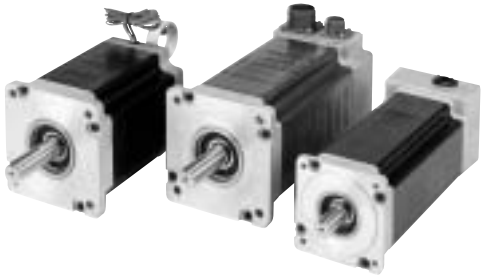


# INTRODUCTION



## SIGMAX® AND STANDARD HYBRID STEP MOTORS

Here's how Sigmax works.

- Stator mounted rare earth magnets concentrate flux at desired points between the rotor and stator
- Flux focusing action optimizes flux paths
- Produces higher torque and current utilization is better than a comparably sized standard hybrid

### GENERAL PURPOSE MOTORS

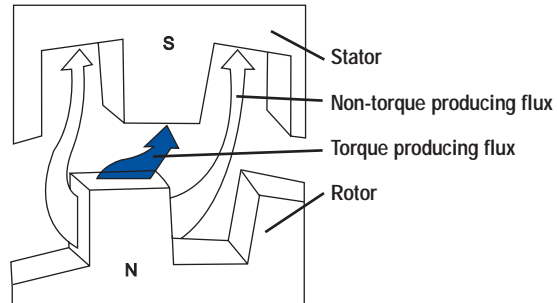
These motors offer torque, speed and acceleration characteristics to fulfill commonly encountered applications. The P and M Powermax motors represent both standard and Sigmax® configurations. Powermax II® hybrid motors are the economical and high performance alternative to conventional NEMA 23 step motors.



### HIGH TORQUE - HIGH ACCELERATION

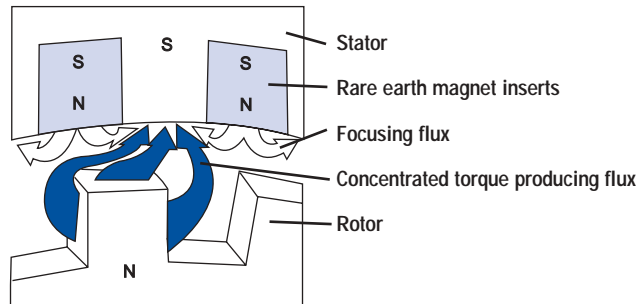
New T Series motors, in NEMA 23 frame and the N and K Series, in both NEMA 34 and 42 frames, provide an impressive range of high torque output. They have high torque-to-inertia ratios that provide high acceleration rates to move loads fast. The K Series, which incorporates the flux-focusing Sigmax technology, provides the highest acceleration rates. Specify the K Series for the most rapid load positioning. See the pages that follow for performance information and rating and characteristics. For detailed information see the MOTIONEERING® CD in the back of this catalog, or look online at [www.DanaherMotion.com](http://www.DanaherMotion.com) for more information.

### STANDARD HYBRID



Typical paths of flux transfer in an energized conventional hybrid step motor. Some flux leakage occurs in normal operation.

### SIGMAX® TECHNOLOGY



Patented Sigmax technology\* redirects magnetic flux to inhibit leakage and optimize torque production.

\*Sigmax technology is covered by U.S. patents 4,712,028, 4,713,470, 4,763,034 and 4,827,164.



Our expertise in high performance servo and stepper technologies has bridged an important gap from traditional, mechanical technologies to more efficient, higher throughput and better controlled electronic technologies. In fact, we have designed and manufactured thousands of custom motion control systems which have significantly reduced the complexity and assembly time of operations in a wide variety of markets, including:

### INDUSTRIAL APPLICATIONS

**Packaging Market.** Our expertise in stepper technology, as represented by the N & P Series motors, has increased the efficiency and performance of a variety of packaging applications.

**Electronic Assembly.** Our PMA servo motors and PC800 drives provide high accuracy, high performance and cost effectiveness for a wide range of pick & place machines.

### NON-INDUSTRIAL APPLICATIONS

**Personal Transportation.** Our innovative PMOE Series servo motor was integral to the development of the Segway™ Human Transporter (HT). Helping to revolutionize the future of personal transportation with quiet, brushless drives and efficient operation.

**Fitness.** Our PMC/PC2300 brushless servo system provides smoother, quieter, more efficient operation in fitness treadmills. These systems are extremely compact resulting in high power-to-weight and power-to-volume ratios. In addition, our brushless technology allows for cooler, more efficient operation with reduced maintenance.

All Pacific Scientific high performance drives and motors consistently deliver the best amount of power and control at a reasonable cost. Pacific Scientific. Just another integral entity of the Danaher Motion Control system, dedicated to providing superior accuracy and reliability in cost-effective products to an ever-changing world of electronic motion control applications.



# 6410/6415 MICROSTEPPING DRIVES



## PACIFIC SCIENTIFIC 6400 MICROSTEPPING DRIVES ARE...

**Modular, Functional, and Flexible**

### Modular

The Pacific Scientific 6000 series high performance microstepper drives are modular to support a broad range of requirements. The modular design assures that you maximize your value. Offered in two power levels, the 6200 and 6400 microsteppers are ideally suited for single or multi-axis applications where space is at a premium.

### Functional & Flexible

Each series is designed to be mounted in either a bookshelf or cold plate configuration. This flexibility allows the user to optimize the available space in your panel. Microstep resolution is selected via DIP switches. Microstepping assures smooth low speed operation and optimum system resolution. The 6200 and 6400 resolutions are adjustable up to 20,000 and 51,200 steps per revolution respectively.

Current ranges are DIP switch selectable as well. Idle current reduction is also offered. This provides the ability to reduce motor heating when at idle. It also conserves system energy typically useful when operating with battery back systems. The 6200 drives require a 24-40 VDC input power source. The 6400 drives require a 24-75 VDC power source.

Both packages are available with two standard options: The 6210 and 6410 accept step and direction inputs from a remote indexing sources. The 6215 and 6415 include an on-board Oscillator card. These units include 4 built-in potentiometers to adjust acceleration, deceleration low speed and run speed settings. Or you can apply an external voltage source and use the pre-configured input to start and stop the motion.

### AGENCY APPROVAL

cUL, CE

## 6410 FEATURES

- Single power supply input
- Patented 4-phase Bipolar Chopper Drive for superior current regulation and low ripple current
- Output current adjustable from 0.625 A to 5 A<sub>RMS</sub> with 3 position dipswitch
- Microstepping provides smooth operation and increased resolution
- Patented Digital electronic Damping™ reduces instability at mid-speed ranges
- Idle current reduction reduces motor heating in many applications
- Selectable step filter rejects noise on step input
- Fault Protection:
  - line-to-line and line-to-neutral shorts
  - Internal power supply under-voltage
  - Bus overvoltage
- Compact size

## 6415 FEATURES

- Single power supply input
- Patented 4-phase Bipolar Chopper Drive for superior current regulation and low ripple current
- Output current adjustable from 0.625 A to 5 A<sub>RMS</sub> with 3 position dipswitch
- Microstepping up to 51,200 steps/revolution
- Patented Digital Electronic Damping™ reduces instability at mid-speed ranges
- Idle current reduction reduces motor heating in many applications
- Selectable step filter rejects noise on step input
- Fault Protection:
  - line-to-line and line-to-neutral shorts
  - Internal power supply under-voltage
  - Bus overvoltage
- Compact size
- Low/high speed select input
- On-board multi-turn potentiometers
- External customer potentiometer
- Customer supplied ±10 VDC analog input
- Optional heat sink

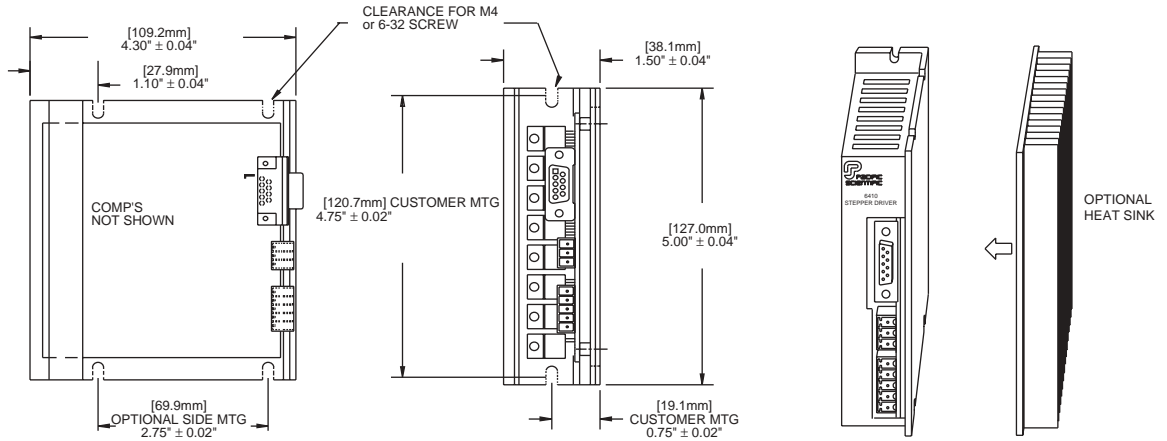
## DRIVE SPECIFICATIONS

	6410	6415
Step Sizes	Binary or Decimal, full to 1/250 or 1/256	Binary or Decimal, full to 1/250 or 1/256
Input Voltage	24-75 VDC	24-75 VDC
Output Current	0.625-7.1 amps, Peak	0.625-7.1 amps, Peak
Interface		
Inputs	Step and Direction	±10 VDC, Step/Dir, Discrete Input
Outputs	n/a	n/a
Connectors	Screw Terminal, D Sub	Screw Terminal, D Sub
Package Size	39.62 x 104.90 x 82.55 mm	39.62 x 104.90 x 82.55 mm
W (w/heat sinks)xHxD	(1.56 x 4.13 x 3.25 in)	(1.56 x 4.13 x 3.25 in)

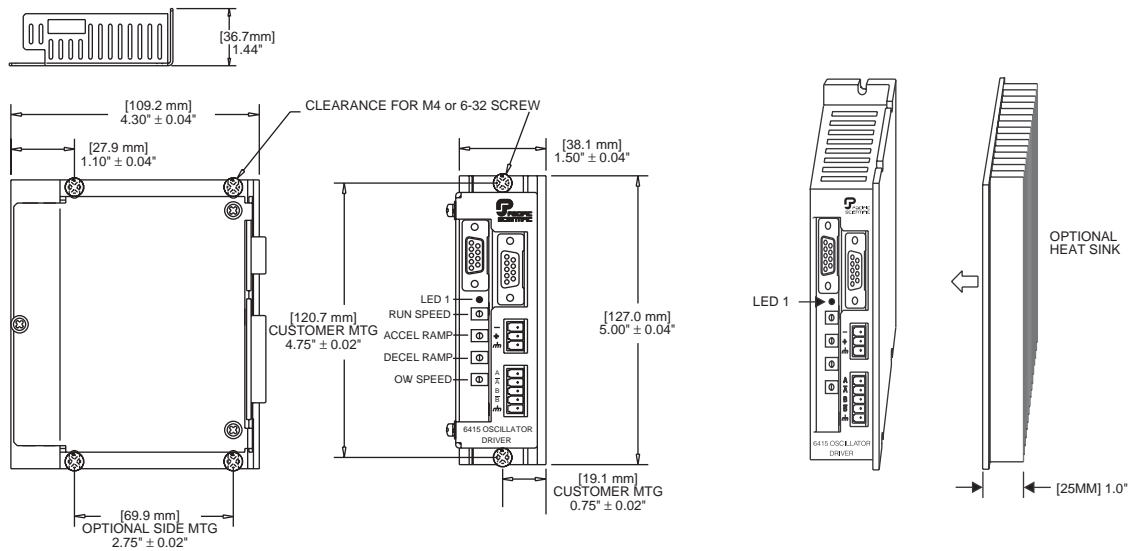
SEE SYSTEM RECOMMENDATIONS AND DATA ON PAGES 86-93.

# 6410/6415 MICROSTEPPING DRIVES

## 6410 [mm] in



## 6415 [mm] in



# 6210/6215 MICROSTEPPING DRIVES



## DRIVE SPECIFICATIONS

	6210	6215
Step Sizes	1/2, 1/10, 1/25, 1/100	1/2, 1/10, 1/25, 1/100
Input Voltage	24-40 VDC	24-40 VDC
Output Current	1 to 3.5 amps, Peak	1 to 3.5 amps, Peak
Interface		
Inputs	Step and Direction	±10 VDC, Step/Dir, Discrete Input
Outputs	n/a	n/a
Connectors	Screw Terminal	Two-Speed Terminal
Package Size	39.62 x 104.90 x 82.55 mm	39.62 x 104.90 x 82.55 mm
W (w/heat sinks)xHxD	(1.56 x 4.13 x 3.25 in)	(1.56 x 4.13 x 3.25 in)

## PACIFIC SCIENTIFIC 6200 MICROSTEPPING DRIVES ARE...

**Modular, Functional and Flexible**

### Modular

The Pacific Scientific 6000 series high performance microstepper drives are modular to support a broad range of requirements. The modular design assures that you maximize your value. Offered in two power levels, the 6200 microsteppers are ideally suited for single or multi-axis applications where space is at a premium.

### Functional & Flexible

Each series is design to be mounted in either a bookshelf or cold plate configuration. This flexibility allows the user to optimize the available space in your panel. Microstep resolution is selected via DIP switches. Microstepping assures smooth low speed operation and optimum system resolution. The 6200 resolutions are adjustable up to 20,000 and 51200 steps per revolution respectively.

Current ranges are DIP switch selectable as well. Idle current reduction is also offered. This provides the ability to reduce motor heating when at idle. It also conserves system energy typically useful when operating with battery back systems. The 6200 drives require a 24-40 VDC input power source.

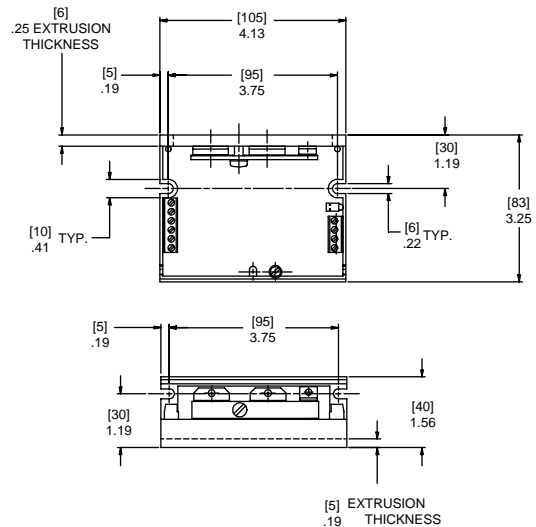
Both packages are available with two standard options: The 6210 accepts step and direction inputs from a remote indexing sources. The 6215 include an on-board Oscillator card. These units include 4 built-in potentiometers to adjust acceleration, deceleration low speed and run speed settings. Or you can apply an external voltage source and use the pre-configured input to start and stop the motion.

## AGENCY APPROVAL

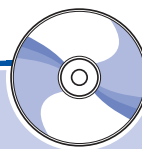
cUL, CE

## 6210/6215

[mm] in



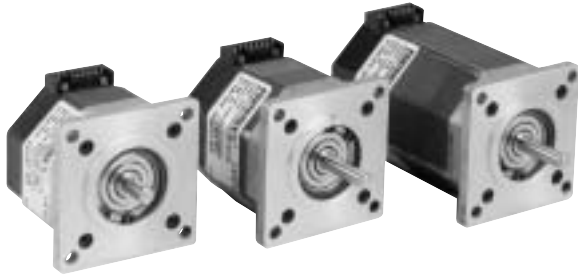
SEE SYSTEM RECOMMENDATIONS AND DATA ON PAGES 86-91.



## MOTIONEERING® CD-ROM

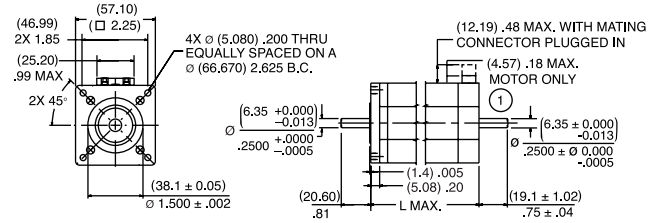
For more detailed product and selection information, see the **MOTIONEERING** CD-ROM inside the back cover of this catalog or visit our website at [www.DanaherMotion.com](http://www.DanaherMotion.com).

# PACIFIC SCIENTIFIC POWERMAX II MOTORS



## MOTOR DIMENSIONS

(mm) in

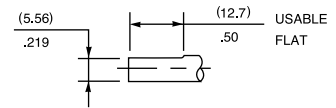


① Optional rear shaft extension available as shown. Same diameter as front shaft extension.

Connector Motor Model	Length	
	mm	in
P2H	40.7	1.60
P or M21	52.3	2.06
P or M22	78.7	3.10

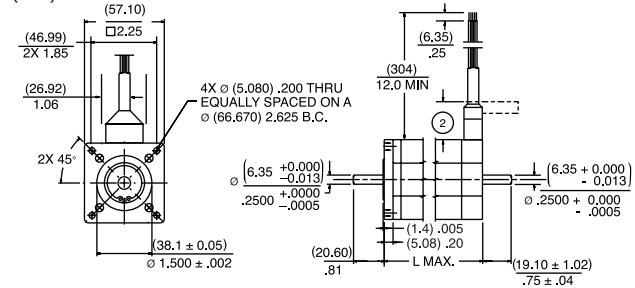
## Standard Shaft Options

1. Shaft modifications also available. Contact factory.
2. Optional flat available on front shaft as shown.



## FLYING LEAD MOTOR

(mm) in



② Flexible rubber boot may be bent as shown. Normal height 1.0 inch (25.4)

Flying Lead Motor Model	Length	
	mm	in
P2H	40.7	1.60
P or M21	52.4	2.06
P or M22	78.8	3.10

## Features

Two year warranty

Polymer encapsulated stator

Polymer end bell with threaded inserts

Largest available shaft diameter on a NEMA 23 stepper

Oversized 30 mm bearings

Optional Sigmax® technology

Optional low inertia rotor

Precision ground rotor OD and honed stator ID for concentric air gap in an economical motor design

Exposed laminations aids thermal dissipation

## Benefits

High quality, dependable operation

Exceptional thermal dissipation

End bell runs cooler, provides greater flexibility in mounting encoder and brake options

Withstands high radial and axial loads. Supports numerous shaft modifications

Increases bearing fatigue life (L<sub>10</sub>), extends motor life, reduces downtime

Increases available torque

Produces the highest acceleration rate possible

High quality performance in an economical motor design

Improved heat dissipation extends motor life, reduces downtime

# PACIFIC SCIENTIFIC POWERMAX II MOTORS

## RATINGS AND CHARACTERISTICS SEE SYSTEM RECOMMENDATIONS AND DATA ON PAGE 87.

Motor parameters and winding data.

Typical Leadwire Motor Model Number	Connection <sup>①</sup>			Holding Torque <sup>②</sup> (2 phases on) oz-in (N-m) ±10%	Rated Current/Phase <sup>③</sup> (amps DC)	Phase Resistance (ohms) ±10%	Phase Inductance <sup>④</sup> (mH) Typical	Detent Torque oz-in (N-m)	Thermal Resistance <sup>⑤</sup> (°C/watt)	Rotor Inertia oz-in-S <sup>2</sup> (kgm <sup>2</sup> x 10 <sup>-3</sup> )	Net Weight kg (lbs)
	Parallel	Series	Unipolar								
<b>STANDARD P2H SERIES 1/2 ROTOR STACK</b>											
P2HNRFH-LNN-NS-00	●			59 (0.42)	5.2	0.22	0.5	2.5 (0.018)	6.6	0.0010 (0.007)	0.45 (1.0)
P2HNRFB-LNN-NS-00		●		59 (0.42)	2.6	0.90	1.9				
P2HNRFB-LNN-NS-00			●	42 (0.29)	3.68	0.44	0.5				
P2HNRFB-LNN-NS-00	●			59 (0.42)	2.6	0.76	1.9				
P2HNRFB-LNN-NS-00		●		59 (0.42)	1.3	3.04	7.6				
P2HNRFB-LNN-NS-00			●	42 (0.29)	1.84	1.52	1.9				
<b>SIGMAX<sup>®</sup> M21 SERIES 1 ROTOR STACK</b>											
M21NRFA-LNN-NS-00	●			142 (1.00)	5.6	0.23	0.7	9.4 (0.066)	5.5	0.0017 (0.012)	0.68 (1.5)
M21NRFB-LNN-NS-00		●		142 (1.00)	2.8	0.92	2.8				
M21NRFB-LNN-NS-00			●	100 (0.71)	4.0	0.46	0.7				
M21NRFB-LNN-NS-00	●			137 (0.97)	4.6	0.32	1.0				
M21NRFB-LNN-NS-00		●		137 (0.97)	2.3	1.28	4.0				
M21NRFB-LNN-NS-00			●	97 (0.68)	3.3	0.64	1.0				
<b>STANDARD P21 SERIES 1 ROTOR STACK</b>											
P21NRFA-LNN-NS-00	●			114 (0.81)	5.6	0.23	0.8	4 (0.028)	5.5	0.0017 (0.012)	0.68 (1.5)
P21NRFB-LNN-NS-00		●		114 (0.81)	2.8	0.92	3.2				
P21NRFB-LNN-NS-00			●	81 (0.57)	4.0	0.46	0.8				
P21NRFB-LNN-NS-00	●			111 (0.79)	4.6	0.32	1.1				
P21NRFB-LNN-NS-00		●		111 (0.79)	2.3	1.28	4.4				
P21NRFB-LNN-NS-00			●	79 (0.55)	3.3	0.64	1.1				
<b>SIGMAX<sup>®</sup> M22 SERIES 2 ROTOR STACK</b>											
M22NRFA-LNN-NS-00	●			230 (1.62)	6.5	0.21	0.7	17 (0.12)	4.5	0.0036 (0.025)	1.13 (2.5)
M22NRFB-LNN-NS-00		●		230 (1.62)	3.3	0.84	2.8				
M22NRFB-LNN-NS-00			●	163 (1.15)	4.6	0.42	0.7				
M22NRFB-LNN-NS-00	●			253 (1.79)	4.6	0.38	1.7				
M22NRFB-LNN-NS-00		●		253 (1.79)	2.3	1.52	6.8				
M22NRFB-LNN-NS-00			●	179 (1.26)	3.3	0.76	1.7				
<b>STANDARD P22 SERIES 2 ROTOR STACK</b>											
P22NRFH-LNN-NS-00	●			197 (1.39)	6.5	0.21	0.8	7 (0.049)	4.5	0.0036 (0.025)	1.13 (2.5)
P22NRFB-LNN-NS-00		●		197 (1.39)	3.3	0.84	3.2				
P22NRFB-LNN-NS-00			●	139 (0.98)	4.6	0.42	0.8				
P22NRFB-LNN-NS-00	●			214 (1.51)	4.6	0.38	2.1				
P22NRFB-LNN-NS-00		●		214 (1.51)	2.3	1.52	8.4				
P22NRFB-LNN-NS-00			●	151 (1.07)	3.3	0.76	2.1				

All ratings typical and at 25°C unless otherwise noted.

- ① Refer to Selection Guide for more information.
- ② With rated current applied.

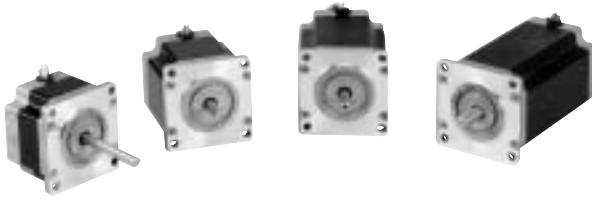
- ③ Windings at 130°C and motor in still air at 40°C (without heat sink). Operation of these motors above rated current may cause demagnetization. Contact factory.
- ④ Small signal inductance as measured with impedance bridge at 1kHz, 1 amp.
- ⑤ Thermal resistance measured with motor hanging in still air (unmounted).



### MOTIONEERING<sup>®</sup> CD-ROM

For more detailed product and selection information, see the MOTIONEERING CD-ROM inside the back cover of this catalog or visit our website at [www.DanaherMotion.com](http://www.DanaherMotion.com).

# PACIFIC SCIENTIFIC T-SERIES NEMA 23 HIGH TORQUE MOTORS



## Features

With holding torques to 380 oz-in, (356 lb-in), the T Series provide the highest torques per frame size in the industry—more than 3 and 5 phase designs.

Improved torque linearity (above rated current) provides high peak torque capability (duty cycle dependent, contact factory)

High torque at moderate speeds

Low detent torque harmonic

Rugged "housingless" square frame

Two phase design

Optional encoder mounting provisions

Optional terminal box construction

Wide selection of shaft configurations, terminations, and windings

## Benefits

Optimized magnetics provide maximum performance in small envelope, reducing space required for the motor.

Acceleration boost to move loads even faster. Provides more torque for intermittent duty applications.

Cost effective alternative to servo motors

Provides smoother microstepping performance

Efficient use of volume for optimal magnetic circuit

Compatible with most drivers, smoother microstepping, and lower input power required vs. three phase for same torque

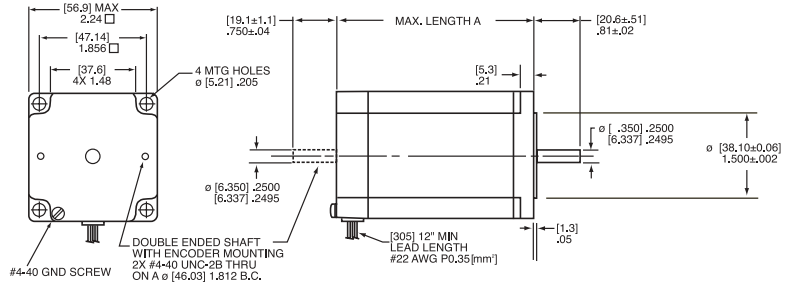
Optimizes control scheme

Enclosed connections for more demanding environments

Standard and custom configurations for cost effective system integration

## LEADWIRE HOOKUP MODELS

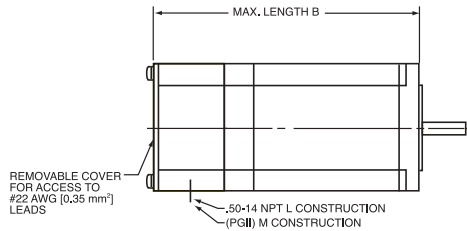
[mm] in



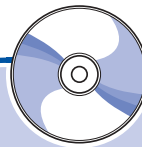
Leaded Motor Model	Max Length A	
	mm	in
T2H	41.6	1.64
T21	56.1	2.21
T22	77.7	3.06
T22	103.1	4.06

## TERMINAL BOX CONSTRUCTION

[mm] in.



Leaded Motor Model	Max Length B	
	mm	in
T21	86.6	3.41
T22	108.2	4.26
T22	133.6	5.26



## MOTIONEERING® CD-ROM

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# PACIFIC SCIENTIFIC T-SERIES NEMA 23 HIGH TORQUE MOTORS

**RATINGS AND CHARACTERISTICS** SEE SYSTEM RECOMMENDATIONS AND DATA ON PAGES 88-89.

Typical Leadwire Motor Model Number	Connection <sup>①</sup>		Holding Torque <sup>②</sup> (2 phases on) oz-in (N-m) ±10%	Rated Current/Phase <sup>③</sup> (amps DC)	Phase Resistance (ohms) ±10%	Phase Inductance <sup>④</sup> (mH) Typical	Detent Torque oz-in (N-m)	Thermal Resistance <sup>⑤</sup> (°C/watt)	Rotor Inertia oz-in-S <sup>2</sup> (kgm <sup>2</sup> x 10 <sup>-3</sup> )	Net Weight kg (lbs)
	4 Lead	6 Lead								
<b>T SERIES - 1/2 ROTOR STACK</b>										
T2HNRHK-LNN-NS-00	●		74 (0.52)	5.3	0.19	0.63	2 (0.0141)	6.14	0.00154 (0.0114)	0.5 (1.03)
T2HNRHJ-LNN-NS-00	●		74 (0.52)	4	0.28	1				
T2HNRHL-LNN-NS-00	●		74 (0.52)	2.7	0.64	2.5				
T2HNRDL-LNN-NS-00	●		74 (0.52)	1.1	3.6	16				
<b>T SERIES - 1 ROTOR STACK</b>										
T21NRHK-LNN-NS-00	●		180 (1.27)	5.4	0.23	1.1	3 (0.0212)	4.64	0.0034 (0.0248)	0.7 (1.6)
T21NRHJ-LNN-NS-00	●		180 (1.27)	4.1	0.33	1.8				
T21NRHL-LNN-NS-00	●		180 (1.27)	2.7	0.85	4.6				
T21NRLE-LNN-NS-00	●		180 (1.27)	1.4	3.0	16				
T21NRDL-LNN-NS-00	●		180 (1.27)	1.1	4.9	30				
<b>T SERIES - 2 ROTOR STACK</b>										
T22NRHK-LNN-NS-00	●		280 (1.98)	6.6	0.20	0.85	6 (0.0424)	3.69	0.0056 (0.0408)	1.0 (2.3)
T22NRHJ-LNN-NS-00	●		280 (1.98)	4.1	0.49	2.5				
T22NRHL-LNN-NS-00	●		280 (1.98)	3.3	0.75	3.4				
T22NRGL-LNN-NS-00	●		280 (1.98)	2.5	1.3	7.1				
T22NRLE-LNN-NS-00	●		280 (1.98)	1.5	2.9	17				
<b>T SERIES - 3 ROTOR STACK</b>										
T23NRHK-LNF-NS-00	●		380 (2.68)	6.0	0.28	1.5	7 (0.0494)	3.04	0.0084 (0.0612)	1.5 (3.2)
T23NRHJ-LNF-NS-00	●		380 (2.68)	3.8	0.64	3.9				
T23NRHL-LNF-NS-00	●		380 (2.68)	3.0	1.0	6.2				
T23NRFL-LNF-NS-00	●		380 (2.68)	1.8	2.8	17				
T23NRLE-LNF-NS-00	●		380 (2.68)	1.5	4.1	24				

All ratings typical and at 25°C unless otherwise noted.

① Refer to Selection Guide for more information.

② With rated current applied.

③ Windings at 105°C and motor in still air at 40°C (without heat sink). Operation of these motors above rated current may cause demagnetization. Contact factory.

④ Small signal inductance as measured with impedance bridge at 1 kHz, 1 amp.

⑤ Thermal resistance measured with motor hanging in still air (unmounted).

# PACIFIC SCIENTIFIC N&K-SERIES NEMA 34 HIGH TORQUE MOTORS



## Features

With holding torques to 5700 oz-in (356 lb-in), the N and K Series provide the highest torques per frame size in the industry—more than 3 and 5 phase designs.

Improved torque linearity (above rated current) provides high peak torque capability (duty cycle dependent, contact factory)

High torque at moderate speeds

Low detent torque harmonic

K Series uses patented Sigmax<sup>®</sup> technology to develop 25% more torque than N Series

Runs cooler than comparable steppers using identical drive parameters

Special rotor design for high acceleration

Rugged "housingless" square frame

Sealed per IP65

Outer bearing races won't turn—front locked (in steel insert) and rear held by O-ring

Extensive selection of shaft configurations, terminations, standard and special windings

Two phase design

Optional encoder mounting provisions

## Benefits

Optimized magnetics provide maximum performance in small envelope, reducing space required for the motor.

Acceleration boost to move loads even faster. Provides more torque for intermittent duty applications.

Cost effective alternative to servo motors

Provides smoother microstepping performance

Select from broad performance range to meet your requirement

Longer, more reliable motor life—backed by a two year warranty

Move/position loads fast

Efficient use of volume for optimal magnetic circuit

For splashproof requirements

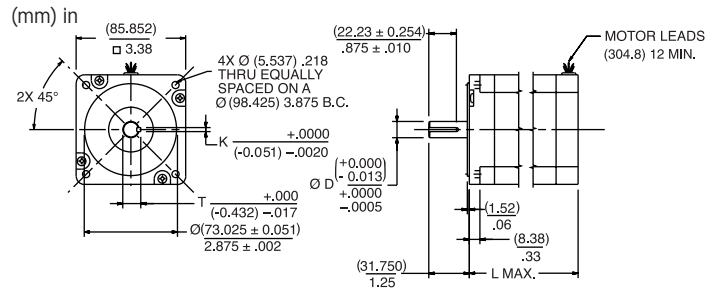
Long life bearings—also prevents axial shaft movement for encoder applications

Match your requirements

Compatible with most drivers, smoother microstepping, and lower input power required vs. three phase for same torque

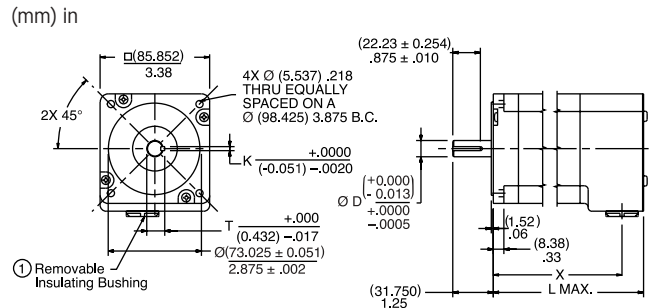
Optimizes control scheme

## LEADWIRE HOOKUP MODELS



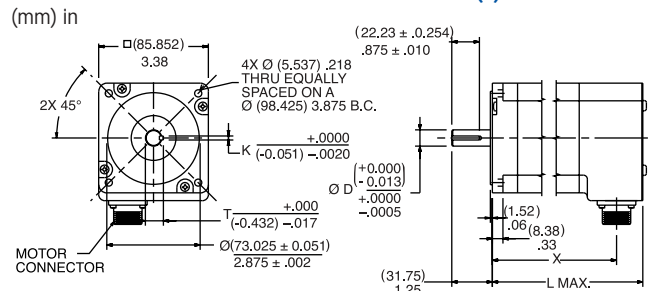
Motor	D	K	T	L MAX
31xR	(12.700) 0.5000	(3.175) 0.1250	(14.097) 0.555	(79.502) 3.13
32xR	(12.700) 0.5000	(3.175) 0.1250	(14.097) 0.555	(118.11) 4.65
33xR	(15.875) 0.6250	(4.763) 0.1875	(17.907) 0.705	(155.70) 6.13
34xR	(15.875) 0.6250	(4.763) 0.1875	(17.907) 0.705	(195.07) 7.68

## SPLASHPROOF CONSTRUCTION-TERMINAL BOARD CONNECTIONS



Motor	D	K	T	X	L MAX
31xL	(12.700) 0.5000	(3.175) 0.1250	(14.097) 0.555	(93.98) 3.70	(112.78) 4.44
32xL	(12.700) 0.5000	(3.175) 0.1250	(14.097) 0.555	(132.59) 5.22	(151.38) 5.96
33xL	(15.875) 0.6250	(4.763) 0.1875	(17.907) 0.705	(171.20) 6.74	(89.99) 7.48
34xL	(15.875) 0.6250	(4.763) 0.1875	(17.907) 0.705	(209.55) 8.25	(228.35) 8.99

## SPLASHPROOF CONSTRUCTION-MS CONNECTOR(S)



Motor	D	K	T	X	L MAX
31xC	(12.700) 0.5000	(3.175) 0.1250	(14.097) 0.555	(90.42) 3.56	(112.78) 4.44
32xC	(12.700) 0.5000	(3.175) 0.1250	(14.097) 0.555	(128.78) 5.07	(151.38) 5.96
33xC	(15.875) 0.6250	(4.763) 0.1875	(17.907) 0.705	(165.10) 6.59	(89.99) 7.48
34xC	(15.875) 0.6250	(4.763) 0.1875	(17.907) 0.705	(205.99) 8.11	(228.35) 8.99

# PACIFIC SCIENTIFIC N&K-SERIES NEMA 34 HIGH TORQUE MOTORS

**RATINGS AND CHARACTERISTICS** SEE SYSTEM RECOMMENDATIONS AND DATA ON PAGES 90-91.  
 Motor parameters and winding data.

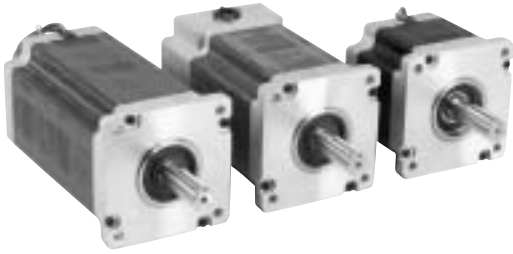
Typical Leadwire Motor Model Number	Connection <sup>①</sup>			Holding Torque <sup>②</sup> (2 phases on) oz-in (N-m) ±10%	Rated Current/Phase <sup>③</sup> (amps DC)	Phase Resistance (ohms) ±10%	Phase Inductance <sup>④</sup> (mH) Typical	Detent Torque oz-in (N-m)	Thermal Resistance <sup>⑤</sup> (°C/watt)	Rotor Inertia oz-in-S <sup>2</sup> (kgm <sup>2</sup> x 10 <sup>-3</sup> )	Net Weight kg(lbs)
	Parallel	Series	Unipolar								
<b>K SERIES - SIGMAX<sup>®</sup> 1 ROTOR STACK</b>											
K31HRFL-LNK-NS-00	●			830 (5.86)	8.6	0.18	1.2	25 (0.18)	2.7	0.0202 (0.14)	2.27 (5)
K31HRFL-LNK-NS-00		●		830 (5.86)	4.3	0.72	4.7				
K31HRFL-LNK-NS-00			●	590 (4.16)	6.1	0.36	1.2				
K31HRFK-LNK-NS-00	●			845 (5.96)	6.6	0.29	2.1				
K31HRFK-LNK-NS-00		●		845 (5.96)	3.3	1.16	8.3				
K31HRFK-LNK-NS-00			●	600 (4.23)	4.7	0.58	2.1				
<b>N SERIES - Standard 1 ROTOR STACK</b>											
N31HRFL-LNK-NS-00	●			650 (4.59)	8.6	0.18	1.4	18 (0.13)	2.7	0.0202 (0.14)	2.27 (5)
N31HRFL-LNK-NS-00		●		650 (4.59)	4.3	0.72	5.8				
N31HRFL-LNK-NS-00			●	460 (3.25)	6.1	0.36	1.4				
N31HRFK-LNK-NS-00	●			665 (4.69)	6.6	0.29	2.6				
N31HRFK-LNK-NS-00		●		665 (4.69)	3.3	1.16	10.3				
N31HRFK-LNK-NS-00			●	470 (3.32)	4.7	0.58	2.6				
<b>K SERIES - SIGMAX<sup>®</sup> 2 ROTOR STACK</b>											
K32HRFM-LNK-NS-00	●			1535 (10.83)	10	0.18	1.4	50 (0.35)	2	0.038 (0.27)	3.81 (8.4)
K32HRFM-LNK-NS-00		●		1535 (10.83)	5	0.7	5.5				
K32HRFM-LNK-NS-00			●	1085 (7.66)	7.1	0.35	1.4				
K32HRFL-LNK-NS-00	●			1515 (10.69)	8.1	0.26	2				
K32HRFL-LNK-NS-00		●		1515 (10.69)	4.1	1.03	8.1				
K32HRFL-LNK-NS-00			●	1070 (7.55)	5.8	0.52	2				
<b>N SERIES - Standard 2 ROTOR STACK</b>											
N32HRFM-LNK-NS-00	●			1215 (8.58)	10	0.18	1.8	36 (0.25)	2	0.038 (0.27)	3.81 (8.4)
N32HRFM-LNK-NS-00		●		1215 (8.58)	5	0.7	7				
N32HRFM-LNK-NS-00			●	860 (6.07)	7.1	0.35	1.8				
N32HRFL-LNK-NS-00	●			1200 (8.47)	8.1	0.26	2.6				
N32HRFL-LNK-NS-00		●		1200 (8.47)	4.1	1.03	10.3				
N32HRFL-LNK-NS-00			●	850 (6.00)	5.8	0.52	2.6				
<b>K SERIES - SIGMAX<sup>®</sup> 3 ROTOR STACK</b>											
K33HRFM-LNK-NS-00	●			2150 (15.17)	9.9	0.22	1.7	75 (0.53)	1.6	0.0567 (0.40)	5.39 (11.9)
K33HRFM-LNK-NS-00		●		2150 (15.17)	5	0.87	7				
K33HRFM-LNK-NS-00			●	1520 (10.73)	7	0.44	1.7				
K33HRFL-LNK-NS-00	●			2340 (16.52)	9	0.26	2.6				
K33HRFL-LNK-NS-00		●		2340 (16.52)	4.5	1.06	10.6				
K33HRFL-LNK-NS-00			●	1655 (11.68)	6.3	0.53	2.6				
<b>N SERIES - Standard 3 ROTOR STACK</b>											
N33HRFM-LNK-NS-00	●			1715 (12.10)	9.9	0.22	2.3	54 (0.38)	1.6	0.0567 (0.40)	5.39 (11.9)
N33HRFM-LNK-NS-00		●		1715 (12.10)	5	0.87	9				
N33HRFM-LNK-NS-00			●	1215 (8.58)	7	0.44	2.3				
N33HRFL-LNK-NS-00	●			1845 (13.02)	9	0.26	3.4				
N33HRFL-LNK-NS-00		●		1845 (13.02)	4.5	1.06	13.6				
N33HRFL-LNK-NS-00			●	1305 (9.21)	6.3	0.53	3.4				
<b>K SERIES - SIGMAX<sup>®</sup> 4 ROTOR STACK</b>											
K34HRFM-LNK-NS-00	●			2725 (19.23)	11.3	0.2	2	65 (0.50)	1.3	0.075 (0.53)	6.84 (15.1)
K34HRFM-LNK-NS-00		●		2725 (19.23)	5.6	0.82	8.2				
K34HRFM-LNK-NS-00			●	1930 (13.62)	8	0.41	2				
K34HRFL-LNK-NS-00	●			2790 (19.69)	8.7	0.33	3.6				
K34HRFL-LNK-NS-00		●		2790 (19.69)	4.4	1.32	14.5				
K34HRFL-LNK-NS-00			●	1975 (13.94)	6.2	0.66	3.6				
<b>N SERIES - Standard 4 ROTOR STACK</b>											
N34HRFM-LNK-NS-00	●			2140 (15.10)	11.3	0.2	2.6	57 (0.40)	1.3	0.075 (0.53)	6.84 (15.1)
N34HRFM-LNK-NS-00		●		2140 (15.10)	5.6	0.82	10.6				
N34HRFM-LNK-NS-00			●	1510 (10.66)	8	0.41	2.6				
N34HRFL-LNK-NS-00	●			2180 (15.39)	8.7	0.33	4.7				
N34HRFL-LNK-NS-00		●		2180 (15.39)	4.4	1.32	18.8				
N34HRFL-LNK-NS-00			●	1545 (10.90)	6.2	0.66	4.7				

All ratings typical and at 25°C unless otherwise noted.

- ① Refer to Selection Guide for more information.
- ② With rated current applied.

- ③ Windings at 130°C and motor in still air at 40°C (without heat sink). Operation of these motors above rated current may cause demagnetization. Contact factory.
- ④ Small signal inductance as measured with impedance bridge at 1kHz, 1 amp.
- ⑤ Thermal resistance measured with motor hanging in still air (unmounted).

# PACIFIC SCIENTIFIC N&K-SERIES NEMA 42 HIGH TORQUE MOTORS



## Features

With holding torques to 5700 oz-in (356 lb-in), the N and K Series provide the highest torques per frame size in the industry— more than 3 and 5 phase designs.

Improved torque linearity (above rated current) provides high peak torque capability (duty cycle dependent, contact factory)

High torque at moderate speeds

Low detent torque harmonic

K Series uses patented Sigmax<sup>®</sup> technology to develop 25% more torque than N Series

Runs cooler than comparable steppers using identical drive parameters

Special rotor design for high acceleration

Rugged "housingless" square frame

Sealed per IP65

Outer bearing races won't turn— front locked (in steel insert) and rear held by O-ring

Extensive selection of shaft configurations, terminations, standard and special windings

Two phase design

Optional encoder mounting provisions

## Benefits

Optimized magnetics provide maximum performance in small envelope, reducing space required for the motor.

Acceleration boost to move loads even faster. Provides more torque for intermittent duty applications.

Cost effective alternative to servo motors

Provides smoother microstepping performance

Select from broad performance range to meet your requirement

Longer, more reliable motor life— backed by a two year warranty

Move/position loads fast

Efficient use of volume for optimal magnetic circuit

For splashproof requirements

Long life bearings— also prevents axial shaft movement for encoder applications

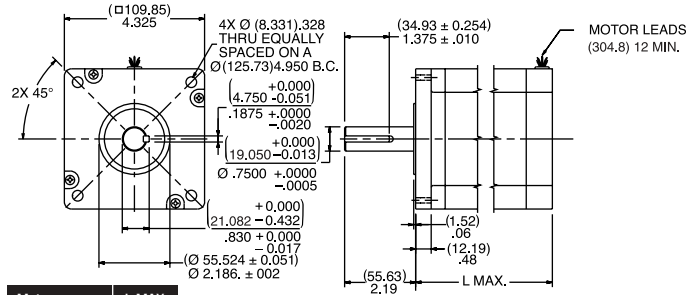
Match your requirements

Compatible with most drivers, smoother microstepping, and lower input power required vs. three phase for same torque

Optimizes control scheme

## LEADWIRE HOOKUP MODELS

(mm) in

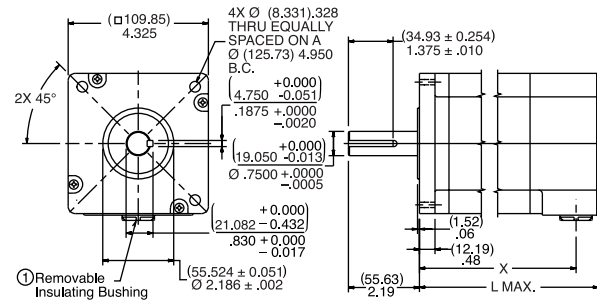


Motor	L MAX
41xx	(98.81) 3.89
42xx	(150.11) 5.91
43xx	(201.17) 7.92

① Motor leads 12.0 Min.

## SPLASHPROOF CONSTRUCTION-TERMINAL BOARD CONNECTIONS

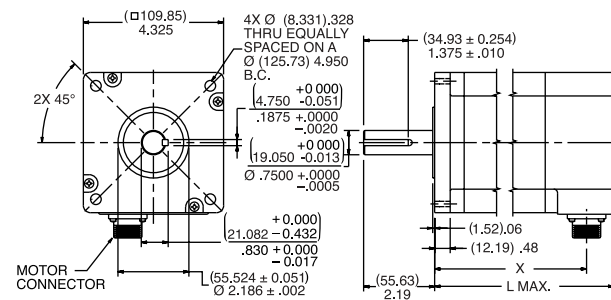
(mm) in



Motor	X	L MAX
41xx	(113.28) 4.46	(132.08) 5.20
42xx	(164.59) 6.48	(183.39) 7.22
43xx	(215.65) 8.49	(234.44) 9.23

## SPLASHPROOF CONSTRUCTION-MS CONNECTOR(S)

(mm) in



Motor	X	L MAX
41xx	(109.73) 4.32	(132.08) 5.20
42xx	(160.78) 6.33	(183.39) 7.22
43xx	(212.09) 8.35	(234.44) 9.23

# PACIFIC SCIENTIFIC N&K-SERIES NEMA 42 HIGH TORQUE MOTORS

## RATINGS AND CHARACTERISTICS SEE SYSTEM RECOMMENDATIONS AND DATA ON PAGE 93.

Motor parameters and winding data.

Typical Leadwire Motor Model Number	Connection <sup>①</sup>			Holding Torque <sup>②</sup> (2 phases on) oz-in (N-m) ±10%	Rated Current/Phase <sup>③</sup> (amps DC)	Phase Resistance (ohms) ±10%	Phase Inductance <sup>④</sup> (mH) Typical	Detent Torque oz-in (N-m)	Thermal Resistance <sup>⑤</sup> (°C/watt)	Rotor Inertia oz-in-S <sup>2</sup> (kgm <sup>2</sup> x 10 <sup>-3</sup> )	Net Weight kg (lbs)
	Parallel	Series	Unipolar								
<b>K SERIES - SIGMAX<sup>®</sup> 1 ROTOR STACK</b>											
K41HRFM-LNK-NS-00	●			2135 (15.07)	10.7	0.16	2.2	65 (0.46)	1.9	0.0783 (0.55)	4.98 (11)
K41HRFM-LNK-NS-00		●		2135 (15.07)	5.3	0.63	8.7				
K41HRFM-LNK-NS-00			●	1510 (10.66)	7.5	0.31	2.2				
K41HRFL-LNK-NS-00	●			2090 (14.75)	8.7	0.23	3.1				
K41HRFL-LNK-NS-00		●		2090 (14.75)	4.4	0.93	12.3				
K41HRFL-LNK-NS-00			●	1480 (10.45)	6.2	0.47	3.1				
<b>N SERIES - Standard 1 ROTOR STACK</b>											
N41HRFM-LNK-NS-00	●			1655 (11.68)	10.7	0.16	2.8	42 (0.30)	1.9	0.0783 (0.55)	4.98 (11)
N41HRFM-LNK-NS-00		●		1655 (11.68)	5.3	0.63	11.1				
N41HRFM-LNK-NS-00			●	1170 (8.26)	7.5	0.31	2.8				
N41HRFL-LNK-NS-00	●			1625 (11.47)	8.7	0.23	3.9				
N41HRFL-LNK-NS-00		●		1625 (11.47)	4.4	0.93	15.8				
N41HRFL-LNK-NS-00			●	1150 (8.12)	6.2	0.47	3.9				
<b>K SERIES - SIGMAX<sup>®</sup> 2 ROTOR STACK</b>											
K42HRFM-LNK-NS-00	●			4000 (28.23)	15.8	0.1	1.6	126 (0.89)	1.3	0.1546 (1.09)	8.34 (18.4)
K42HRFM-LNK-NS-00		●		4000 (28.23)	7.9	0.41	6.5				
K42HRFM-LNK-NS-00			●	2830 (19.97)	11.2	0.21	1.6				
K42HRFM-LNK-NS-00	●			4025 (28.41)	9.9	0.25	4.2				
K42HRFM-LNK-NS-00		●		4025 (28.41)	4.9	1.02	16.9				
K42HRFM-LNK-NS-00			●	2845 (20.08)	7	0.51	4.2				
<b>N SERIES - Standard 2 ROTOR STACK</b>											
N42HRFM-LNK-NS-00	●			3130 (22.09)	15.8	0.1	2.1	84 (0.59)	1.3	0.1546 (1.09)	8.34 (18.4)
N42HRFM-LNK-NS-00		●		3130 (22.09)	7.9	0.41	8.4				
N42HRFM-LNK-NS-00			●	2215 (15.63)	11.2	0.21	2.1				
N42HRFM-LNK-NS-00	●			3145 (22.20)	9.9	0.25	5.5				
N42HRFM-LNK-NS-00		●		3145 (22.20)	4.9	1.02	22				
N42HRFM-LNK-NS-00			●	2225 (15.70)	7	0.51	5.5				
<b>K SERIES - SIGMAX<sup>®</sup> 3 ROTOR STACK</b>											
K43HRFM-LNK-NS-00	●			5700 (40.23)	15.4	0.14	2.5	118 (0.83)	1	0.2293 (1.62)	11.64 (25.7)
K43HRFM-LNK-NS-00		●		5700 (40.23)	7.7	0.55	10				
K43HRFM-LNK-NS-00			●	4030 (28.44)	10.9	0.28	2.5				
K43HRFM-LNK-NS-00	●			5630 (39.74)	9.9	0.33	5.9				
K43HRFM-LNK-NS-00		●		5630 (39.74)	4.9	1.32	23.7				
K43HRFM-LNK-NS-00			●	3985 (28.13)	7	0.66	5.9				
<b>N SERIES - Standard 3 ROTOR STACK</b>											
N43HRFM-LNK-NS-00	●			4365 (30.81)	15.4	0.14	3.2	106 (0.75)	1	0.2293 (1.62)	11.64 (25.7)
N43HRFM-LNK-NS-00		●		4365 (30.81)	7.7	0.55	13				
N43HRFM-LNK-NS-00			●	3090 (21.81)	10.9	0.28	3.2				
N43HRFM-LNK-NS-00	●			4320 (30.49)	9.9	0.33	7.7				
N43HRFM-LNK-NS-00		●		4320 (30.49)	4.9	1.32	30.7				
N43HRFM-LNK-NS-00			●	3055 (21.56)	7	0.66	7.7				

All ratings typical and at 25°C unless otherwise noted.

① Refer to Selection Guide for more information.

② With rated current applied.

③ Windings at 130°C and motor in still air at 40°C (without heat sink). Operation of these motors above rated current may cause demagnetization. Contact factory.

④ Small signal inductance as measured with impedance bridge at 1 kHz, 1 amp.

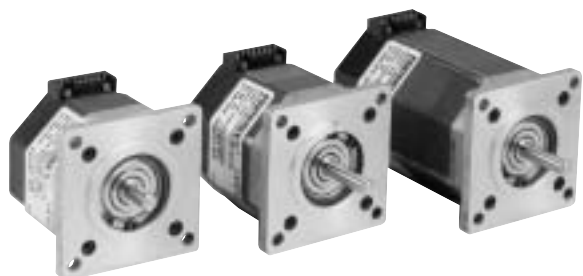
⑤ Thermal resistance measured with motor hanging in still air (unmounted).



### MOTIONEERING<sup>®</sup> CD-ROM

For more detailed product and selection information, see the MOTIONEERING CD-ROM inside the back cover of this catalog or visit our website at [www.DanaherMotion.com](http://www.DanaherMotion.com).

## POWERMAX II STEPPER SYSTEMS



The performance information shown in the torque/speed curves that follow show the POWERMAX II family of NEMA 23 step motors with windings, connections and current levels selected for maximum performance with the drives shown on this page. For additional assistance in sizing or selecting the stepper system appropriate for your application, contact Danaher Motion Customer Support at 815-226-2222.

## POWERMAX II STEPPER SYSTEMS

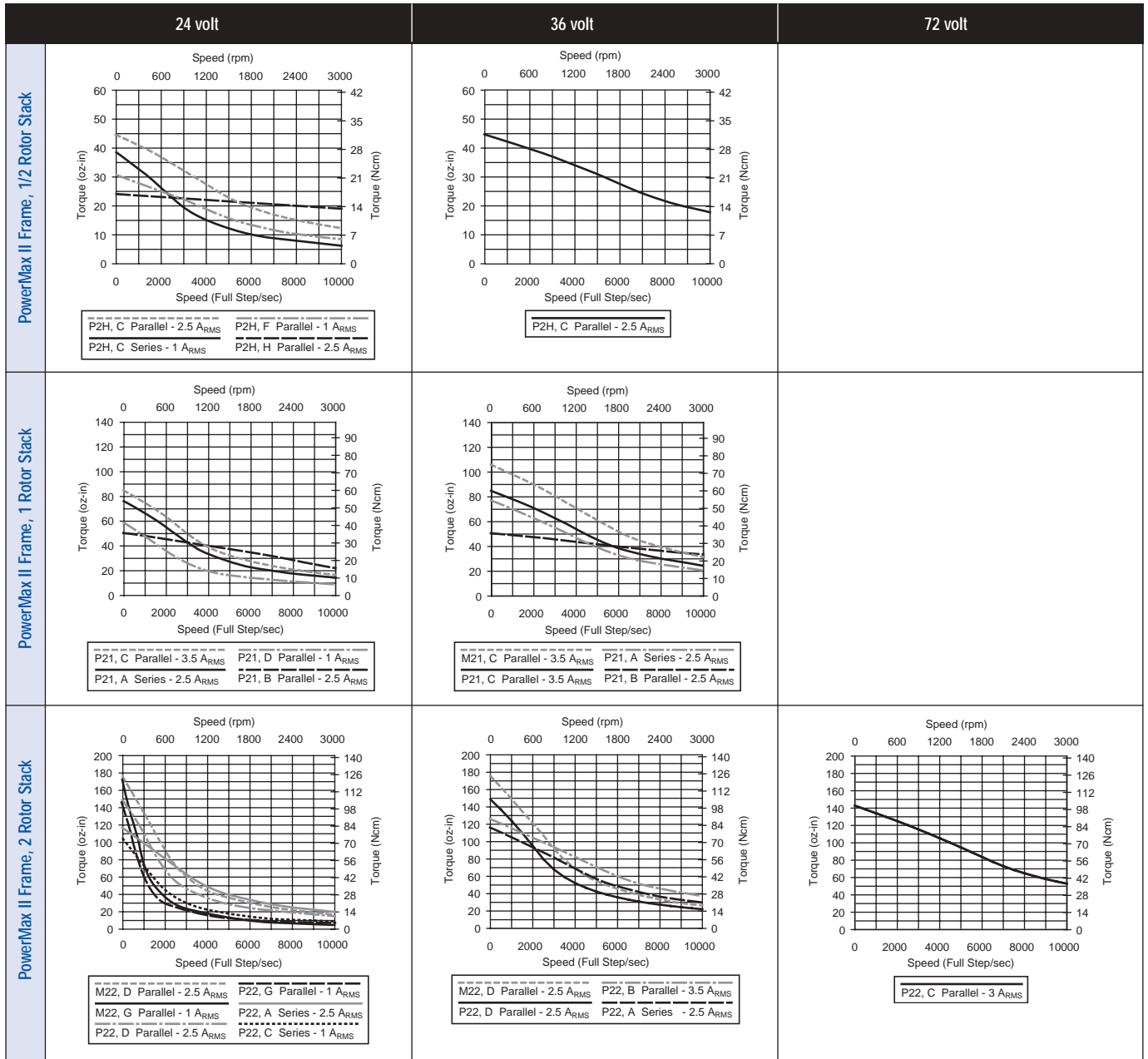
**6210/6215 Microstepping Drives** SEE PAGE 74

- 24-40 VDC input
- Step/direction input or oscillator models
- Current selectable from 1 to 3.5 amps peak
- Microstepping - 4 step sizes

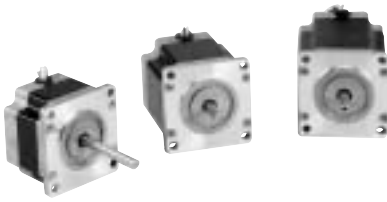
**6410/6415 Microstepping Drives** SEE PAGE 72

- 24-75 VDC input
- Step/direction input or oscillator models
- Current selectable from 0.625 to 7.1 amps peak
- Selectable step sizes, binary or decimal, full to 1/250 or 1/256

# POWERMAX II STEPPER SYSTEMS



# PACIFIC SCIENTIFIC T-SERIES NEMA 23 STEPPER SYSTEMS



The performance information shown in the torque/speed curves that follow show the T series of NEMA 23 step motors with windings, connections and current levels selected for maximum performance with the drives shown on this page. For additional assistance in sizing or selecting the stepper system appropriate for your application, contact Danaher Motion Customer Support at 815-226-2222.

## PACIFIC SCIENTIFIC T-SERIES NEMA 23 STEPPER SYSTEMS



### 6210/6215 Microstepping Drives SEE PAGE 74

- 24-40 VDC input
- Step/direction input or oscillator models
- Current selectable from 1 to 3.5 amps peak
- Microstepping - 4 step sizes



### 6410/6415 Microstepping Drives SEE PAGE 72

- 24-75 VDC input
- Step/direction input or oscillator models
- Current selectable from 0.625 to 7.1 amps peak
- Selectable step sizes, binary or decimal, full to 1/250 or 1/256



### Impulse Microstepping Drives SEE PAGE 75

- 90-120 VAC input, 160 VDC bus
- Step/direction input
- Programmable inputs/outputs
- Current selectable from 0.75 to 4.0 amps
- Microstepping 200 to 100,000, selectable in increments of 200



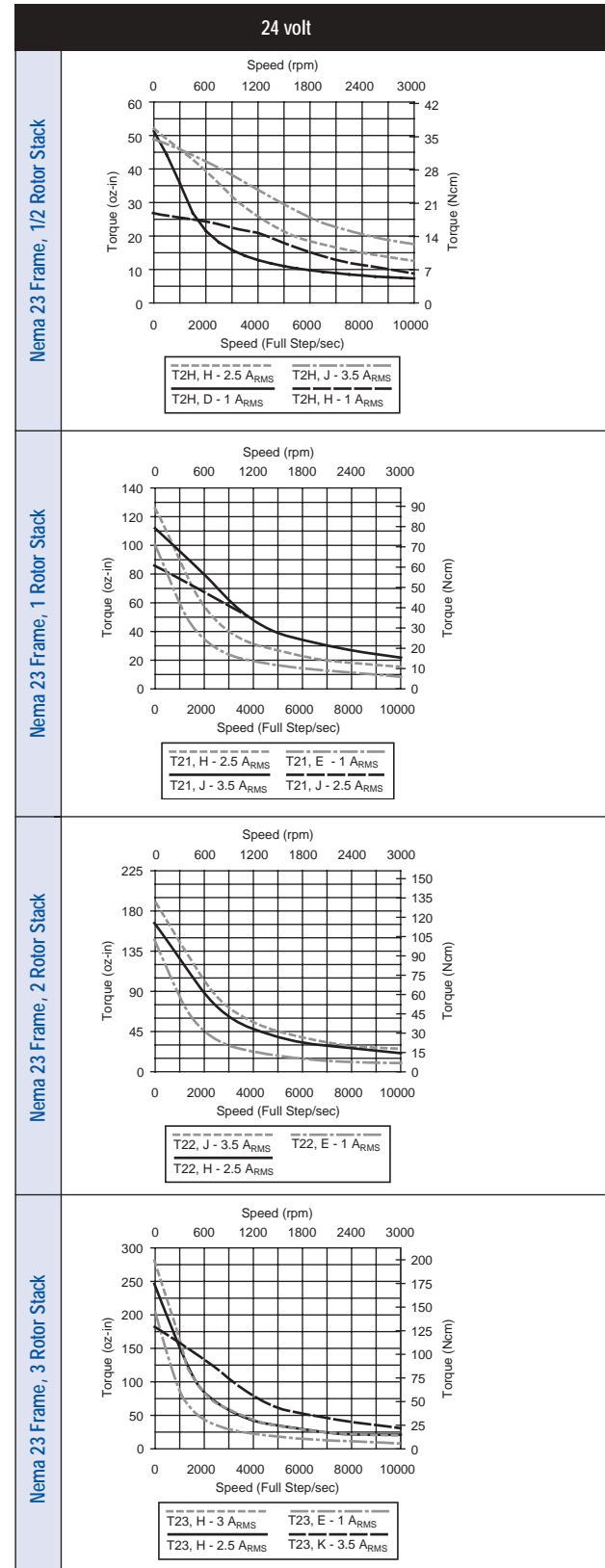
### NextStep® Microstepping Drives SEE PAGE 76

- 90-120 VAC input, 160 VDC bus
- Step/direction input
- Current selectable from 0 to 7.9 amps
- 5,000 steps/rev to 50,000 steps/rev microstepping

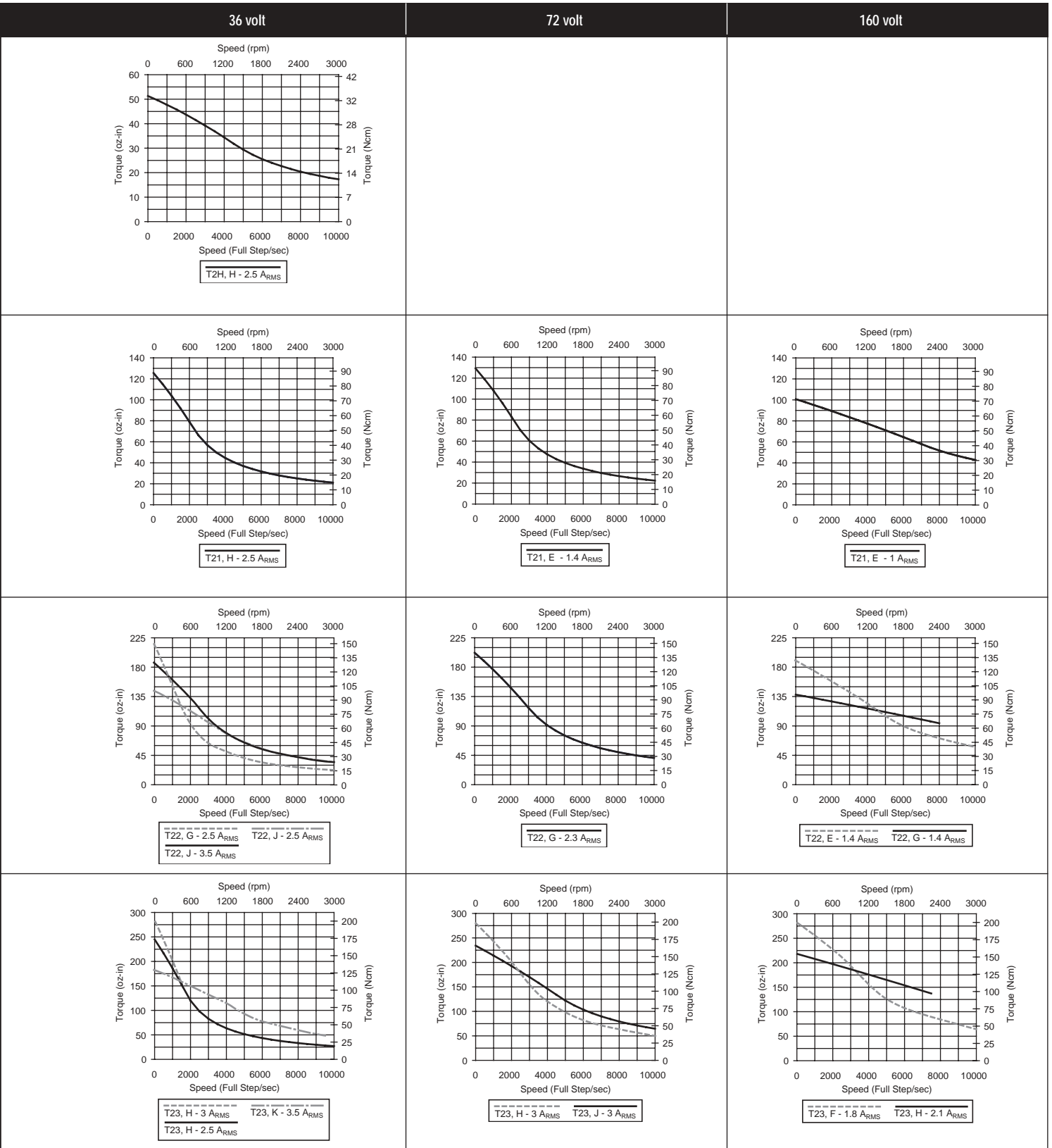


### SMARTSTEP Microstepping Drives SEE PAGE 77

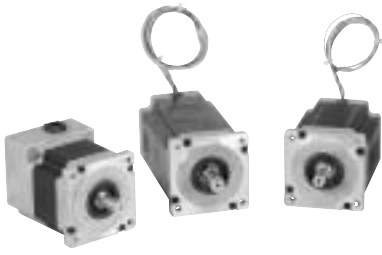
- 90-120 VAC input, 160 VDC bus
- Programmable indexing
- Current selectable from 0 to 7.9 amps
- 36,000 steps/rev microstepping



# PACIFIC SCIENTIFIC T-SERIES NEMA 23 STEPPER SYSTEMS



# PACIFIC SCIENTIFIC N&K-SERIES NEMA 34 STEPPER SYSTEMS



The performance information shown in the torque/speed curves that follow show the N & K series of NEMA 34 step motors with windings, connections and current levels selected for maximum performance with the drives shown on this page. For additional assistance in sizing or selecting the stepper system appropriate for your application, contact Danaher Motion Customer Support at 815-226-2222.

## PACIFIC SCIENTIFIC N&K-SERIES NEMA 34 STEPPER SYSTEMS



### 6210/6215 Microstepping Drives SEE PAGE 74

- 24-40 VDC input
- Step/direction input or oscillator models
- Current selectable from 1 to 3.5 amps peak
- Microstepping - 4 step sizes



### 6410/6415 Microstepping Drives SEE PAGE 72

- 24-75 VDC input
- Step/direction input or oscillator models
- Current selectable from 0.625 to 7.1 amps peak
- Selectable step sizes, binary or decimal, full to 1/250 or 1/256



### Impulse Microstepping Drives SEE PAGE 75

- 90-120 VAC input, 160 VDC bus
- Step/direction input
- Programmable inputs/outputs
- Current selectable from 0.75 to 4.0 amps
- Microstepping 200 to 100,000, selectable in increments of 200



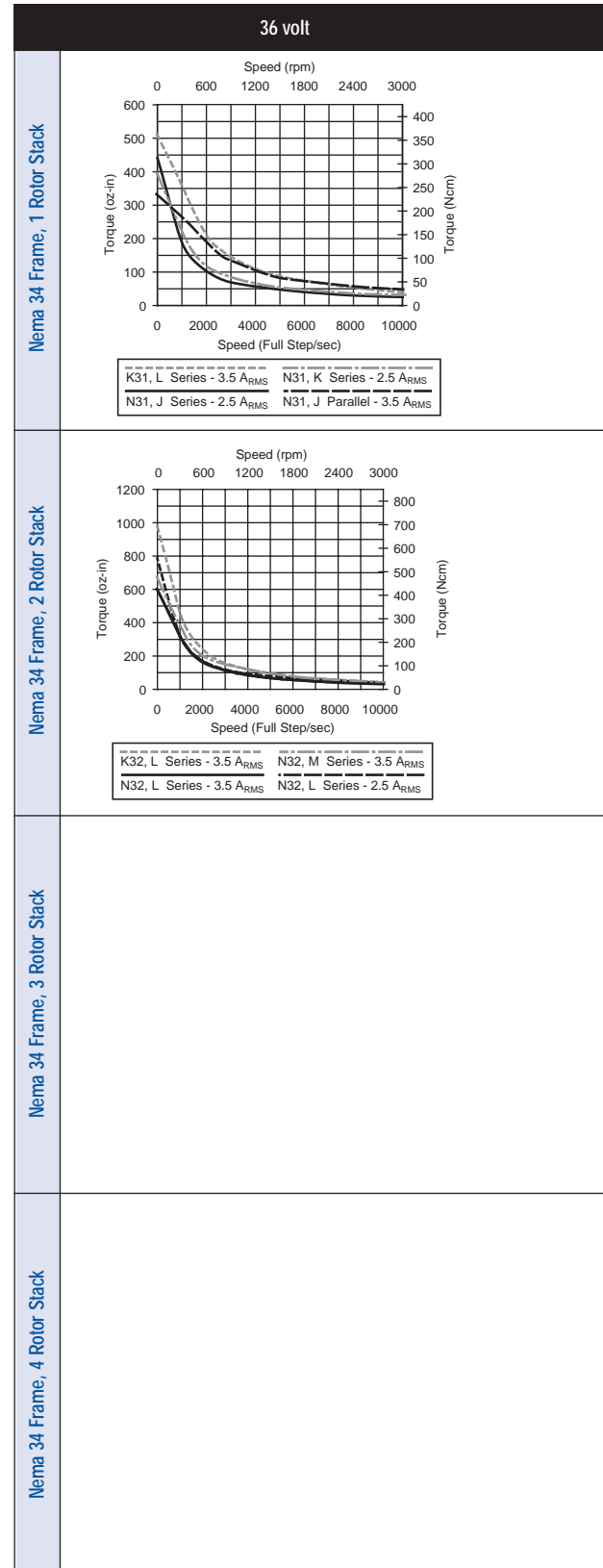
### NextStep® Microstepping Drives SEE PAGE 76

- 90-120 VAC input, 160 VDC bus. 240 V model available
- Step/direction input
- Current selectable from 0 to 7.9 amps, to 3.9 A for 240 V model
- 5,000 steps/rev to 50,000 steps/rev microstepping

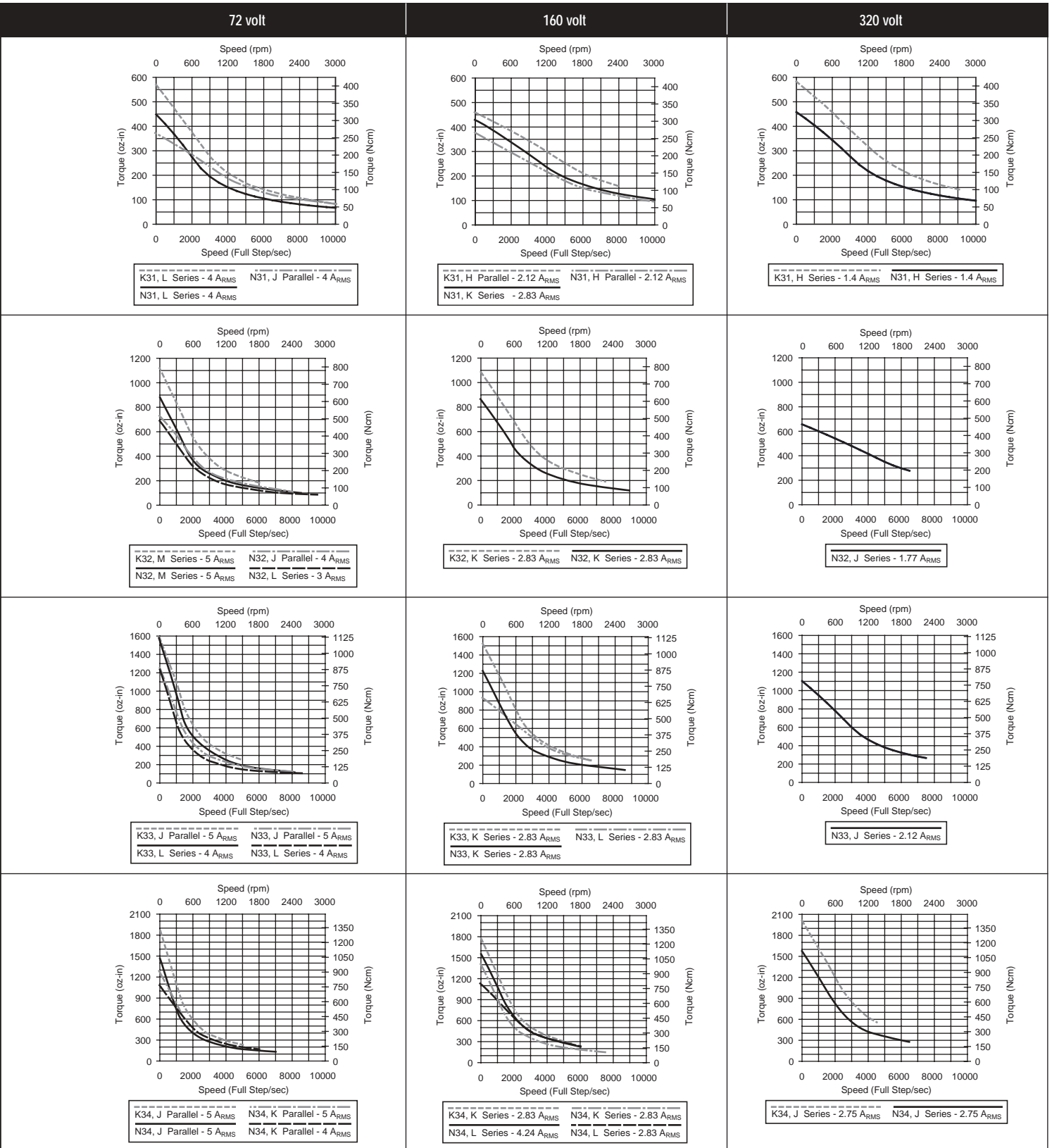


### SMARTSTEP Microstepping Drives SEE PAGE 77

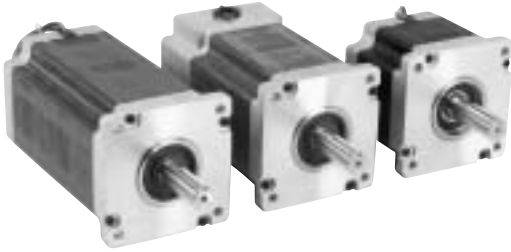
- 90-120 VAC input, 160 VDC bus. 240 V model available
- Programmable indexing
- Current selectable from 0 to 7.9 amps, to 3.9 A for 240 V model
- 36,000 steps/rev microstepping



# PACIFIC SCIENTIFIC N&K-SERIES NEMA 34 STEPPER SYSTEMS



# PACIFIC SCIENTIFIC N&K-SERIES NEMA 42 STEPPER SYSTEMS



The performance information shown in the torque/speed curves that follow show the N & K series of NEMA 42 step motors with windings, connections and current levels selected for maximum performance with the drives shown on this page. For additional assistance in sizing or selecting the stepper system appropriate for your application, contact Danaher Motion Customer Support at 815-226-2222.

## PACIFIC SCIENTIFIC N&K-SERIES NEMA 42 STEPPER SYSTEMS



### 6410/6415 Microstepping Drives SEE PAGE 72

- 24-75 VDC input
- Step/direction input or oscillator models
- Current selectable from 0.625 to 7.1 amps peak
- Selectable step sizes, binary or decimal, full to 1/250 or 1/256



### Impulse Microstepping Drives SEE PAGE 75

- 90-120 VAC input, 160 VDC bus
- Step/direction input
- Programmable inputs/outputs
- Current selectable from 0.75 to 4.0 amps
- Microstepping 200 to 100,000, selectable in increments of 200



### NextStep® Microstepping Drives SEE PAGE 76

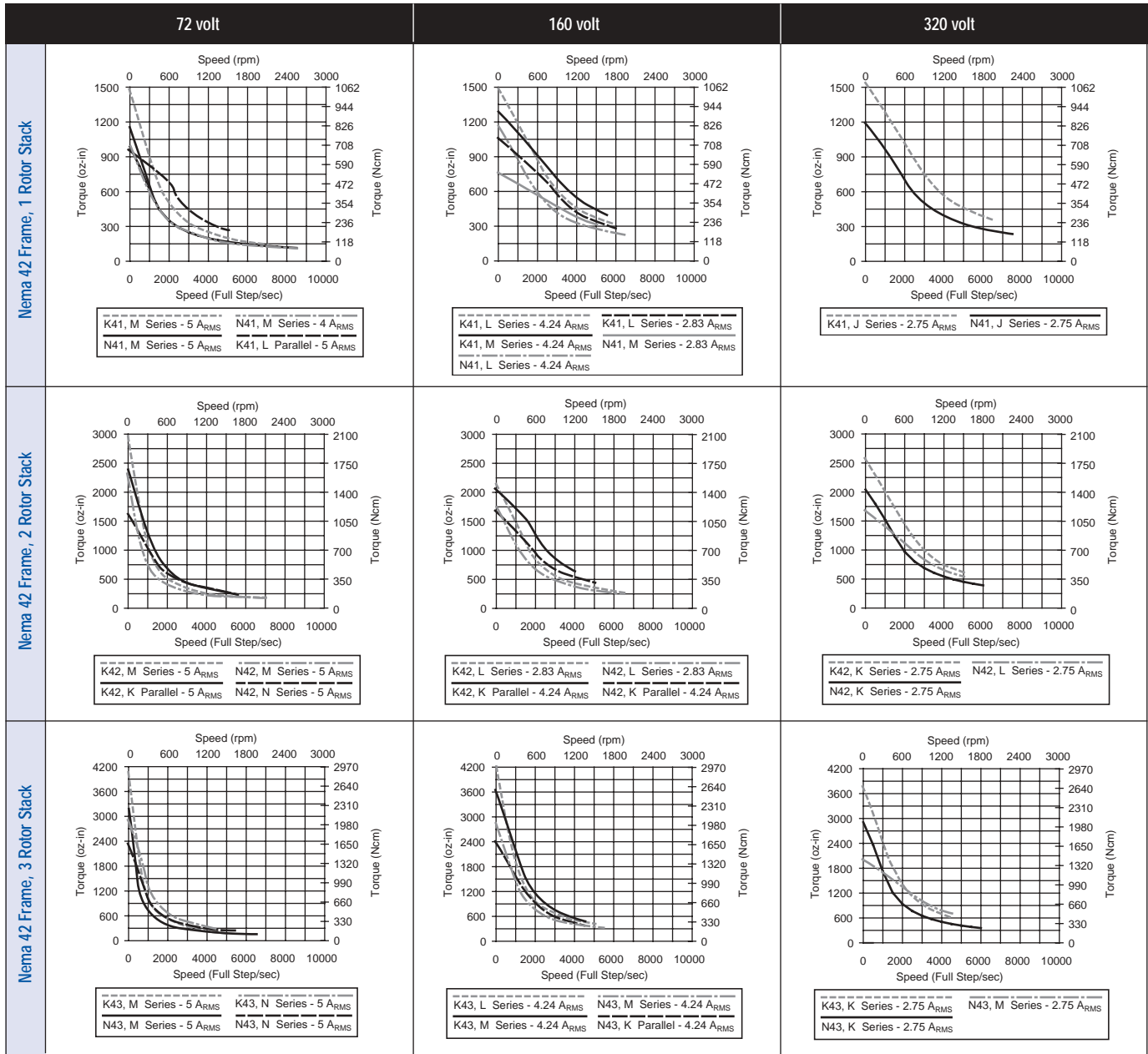
- 90-120 VAC input, 160 VDC bus. 240 V model available
- Step/direction input
- Current selectable from 0 to 7.9 amps, to 3.9 A for 240 V model
- 5,000 steps/rev to 50,000 steps/rev microstepping



### SMARTSTEP Microstepping Drives SEE PAGE 77

- 90-120 VAC input, 160 VDC bus. 240 V model available
- Programmable indexing
- Current selectable from 0 to 7.9 amps, to 3.9 A for 240 V model
- 36,000 steps/rev microstepping

# PACIFIC SCIENTIFIC N&K-SERIES NEMA 42 STEPPER SYSTEMS



## MOTIONEERING® CD-ROM

For more detailed product and selection information, see the MOTIONEERING CD-ROM inside the back cover of this catalog or visit our website at [www.DanaherMotion.com](http://www.DanaherMotion.com).