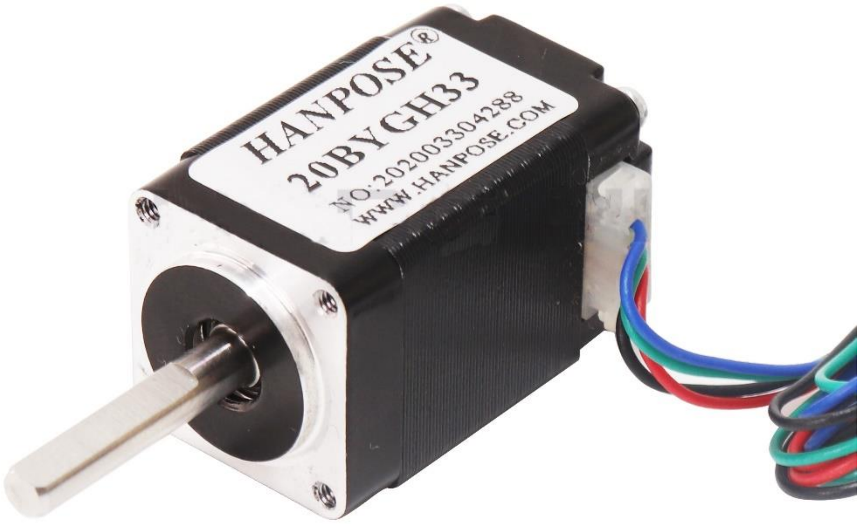
Nema 8, 3oz-in Stepper Motor Wiring & Application Guide



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0.0 Safety Statement

All machinery, especially CNC or automated machinery, has inherent dangers and risks. It is the responsibility of the system designer to ensure that any systems built using any Viking Machinery Ltd. products are safe for use. Any technical information is provided as a reference only, and does not constitute a recommendation as to the fitness of use in any particular application.

Viking Machinery Ltd. strongly urges customers to seek expert advice when dealing with potentially dangerous electrical voltages and sources of mechanical energy. Information contained in this document does not constitute a substitute for expert advice.

Under no circumstances should this product ever be used in a safety critical application.

It is essential that stepper motors are not connected or disconnected to a powered driver. There is a high likelihood of damaging the driver if this happens.

1.0 Product Specifications

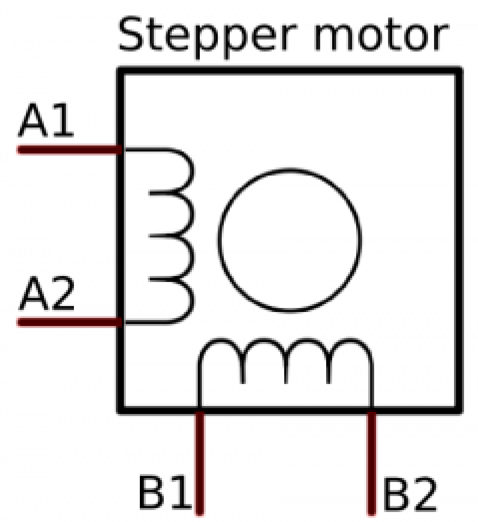
- Step Angle: 1.8° (200 steps per revolution)
- Rated Voltage: 4.50V (Discussed further later)
- Rated Single Coil Current: 0.80A (Discussed further later)
- Phase Resistance: 4.5Ω
- Phase Inductance: 1.6mH
- Holding Torque: 0.021N.m / 3oz-in
- Rotor Inertia: 18g.cm^2
- Motor Weight: 62g

2.0 Scope of Document

This document is designed to give an overview of the wiring options for Nema 8 frame sized 3oz-in stepper motors that Viking Machinery stock. Wiring examples are given for typical motion control applications. These are by no means exhaustive, but are a good starting point for beginners.

3.0 Identifying Phase Coils

Your new stepper motors have two coil windings and four wires as shown in the diagram below. We describe these as “A Coil” and “B Coil”. Each coil has two wires, giving us the four leads A1, A2, B1 & B2.



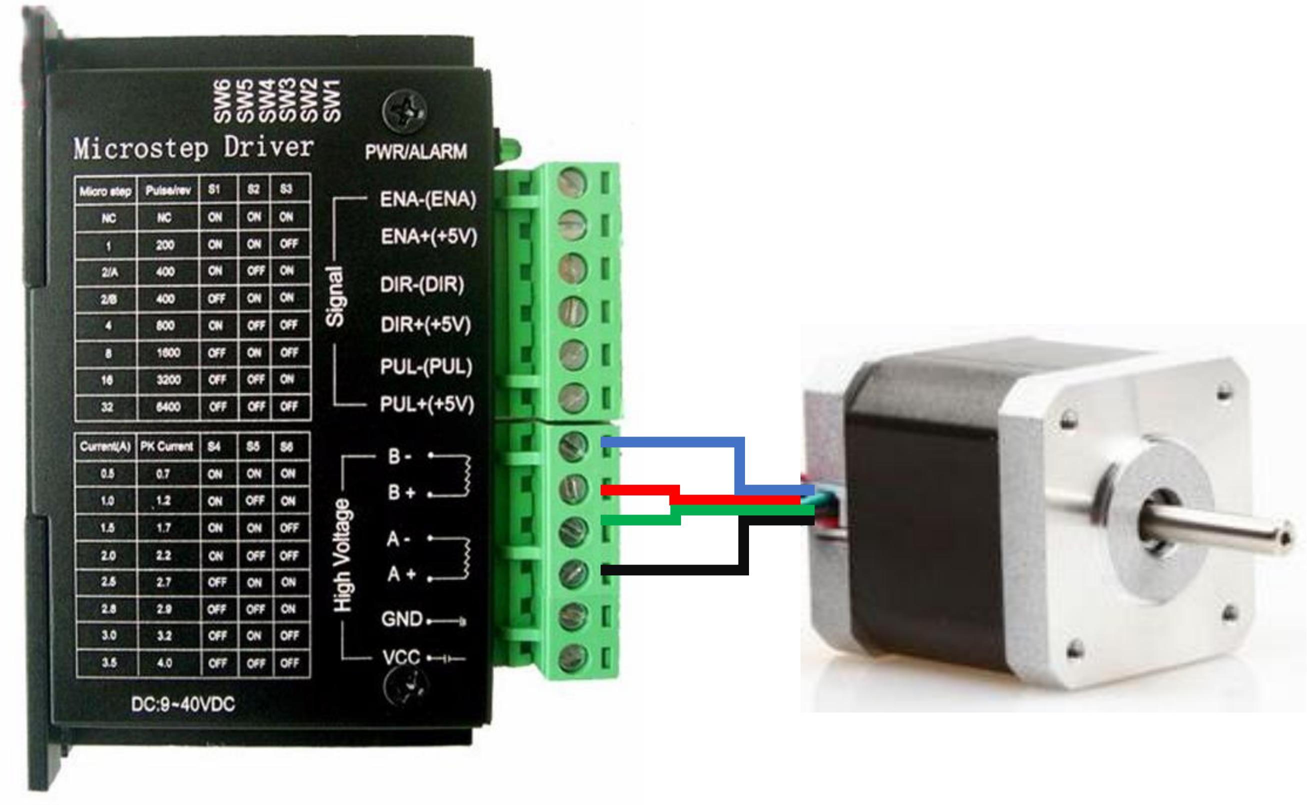
To identify these coils, we will use a multimeter to check for continuity. To do this, connect any one wire from the motor to one of the leads of your multimeter. We will call this “A1”.
Now touch the free multimeter lead to each of the remaining coils until you find the one that has continuity with A1. We will now call this “A2”. It is a good idea to mark these wires or else record their colours. There is no correct way to identify the 1 & 2 leads – just number them at random.

It is now a good idea to check that the two remaining wires do indeed have continuity, and to label them as “B1” and “B2”.

It is now essential that you test for continuity between the A coil and the B coil – you should not have any continuity.

4.0 Wiring to a Stepper Motor Driver

The diagram below shows the typical motor wiring to a TB6600 style stepper motor driver. As you can see, the A and B coil terminals are clearly identified. This is typical of most stepper drivers that are commercially available. If your motor driver does not have the coils marked, you will need to refer to the documentation that came with it to identify the terminals.



5.0 Calculating Maximum Supply Voltage

We will now calculate the maximum power supply voltage that the motor will allow you to supply its driver. As the maximum speed of the motor is proportional to the supply voltage, it is worth using the highest voltage that is practically possible. To calculate the maximum voltage the motor will tolerate, we will use the following formula:

$$V_{max} = 32 \times \sqrt{L}$$

Where V is the voltage we are calculating, and L is the inductance of the motor in milli-Henrys (mH).

Working through the calculation below, we get the maximum supply voltage the motor will tolerate.

$$V_{max} = 32 \times \sqrt{1.6}$$

$$V_{max} = 40V$$

It is important to note that this is the maximum voltage that to motor will run at, not the maximum voltage that your driver will support. You may also wish to keep your voltage below 50V DC, as this is generally well within the ELV (extra low voltage) range and so may make your electrical compliance easier.

6.0 Supply Current Requirements

This motor has a phase current of 0.80 Amp. Typically, these motors will draw only 1/3-1/5 the rated coil voltage during normal operation. To specify your power supply current, we recommend using the following formulas to work out the limits that you need to select your power supply within. There is no harm in going over, except that you may be paying for more power supply than you need.

$$I_{min} = 0.80 \times N \times 1/3 \times 1.1$$

$$I_{max} = 0.80 \times N \times 1/1 \times 1.1$$

I = Required supply current
N = Number of motors being supplied
0.80= The rated coil current of this particular motor
1/3 & 1/1 = the limits of motor current utilisation factor
1.1 = 10% allowance for losses

7.0 Reference Links

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https://grabcad.com/james.hussey-3

https://github.com/Viking-Machinery