



Mk3ECO controller user manual

2017/01/31

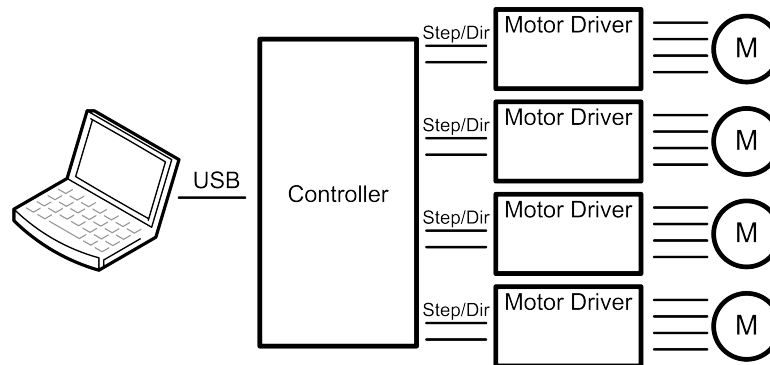
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1 Introduction

1.1 Overview



The PlanetCNC series of USB CNC motion controllers is link between a personal computer and motor drivers supporting step/direction control. PlanetCNC series of motion controllers are compatible with most motor drivers. The controllers use the USB port, available on all modern computers and laptops. They can serve as direct replacement or upgrade for many parallel port break-out boards.

PlanetCNC controllers provide a complete, fully integrated software/hardware solution. Additional machine control software is NOT required. The USB CNC Controller software is a dedicated application, designed to fully exploit the features of the purpose-built hardware. It has many advanced features to assist day-to-day CNC machine operation.

1.2 Features and specifications:

- USB (V2.x) from PC/Laptop running Windows XP, Vista, Windows 7, 8 or 8.1 (32 bit or 64bit)
- motor driver connector pin-out is compatible with 10 pin open source interface (Linistepper, PICStep)
- controller works with most step/dir stepper and servo motor drivers available on the market
- buffered IO for maximum performance
- advanced interpolation algorithms
- start, stop, pause and resume execution of program on your machine
- standard RS274/NGC G-code (EMC2 and LinuxCNC compatible)
- advanced G-codes - G40, G41, G42 (Cutter Radius Compensation) supported
- advanced G-codes - G43, G49 (Tool Length Offsets) supported
- advanced G-codes - G54, G59.3 (Coordinate System Origins) supported
- tested with SolidCAM, MasterCAM, ArtCAM, Vectric, CamBam, MeshCAM ... generated G-code
- Profili 4-axes and 3-axes G-code supported
- import toolpath from DXF files
- import toolpath from PLT/HPGL files
- import toolpath from image files
- import toolpath from NC-Drill (Excellon) files
- import toolpath from Gerber (RS-274X) files
- toolpath simulation
- automatic homing procedure
- advanced toolchange procedures
- automatic tool length measuring
- export toolpath to G-code
- export toolpath to DXF
- SDK (software developers kit) is available
- works on MacOS with virtual machine emulating Windows

Mk3ECO - 4 axes USB CNC controller

- 4 axes controller for stepper and servo motors
- USB connection
- 110 kHz maximum step frequency
- 25 us minimum pulse width, 50% duty cycle at higher frequencies
- 3 digital outputs on board
- 1 PWM output with selectable frequency (10Hz to 500kHz)
- 1 RC servo motor output
- 4 limit switch inputs
- 4 digital inputs, filtered and protected
- homing procedure
- tool change procedure
- tool length sensor support
- sensor for capturing and measuring support
- digitizing probe support
- H-bot kinematics support
- transformation matrix
- soft limits
- slave axes
- backlash compensation
- API

1.3 System Requirements

Minimum system requirements:

- 1 GHz or faster processor
- 512MB RAM
- 500 MB available hard disk space
- Graphics with OpenGL support
- USB 2.0 port
- .NET Framework 3.5 SP1

Recommended system requirements:

- 2 GHz or faster processor
- 2GB RAM
- 500 MB available hard disk space
- Graphics with OpenGL support
- USB 2.0 port
- .NET Framework 3.5 SP1

2 Hardware

2.1 Installation

Installation of PlanetCNC motion controller requires a USB equipped PC or laptop along with motor drivers appropriate to the motors in use. The USB CNC controller is compatible with the vast majority of motor drivers that use step/direction signals.

Optional support hardware can be employed to customize installation to suit user requirement. Use of a Mk3ECO adapter board makes connection to the type of drive in the image much easier. A DB25 adapter is available, for motor drivers requiring this form of input, with male or female DB25 connector.

For maximum flexibility in controller layout, a ribbon cable and plug kit is available. This aids the construction of longer cables and ensures plug-in connections correspond to the USB CNC Controller pin outs.

IMPORTANT:

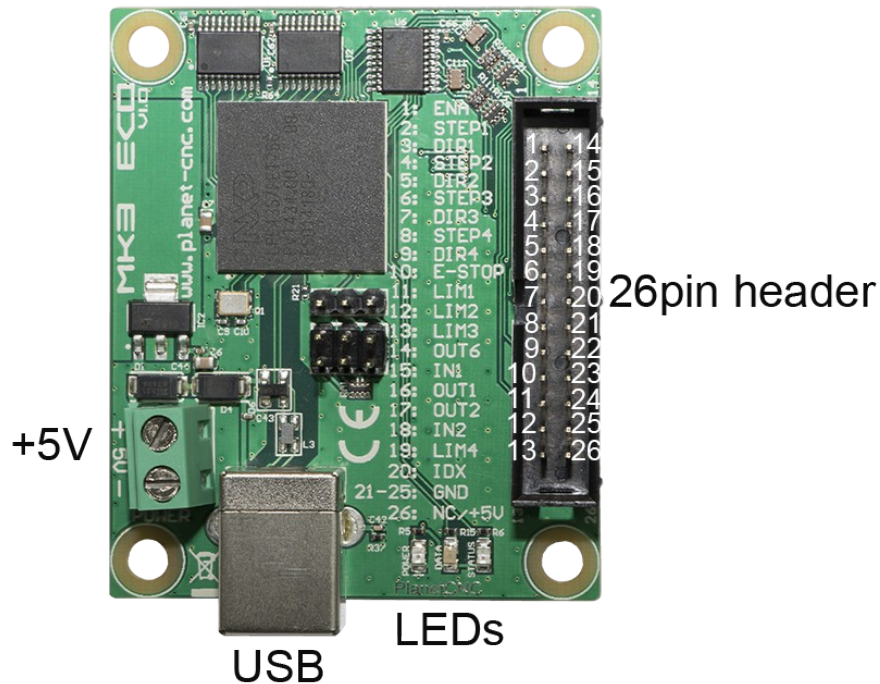
Controller should be powered with an external power supply.

Mk3ECO 4 Axis controller hardware requires 5V DC supply!

Wrong power supply voltage will permanently damage controller!

Power supply should be at least 200mA.

2.2 Mk3ECO - 4 axis CNC USB controller description



2.2.1 Mk3ECO 26 pin header pin description

Pin 1:	ENABLE
Pin 2:	STEP 1
Pin 3:	DIR 1
Pin 4:	STEP 2
Pin 5:	DIR 2
Pin 6:	STEP 3
Pin 7:	DIR 3
Pin 8:	STEP 4
Pin 9:	DIR 4
Pin 10:	E-STOP
Pin 11:	LIMIT 1
Pin 12:	LIMIT 2
Pin 13:	LIMIT 3
Pin 14:	OUT 6
Pin 15:	INPUT 1
Pin 16:	OUT 1
Pin 17:	OUT 2
Pin 18:	INPUT 2
Pin 19:	LIMIT 4
Pin 20:	IDX
Pin 21-25:	GND
Pin 26:	NC/+5V

+5V: +5V power. Motor drivers can take power for logic circuit or common anode connection from the USB controller.

STEP: Provides a STEP signal of minimum 12 us pulse width to the motor driver.

DIR: Provides DIR or DIRECTION signal to the motor driver.

ENABLE: Provides an ENABLE signal for motor drivers. When the ENABLE signal is lost due to output command, E-Stop or limit switch activation, motor drivers will deactivate.

A dedicated **E-Stop** switch connected to the E-STOP pin can control the signal. It can also be operated by limit switch activation, software command or on shutdown of the control software. This arrangement provides a useful safety feature that can be user-configured to operate under manual and/or computer control.

GND: Ground connections.

LIMIT 4: Axis 4 positive and negative limit.

LIMIT 3: Axis 3 positive and negative limit.

LIMIT 2: Axis 2 positive and negative limit.

LIMIT 1: Axis 1 positive and negative limit.

IDX: Index signal for spindle

IN2: Assignable input 2

IN1: Assignable input 1

OUT 6: Digital Output

OUT 2: Digital Output

OUT 1: Digital Output

2.2.2 Mk3ECO *USB* connector

The Mk3ECO USB CNC controller connects to computer via the USB port. The port uses the USB 2.x standard.

2.2.3 Mk3ECO *Power* terminal

The controller should be powered with an external power supply.

Mk3ECO - 4 Axis controller hardware requires 5V DC supply.

Power supply should be at least 200mA.

2.2.4 Mk3ECO *LED* indicators

The user is provided with helpful feedback and live 'status' information via on-board LED indicators. There are three indicators.

POWER: Lights when the controller is powered.

DATA: Indicates controller functions.

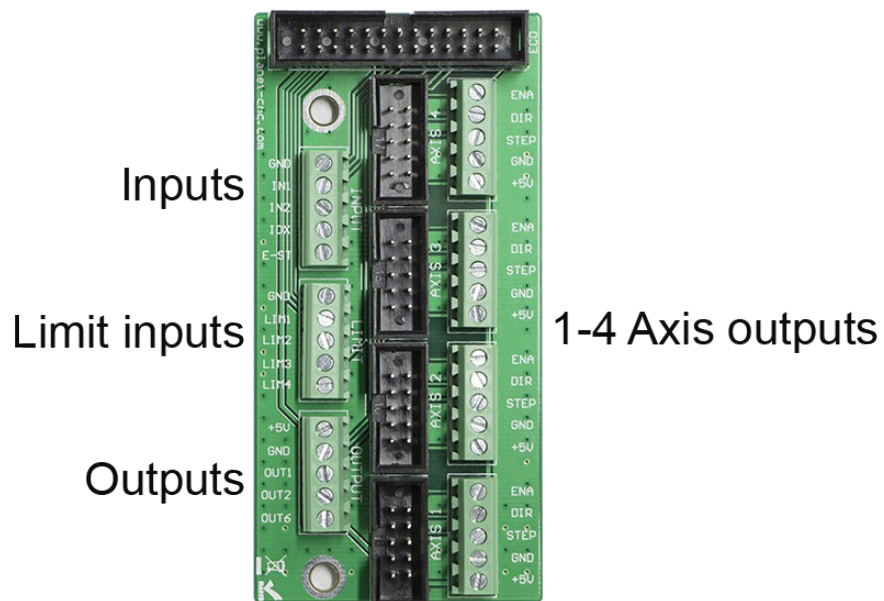
STATUS: Blinks to indicate controller function is 'good'.

3 Connection diagrams

Mk3ECO controller has all axis, input, output and CTRL pins populated on 26pin header.

Use of a Mk3ECO adapter board simplifies connection of motor drivers, limit switches and additional external electrical equipment. Not included with Mk3ECO controller!

Further chapters will describe connection of motor drivers, limits switches and inputs with use of a **Mk3ECO adapter board**:



3.1 Wiring of limit switches

Mk3ECO controller has 4 designated limit switch inputs. This means that 'Single Input' method of wiring must be used.

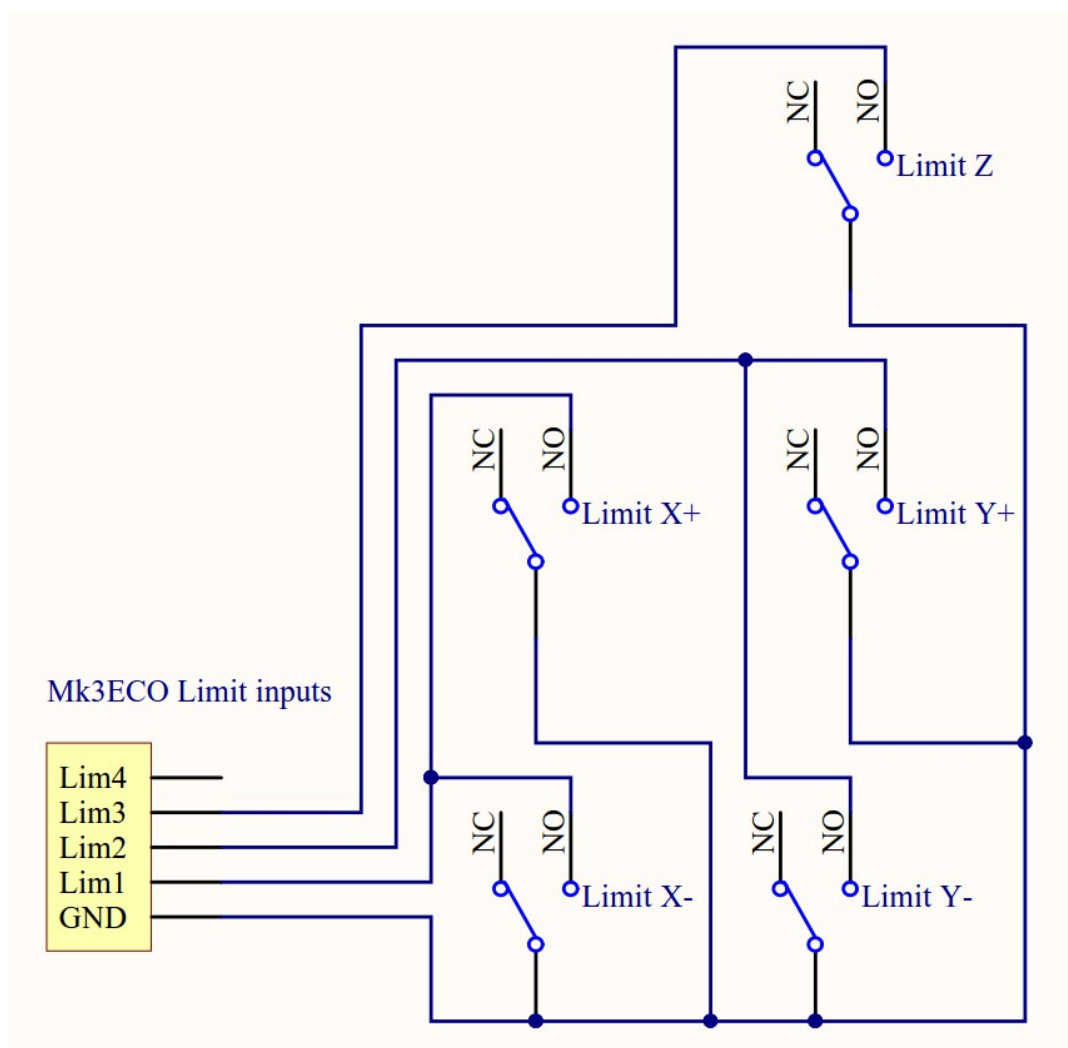
When 'Single input' method is used, both limit switches are connected to one limit pin. Depending on normally closed or normally opened

If 'normally open' (NO) type switches are used, wiring must be done in parallel method, if 'normally closed' (NC) type switches are used, wiring must be done in serial method.

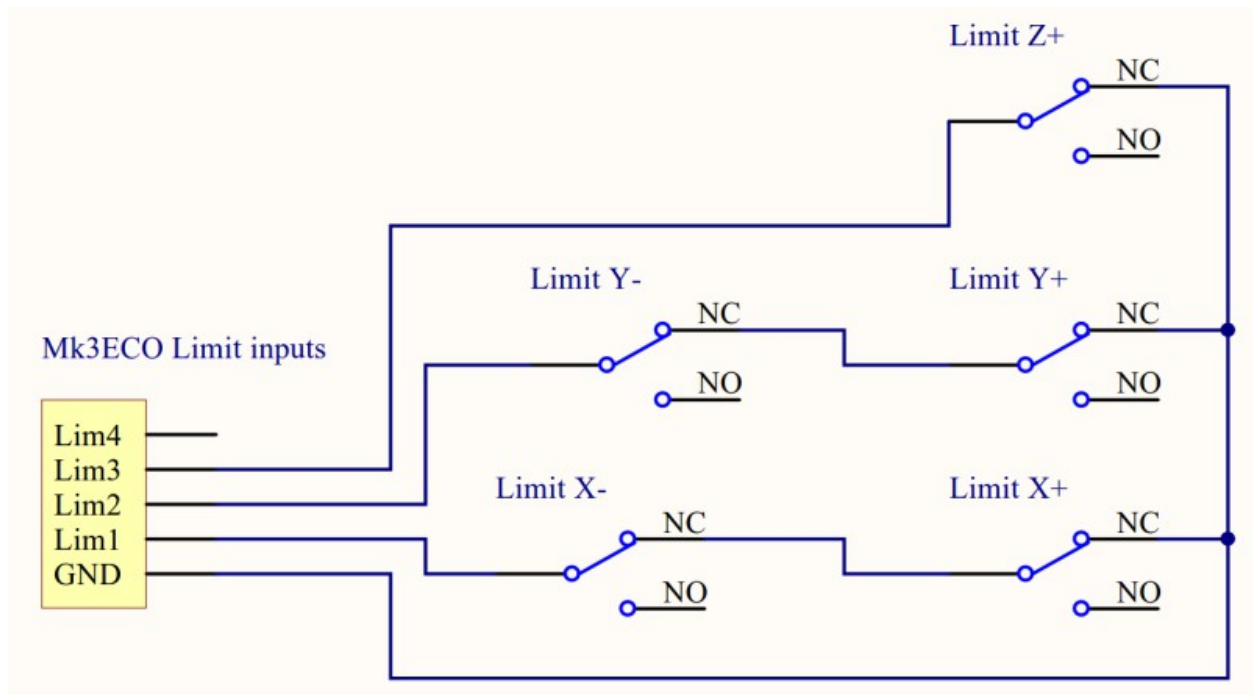
Software 'Invert' options allow use of 'normally closed' or 'normally open' switch hardware. This feature can be set in File/Settings/Limit/Invert

3.1.1 Single input wiring methods:

3.1.1.1 Parallel wiring of NO type switches:

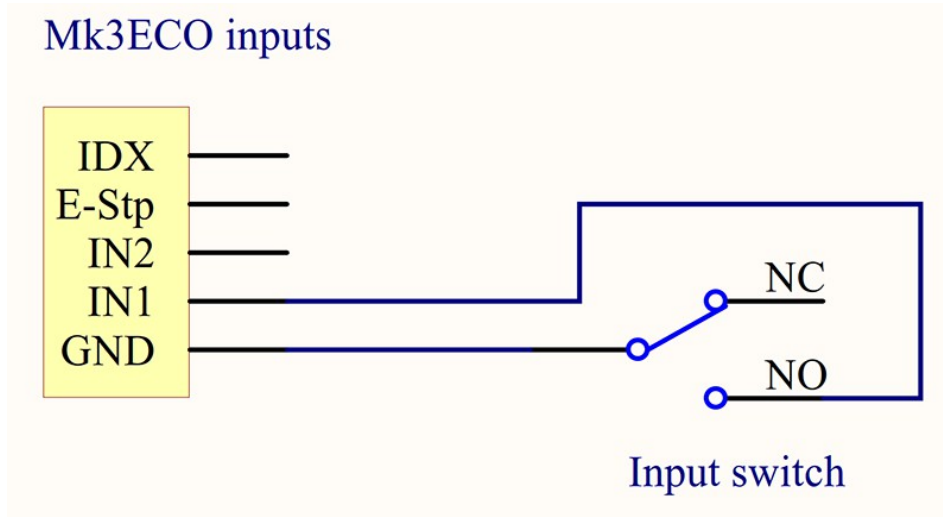


3.1.1.2 Serial wiring of NC type limit switches:



3.2 Wiring of inputs

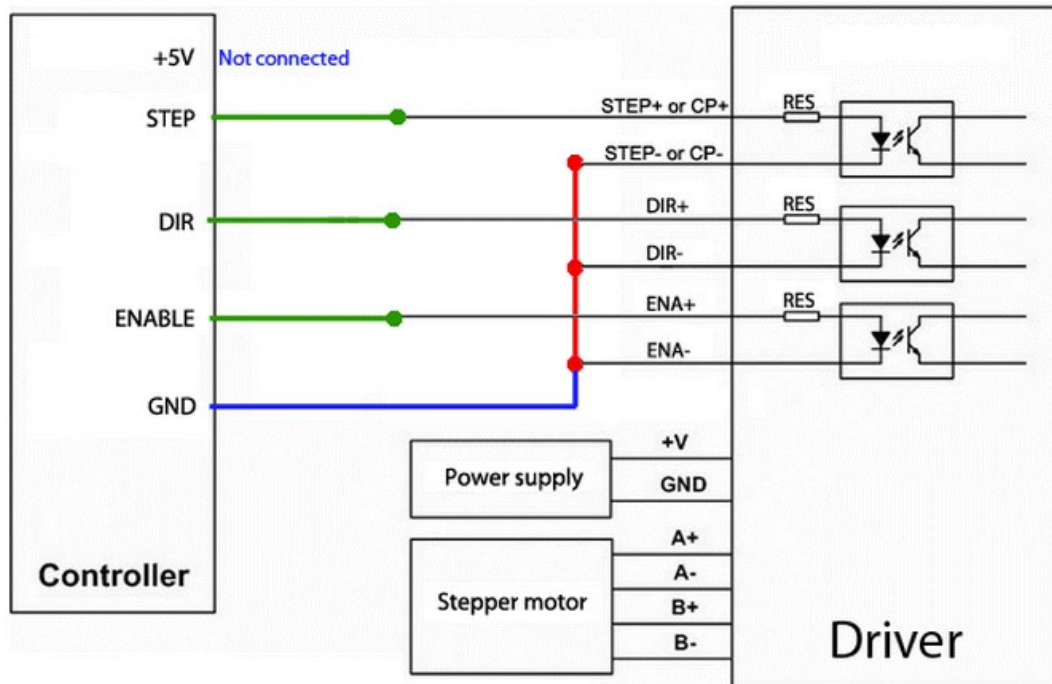
Mk3ECO controller has IDX, E-Stop and 2 assignable inputs. Bellow is wiring diagram of switch connected to Mk3ECO assignable input. Inputs function is assigned in settings.



3.3 Connecting motor driver with Mk3ECO controller

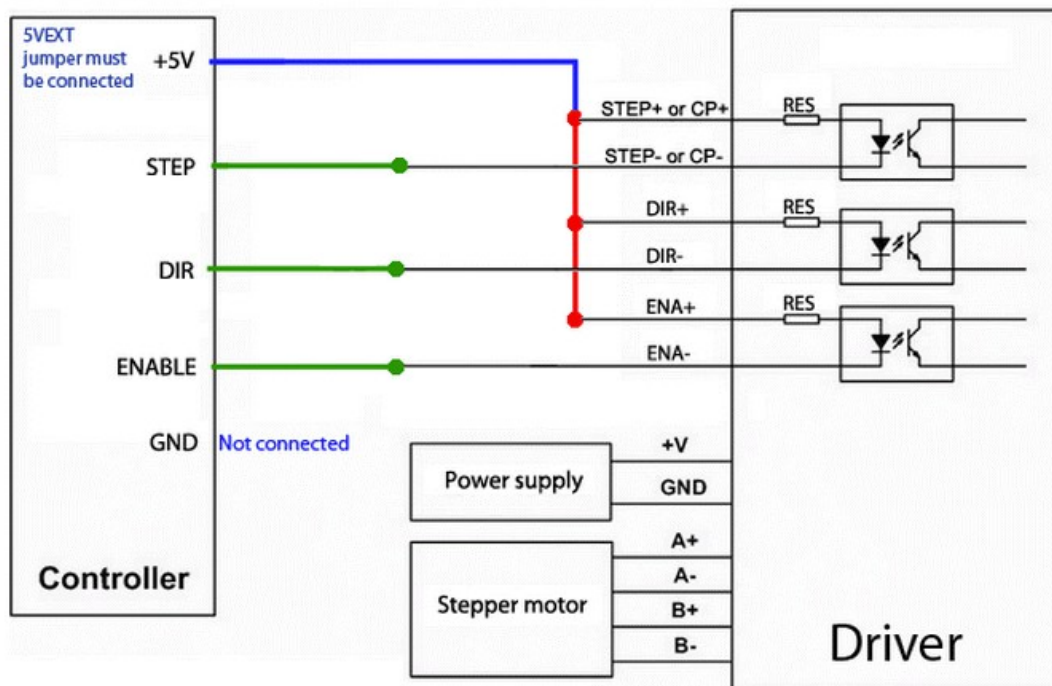
Wiring diagrams for COMMON CATHODE and COMMON ANODE connection of motor driver:

COMMON CATHODE



2. Common anode

COMMON ANODE



Connection of Leadshine stepper motor driver:

Driver is connected with Mk3ECO adapter board using single wires.

Common cathode method was used for this example:

PUL+ pin of driver connected to STEP pin of adapter

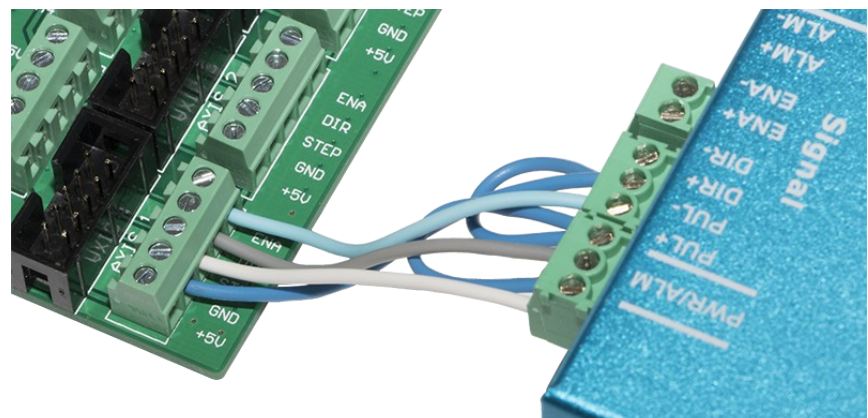
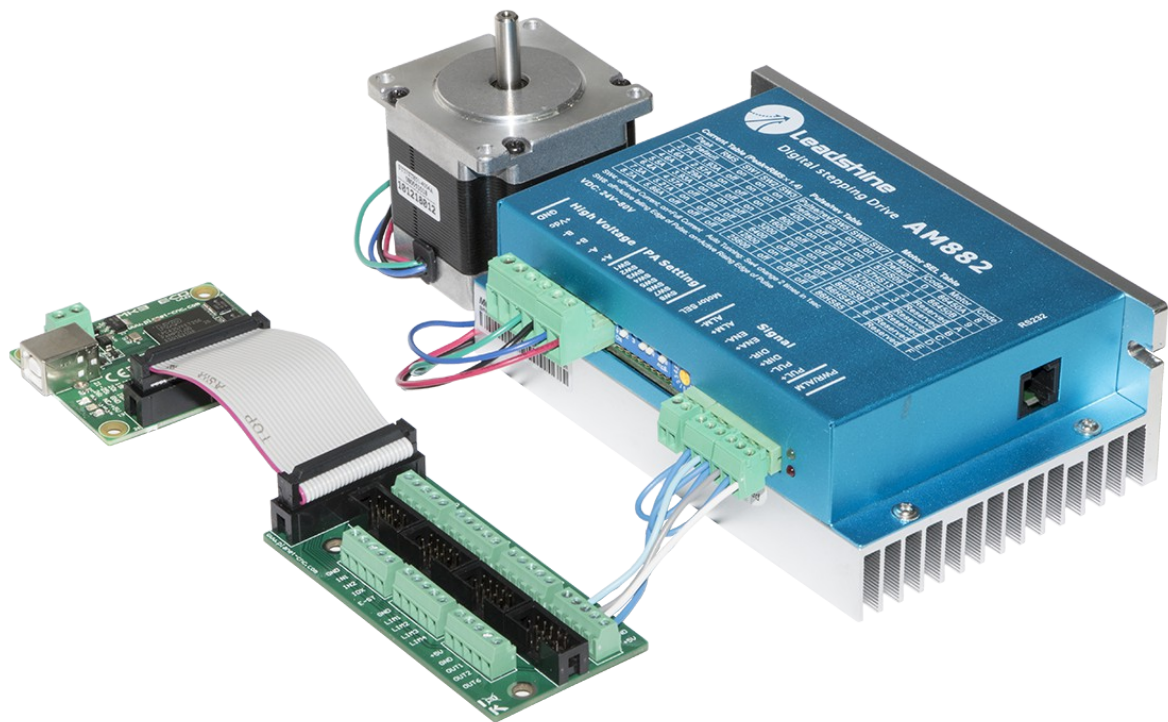
PUL- pin connected to GND of adapter

DIR+ pin connected to DIR pin of adapter

DUR- pin connected to GND of adapter

ENA+ pin connected to ENABLE pin of adapter

ENA- pin connected to GND pin of adapter



Connection of Gecko 251X V9 stepper motor driver:

Driver is connected with adapter axis outputs screw terminals via single wires.

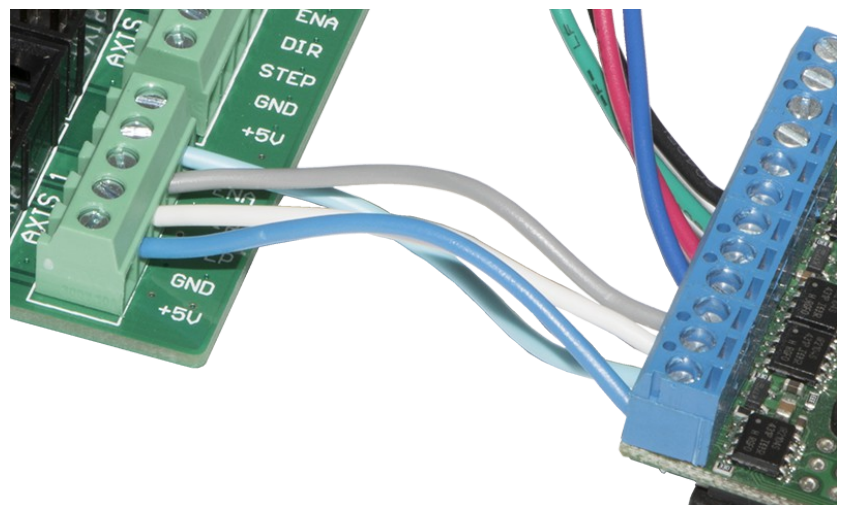
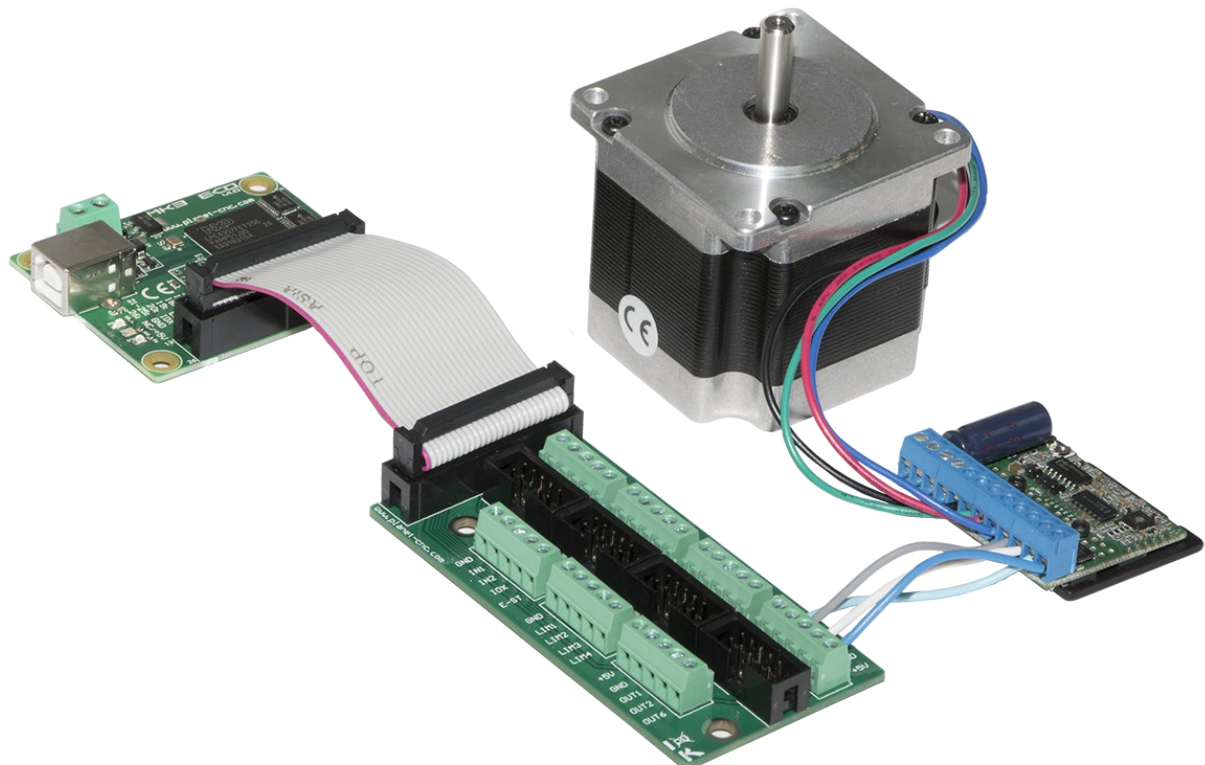
Common cathode method was used for this example:

STEP pin of driver connected to STEP pin of adapter

DIRECTION pin of driver connected to GND pin of adapter

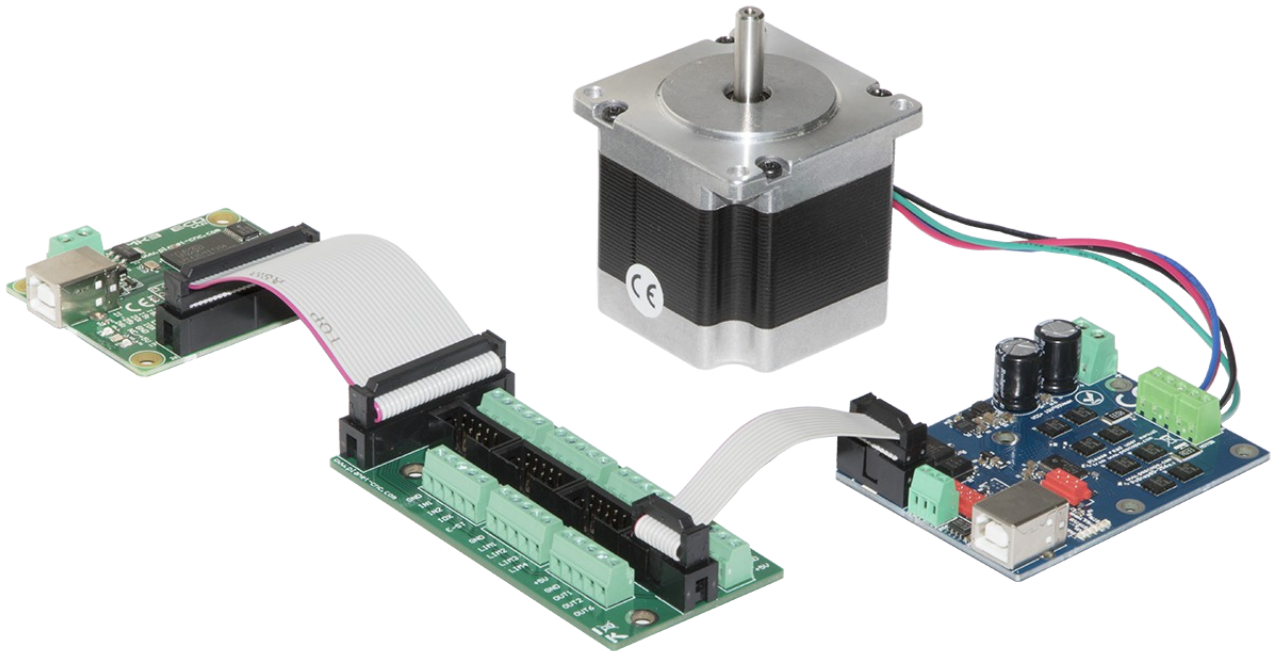
DISABLE pin of driver connected to ENABLE pin of adapter

SIGNAL GND pin of driver connected to GND pin of adapter



Connection of motor driver 6.0A:

Stepper driver is directly connected with Mk3ECO adapter board via 10pin flat cable:

**Connection of of motor driver 2.5A:**

Stepper driver is directly connected with Mk3ECO adapter board via 10pin flat cable:

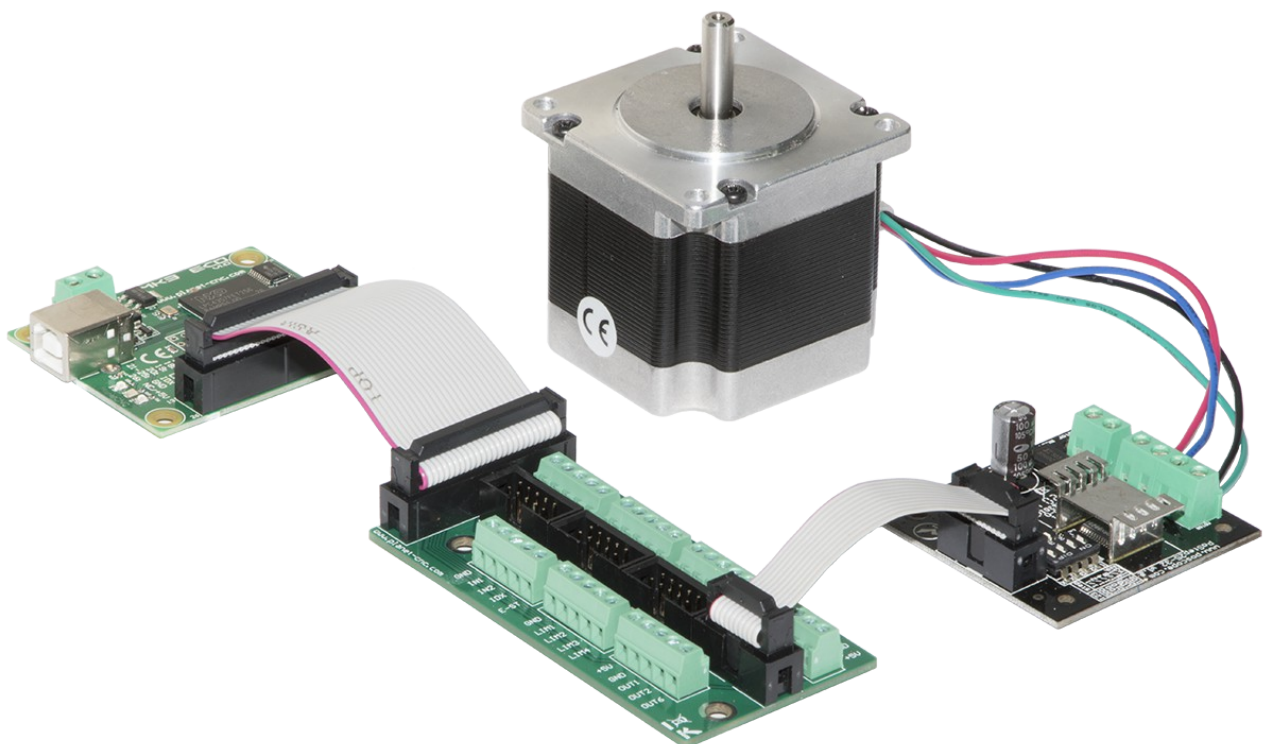


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