
Soigeneris

Stepper Motors

Users Manual V1.0



A word about safety

We at Soigeneris take pride in providing high quality components for small scale CNC systems. While we make every effort to provide in depth and accurate technical information we cannot make any guarantees about their applicability to your particular application. In reality the only person who can keep you safe is you. We strongly suggest that you avail yourself of all the information available for the components you're putting into your CNC system and understand how they will all interact.

Safety Tips

- If you're unsure about something ask for help. High voltages can be deadly!
- Always double check your wiring before applying power.

Conventions used

- *Measurements: Inches (mm), i.e. 1.0" (25.4)*

Introduction to stepper motors

Choosing the right stepper motor for an application can be tricky. Intuition would seem to tell us that 'bigger is better', but this is not the case. The motor needs to fit the application at hand. One analogy would be choosing an engine for a vehicle. A lower displacement but high revving engine would be well suited to a sports car but not a dump truck. The dump truck would be better served by a lower revving, high torque engine.

There are a many factors that can be considered when picking the correct stepper motor; two of the big ones are inductance and rotating mass (inertia.) Stepper motors have coils of wire inside that form electromagnets, these coils are energized in sequence to move the motor. When the coil is energized it takes some small amount of time for the magnetic field to be developed, the higher the inductance of the motor the longer it takes. Inductance limits the acceleration and maximum velocity of the motor.

When a stepper motor is made longer to fit longer coils of wire the magnetic rotor is also made longer which means it is heavier. The mass of the rotor, which is referred to as inertia in the specifications, limits the acceleration of the motor because there is more weight to get moving.

NEMA 23 Motors

The NEMA 23 frame stepper motor is a popular size for desktop sized CNC systems. They are available in different torque ratings but we find that those in the 150oz-in to 300oz-in range offer the best performance for this size motor. Over the 300oz-in range motor's extended length leads to an abundance of rotating mass and high inductance both of which lead to poor performance.

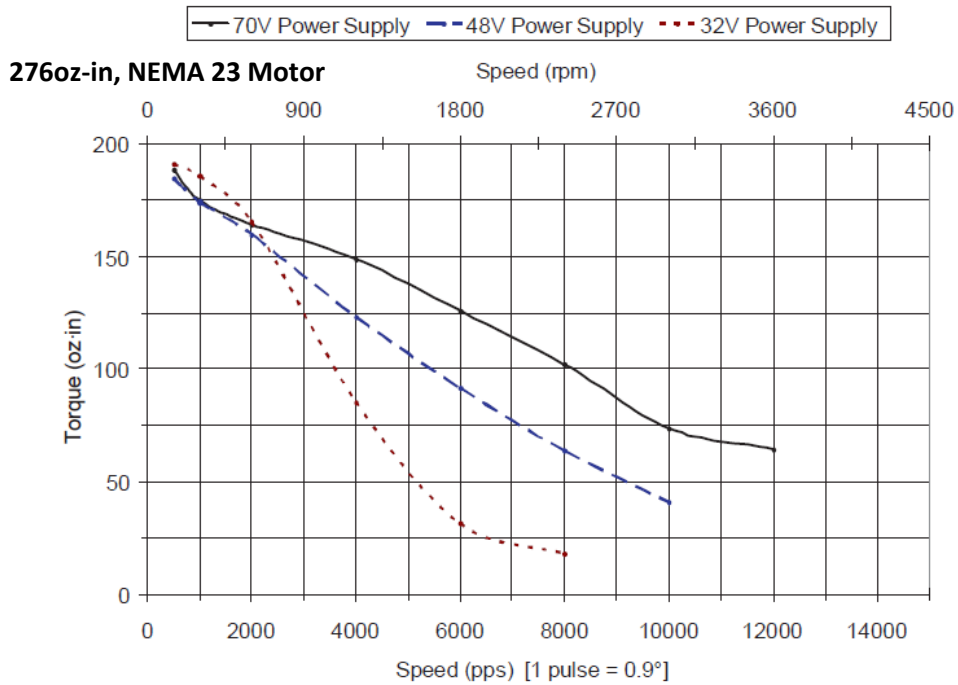
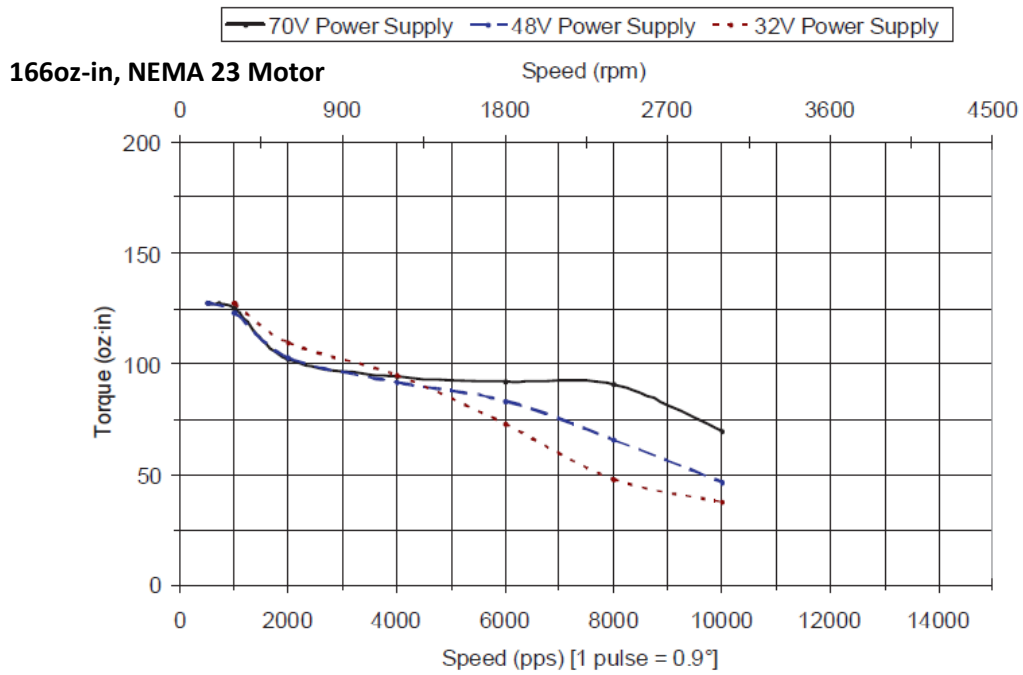
NEMA 24 Motors

The NEMA 24 frame stepper motor is made with the same sized mounting flange and shaft as the NEMA 23. The square body of the NEMA 24 motor is increased to 60mm whereas the NEMA 23 is 57mm. A difference of 3mm is small but it makes a huge difference in motor performance. The increased body size allows the motor to be shorter with lower rotating mass and inductance. These NEMA 24 motors are a good fit for applications that need a 300oz-in to 400oz-in motor without the expense of moving up to the larger frame NEMA 34 size.

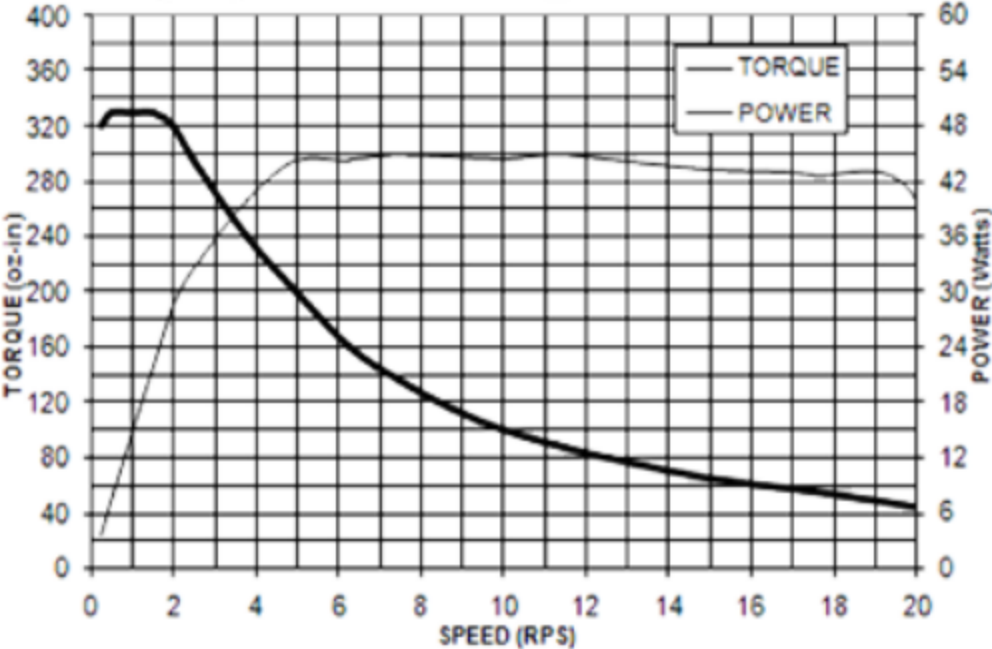
Specifications

Motor	SOI-STP23-166	SOI-STP23-276	SOI-STP24-380
Frame	23	23	24
Torque (on-in)	166	276	380
(N-m)	1.17	1.95	2.7
Inertia (oz-in ²)	1.483	2.596	3.16
(kG-cm ²)	0.271	0.475	0.578
A/phase parallel	2.8	2.8	2.8
A/phase series	n/a	n/a	1.4
A/phase unipolar	n/a	n/a	2
Resistance parallel (ohms)	0.75	1.1	1.25
Inductance parallel (mH)	2.36	3.82	4
Inductance series (mH)	n/a	n/a	8
Inductance unipolar (mH)	n/a	n/a	20
Shaft diameter (in)	0.25	0.25	0.25
Weight	1.5	2.2	2.65
Length (in)	2.17	3.1	3.03
# Wires	4	4	8

Torque / Speed Curves

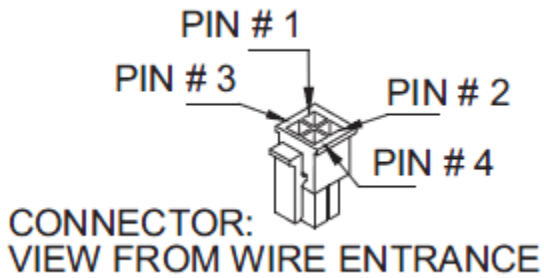


380oz-in, NEMA 24Motor



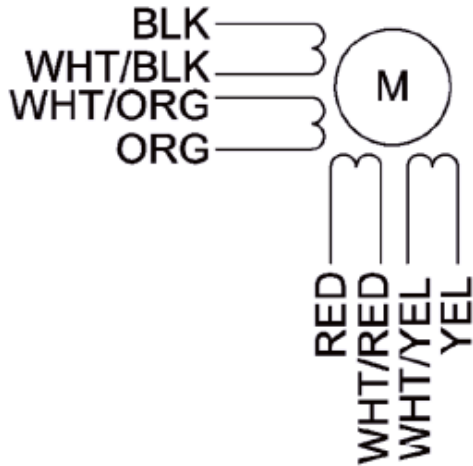
Wiring

NEMA23 motors



PIN #	COLOR	PHASE
1	RED	A
2	WHITE	\bar{A}
3	GREEN	B
4	BLACK	\bar{B}

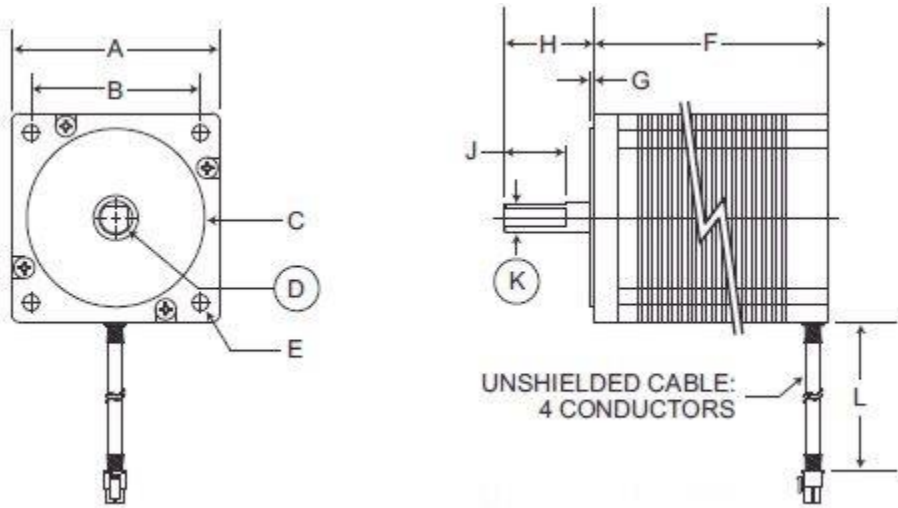
NEMA24 motors



Bipolar Parallel Wiring	
Phase 1 - A	Black & White/Orange
Phase 3 - /A	Orange & White/Black
Phase 2 - B	Red & White/Yellow
Phase 4 - /B	Yellow & White/Red
Bipolar Series Wiring	
Phase 1 - A	Black
Phase 3 - /A	Orange
Phase 2 - B	Red
Phase 4 - /B	Yellow
Connect	White/Black & White/Orange
Connect	White/Red & White/Yellow
Unipolar Wiring	
Phase 1 - A	Black
Phase 3 - /A	Orange
Phase 2 - B	Red
Phase 4 - /B	Yellow
Com 1&3	White/Black & White/Orange
Com 2&4	White/Red & White/Yellow

Mechanical

NEMA23



	A	B	C	D	E	F	G	H	J	K	L
166oz-in	2.25" (57.15)	1.86" (47.24)	1.5" (38.10)	0.25" (6.35)	0.20" (5.08)	2.17" (55.12)	0.06" (1.52)	0.81" (20.57)	0.59" (14.99)	0.230" (5.84)	12.0" (305)
276oz-in	2.25" (57.15)	1.86" (47.24)	1.5" (38.10)	0.25" (6.35)	0.20" (5.08)	3.10" (78.74)	0.06" (1.52)	0.81" (20.57)	0.59" (14.99)	0.230" (5.84)	12.0" (305)

NEMA23

