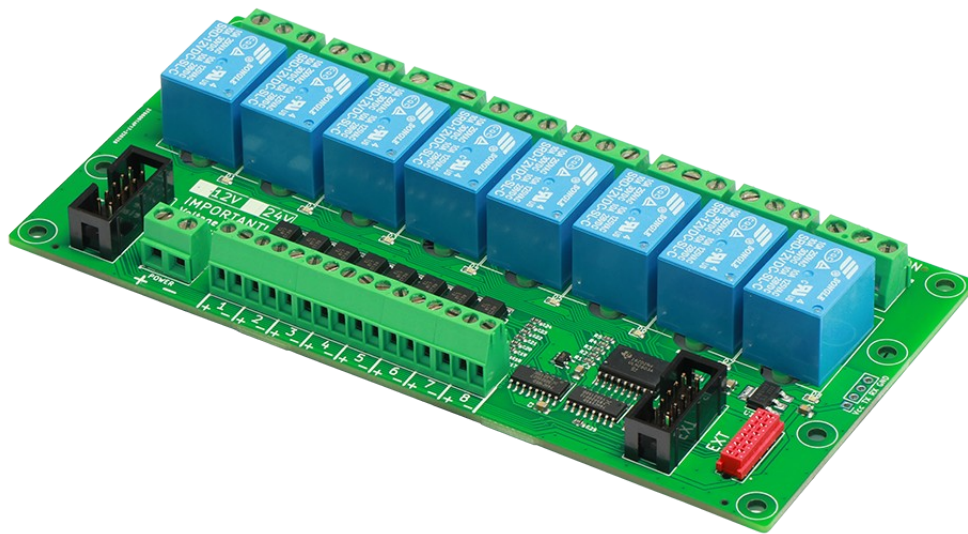




## ExtInOut expansion board

2022/08/22 Rev1.2



## **Disclaimer**

EXTINOUT EXPANSION BOARD IS PROVIDED TO YOU "AS IS," WITHOUT WARRANTY. THERE IS NO WARRANTY FOR THE BOARD, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OF THIRD PARTY RIGHTS. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE DEVICES IS WITH YOU. SHOULD THE HEIGHT SENSOR OR HEIGHT CONTROLLER PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

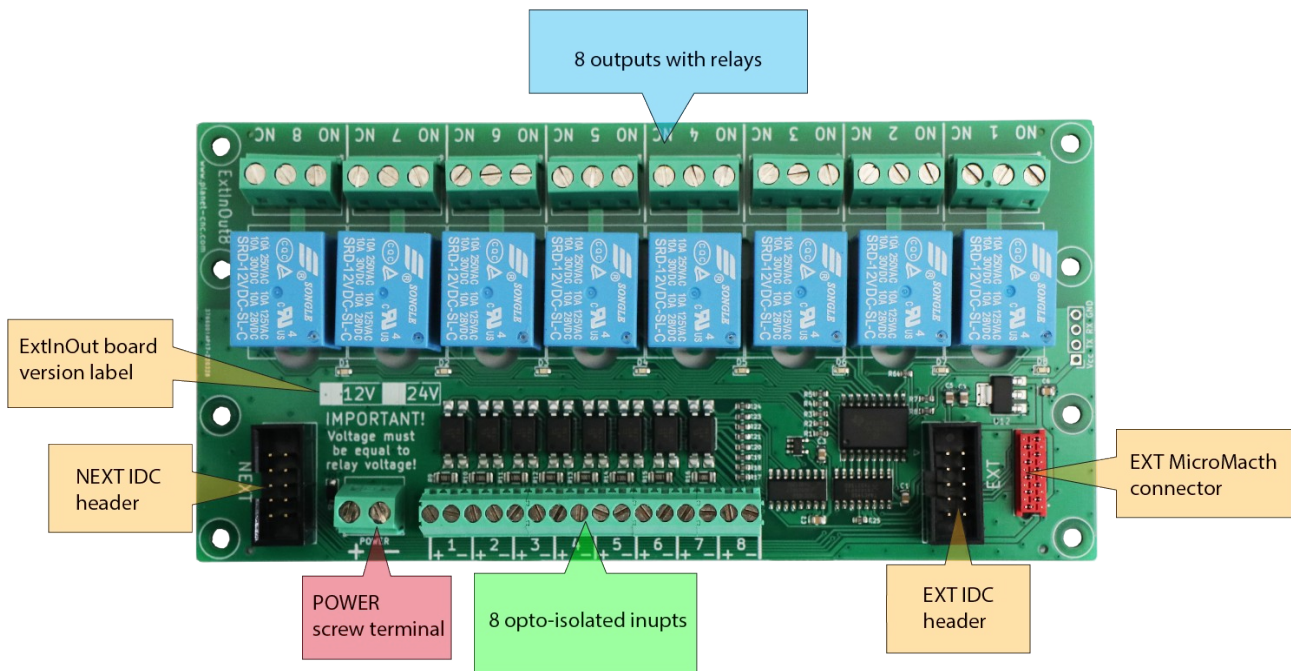
IN NO EVENT SHALL THE AUTHOR BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE EXTINOUT EXPANSION BOARD.

# Introduction

## Overview

ExtInOut expansion board is a device, that expands the number of motion controller inputs and outputs. This board can be used with Mk3, Mk3/4 and Mk3DRV controller.

## Features and specifications:



### ExtInOut board version label:

- ExtInOut expansion board is available in two versions: 12VDC and 24VDC. Version used, depends on the type of external power supply.
- Board will have a mark next to 12V label if version is suitable for 12V power supply
- Board will have a mark next to 24V label if version is suitable for 24V power supply

### 8 Outputs with relays:

- Single ExtInOut expansion board offers 8 outputs with relays
- Outputs with relays can be used to control:
  - solenoid valves
  - light indicators
  - various motors
  - switching devices such as contactors and/or motor starters

### 8 Opto-isolated inputs:

- Single ExtInOut expansion board offers 8 opto-isolated input channels
- Inputs can be used with:
  - buttons
  - switches
  - PNP and NPN proximity sensors
  - other switching devices

**NEXT IDC header:**

- You can daisy chain up to 4 ExtInOut boards, providing a total of 32 inputs and 32 outputs with relays.
- NEXT header is used to connect a current ExtInOut board with the next ExtInOut board in the daisy chain connection

**EXT IDC header:**

- EXT IDC header is used to connect a previous ExtInOut board with the current ExtInOut board in the daisy chain connection
- This header can also be used to connect first ExtInOut board with older MK3 controllers EXT IDC header.

**POWER screw terminal:**

- External power supply screw terminal connector, used for powering on-board relays.
- External power supply voltage value depends on the version (12V or 24V) of ExtInOut board used

**EXT MicroMatch connector:**

- You can daisy chain up to 4 ExtInOut boards, providing a total of 32 inputs and 32 outputs with relays.
- NEXT header is used to connect a current ExtInOut board with the next ExtInOut board in the daisy chain connection

## Input specification:

Inputs use opto-coupler and a resistor.

Min voltage supplied to input : 5VDC

Max voltage supplied to input without external current limiting resistor: 12VDC\*

### \*PLEASE NOTE:

- Input voltage source is independent from POWER terminal voltage source (relay voltage source).
- When using power supply that exceeds max voltage input ratings, please use current limiting resistor for opto-isolated inputs.

## Output specification:

Relay outputs offer: Common, NC (normally closed) and NO(normally opened) terminals.

Relays\* specification:

@ Voltage 250VAC, capable of switching up to 10A

@ Voltage 125VAC, capable of switching up to 10A

@ Voltage 30VDC, capable of switching up to 10A

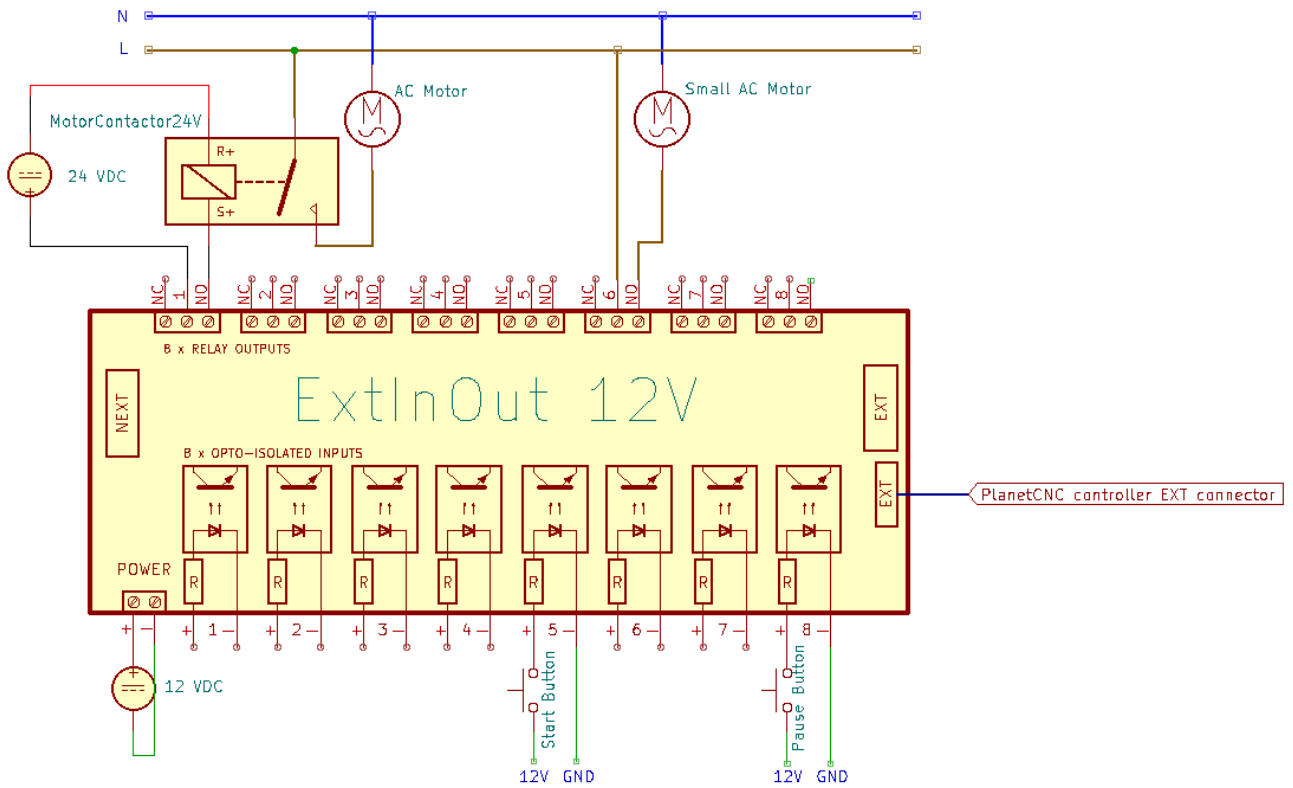
@ Voltage 28VDC, capable of switching up to 10A

\*ExtInOut 12VDC → uses 12VDC relays

\*ExtInOut 24VDC → uses 24VDC relays

# Connection diagrams

Schematic below describes the use of ExtInOut board with motor contactor, small motor and input buttons:



Schematic below describes the use of ExtInOut board with LED's, solenoid valve and PNP/NPN proximity sensors:

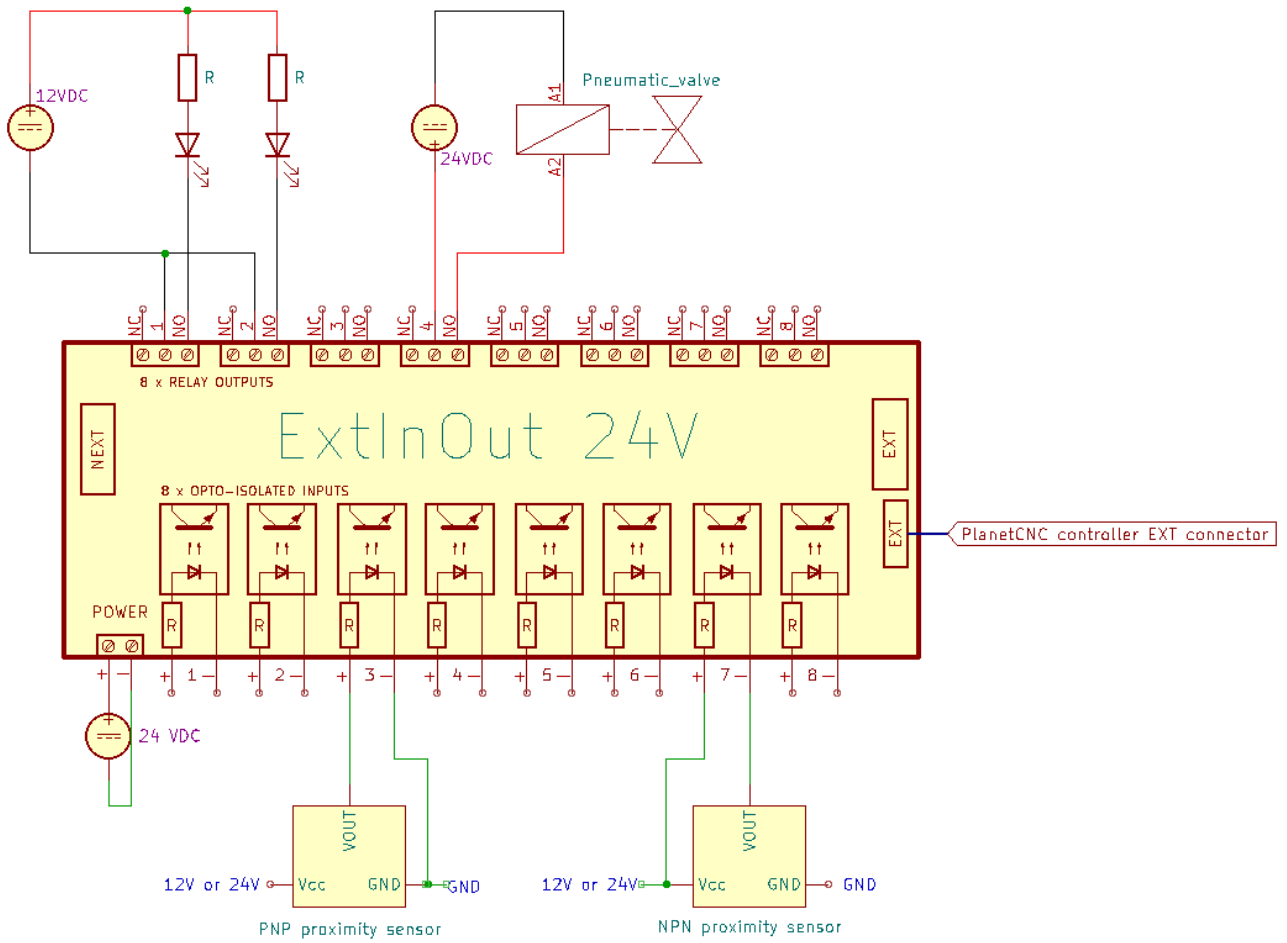




Diagram below, illustrates connection between Mk3/4 controller and ExtInOut board.

It also illustrates connection of small DC motor and PNP proximity sensor with ExtInOut board.

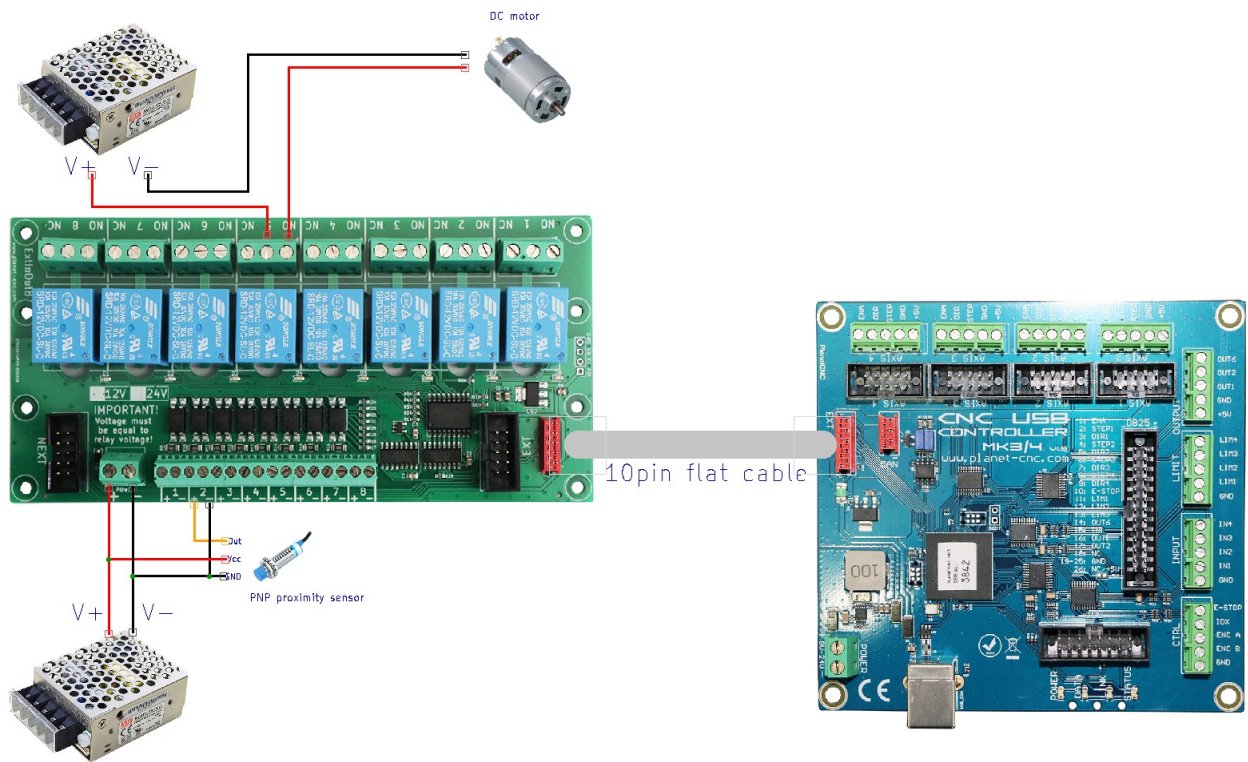


Diagram below, illustrates connection between Mk3/4 controller and ExtInOut board.

It also illustrates connection of solenoid valve and input button with ExtInOut board.

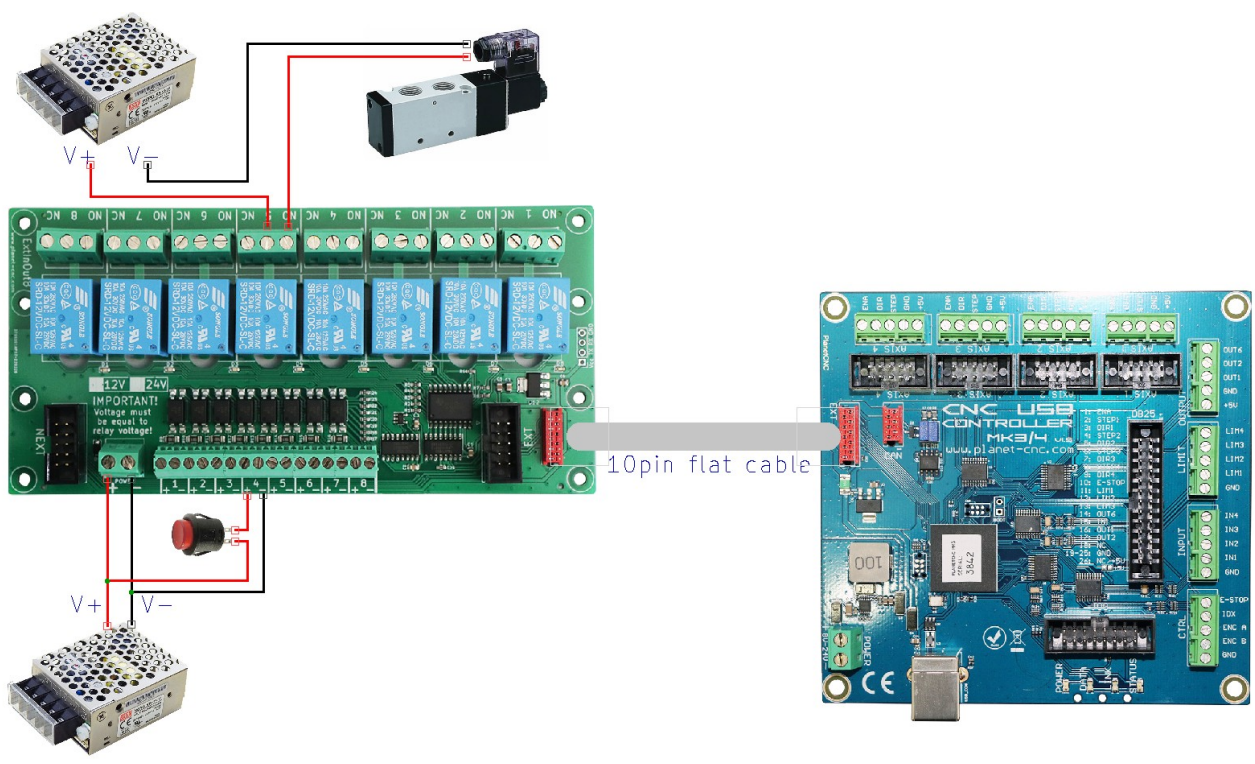


Diagram below, illustrates connection between Mk3/4 controller and ExtInOut board.

It also illustrates connection of motor starter for AC motor valve and NPN proximity sensor with ExtInOut board.

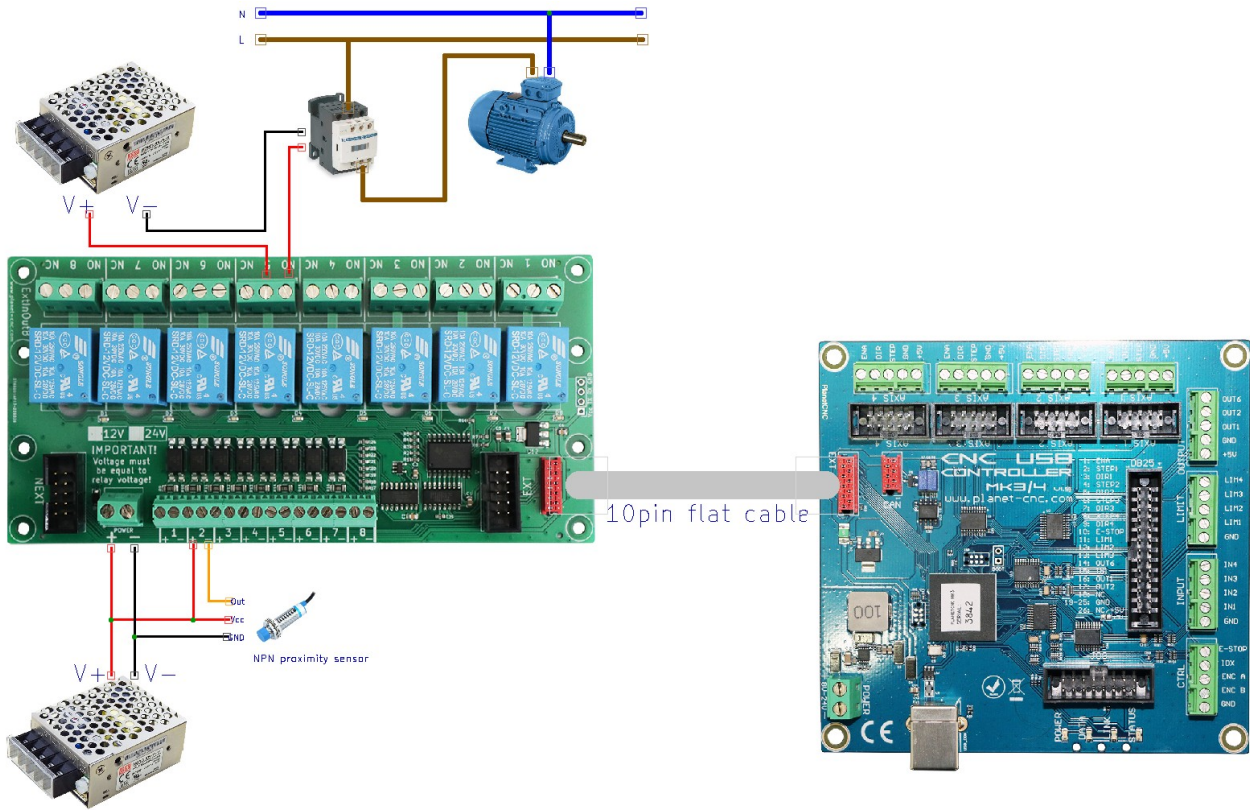
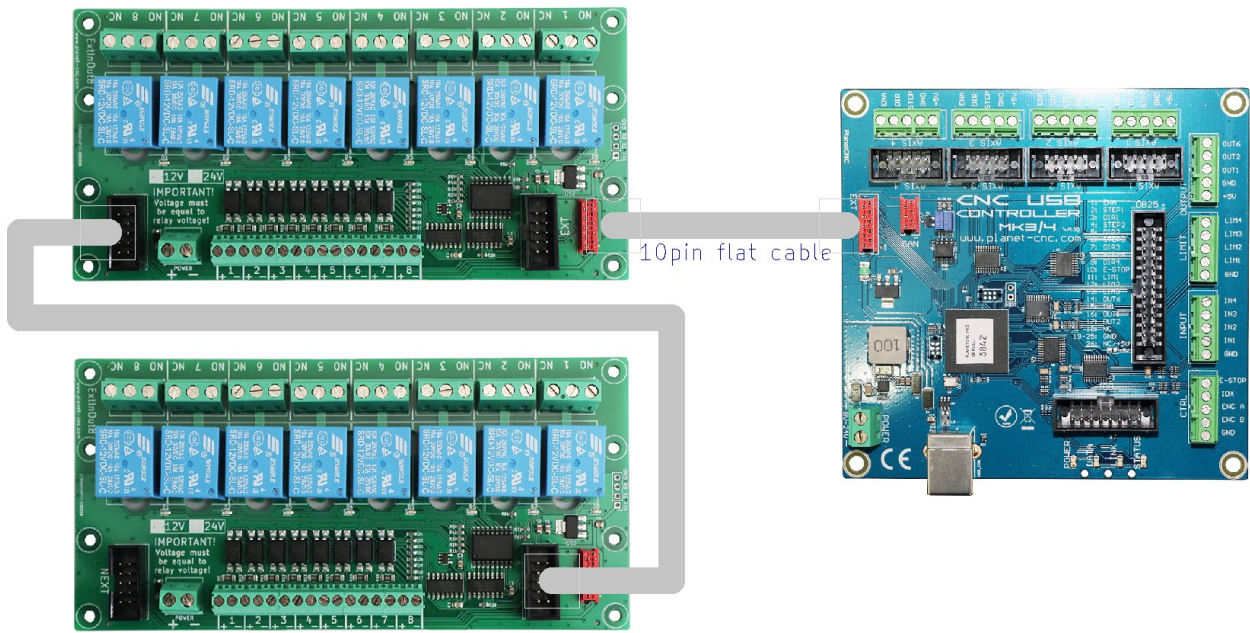


Diagram below, illustrates connection between Mk3/4 controller and two ExtInOut boards:





## ExtInOut board's use with PlanetCNC TNG software

Settings related to EXT are located under File/Settings/Input/Output → I2C,Serial,Ext

Example of EXT settings configuration for one ExtInOut board connected to PlanetCNC controller:

The screenshot shows the PlanetCNC TNG software settings interface. On the left is a sidebar menu with categories: General, Connection, User Interface (Menu, Toolbars, Position, Speed, State, Jog, 3D, GCode, Utilities), Shortcuts, Motors (StepsPerUnit, Speed, Acceleration, Backlash, Limits, Limit Switches), Motion (Blend, Advanced), Jogging (Keyboard, Handwheel), Input/Output (Spindle, Coolant, I2C, Serial, Ext), and Program Options. The 'I2C, Serial, Ext' menu item is highlighted. The main panel is titled 'I2C, Serial, Ext' and contains the following settings:

- I2C**: Frequency: 400000
- Serial**: Baudrate 0: 9600, Timeout: 0 μs; Baudrate 1: 115200, Timeout: 0 μs
- Encoder**: PPR: 100, Reverse:
- Ext**: Frequency: 100000
- SEL1**: SEL1 Pin:  Invert,  Latch; Size: 1, Timer: 100 ms
- SEL2**: SEL2 Pin:  Invert,  Latch; Size: 0, Timer: 1000 ms

**Please note:** MK3 controller uses also EXT2 connector. Settings related to EXT2, are under SEL2 chapter.

**Frequency:**

Value of EXT clock frequency. Default value is suitable for most cases.

**SEL1 Pin:**

**Invert:** Inverts SEL1 pin

**Latch:**

**Size:**

Inserted value should be equal to the number of ExtInOut boards used with EXT1 connector of controller.

Eg.g.: If you use only one board, value is 1. If you use 3 boards connected in daisy chain, value is 3.

**Timer:**

Refresh time value of ExtInOut board inputs and outputs.

**SEL2 Pin:**

**Invert:** Inverts SEL2 pin

**Latch:**

**Size:**

Inserted value should be equal to the number of ExtInOut boards used with EXT2 connector of Mk3 controller.

Eg.g.: If you use only one board, value is 1. If you use 3 boards connected in daisy chain, value is 3.

**Timer:**

Refresh time value of ExtInOut board inputs and outputs

## Gcode commands:

### ExtInOut relay output control:

There are multiple ways on how you can control ExtInOut relay outputs:

#### Example: M64 H P Q <L>

Activate relay outputs 1 and 7:

```
M64 H1 P1 Q1
```

```
M64 H1 P7 Q1
```



To turn relay outputs 1 and 7 off:

```
M64 H1 P1 Q0
```

```
M64 H1 P7 Q0
```

#### Example: #<\_extout1|num>

Activate relay outputs 1 and 7:

```
#<_extout1|1> = 1
```

```
#<_extout1|7> = 1
```



To turn relay outputs 1 and 7 off:

```
#<_extout1|1> = 0
```

```
#<_extout1|7> = 0
```

**Example: #<\_extout1> = n**

Activate relay outputs 1 – 4 of first ExtInOut board:

#<\_extout1> = 15



Activate relay outputs 1 – 4(outputs 9-12) of second ExtInOut board:

#<\_extout1> = 3840



**Example: #<\_extout1> = BIN[ ]**

Activate relay outputs 1 – 4 of first ExtInOut board:

#<\_extout1> = BIN[00001111]



Activate relay outputs 1 – 4(outputs 9-12) of second ExtInOut board:

#<\_extout1> = BIN[0000111100000000]



**Example: #<\_extout1> = HEX[ ]**

Activate relay outputs 5 – 8 of first board:

#<\_extout1> = HEX[F0]



Activate relay outputs 5 – 8 (outputs 13-16)of second board:

#<\_EXTOUT1> = HEX[F000]





## Reading ExtInOut board inputs:

ExtInOut board input status values are available through parameters:

**#<\_extin1> and #<\_extin2> or #<\_extin1|num> and #<\_extin2|num>**

You can use them with your gcode, script files, expressions, toolbar buttons etc..

## G-code program example:

G-code program below demonstrates ExtInOut output and input manipulation:

```
%  
#<_extout1|7> = 0 //reset ExtOut output 7  
G00 X0  
G00 X100  
o<extin_read> if [#<_extin1|4> EQ 1] //read ExtIn input 4  
  (msg,program stop: input active)  
  #<_extout1|7> = 0  
  M2  
o<extin_read> else  
G00 X0  
#<_extout1|7> = 1 //set ExtOut output 7  
o<extin_read> endif  
%
```

We recommend that you read TNG G-code reference manual for more info about the ExtInOut parameter, gcode command and expression functions syntax.

More examples are demonstrated also in the “Custom toolbar buttons” tutorial. Note that in this tutorial expression functions for ExtInOut are used:

[Toolbar buttons tutorial](#)

ExtInOut board was also used in semaphore application blog, where it was used for input evaluation and semaphore lights control:

[CNC machine semaphore application](#)

## EXT State panel settings:

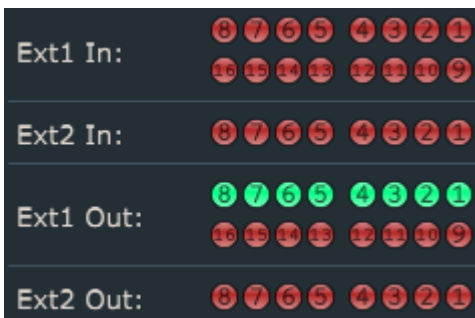
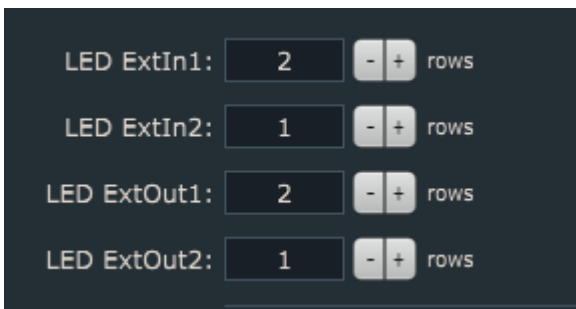
EXT input and output status lights can be displayed under IO state panel of PlanetCNC TNG sw.

EXT IO LED settings are located under *File/Settings/User Interface/State* →

LED ExtIn1 and LED ExtIn2 → Rows

LED ExtOut1 and LED ExtOut2 → Rows

Each row displays 8 inputs and outputs of dedicated ExtInOut board. So if you use two ExtInOut boards with EXT1 of your controller, you should use insert value 2:



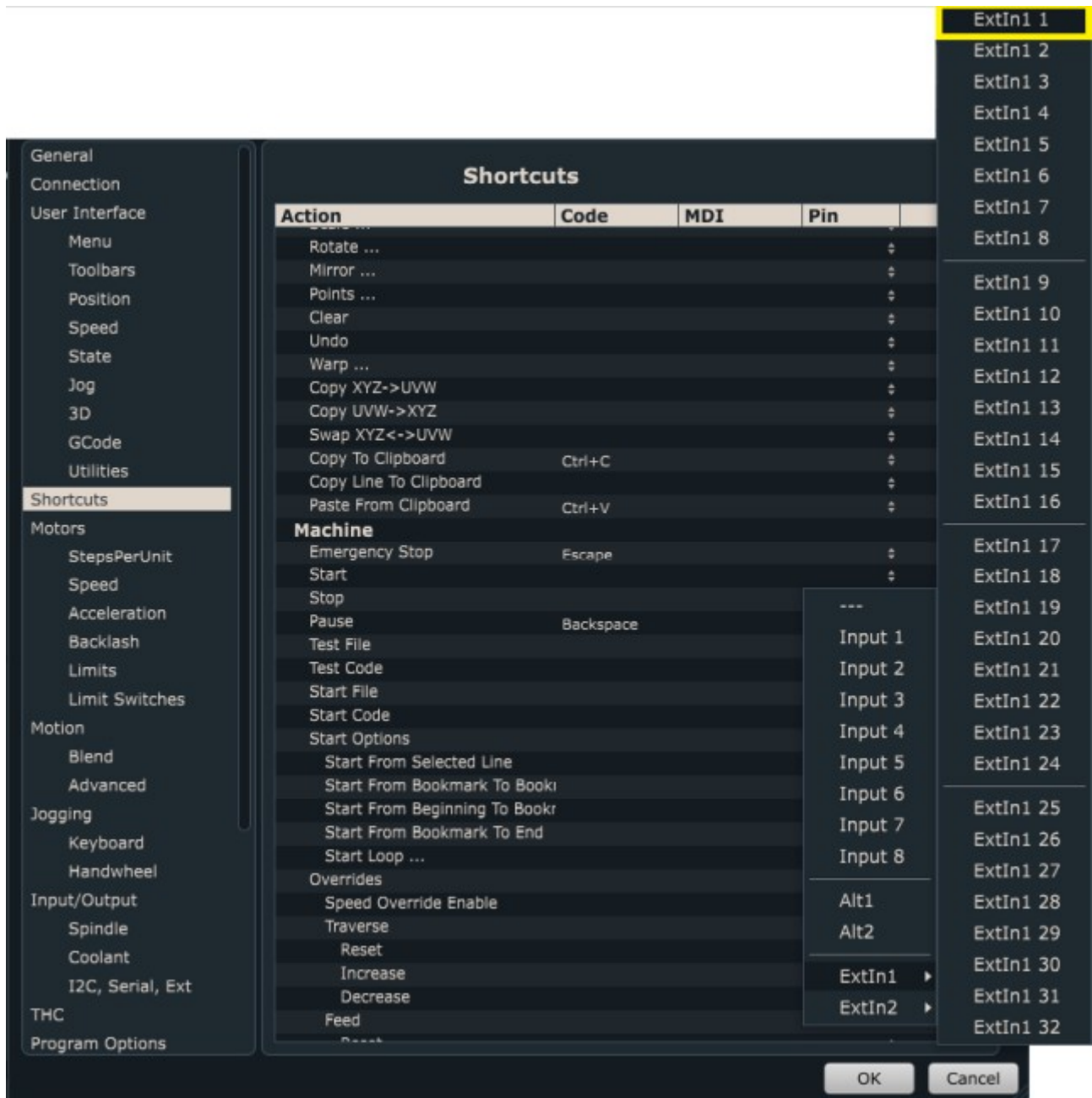
# Using PlanetCNC TNG software pin shortcuts with ExtInOut board inputs:

You can map inputs of ExtInOut board as a shortcut pin in PlanetCNC TNG.

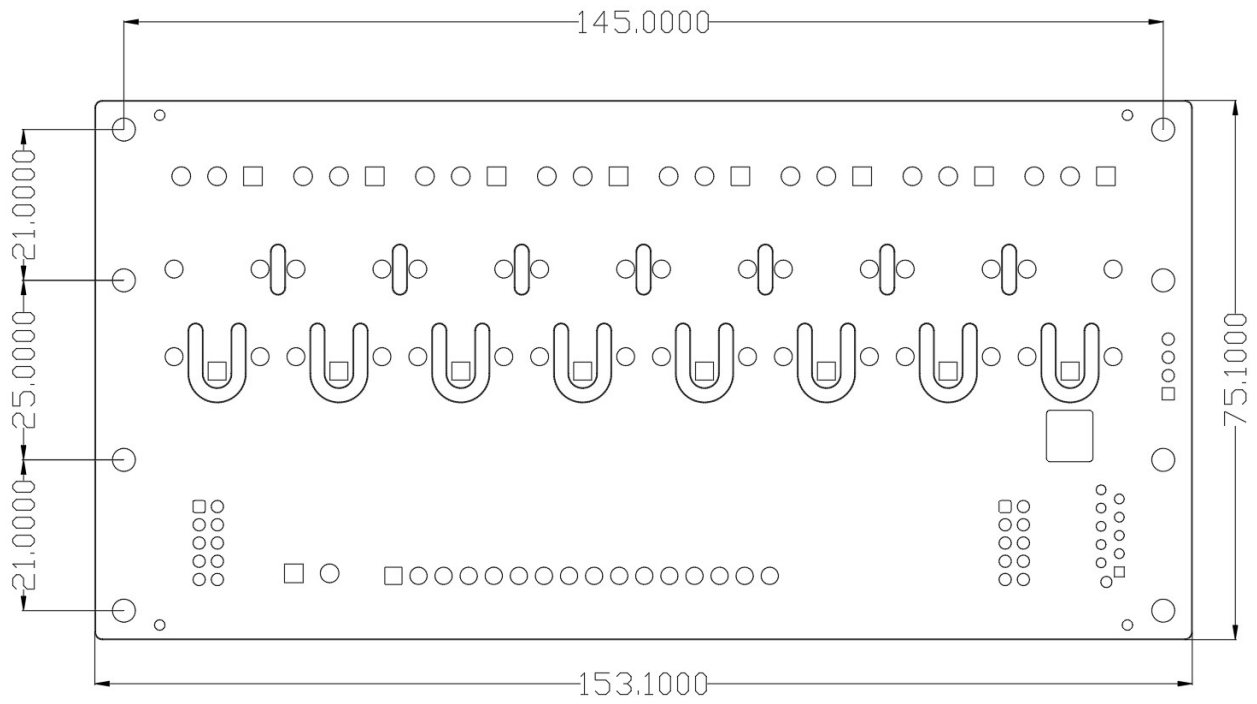
Example:

We want to use ExtInOut boards input 1 as a **program start button**.

Under File/Settings/User Interface/Shortcuts → Machine/Start → Pin → ExtIn1 → ExtIn1 1



## Dimensions:



DXF file is available at link below:

[ExtInOut DXF file](#)

# Table of Contents

Introduction.....	3
Overview.....	3
Features and specifications:.....	4
ExtInOut board version label:.....	4
8 Outputs with relays:.....	4
8 Opto-isolated inputs:.....	4
NEXT IDC header:.....	5
EXT IDC header:.....	5
EXT MicroMatch connector:.....	5
Input specification:.....	6
Output specification:.....	6
Connection diagrams.....	7
ExtInOut board's use with PlanetCNC TNG software.....	13
Gcode commands:.....	15
ExtInOut relay output control:.....	15
Reading ExtInOut board inputs:.....	17
EXT State panel settings:.....	18
Using PlanetCNC TNG software pin shortcuts with ExtInOut board inputs:.....	19
Dimensions:.....	20