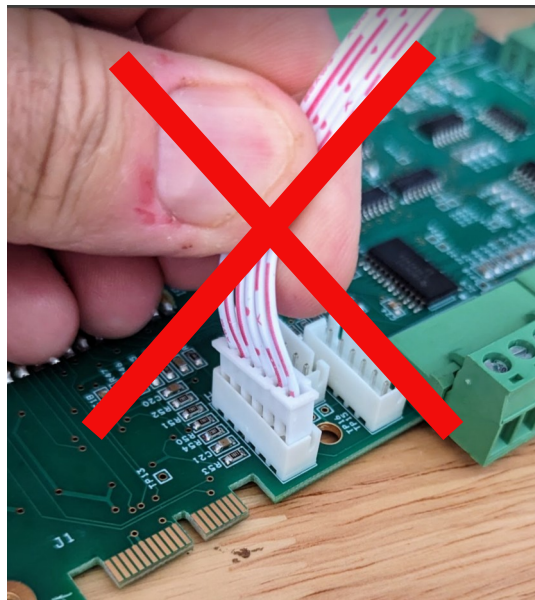
If your application requires longer Rapid, Feed, or Spindle encoder cables you can make your own or purchase them online. The JST XH series connector is commonly used in many other applications.

Our general guidance on cable lengths:

Typically when connecting devices to USB-BOB inputs <u>inside an operator control panel or console</u> with short cables, shielding is not necessary as long as the cables are inside a metal box (the CNC console itself) and are separate from the main CNC control cabinet.

If going outside the CNC Control Console with a DIY cable it is highly recommended to use Shielded Cable with a drain wire. Use 5 conductor cable and put the shield on pin 6.

Stock ribbon cable length: 30cm
Housing: JST XHP-6
Contacts: JST SXH-001T-P0.6 (for 28 to 22 AWG)

5 conductor shielded cable
22 to 28 AWG

USB-BOB   FEEDKNOB
                                                                              Pin 1
            SHIELD DRAIN
            COM
            AUX
            SW
            B
Pin 1   A
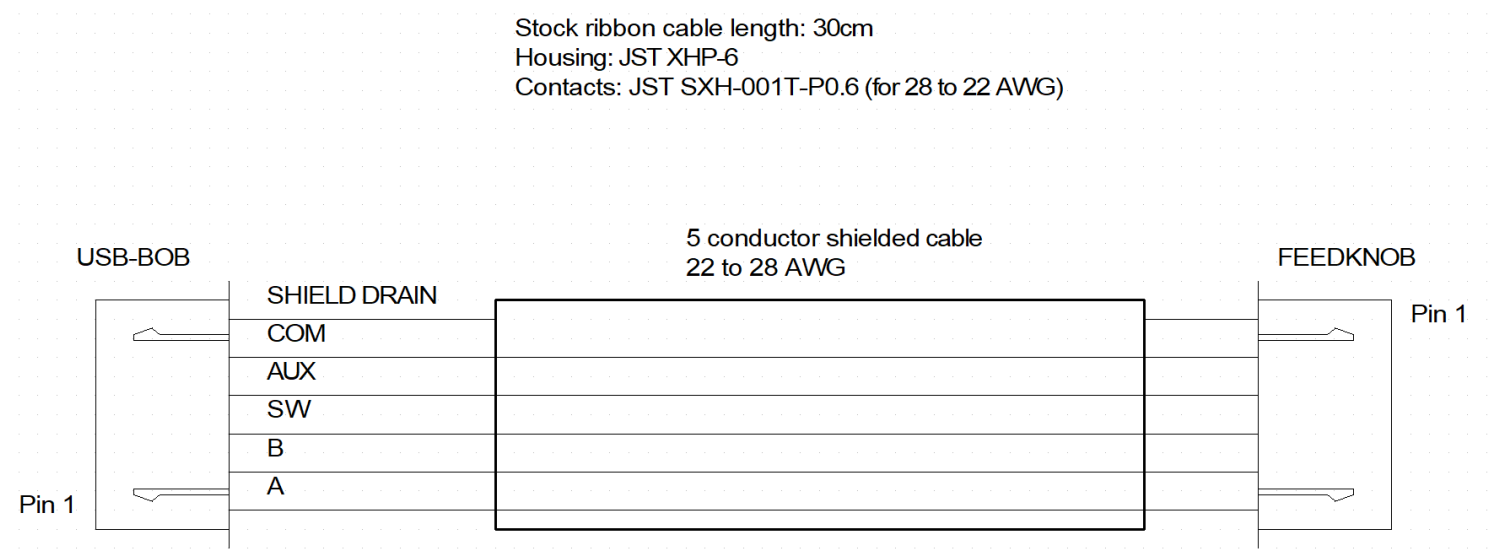
When making your own cables: **note the FLIP!** Pin 1 on the USB-BOB connects to Pin 6 on the Rapid/Feed/Spindle encoder connector as seen in the drawing above.

The mating connector that connects to both the Centroid Encoder PC board and the USB-BOB itself is:
JST XHP-6.

The contact pins used with the JST XHP-6 are: JST SXH-001T-P0.6 (for use with 28 to 22 AWG wire).

Wiring Outputs

Twelve open collector outputs are available to control LED indicators. The default behavior is to acknowledge that the change in state of the corresponding input was received by the PLC. External resistors are required and the maximum voltage is 50V DC. It is recommended that you use the lowest current LEDs possible if the LEDs are normally on – 20 mA is always a safe value. Do not exceed continuous 100 mA per channel and reduce the current if ambient temperature exceeds 140 °F (60 °C).

LED powered from 5VDC

H2

5VDC	
IN1	
LED1	
IN2	
LED2	
IN3	
LED3	
IN4	
LED4	
COM	

R1 = 330
D1 = LED

5 VDC / 330 ohms = 15 mA

Ensure current through LED is less than or equal to max current rating of LED.

Minimum resistor values for LEDs with 5V power

LED max current rating	Minimum resistance	Nominal current thru LED
30 mA	180 ohms	27.7 mA
20 mA	270 ohms	18.5 mA
10 mA	560 ohms	8.9 mA

LED powered from external source

H2

5VDC	
IN1	
LED1	
IN2	
LED2	
IN3	
LED3	
IN4	
LED4	
COM	

EXT_VDC
R1 = ?
D1 = LED

Choose R1 to set current less than or equal to LED max current rating
EXT_VDC maximum 50 VDC
Be careful to not connect EXT_VDC to the input pins

A single open collector output is available on H1 to indicate Centroid Operator Control Panel Interface Board connection status. This is an "All good and ready to go" status LED. This output is connected the same way as other LEDs on the USB-BOB board. If using 5V to power the LED then it may be taken from the other headers.

Typical H1
Wiring

H1

5VIN	
N/C	
LED	
COM	
COM	

R1
330

H2 pin 1 (5V)

D1
LED
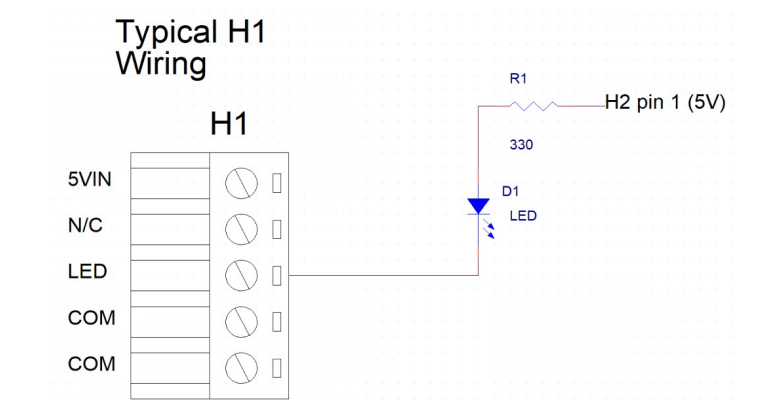
An auxiliary input for 5V DC power is provided on H1 and is useful when many higher current LEDs are powered from pin 1 on H2, H3, and H4.

Optional
H1 Wiring

H1

5VIN	
N/C	
LED	
COM	
COM	

R1
330

D1
LED

5V out

5V DC Supply
500 mA

COM

Advanced Custom Button Functionality programming **without** using the Wizard Canned Functions
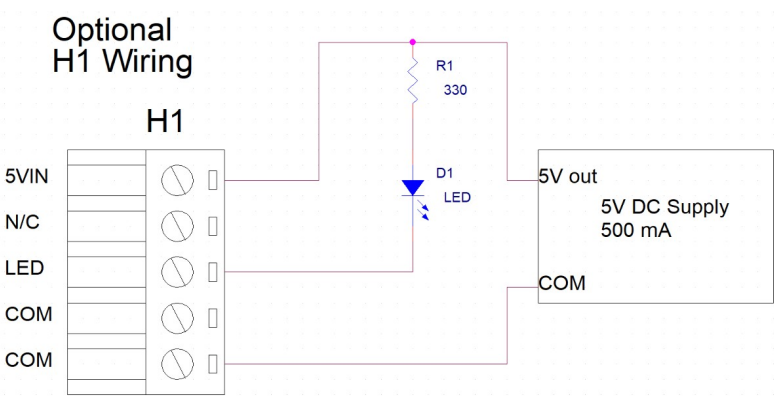
Assigning Functionality in the PLC:

ALL Operator Control Panel Interface Board button and knob functions can be modified by the PLC. In this example, we will change the "Feed Hold" button on the Operator Control Panel Interface Board to perform the actions of an Aux1 key.

Open the .src file for your PLC found in the CNCM/CNCT directory. Typically this will be called "acorn_mill_plc.src" or similar. There you will find the following code:

```
;----------------------------------------------------------------------------
; System Variables: External USB Panel
;----------------------------------------------------------------------------
;Buttons
ExtUsbCycleStart_SV          IS SV_PC_EXT_USB_PANEL_INP_1 ;Cycle Start
ExtUsbFeedHold_SV            IS SV_PC_EXT_USB_PANEL_INP_2 ;Feed Hold
ExtUsbToolCheck_SV           IS SV_PC_EXT_USB_PANEL_INP_3 ;Tool Check
ExtUsbCycleCancel_SV         IS SV_PC_EXT_USB_PANEL_INP_4 ;Cycle Cancel
ExtUsbBtn5_SV                IS SV_PC_EXT_USB_PANEL_INP_5
ExtUsbBtn6_SV                IS SV_PC_EXT_USB_PANEL_INP_6
ExtUsbBtn7_SV                IS SV_PC_EXT_USB_PANEL_INP_7
ExtUsbBtn8_SV                IS SV_PC_EXT_USB_PANEL_INP_8

;FeedKnobs (32bit Word)
ExtUsbFeedKnob_W             IS SV_PC_EXT_USB_PANEL_W_1
ExtUsbSpinKnob_W             IS SV_PC_EXT_USB_PANEL_W_2
ExtUsbRapidKnob_W            IS SV_PC_EXT_USB_PANEL_W_3
ExtUsbKnob4_W                IS SV_PC_EXT_USB_PANEL_W_4
ExtUsbKnob5_W                IS SV_PC_EXT_USB_PANEL_W_5
ExtUsbKnob6_W                IS SV_PC_EXT_USB_PANEL_W_6
```

These variables represent the first two Operator Control Panel Interface Board boards connected to the system. The first 4 buttons and first 3 knobs (for the first Operator Control Panel Interface Board) are named to their default Centroid functions. We will be editing the "ExtUsbFeedHold_SV". Let's rename it to reflect the new function.

```
ExtUsbAux1_SV   IS SV_PC_EXT_USB_PANEL_INP_2 ;Aux 1 Key
```

In addition, we will want to remove "ExtUsbFeedHold_SV" from any logic it was used in:

```
;--Feed Hold Mode
; Note: the feedrate override values used here for testing against P146
; are those calculated in the previous scan.  There is no problem with that.
IF (FeedHoldKey || KbFeedHold_M || SkinFeedHold_M || MpgFeedHold_M ||
   FeedHold2 || ExtUsbFeedHold_SV) THEN (FeedHoldPD)
```

This section after removing "ExtUsbFeedHold_SV" should look like this:

```
;--Feed Hold Mode
; Note: the feedrate override values used here for testing against P146
; are those calculated in the previous scan.  There is no problem with that.
IF (FeedHoldKey || KbFeedHold_M || SkinFeedHold_M || MpgFeedHold_M ||
   FeedHold2) THEN (FeedHoldPD)
```

We now want to add "ExtUsbAux1_SV" to the Aux 1 Key functions. First, the stock PLC:

```
IF (Aux1Key  || KbAux1Key_M || SkinAux1_M) THEN (DoAux1Key)
IF (Aux2Key  || KbAux2Key_M || SkinAux2_M) THEN (DoAux2Key)
IF (Aux3Key  || KbAux3Key_M || SkinAux3_M) THEN (DoAux3Key)
```

Now with "ExtUsbAux1_SV" added, it should look like this:

```
IF (Aux1Key  || KbAux1Key_M || SkinAux1_M || ExtUsbAux1_SV) THEN (DoAux1Key)
```

Now you can save the .src file and recompile the PLC. Ensure to power cycle the system. When you press the Operator Control Panel Interface Board "Feed Hold" Button, it will now perform the actions of the Aux 1 Key.

Applicable System Variables:

Input system variables:

```
ExtUsbCycleStart_SV          IS SV_PC_EXT_USB_PANEL_INP_1 ;Cycle Start
ExtUsbFeedHold_SV            IS SV_PC_EXT_USB_PANEL_INP_2 ;Feed Hold
ExtUsbToolCheck_SV          IS SV_PC_EXT_USB_PANEL_INP_3 ;Tool Check
ExtUsbCycleCancel_SV        IS SV_PC_EXT_USB_PANEL_INP_4 ;Cycle Cancel
ExtUsbBtn5_SV               IS SV_PC_EXT_USB_PANEL_INP_5
ExtUsbBtn6_SV               IS SV_PC_EXT_USB_PANEL_INP_6
ExtUsbBtn7_SV               IS SV_PC_EXT_USB_PANEL_INP_7
ExtUsbBtn8_SV               IS SV_PC_EXT_USB_PANEL_INP_8
ExtUsbBtn9_SV               IS SV_PC_EXT_USB_PANEL_INP_9
ExtUsbBtn10_SV               IS SV_PC_EXT_USB_PANEL_INP_10
ExtUsbBtn11_SV               IS SV_PC_EXT_USB_PANEL_INP_11
ExtUsbBtn12_SV               IS SV_PC_EXT_USB_PANEL_INP_12
ExtUsbBtn13_SV               IS SV_PC_EXT_USB_PANEL_INP_13
ExtUsbBtn14_SV               IS SV_PC_EXT_USB_PANEL_INP_14
ExtUsbBtn15_SV               IS SV_PC_EXT_USB_PANEL_INP_15
ExtUsbBtn16_SV               IS SV_PC_EXT_USB_PANEL_INP_16

;FeedKnobs (32bit Word)
ExtUsbFeedKnob_W            IS SV_PC_EXT_USB_PANEL_W_1
ExtUsbSpinKnob_W            IS SV_PC_EXT_USB_PANEL_W_2
ExtUsbRapidKnob_W          IS SV_PC_EXT_USB_PANEL_W_3
;FeedKnobs for second USBBOB (32bit Word)
ExtUsbKnob4_W              IS SV_PC_EXT_USB_PANEL_W_4
ExtUsbKnob5_W              IS SV_PC_EXT_USB_PANEL_W_5
ExtUsbKnob6_W              IS SV_PC_EXT_USB_PANEL_W_6
```

Output system variables:

```
ExtUsbOut1_SV               IS SV_PC_EXT_USB_PANEL_OUT_1
ExtUsbOut2_SV               IS SV_PC_EXT_USB_PANEL_OUT_2
ExtUsbOut3_SV               IS SV_PC_EXT_USB_PANEL_OUT_3
ExtUsbOut4_SV               IS SV_PC_EXT_USB_PANEL_OUT_4
ExtUsbOut5_SV               IS SV_PC_EXT_USB_PANEL_OUT_5
ExtUsbOut6_SV               IS SV_PC_EXT_USB_PANEL_OUT_6
ExtUsbOut7_SV               IS SV_PC_EXT_USB_PANEL_OUT_7
ExtUsbOut8_SV               IS SV_PC_EXT_USB_PANEL_OUT_8
ExtUsbOut9_SV               IS SV_PC_EXT_USB_PANEL_OUT_9
ExtUsbOut10_SV               IS SV_PC_EXT_USB_PANEL_OUT_10
ExtUsbOut11_SV               IS SV_PC_EXT_USB_PANEL_OUT_11
ExtUsbOut12_SV               IS SV_PC_EXT_USB_PANEL_OUT_12
ExtUsbOut13_SV               IS SV_PC_EXT_USB_PANEL_OUT_13
ExtUsbOut14_SV               IS SV_PC_EXT_USB_PANEL_OUT_14
ExtUsbOut15_SV               IS SV_PC_EXT_USB_PANEL_OUT_15
ExtUsbOut16_SV               IS SV_PC_EXT_USB_PANEL_OUT_16
```

Specifications

Operator Control Panel Interface Board Specifications

Characteristic	Min.	Typ.	Max.	Unit
Input Voltage	4.5	5.0	5.5	VDC
Input Current	-	-	0.5	A
Power and Data Connector	Micro USB type B			
Aux. Voltage Input Voltage	-	5	-	VDC
Aux. Voltage Input Current	0.5	-	-	A
Switch / Button Inputs	-	12	-	Channels
Switch/Button Input Pull-up Voltage	4.5	5	5.5	VDC
Rotary Encoder Channels	-	3	-	Channels
Jog Encoder Channels	-	3	-	Channels
Jog Encoder Voltage	4.5	5	5.5	VDC
Open Collector Connection Status LED Outputs	-	1	-	Channels
Open Collector LED Outputs	-	12	-	Channels
LED Output Voltage	5	-	50	VDC
LED Output Current Per Channel	-	0.02	0.1	A
Weight	-	16	-	oz.
Size (W*D*H):	7.19 * 4.40 * 1.41			Inches

.

System Timing Specifications

Characteristic	Min.	Typ.	Max.	Unit
End to End Button Press Delay	20	40	60	ms

Troubleshooting

Operator Control Panel Interface Board Troubleshooting

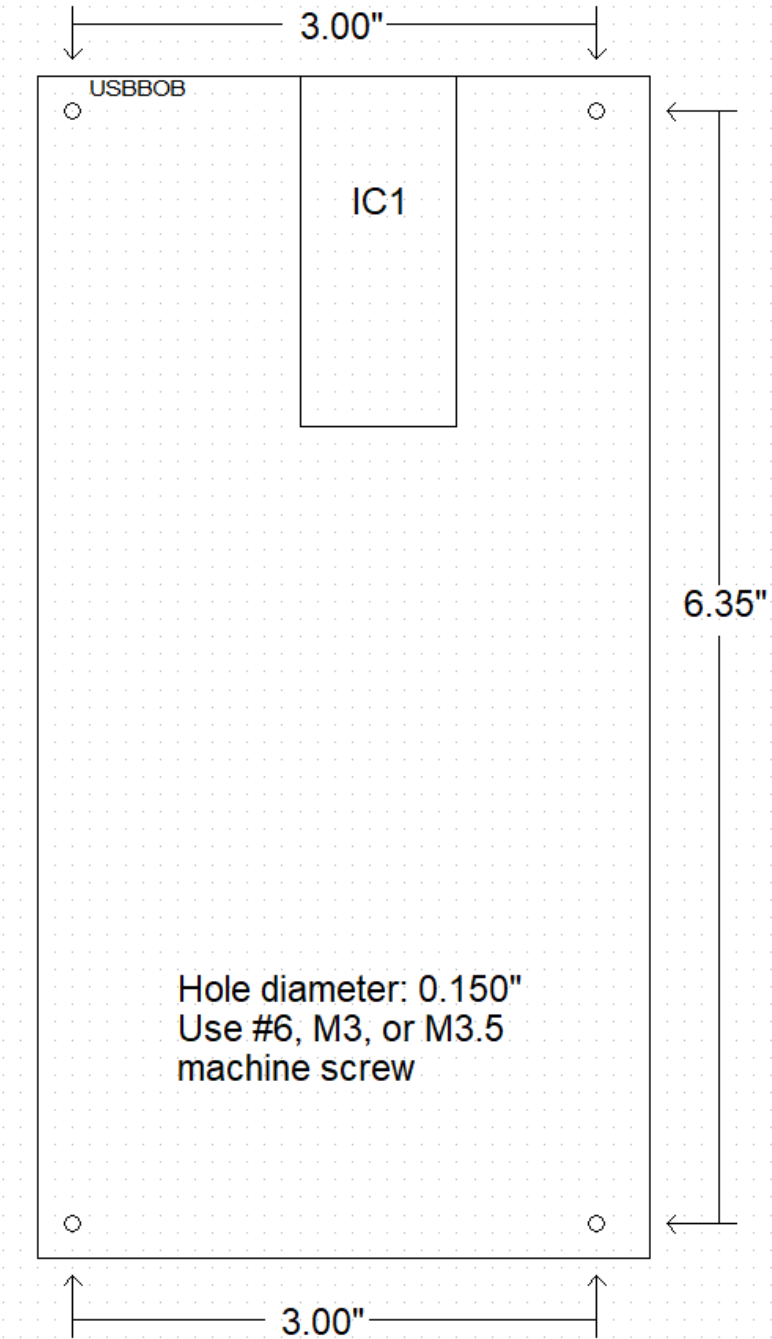| Symptom	Possible Cause	Corrective Action
Buttons not lit CNC12 did not connect to the Operator Control Panel Interface Board		Check USB cable connection
		Check if Parameter #496 is set to correct COM port number
		Laptop USB port has gone to sleep. Run Centroid PC Tuner to configure the PC for CNC use.
Buttons lit but nothing changes in CNC12	Communication lost without closing connection	Check USB cable connection
		Check strain relief at Operator Control Panel Interface Board end - connector should not be able to move around when cable is moved on other side of strain relief
		Laptop USB port has gone to sleep. Run Centroid PC Tuner to configure the PC for CNC use.

Error Messages

Symptom	Possible Cause	Corrective Action
9111 USB PANEL 1 FAULT	CNC12 did not connect to the Operator Control Panel Interface Board	Check USB cable connection
		Check if Parameter #496 is set to correct COM port number
	CNC12 lost connection to Operator Control Panel Interface Board	Laptop USB port has gone to sleep. Run Centroid PC Tuner to configure the PC for CNC use.

Appendix A: Additional Diagrams

<div align="center">

Mounting Pattern

</div>

Applies to Production PCB revision 240604 and newer:

```
                    3.00"

      USBBOB
        ○                        ○

                      IC1




                                        6.35"




        Hole diameter: 0.150"
        Use #6, M3, or M3.5
        machine screw




        ○                        ○

                    3.00"
```

Revision History

04/05/24	Document created
04/08/24	Added input and output sections
4/10/24	Added Ribbon cable and connector info
04/11/24	Formatting and content updates
04/29/24	Heading fixes
07/26/24	Added images
08/06/24	Added Wizard section and update to match v5.19 rev2 CNC12 software.
08/08/24	Formatting and heading fixes
4/23/25	Fixed up bench test section