

# TECHNICAL DOCUMENT

## USB I/O Module Installation

**Product Identification:** USB M-code I/O Interface Kit (PN 32616)


**Purpose:** This document details installation and use of the USB I/O module to integrate external devices with the PathPilot® controller.

Qty.	USB M-code I/O Interface Kit	PN
1	Enclosure	—
1	Cover Plate	—
1	Base	—
1	DIN Rail Latch	—
2	Terminal Block Cover	—
1	USB Cable	32370
1	Control Board	32359



### Overview

The USB I/O module extending the inputs and outputs controlled by G- and M-code inside programs: once plugged into a PathPilot controller USB port, a USB I/O Module can expand the functionality of a PCNC mill or 15L Slant-PRO Lathe.

 **WARNING! Operator Education:** Before using this product, you must have adequate knowledge of electrical circuits, mill wiring, and proper safety procedures associated with a component-level product. Failure to do so could result in serious injury and/or machine damage.

### Required Tools

- Razor Blade

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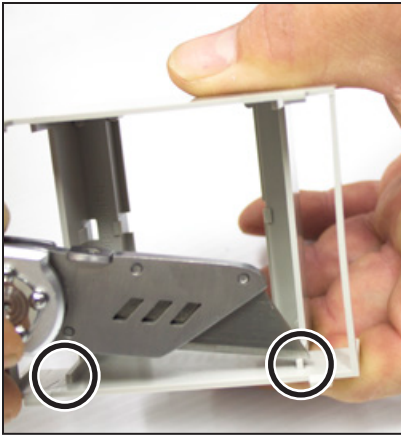


Figure 1

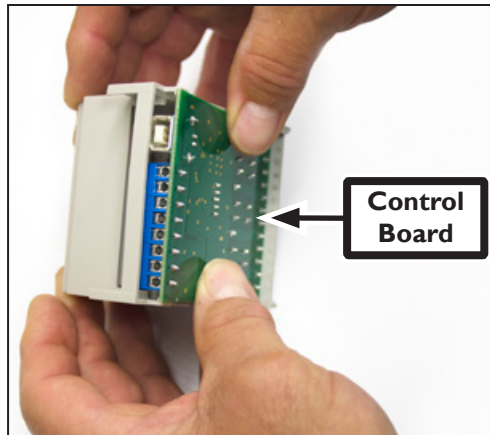


Figure 2

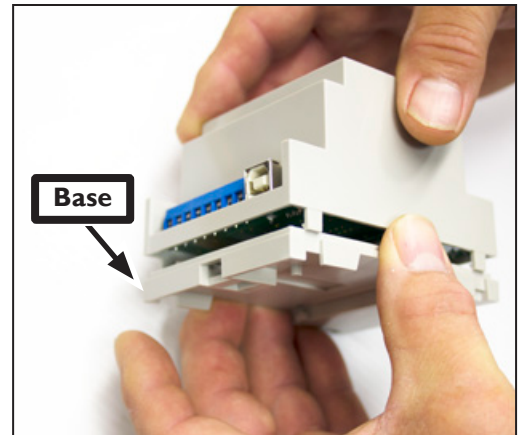


Figure 3

## Assembly

1. Using a razor blade, trim the Enclosure 1/16 inch at the locations indicated in **Figure 1**.

**NOTE:** The enclosure is symmetrical — you can trim either side.

2. Place the Control Board into the Enclosure as shown in **Figure 2**.
3. Snap the Base on to the bottom of Enclosure (see **Figure 3**) and attach the Cover Plate to the top of the Enclosure. Make sure the text on the sticker matches the terminal block locations and the USB port on the Control Board.
4. Attach the Terminal Block Covers over both terminal blocks (see **Figure 4**).
5. Snap the DIN Rail Latch into the bottom of the Base (see **Figure 5**); you can use the hook to mount the USB I/O module on the DIN rail in the electrical cabinet.
6. From the PathPilot interface, on the Settings tab, select the *Enable the USB I/O* checkbox.

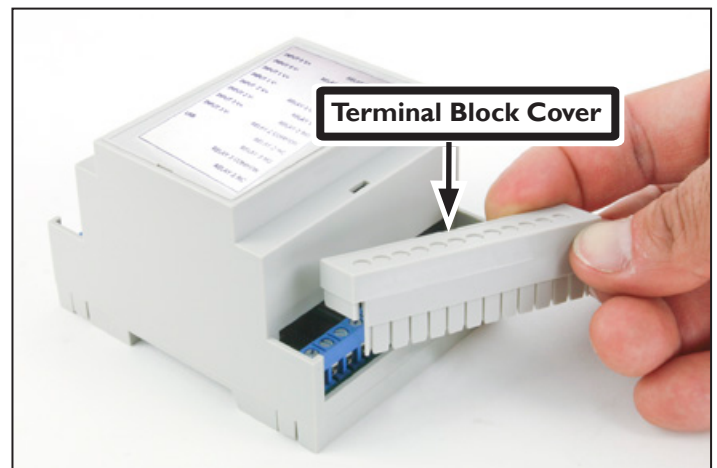


Figure 4

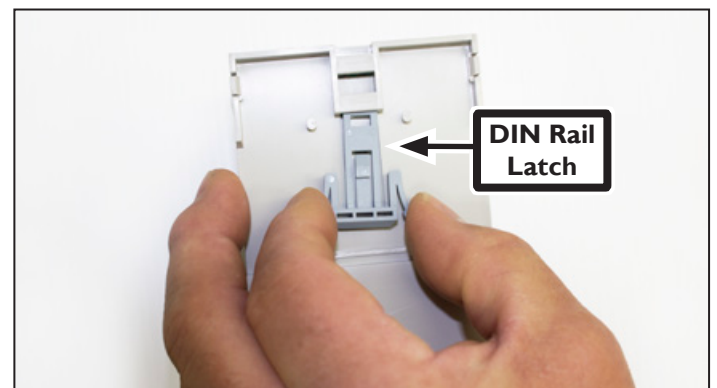
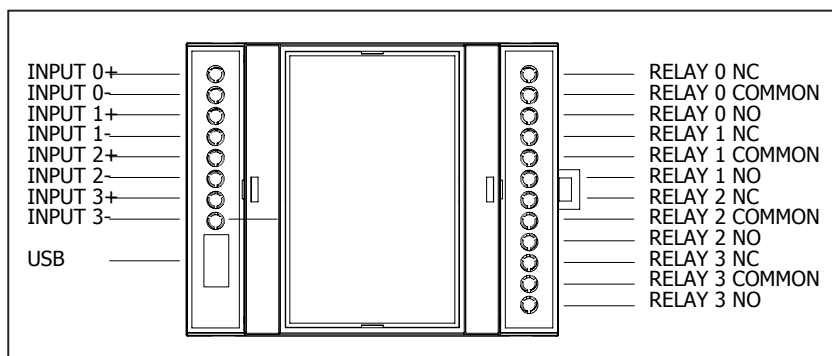


Figure 5

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## Input and Output Specifications



Inputs (Sinking)		Outputs	
Minimum Current:	2 mA	Rated Load:	10 A at 120 Vac; 8 A at 30 Vdc
Current Short Circuit:	5 mA	Maximum Switching Current:	10 A at 240 Vac (12 and 24 Vdc coil)
Open Circuit:	5 Vdc	Maximum Switching Current:	250 Vac, 125 Vdc (30 Vdc when UL/CSA standard is applied)
			AC: 10 A; DC: 8 A
		Maximum Switching Power:	1200 VA, 240 W
		Maximum Permissible Load:	100 mA at 5 Vdc

## Using Inputs

Inputs are used to control progress of the G-code and M-code programs.

You can wire the USB I/O inputs in one of two ways:

1. Using an NPN (sinking) proximity switch
2. Using a snap action or micro switch

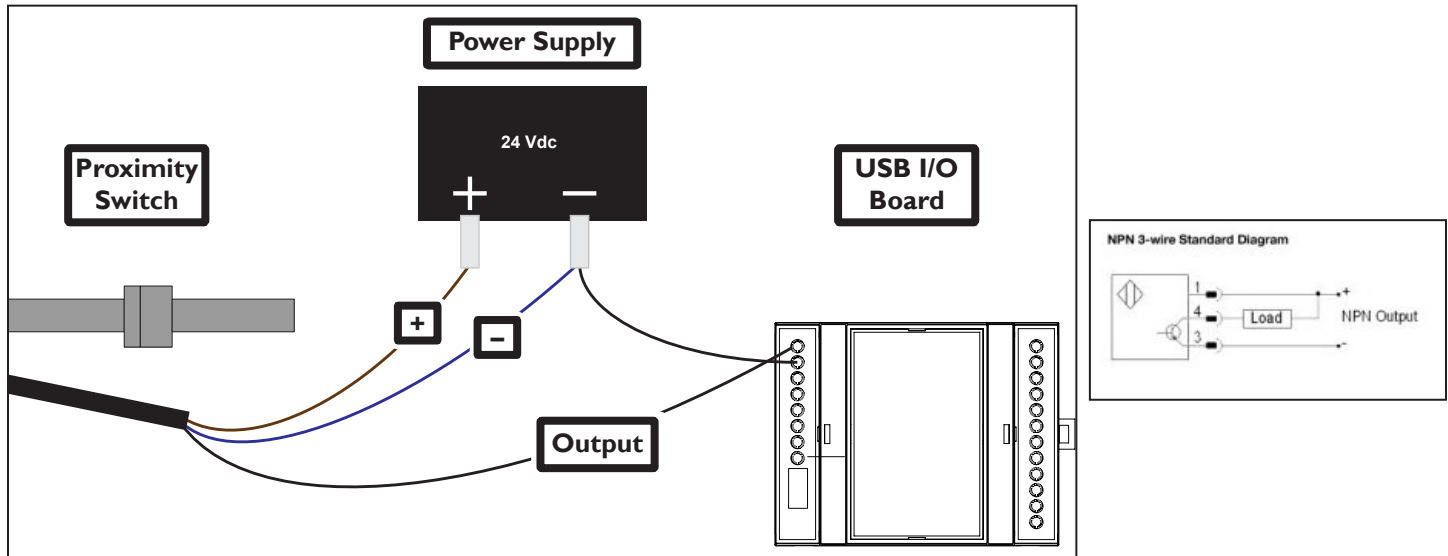
## Input Modes

Mode	Result	Mode	Result
L0	No waiting; returns immediately	L3	Wait for input (high)
L1	Wait for input to rise	L4	Wait for input (low)
L2	Wait for input to fall		

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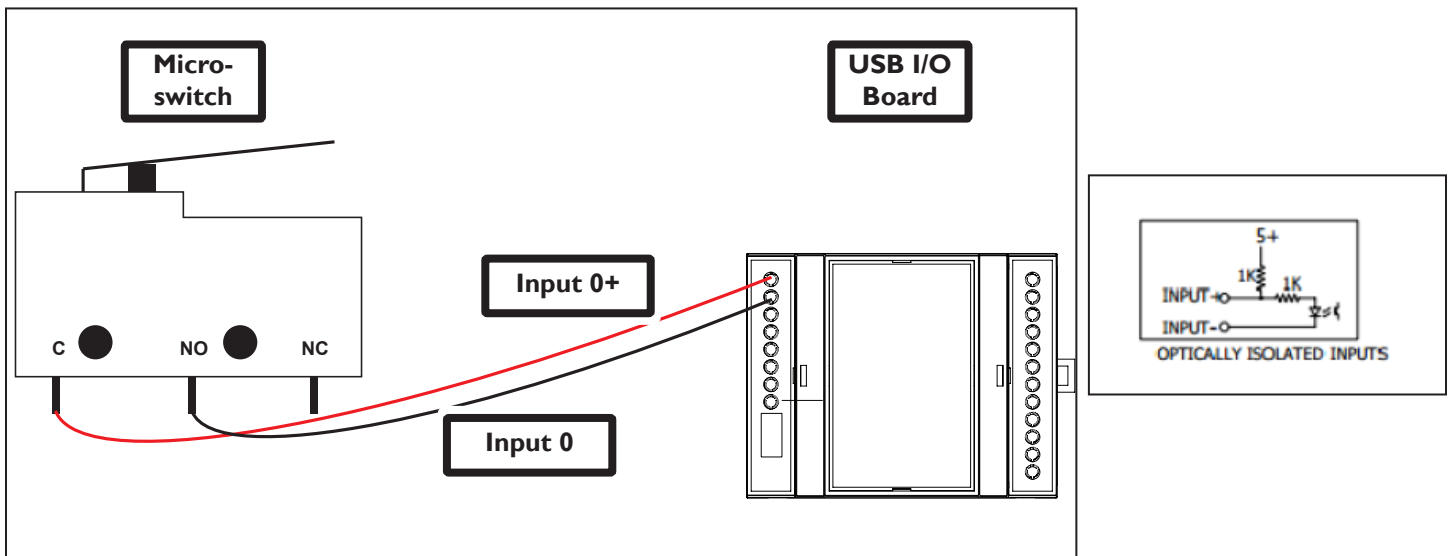
## NPN (Sinking) Proximity Switch

You can use an NPN (sinking) proximity switch by sharing the power supply ground with the USB I/O board's *0* input. Wire the proximity power and route the load to the *0+* input.



## Snap Action or Micro Switch

You can use a snap action or micro switch to wire the input wires to the switch between *Common* and *NO*.



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## G-Code Example

**NOTE:** You can only use one subcall in each program.

```
%  
(start)  
N20 G90 G54 G64 G50 G17 G40 G80 G49  
N30 G20 (Inch)  
  
(Check input)  
M66 P0 L3 Q100  
O100 IF [#5399 LT 0]  
(msg,The input is missing or was applied too late)  
M2  
O100 END IF  
N39 M1 (Wait for cycle start)  
(Hole machining call tool)  
N40 G54  
N50 T1 G43 H1 M6  
  
(Center Drill)  
N60 S5000 M3  
N70 G0X-1.0625 Y0.3437 Z0.1754  
N80 G98 G81 Z-0.031 R0.0394 F30  
N90 X-0.7873 Y0.476  
N100 G80  
N110 M5 M9  
N120 G30  
N130 M30  
%
```

### What is happening?

(Start)- The program starts and defines the modal codes used.

(Check Input)-

M66 = Check Input

P0 = Input 1

L3 = Input High Mode

Q100 = time to wait before error

Code checks the #5399 parameter to verify the input 1 is present. If it is not, end the program and send an error to the status page after 100 seconds(Q100).

M66 = check Input

P0 = Input 1

L3 = Input High Mode

Q100 = time to wait before error

-If the input is present, the program proceeds to call the tool and drill the hole.

## Using Outputs

The outputs are programmed using M64 (contact close) and M65 (contact open). There are four contacts, numbered from 0 to 3 on a mill and from 5-8 on a lathe. The contact is specified by the P word.

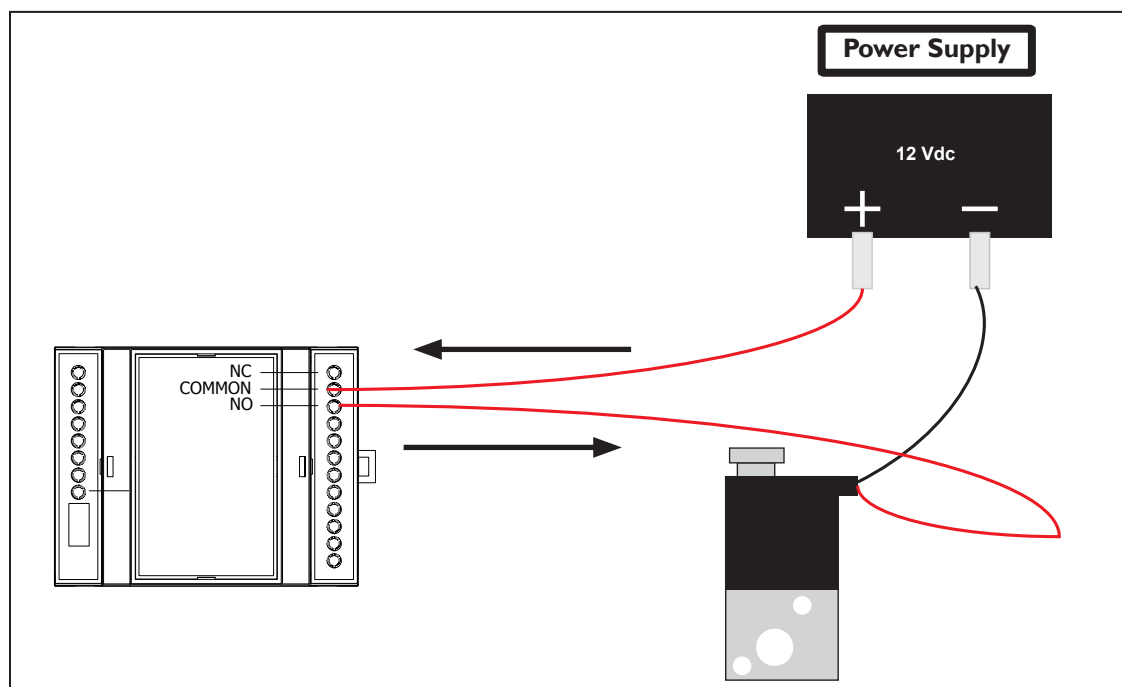
**IMPORTANT!** The lathe uses different P calls than the mills.

Output Contacts for Mills	Output Contacts for Lathe
P0	P5
P1	P6
P2	P7
P3	P8

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## Output Relay Examples

Activate the Output (M64)	Deactivate the Output (M65)
Activate the first relay on a mill: M64 P0	Deactivate the first relay on a mill: M65 P0
Activate the first relay on a lathe: M64 P5	Deactivate the first relay on a lathe: M65 P5



## Syntax Limitations

There is only one P word and one relay per line.

**IMPORTANT!** Each relay command must be done on an individual line.

Correct Syntax	Incorrect Syntax
M64 P0	M64 P023
M64 P2	M64 P0 P2 P3
M64 P3	M64 P0 P2 P3 M65 P0

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## Troubleshooting

There are 12 diagnostic LEDs on the Control Board. These can be accessed by removing the Cover Plate.

Under normal conditions (i.e., after plugging the board into a USB port), the following happens on the control board:

- The Input and Output LEDs flash
- The CPU Booted LED comes on
- The Power LED comes on

**NOTE:** The Communication LED does not flash until the USB I/O Module Control Board is both plugged in and enabled in PathPilot.

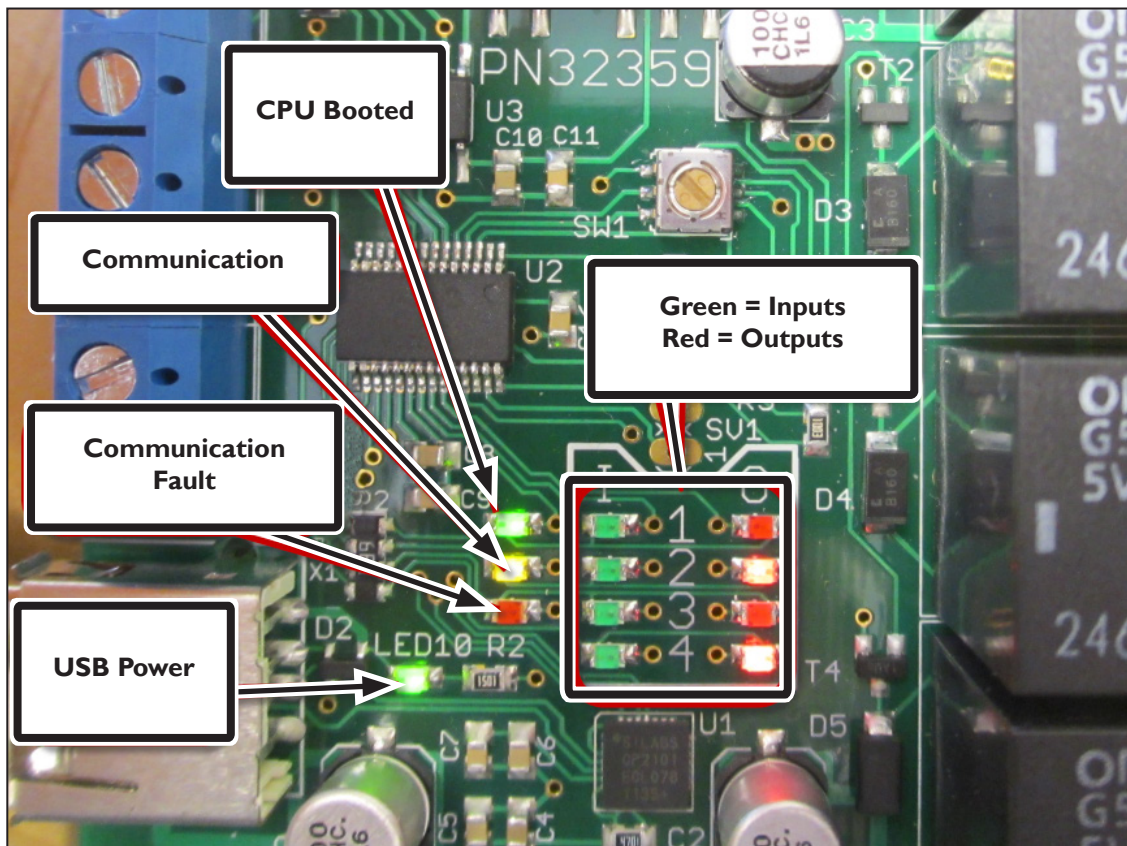


Figure 6



## Important Considerations

### Electrical Noise

Interruption of an electrical circuit (opening a relay contact) can create electrical noise that may disrupt USB communications. If there is any inductance (coil, motor, solenoid, etc.) on the load, include the appropriate RC filter across the load. These may be referred to as snubbers, suppressors, RC filter, or noise filters. For further information, refer to Tormach Service Bulletin SB0039, *Problems from Electrical Noise*.

### Starting Up

Relay outputs may be pulsed for a fraction of a second when the controller is powered on.

### Last State

The USB I/O driver maintains the last state if a G-code and/or M-code program is halted or reset. If the USB I/O board is disconnected from USB communications, the output relays are deactivated, but they are restored to their last state when the USB I/O board is reconnected via a USB.