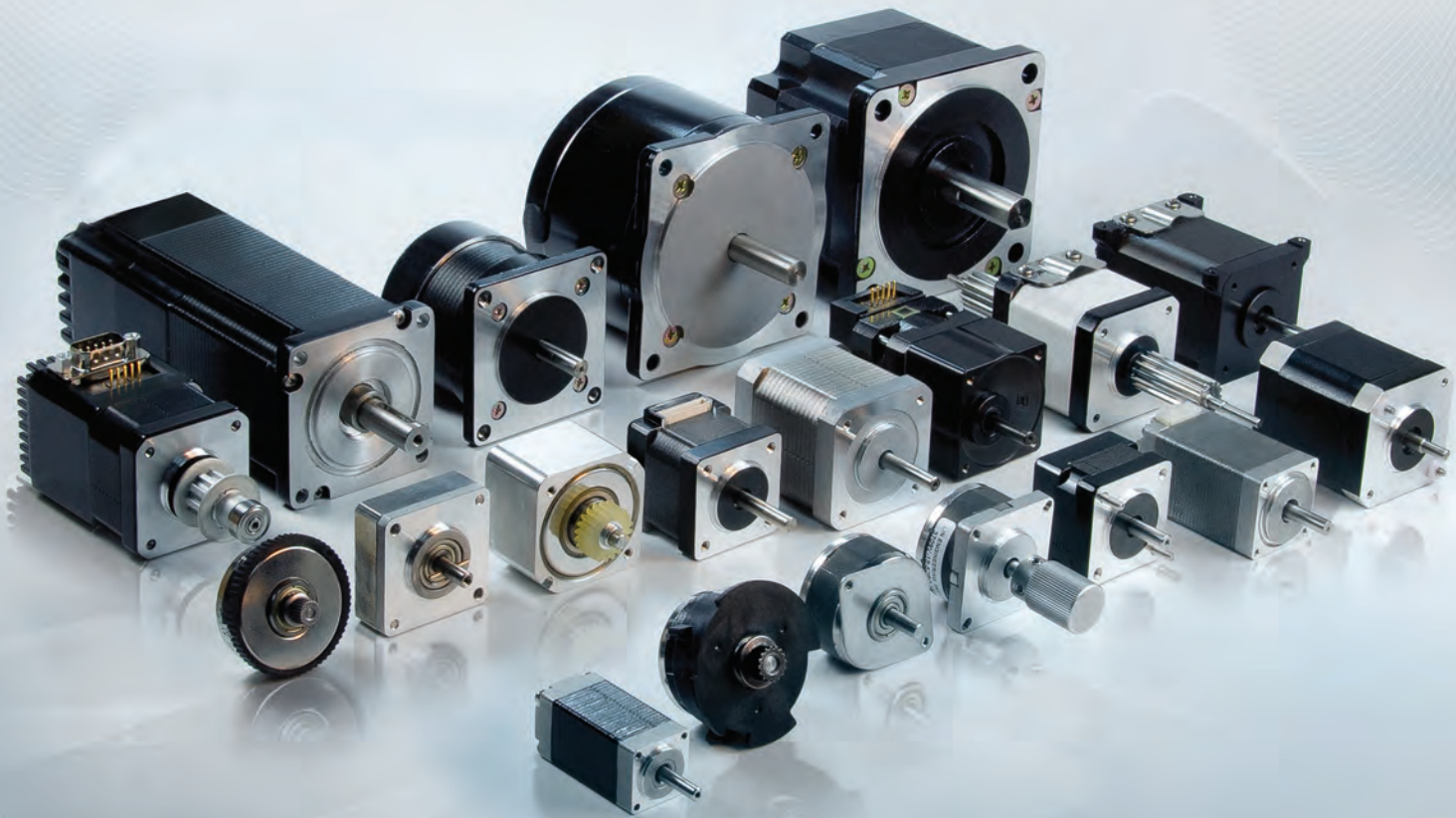


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ELECTROMATE

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Toll Free Fax (877) SERV099
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sales@electromate.com

LIN ENGINEERING

The Step Motor Specialists



Proven Application Support, Performance and Quality

Over the past decade, Lin Engineering has gained a tremendous amount of market share and earned a reputation as the "Leader in Step Motor Technology."

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 sales@electromate.com
Versatile Product Lines

Why are more and more engineers choosing Lin Engineering?



High Torque and Extreme Torque stepper motors that will help you avoid stalling and skipping steps.



Get high accuracy, low resonance, and quiet performance from these stepper motors.



Stepper motors specifically designed to weather extreme environments like high/low temperatures, clean rooms, dust and water.



Small stepper motors perfect for applications with compact space and size constraints.

Proven Application Support, Performance and Quality



Unrivaled Application Support

- 98% application success rate
- 95% of prototypes shipped in less than 1 week



High Performance

- Highest torque output
- High accuracy = no skipping steps
- Reduced vibration and resonance
- Versatile Product Lines to accommodate many applications



Reliable Quality

- Consistent Performance
- 4.5 Sigma System
- ISO 9001 Certified
- Continuous Improvement

Growing Market Share



Customers in 2005



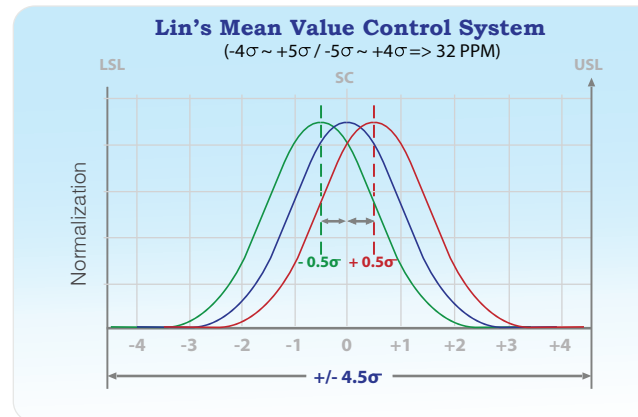
Customers in 2015

RELIABLE QUALITY

Lin Engineering has a reputation for high quality products for good reason; our quality policy is "Continuous Improvement" utilizing the 4.5 Sigma Way.

Why does our quality consistently out perform the competition?

4.5 Sigma From Lin Engineering - a True Quality System



We've implemented 4.5 Sigma in order to accomplish the following goals:

- Establish a robust Mean Value Control System
- Perform incoming inspection at our supplier's site
- Ensure quality products with every shipment



Our Certifications



Small Business Administration
 Lin Engineering has been certified as a Small Disadvantaged Business under the U.S. Small Business Administration (SBA) guidelines



ISO 9001
 The Certification Body of TUV America Inc. has certified that Lin Engineering has implemented a Quality Management System in Accordance with ISO 9001:2000.



UL
 At Lin Engineering, safety is our mission, and product safety testing and certification is one way we deliver that mission every day.



ITAR
 Lin Engineering has been ITAR registered since 2010; over the years we have worked with a number of different customers on ITAR projects and have built a proven system to ensure success.



RoHS Compliant
 Lin Engineering is committed to offering products compliant with the EU RoHS directive.



CE Declaration
 Lin Engineering assures that our motors meet the following European Norm Standards:
 ■ EN55014-1: 2007
 ■ EN60034-1.5.11



REACH
 Lin Engineering is a supplier of products that do not "intentionally release" chemicals, and therefore we are not bound by the REACH regulation regarding chemical registration.

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- ✓ Torque (i.e. stalling, missed steps, etc.)
- ✓ Noise
- ✓ Vibration/Resonance
- ✓ Accuracy & Repeatability
- ✓ Heat Generation
- ✓ Outlasting Environmental Elements

Read on to Discover Your Solution



Small stepper motors perfect for applications with compact space and size constraints.

COMPACT MOTORS

NEMA 8 | 1.8° Step Angle



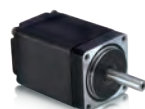
208
 HOLDING TORQUE
 Up to 4.0 oz-in
 (0.03 N-m)

NEMA 14 | 0.9° Step Angle



3709
 With *Signature Series* TECHNOLOGY
 HOLDING TORQUE
 Up to 16 oz-in
 (0.11 N-m)

NEMA 11 | 1.8° Step Angle



211
 HOLDING TORQUE
 Up to 16.6 oz-in
 (0.12 N-m)

NEMA 17 | 0.9° Step Angle



4109
 With *Signature Series* TECHNOLOGY
 HOLDING TORQUE
 Up to 22 oz-in
 (0.16 N-m)



Stepper motors specifically designed to weather extreme environments like high/low temperatures, clean rooms, dust, and water.

IP65 RATED MOTORS

NEMA 17 | 1.8° Step Angle



4118
 HOLDING TORQUE
 Up to 125 oz-in
 (0.88 N-m)

IPX7 RATED MOTORS

NEMA 17 | 1.8° Step Angle



4118
 HOLDING TORQUE
 Up to 125 oz-in
 (0.88 N-m)

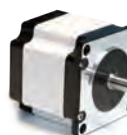
VACUUM RATED MOTORS

NEMA 11 | 1.8° Step Angle



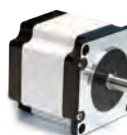
211
 HOLDING TORQUE
 Up to 16.6 oz-in
 (0.12 N-m)

NEMA 23 | 1.8° Step Angle



5718
 HOLDING TORQUE
 Up to 294 oz-in
 (2.08 N-m)

NEMA 23 | 1.8° Step Angle



5718
 HOLDING TORQUE
 Up to 294 oz-in
 (2.08 N-m)

NEMA 17 | 1.8° Step Angle



4118
 HOLDING TORQUE
 Up to 125 oz-in
 (0.88 N-m)

NEMA 34 | 1.8° Step Angle



8718
 HOLDING TORQUE
 Up to 1288 oz-in
 (9.10 N-m)

NEMA 34 | 1.8° Step Angle



8718
 HOLDING TORQUE
 Up to 1288 oz-in
 (9.10 N-m)

NEMA 23 | 1.8° Step Angle



5718
 HOLDING TORQUE
 Up to 294 oz-in
 (2.08 N-m)

HIGH TEMP MOTORS

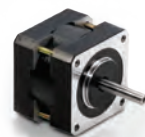


These motors are designed to withstand ambient temperatures of up to 110° C

High Torque and Extreme Torque stepper motors that will help you avoid stalling and skipping steps.

XTREME TORQUE

NEMA 17 | 1.8° Step Angle



4018

HOLDING TORQUE
Up to 42 oz-in
(0.30 N-m)



4118

HOLDING TORQUE
Up to 125 oz-in
(0.89 N-m)

NEMA 17 | 1.8° Step Angle



4418

HOLDING TORQUE
Up to 100 oz-in
(0.71 N-m)

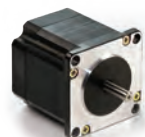


G4518

HOLDING TORQUE
Up to 125 oz-in
(0.88 N-m)

WHISPER TORQUE

NEMA 23 | 0.9° Step Angle

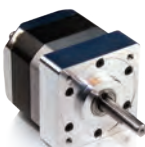


G5709

With *Signature Series*
TECHNOLOGY
HOLDING TORQUE
Up to 270 oz-in
(1.91 N-m)

GEAR MOTORS

NEMA 17 | 1.8° Step Angle



4418

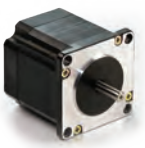
With *Slim Line*
GEARBOX
CONTINUOUS TORQUE
Up to 141 oz-in
(0.99 N-m)
Less than 2" in
overall length

NEMA 23 | 1.8° Step Angle



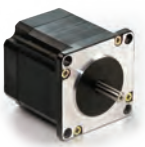
5618

HOLDING TORQUE
Up to 175 oz-in
(1.24 N-m)



5718

HOLDING TORQUE
Up to 305 oz-in
(2.16 N-m)



5818

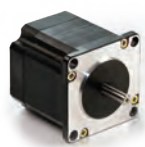
HOLDING TORQUE
Up to 294 oz-in
(2.08 N-m)

NEMA 23 | 1.8° Step Angle



E5618

With *Enhanced*
TECHNOLOGY
HOLDING TORQUE
Up to 150 oz-in
(1.06 N-m)
2.01" Max body length



E5718

With *Enhanced*
TECHNOLOGY
HOLDING TORQUE
Up to 400 oz-in
(2.82 N-m)
3.54" Max body length

NEMA 34 | 1.8° Step Angle



E8718

With *Enhanced*
TECHNOLOGY
HOLDING TORQUE
Up to 1500 oz-in
(10.59 N-m)
2.64" Max body length

NEMA 34 | 1.8° Step Angle



8618

HOLDING TORQUE
Up to 700 oz-in
(4.94 N-m)



8718

HOLDING TORQUE
Up to 1288 oz-in
(9.10 N-m)

GET MORE TORQUE

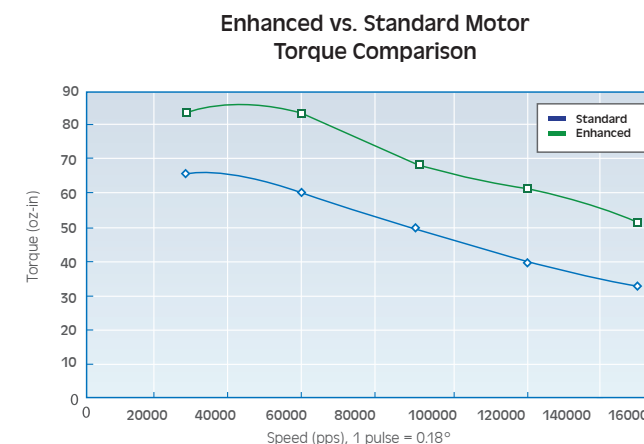


With *Enhanced*
TECHNOLOGY

Enhance your application's performance with the new NEMA 23 and 34 Enhanced Stepper Motor series!

The Benefits?

- ✓ No Stalling
- ✓ No Skipping Steps
- ✓ More Efficient



Get Up to

35%

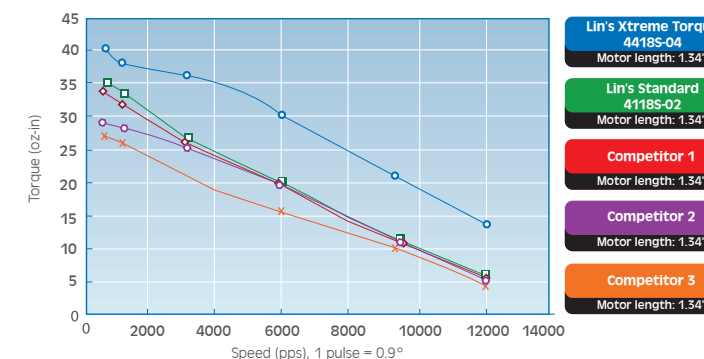
More Torque with the Same Power Input

The Benefits?

- ✓ No Stalling
- ✓ Better Heat Dissipation
- ✓ Space Efficient



Xtreme Torque 4418S Series Comparison
1.8° Step Motor, 24VDC, Rated Current, Bipolar, 1/2 Stepping



More Torque = No Skipping Steps + Avoid Stalling

Get high accuracy, low resonance, and quiet performance from these stepper motors.

HIGH ACCURACY

NEMA 17 | 0.9° Step Angle

4209
 HOLDING TORQUE
 Up to 62 oz-in
 (0.44 N-m)

NEMA 23 | 0.45° Step Angle

5704
 HOLDING TORQUE
 Up to 140 oz-in
 (0.99 N-m)

NEMA 23 | 0.9° Step Angle

5609
 HOLDING TORQUE
 Up to 108 oz-in
 (0.75 N-m)

XTREME ACCURACY

NEMA 14 | 0.9° Step Angle

3709
 With *Signature Series* TECHNOLOGY
 HOLDING TORQUE
 Up to 16 oz-in
 (0.12 N-m)

3809
 With *Signature Series* TECHNOLOGY

HOLDING TORQUE
 Up to 16 oz-in
 (0.12 N-m)

NEMA 17 | 0.9° Step Angle

416-05/06
 With *Signature Series* TECHNOLOGY
 HOLDING TORQUE
 Up to 7.3 oz-in
 (0.05 N-m)

416-07
 With *Signature Series* TECHNOLOGY
 HOLDING TORQUE
 Up to 8.4 oz-in
 (0.06 N-m)

4109
 With *Signature Series* TECHNOLOGY
 HOLDING TORQUE
 Up to 22 oz-in
 (0.16 N-m)

417
 With *Signature Series* TECHNOLOGY
 HOLDING TORQUE
 Up to 30 oz-in
 (0.21 N-m)

WHISPER TORQUE

NEMA 17 | 0.9° Step Angle

Z417-11
 With *Signature Series* TECHNOLOGY
 HOLDING TORQUE
 Up to 12 oz-in
 (0.08 N-m)

ZH417-11
 With *Signature Series* TECHNOLOGY

HOLDING TORQUE
 Up to 12 oz-in
 (0.08 N-m)

Hollow Shaft with up to 11mm ID available!

NEMA 23 | 0.9° Step Angle

G5709
 With *Signature Series* TECHNOLOGY
 HOLDING TORQUE
 Up to 270 oz-in
 (1.91 N-m)

PATENTED

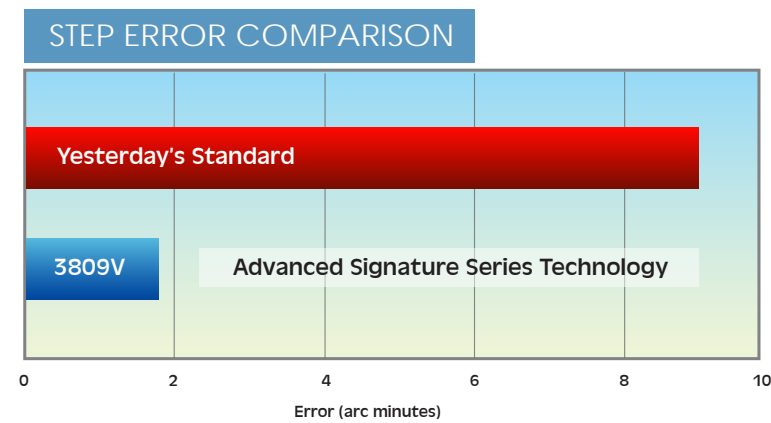
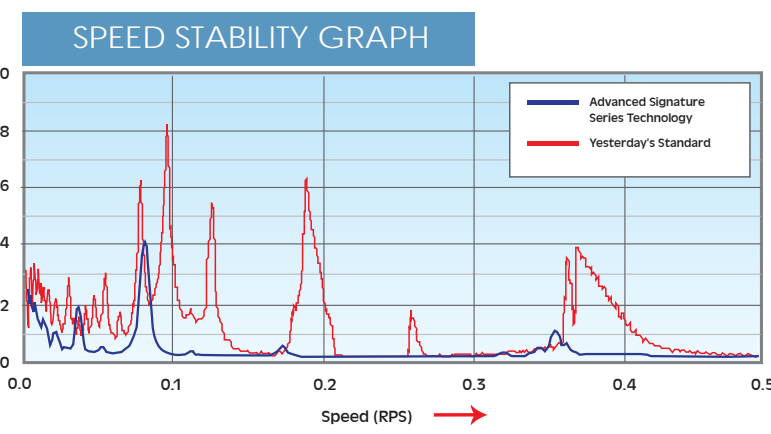


GET MORE ACCURACY



Reduce Resonance

Increase Accuracy



Signature Series Stepper Motors produce less resonance and are more accurate than standard stepper motors

More Accuracy = No Skipping Steps + Smoother Motion

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Take Advantage of Our Value Added Services
 sales@electromate.com



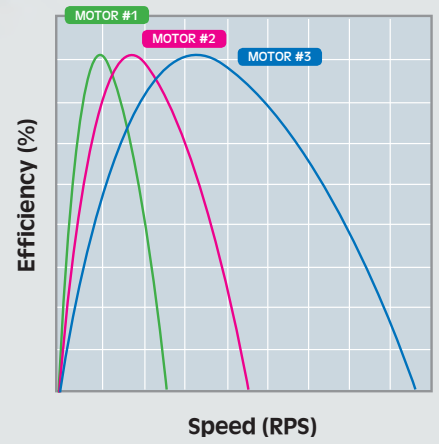
Multiple Mounting Configurations

NEMA 8, 11, 14, 17, 23 and 34

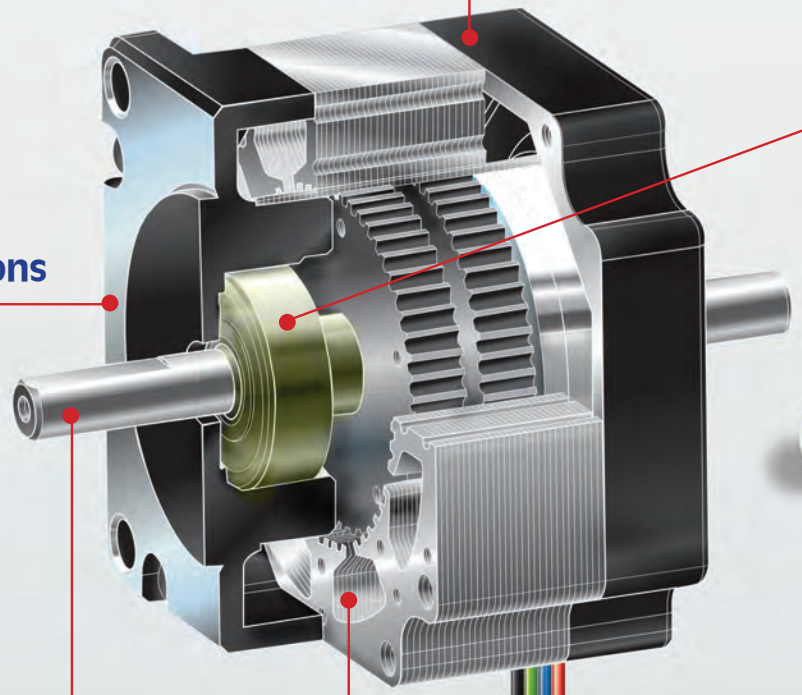


Multiple Shaft Options *

* Based on customer provided drawings and specifications



- ✓ Reduce Cost
- ✓ Save Time
- ✓ Better Supply Chain Control
- ✓ Lin Quality Standards for Every Component



Encoders, Dampers, Gearboxes, & Mechatronics



- ▲ **Position**
Verification & Accuracy with Encoders
- ▲ **Reduce**
Resonance & Vibration with Dampers
- ▲ **Increase**
Torque & Speed with Gearboxes
- ▲ **Utilize**
Intelligent Motors with Mechatronics

Bearings & Lubricants

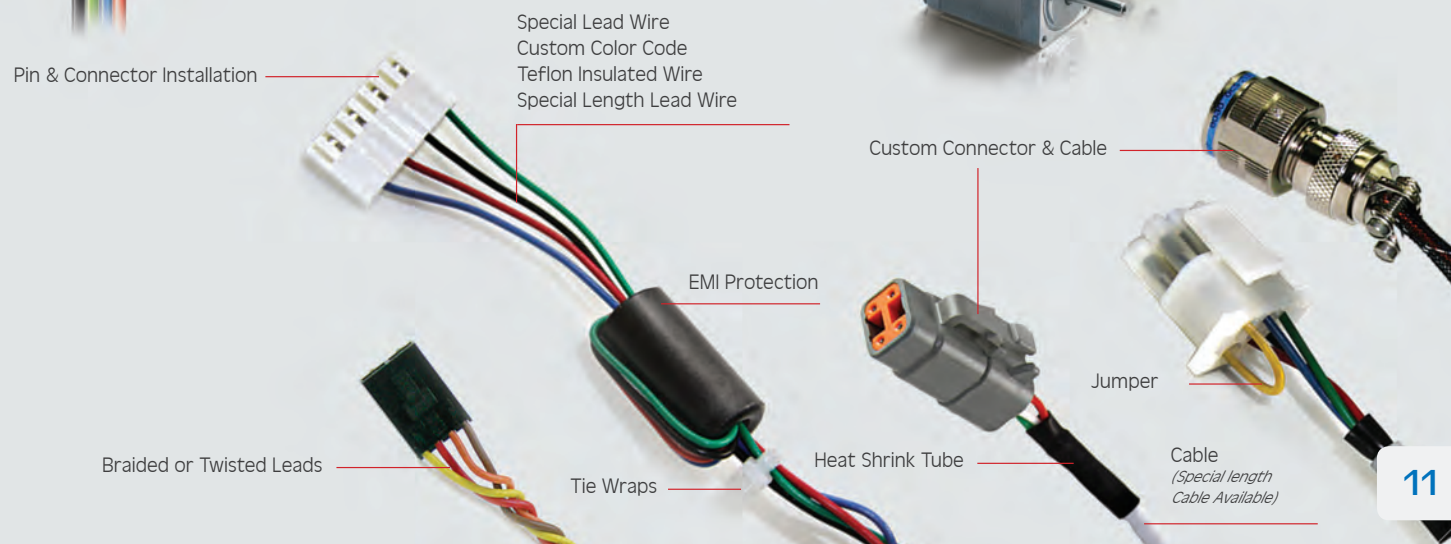
Ball Bearings, Stainless Steel Bearings, Seals, Special Lubricants for high temperature/humid operation



- ▲ **Water/Dust Protection**
IP65 (Splash Proof)
IPX7 (Submersible)

- ▶ **Vacuum Rated**
NEMA 11, 17 & 23 - 1.8°

Lead Wires & Cables



- Pin & Connector Installation
- Special Lead Wire
- Custom Color Code
- Teflon Insulated Wire
- Special Length Lead Wire
- EMI Protection
- Custom Connector & Cable
- Jumper
- Heat Shrink Tube
- Cable (Special length Cable Available)
- Braided or Twisted Leads
- Tie Wraps

Winding

Lin can help calculate speed, torque and input power creating a winding that is specific to your application at no extra cost

▲ **The Benefits?**

- ✓ High Efficiency
- ✓ Less Power Input
- ✓ No Trial & Error
- ✓ Save Time, Money, and Energy

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▼ R325P

Smooth Driver
 Microstepping: Full - 256x
 Current: 0.3 - 3.0 Amps
 RoHS Compliant

▼ R525P

Closed Loop Driver
 Microstepping: Full - 256x
 Current: 0.1 - 5.0 Amps
 RoHS Compliant

▼ R1025

Power House Driver
 Microstepping: Full - 256x
 Current: 0.8 - 10 Amps
 RoHS Compliant

▼ R701/710

High Power Driver
 Microstepping: 10x
 Current: 1-7 Amps
 RoHS Compliant



▲ R356

Single Axis Driver/Controller
 Microstepping: 2x - 256x
 Current: 0.2 - 3.0 Amps
 RoHS Compliant

▲ R256

Driver/Intelligent Controller
 Microstepping: 2x - 256x
 Current: 0.2 - 2.0 Amps
 RoHS Compliant

▲ R208

Low Cost Driver
 Microstepping: Full - 8x
 Current: 0.35 - 2.0 Amps
 RoHS Compliant



▲ BL100-RO

BLDC Speed Controller
 Current: Up to 20 Amps
 Voltage: Up to 48 VDC
 RoHS Compliant

▲ USB485

Converter Card
 Compatibility: Serial USB
 Used with: SP17C, SP23C,
 R256, R356, R525

▲ RS232-RS485

Converter Card
 Compatibility: Serial Port
 Used with: SP17C, SP23C,
 R256, R356, R525

Utilize over 40 years of design & development experience.

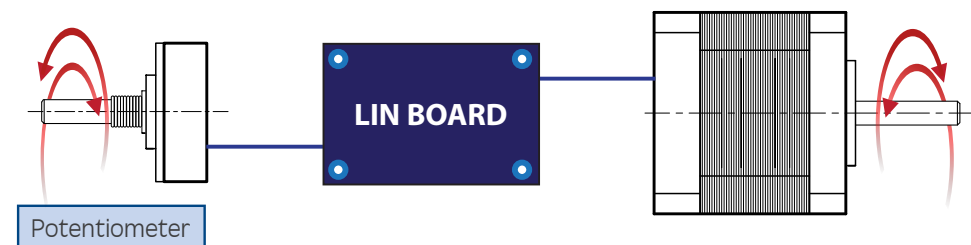
Whether you are looking for a simple plug & play solution or something a bit more advanced, we can help design, develop, and even manufacture products that are tailor made for your application

The Benefits?

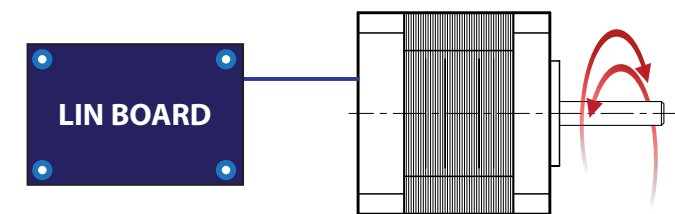
- ▶ Save on development time
- ▶ Reduce overall product cost
- ▶ Utilize over 40 years of motion control experience

Below are 2 examples of products that were developed for specific customer applications:

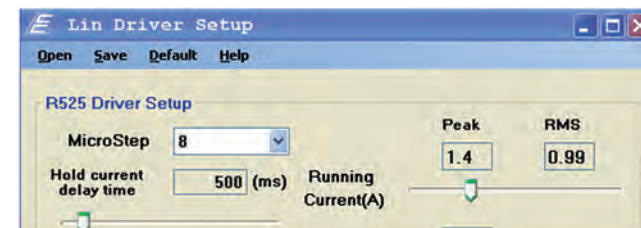
1- Simple controller with variable microstepping and speed control via potentiometer



2- Controller with factory programmed settings. Variable settings include speed, time, microstepping, and direction.



Intuitive Graphical User Interfaces (GUI) can also be developed



Lin Driver shown as an example

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Power House

▼ **Silverpak 34D**

Motor + Driver

- Up to 7 Amps Peak Current
- Up to 75 VDC Voltage
- High Torque
- Up to 1288 oz-in (9.10 N-m) of Holding Torque

Intelligent/ On-Board Memory

▼ **Silverpak 17C**

Motor + Driver + Controller

- High Resolution
- Up to 256x Microstepping
- High Torque
- Up to 85 oz-in (0.60 N-m) of Holding Torque

Intelligent/ On-Board Memory

▼ **Silverpak 23C**

Motor + Driver + Controller

- Optional Encoder
- High Torque
- Up to 294 oz-in (2.08 N-m) of Holding Torque

Versatile House

▼ **Silverpak 23D *Plus***

Motor + Driver

- Up to 5 Amps Peak Current
- Up to 75 VDC Voltage
- High Torque
- Up to 294 oz-in (2.08 N-m) of Holding Torque

Cost Effective

▼ **Silverpak 17D**

Motor + Driver

- Small Package
- High Torque
- Up to 85 oz-in (0.60 N-m) of Holding Torque

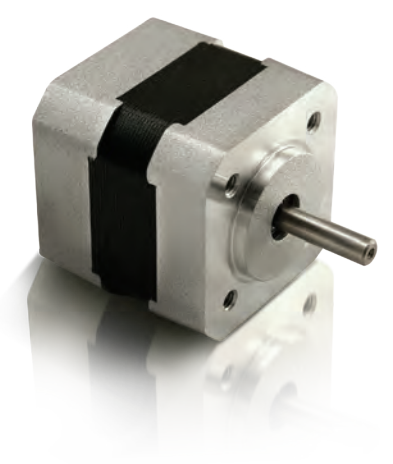
Customize Your Integrated Motor

Shaft	Gearboxes	Custom Windings	Encoder options

For Torque Curves, Drawings, and Specifications Visit
www.linengineering.com/silverpak

▼ **NEMA 17**

- Available in 4 Stack Lengths
- Up to 82 oz-in (0.58 N-m)
- Rated Speed of up to 4,000 RPM
- Additional Windings Available



▼ **NEMA 23**

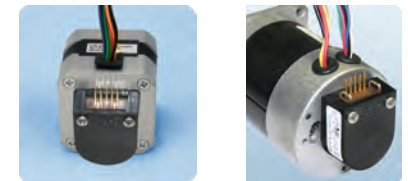
- Available in 4 Stack Lengths
- Up to 156 oz-in (1.1 N-m) Peak Torque
- Rated Speed of up to 4,000 RPM
- Additional Windings Available



CUSTOMIZE YOUR BLDC

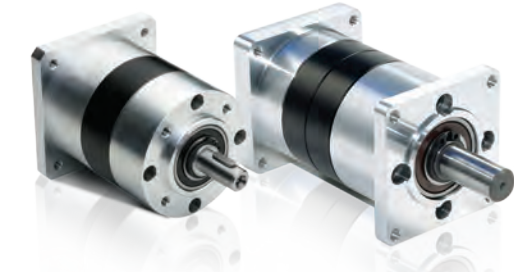
Encoders

- Various Options Available**
- Models: E2, E3 & E5



Gearboxes

- Spur and Planetary Available**
- Available in multiple ratios
 - Available for NEMA 17 and NEMA 23 BLDC's



Shafts & Connectors

- Double Shaft
- Flats on Front and Rear Shafts
- Shorter or Longer Shafts
- Cross Hole
- Connectors & Sleeving
- High Temp Environment



Headquarters in Nanjing, China
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Scale your business with Lin Engineering at design and pre-production levels. At low volumes, Lin Engineering has full design and manufacturing capabilities in Morgan Hill, CA. For high volumes, we have a proven process for transferring both technology and product to our Asia Headquarters, LEaN, for cost effective manufacturing without sacrificing quality.

▼ **The Benefits?**

- ✓ Cost effective solution without sacrificing quality
- ✓ Double source through a single supplier
- ✓ Consistently high service and support
- ✓ Minimize lead times

▼ **Customer Service**

LEaN has a team of customer service personnel dedicated to providing you with personal and professional service.

▼ **Quality & Reliability**

Similar to Lin Engineering's U.S. headquarters, LEaN produces high quality and consistently reliable products.

▼ **Value Added Services**

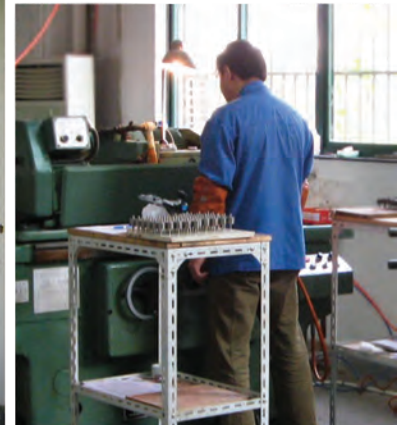
Whether its a simple request to add a cable or connector or something a bit more complex like mounting a pulley or customizing the motor's shaft, LEaN has a long list of value added services that help you minimize costs and lead times.

LEaN

(LIN ENGINEERING AT NANJING)

Located within the industrialized Nanjing province:
**201 XinKe 1st Road, GaoXin Zone
 Nanjing 210061, P.R. China**

TEL. **86-25-58844655 X8006**
 FAX. **86-25-58690086**
 EMAIL. **sales_Lean@linengineering.com**



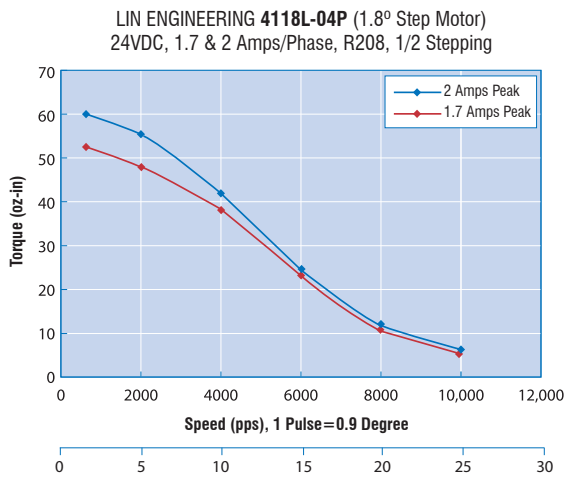
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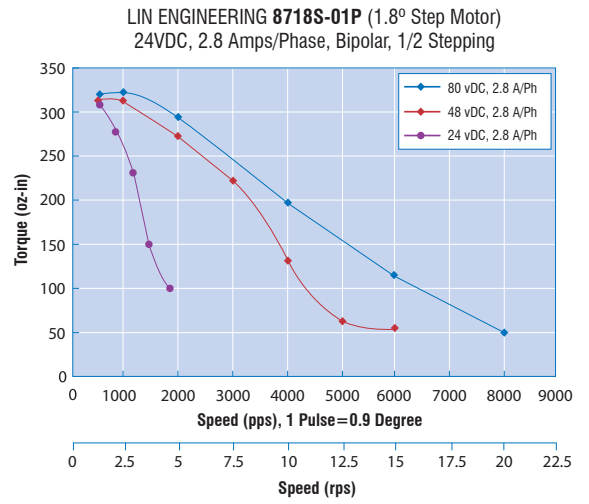
Since step motors are operated by sending current to the different phases in a specific switching sequence each pulse that is sent to the motor must rise and deplete (also known as a current-rise time). At slow speeds, each step it takes should have plenty of time to fully rise to 100% current and deplete. You will receive maximum power and thus, the reason why torque-speed curves have high torque at the low speeds. Voltage acts like a means to allow current to flow faster or slower. If you increase voltage, you are pushing the current through the motor windings at a faster rate. Now, instead of only rising and depleting about 50% of the max current, perhaps it has increased to about 60 or 75% by increasing the voltage.

Below shows a few curves that depict what different voltages and currents do to the torque-speed curves of several motors.

This curve shows that current will affect the slower speeds

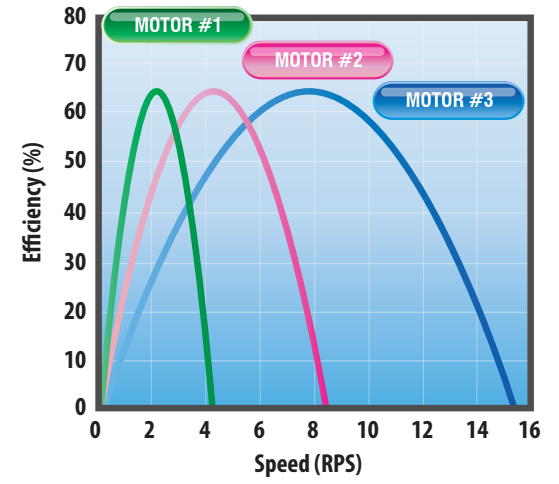


This curve shows that voltage affects the curve at higher speeds



EFFICIENCY

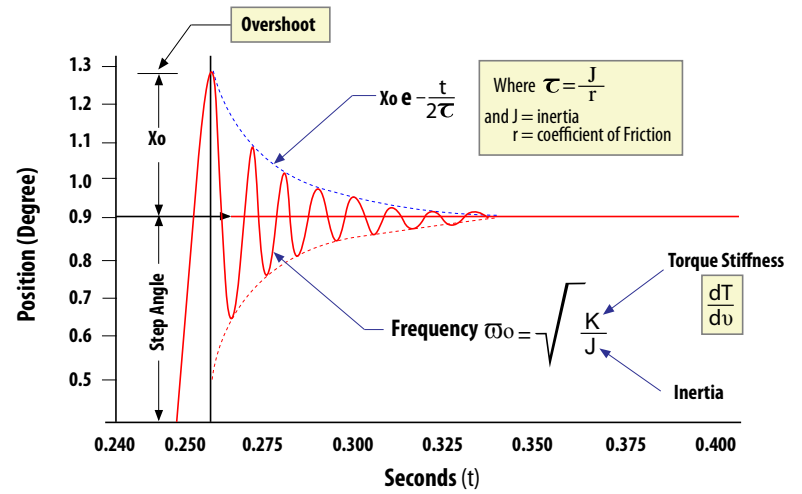
An efficiency curve exists for every motor to help ensure that the proper one has been selected. The image depicts three different motor efficiencies when plotted across a speed range. Some motors, such as #1, perform at their best only at low speeds while others, such as #3, perform better at high speeds.



TIPS ON REDUCING RESONANCE:

Every step motor has a resonant frequency wherein more vibration will be seen by the motor at a specific speed. This resonant frequency is due to the oscillation (i.e. back and forth movement) that occurs before the motor settles into each desired position. The oscillation frequency will resonate at certain speeds and cause a 1st order, 2nd order and sometimes even a 3rd order amplitude at several speed ranges. A classic example is vibration seen at 1 RPS (the 1st order), and then slightly less vibration at 2 RPS (the 2nd order).

Below is a graph of a step motor's step response or the oscillation that the motor makes just prior to settling into the desired position. In this particular graph, the desired position was going from 0 to 0.9 degrees.



STEP RESPONSE

Although resonance cannot truly be avoided, there are ways to both reduce resonance and shift the resonance to a different speed location altogether. Looking at the equation for the resonant frequency, ω , the two main factors are Torque Stiffness and Inertia. By changing one of these factors, you can shift the resonance to a lower or higher speed.

INCREASE OR DECREASE VOLTAGE AND/OR CURRENT

By changing the input voltage to the drive, or changing the current (Amps) going from the driver to the motor windings you are essentially altering the torque, and therefore the top numerator of the frequency equation. If you are able to sacrifice some torque, try decreasing the overall power as this could help reduce or shift resonance away from your operating point.

INCREASE YOUR INERTIA LOAD

When you add more load to the shaft of the motor, you are essentially dampening the vibrations. Based on the equation, increasing the bottom denominator will shift the resonance to a lower spot.

INCREASE MICROSTEPPING

If you have capabilities to increase microstepping from the driver this will force the motor to take much smaller steps which will oscillate much less. Reducing the amount of oscillation directly reduces the amount of resonance. This method reduces resonance across the entire speed range.

CHOOSE A DIFFERENT MOTOR

If all else fails you may need a different motor. In most cases, the motor is too powerful and causes vibration and resonance since it is expecting to move a much heavier load. Choosing a motor that is more suitable for the job could be the solution. If all else fails try Lin Engineering's Signature Series line of steppers which are mechanically designed to reduce vibrations for a smoother motion profile. See page 6-7 for further details.