The example model number above indicates a N series standard NEMA 34 frame motor with a three stack rotor. This motor is equipped with a heavy duty front end bell and shaft, and a sealed system rear end bell with MS connectors. It also has a bipolar parallel connection, a J winding, a straight keyway, encoder mounting options and a shaft seal.

HOW TO ORDER
Review the Motor Model Number Code to assure that all options are designated. Call your nearest Pacific Scientific Motor Products Distributor to place orders and for application assistance. If you need to identify your Distributor, call the Motor Products Division at (815) 226-3100.
### NEMA 34 FRAME (3.38” Square)—Ratings and Characteristics

Review the Model Number Code, page 14, to assure that all options are designated. Connections, encoders and phasing diagrams start on page 34. Motor dimensions start on page 23. In addition to those below, motors with characteristics for specific performance requirements are offered. Contact factory for more details.

#### Motor Specifications

- **Motor (2 phases on) Phase Resistance Detent Resistance Inertia**
- **Rated Inductance**
- **Current/Phase Thermal Rotor**
- **Rated Inductance**
- **Parallel  Series  Unipolar**
- **Rated Current Phase (amps DC) Phase Resistance (ohms) (mH)**
- **Torque oz-in (Nm) (ohms) (mH)**
- **Temperature Rise (%) Typical**
- **Detent Torque (oz-in) (Nm)**
- **Thermal Resistance (°C/watt)**
- **Rotor Inertia (oz-in ² x 10⁵) (kgm ² x 10⁻³)**
- **Weight (lbs) (kg)**

#### Table of Values

<table>
<thead>
<tr>
<th>Motor Number</th>
<th>Connection</th>
<th>Holding Torque</th>
<th>Rated Current Phase</th>
<th>Phase Resistance</th>
<th>Phase Inductance</th>
<th>Detent Torque</th>
<th>Thermal Resistance</th>
<th>Rotor Inertia</th>
<th>Weight</th>
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<tr>
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<td>86</td>
<td>0.18</td>
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#### K Series - SIGMAX®

- **1 rotor stack**

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<th>Holding Torque</th>
<th>Rated Current Phase</th>
<th>Phase Resistance</th>
<th>Phase Inductance</th>
<th>Detent Torque</th>
<th>Thermal Resistance</th>
<th>Rotor Inertia</th>
<th>Weight</th>
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#### N Series - Standard

- **1 rotor stack**

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<th>Rated Current Phase</th>
<th>Phase Resistance</th>
<th>Phase Inductance</th>
<th>Detent Torque</th>
<th>Thermal Resistance</th>
<th>Rotor Inertia</th>
<th>Weight</th>
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<td>2.6</td>
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<td></td>
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<tr>
<td>00(14.44)</td>
<td>+</td>
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<td>00(14.44)</td>
<td>+</td>
<td>90(34.20)</td>
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<td>0.84</td>
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All ratings typical and at 25°C unless otherwise noted.

- Motor connections are determined by the Windings/Leads designation in the Model Number Code on page 14. Note that the F designation, although not shown in the above tables, is an F-led option—see Terminations, page 23. In addition to the lead wire termination, terminal board and MS connector hookup for parallel, series or unipolar operation is also available.
- With rated current applied. Windings at 130°C and motor unmounted and in still air at 40°C.
- Windings at 130°C and motor in still air at 40°C (without heat sink). Motors may be operated up to 2 times rated current to provide high peak torque with good torque linearity—duty cycle dependent, contact factory.
- Small signal inductance as measured with impedance bridge at 5kHz, 1 amp.
- Thermal resistance measured with motor hanging in still air (unmounted).
POWERPAC HYBRIDS

Also see:
- Torque and Acceleration Comparisons, p. 19
- Torque Linearity Curves, p. 20
- Performance Curves, p. 21-22

NEMA 34 FRAME (3.38" Square)—Ratings and Characteristics (Con’t)

Review the Model Number Code, page 14, to assure that all options are designated. Connections, encoders and phasing diagrams start on page 34. Motor dimensions start on page 23. In addition to those below, motors with characteristics for specific performance requirements are offered. Contact factory for more details.

### Torque and Acceleration Comparisons

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<th>Motor Model Number</th>
<th>Connection</th>
<th>Holding Torque</th>
<th>Rated Current/Phase</th>
<th>Phase Resistance</th>
<th>Phase Inductance</th>
<th>Detent Torque</th>
<th>Thermal Resistance</th>
<th>Rotor Inertia</th>
<th>Weight</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>(2 phases on) oz-in (Nm)</td>
<td>(amps DC)</td>
<td>(ohms)</td>
<td>(mH)</td>
<td>oz-in-S</td>
<td>°C/Watt</td>
<td>kgm² x 10⁻³</td>
<td>lbs (kg)</td>
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<tr>
<td>K Series - SIGMAX® 2 rotor stacks</td>
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<td>1500(10.69)</td>
<td>10</td>
<td>0.18</td>
<td>1.4</td>
<td>1195</td>
<td>1245</td>
<td>1215</td>
<td>1200</td>
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<td></td>
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<td>1500(10.69)</td>
<td>10</td>
<td>0.18</td>
<td>1.4</td>
<td>1195</td>
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<td>1215</td>
<td>1200</td>
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Motor connections are determined by the Windings/Ledas designation in the Model Number Code on page 14. Note that the F designation, although not shown in the above tables, is an 8-lead option...see Terminations, page 34. In addition to the 2-lead option, see Terminations, page 26. In addition to the lead wire termination, terminal board and MS connector hookup for parallel, series or unipolar operation is also available.

**With rated current applied.** Windings at 130°C and motor unmounted and in still air at 40°C.

**Windings at 130°C and motor in still air at 40°C (without heat sink).** Motors may be operated up to 2 times rated current to provide high peak torque with good torque linearity - duty cycle dependent, contact factory.

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

**Thermal resistance measured with motor hanging in still air (unmounted).**
### NEMA 34 FRAME (3.38” Square)—Ratings and Characteristics (Con’t)

Review the Model Number Code, page 14, to assure that all options are designated. Connections, encoders and phasing diagrams start on page 34. Motor dimensions start on page 23. In addition to those below, motors with characteristics for specific performance requirements are offered. Contact factory for more details.

#### Motor Specifications

**K Series - SIGMA² 3 rotor stacks**

<table>
<thead>
<tr>
<th>Motor Model Number</th>
<th>Motor (2 phases on) Phase Resistance Detent Resistance Inertia (o C/watt) Rated Inductance (kgm ² x 10⁻³)</th>
<th>Parallel</th>
<th>Series</th>
<th>Holding Torque (amps DC)</th>
<th>Rated Current Phase (amps DC)</th>
<th>Phase Inductance Typical</th>
<th>Torque Linearity Curves, p. 20</th>
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<tbody>
<tr>
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<td>1715(12.10)</td>
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<td>1.7</td>
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<tr>
<td>K2HH0-HL-L00-XX-XX</td>
<td></td>
<td>1715(12.10)</td>
<td>3.9</td>
<td>0.22</td>
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<td>1.7</td>
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<tr>
<td>K2HH0-HL-L00-XX-XX</td>
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<td>1215(8.58)</td>
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<tr>
<td>K2HH0-HL-L00-XX-XX</td>
<td></td>
<td>1845(13.02)</td>
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<td>0.26</td>
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<tr>
<td>K2HH0-HL-L00-XX-XX</td>
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<tr>
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<td>1305(9.21)</td>
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<td>0.56</td>
<td>6.4</td>
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<td>1210(8.54)</td>
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**N Series - Standard 3 rotor stacks**

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<thead>
<tr>
<th>Motor Model Number</th>
<th>Motor (2 phases on) Phase Resistance Detent Resistance Inertia (o C/watt) Rated Inductance (kgm ² x 10⁻³)</th>
<th>Parallel</th>
<th>Series</th>
<th>Holding Torque (amps DC)</th>
<th>Rated Current Phase (amps DC)</th>
<th>Phase Inductance Typical</th>
<th>Torque Linearity Curves, p. 20</th>
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</thead>
<tbody>
<tr>
<td>N2HH0-HL-L00-XX-XX</td>
<td></td>
<td>1715(12.10)</td>
<td>3.9</td>
<td>0.22</td>
<td>9</td>
<td>1.7</td>
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<tr>
<td>N2HH0-HL-L00-XX-XX</td>
<td></td>
<td>1715(12.10)</td>
<td>3.9</td>
<td>0.22</td>
<td>9</td>
<td>1.7</td>
<td></td>
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<tr>
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<td>1215(8.58)</td>
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<tr>
<td>N2HH0-HL-L00-XX-XX</td>
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<td>1845(13.02)</td>
<td>9</td>
<td>0.26</td>
<td>3.4</td>
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<tr>
<td>N2HH0-HL-L00-XX-XX</td>
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<td>1845(13.02)</td>
<td>4.5</td>
<td>1.06</td>
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<tr>
<td>N2HH0-HL-L00-XX-XX</td>
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<td>N2HH0-HL-L00-XX-XX</td>
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<td>6.1</td>
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<tr>
<td>N2HH0-HL-L00-XX-XX</td>
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<td>N2HH0-HL-L00-XX-XX</td>
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<tr>
<td>N2HH0-HL-L00-XX-XX</td>
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<td>1210(8.54)</td>
<td>3.5</td>
<td>1.65</td>
<td>9</td>
<td></td>
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</tr>
</tbody>
</table>

All ratings typical at 25°C unless otherwise noted.


Motor connections are determined by the Windings/Leads designation in the Model Number Code on page 14. Note that the F designation, although not shown in the above tables, is an 8-lead option...see Terminations, page 34. In addition to the lead wire termination, terminal board and MS connector hookup for parallel, series or unipolar operation is also available.

With rated current applied. Windings at 130°C and motor unmounted and in still air at 40°C.

Windings at 130°C and motor in still air at 40°C (without heat sink). Motors may be operated up to 2 times rated current to provide high peak torque with good torque linearity - duty cycle dependant, contact factory.

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

Thermal resistance measured with motor hanging in still air (unmounted).
**POWERPAC HYBRIDS**

Also see:
- Torque and Acceleration Comparisons, p. 19
- Torque Linearity Curves, p. 20
- Performance Curves, p. 21-22

**NEMA 34 FRAME (3.38" Square)—Ratings and Characteristics (Con’t)**

Review the Model Number Code, page 14, to assure that all options are designated. Connections, encoders and phasing diagrams start on page 34. Motor dimensions start on page 23. In addition to those below, motors with characteristics for specific performance requirements are offered. Contact factory for more details.

---

### Motor (2 phases on) Phase Resistance Detent Resistance Inertia

<table>
<thead>
<tr>
<th>Connection</th>
<th>Holding Torque (2 phases on) (Nm)</th>
<th>Rated Current/Phase (amps DC)</th>
<th>Phase Resistance (ohms)</th>
<th>Phase Inductance (mH)</th>
<th>Torque (Nm) Typical</th>
<th>Detent Torque (oz-in)</th>
<th>Thermal Resistance (°C/watt)</th>
<th>Rotor Inertia (kgm² x 10⁻³)</th>
<th>Weight (lbs)</th>
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<td><strong>SIGMAX®</strong> 4 rotor stacks</td>
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<tr>
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<td>0.64</td>
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<td><strong>N Series</strong></td>
<td><strong>Standard</strong> 4 rotor stacks</td>
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<td>0.41</td>
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<td>N4H00HL-LXX-XX-XX</td>
<td>2180 (15.39)</td>
<td>8.7</td>
<td>0.33</td>
<td>4.7</td>
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<td>4.4</td>
<td>1.32</td>
<td>18.8</td>
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<td>N4H00EL-LXX-XX-XX</td>
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<td>6.2</td>
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<td>8.1</td>
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<tr>
<td>N4H00LJ-LXX-XX-XX</td>
<td>2030 (14.26)</td>
<td>3</td>
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<tr>
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<td>1440 (10.16)</td>
<td>4.3</td>
<td>1.35</td>
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<td>N4H00HJ-LXX-XX-XX</td>
<td>2170 (15.32)</td>
<td>5.5</td>
<td>0.8</td>
<td>11.5</td>
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<tr>
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<td>2.8</td>
<td>3.19</td>
<td>45.9</td>
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<tr>
<td>N4H00EJ-LXX-XX-XX</td>
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<td>3.9</td>
<td>1.6</td>
<td>11.5</td>
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All ratings typical and at 25°C unless otherwise noted.

- Motor connections are determined by the Windings/Leads designation in the Model Number Code on page 14. Note that the F designation, although not shown in the above tables, is an 8-lead option...see Terminations, page 34. In addition to the F designation, although not shown in the above tables, is an undefined option. Colored letter indicates winding. See Model Number Code on page 14.

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**With rated current applied. Windings at 130°C and motor unmounted and in still air at 40°C.**

**Windings at 130°C and motor in still air at 40°C (without heat sink). Motors may be operated up to 2 times rated current to provide high peak torque with good torque linearity - duty cycle dependent, contact factory.**

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

**Thermal resistance measured with motor hanging in still air (unmounted).**
A significant POWERPAC performance attribute is that when a current higher than rated current is applied, the increase in torque will be more linear than other hybrids. Furthermore, current levels increasingly higher than rated current are less likely to cause demagnetization. Capitalize on this performance characteristic which will provide an acceleration boost to move loads even faster. This technique is applicable to intermittent duty applications in that the thermal limit of the motor cannot be exceeded. Driving the motor at higher than rated current is duty cycle dependent. Contact the factory for application assistance.

These curves show the torque at rated current and the torque linearity up to two times rated current.
POWERPAC HYBRIDS

NEMA 34 FRAME (3.38" Square)—Performance

Motors will perform continuously as shown without the winding temperature exceeding 130°C when the motor is operated (without heat sink) in an ambient temperature of up to 40°C. The curves do not reflect system resonance points, which will vary with motor coupling and system parameters.

NEMA 34 FRAME – ONE ROTOR STACK

5A per phase; K31* and N31*
J winding, parallel connection, See Ratings and Characteristics, p. 15.

NEMA 34 FRAME – TWO ROTOR STACKS

5A per phase; K32* and N32*
J winding, parallel connection, See Ratings and Characteristics, p. 16.

*See Model Number Code on page 14 for clarification.
POWERPAC HYBRIDS

NEMA 34 FRAME (3.38" Square)—Performance

Motors will perform continuously as shown without the winding temperature exceeding 130°C when the motor is operated (without heat sink) in an ambient temperature of up to 40°C. The curves do not reflect system resonance points, which will vary with motor coupling and system parameters.

NEMA 34 FRAME – THREE ROTOR STACKS

5A per phase; K33* and N33*

J winding, parallel connection, See Ratings and Characteristics, p. 17.

NEMA 34 FRAME – FOUR ROTOR STACKS

5A per phase; K34* and N34*

J winding, parallel connection, See Ratings and Characteristics, p. 18.

*See Model Number Code on page 14 for clarification.
NEMA 34 FRAME: All motors have a heavy duty NEMA front end bell and large diameter shaft to support the higher output torques.

LEADWIRE HOOKUP - ENCODER OPTIONS

LEADWIRE HOOKUP
DOUBLE SHAFT CONFIGURATION

LEADWIRE HOOKUP
ENCODER MOUNTING PROVISION
DIMENSIONS...POWERPAC HYBRIDS

mm

NEMA 34 FRAME: All motors have a heavy duty NEMA front end bell and large diameter shaft to support the higher output torques.

SPLASHPROOF CONSTRUCTION/TERMINAL BOARD CONNECTIONS
(via English or Metric thread for conduit) Model Number Code designation L or M (Construction/Hookup), p 14.

SPLASHPROOF CONSTRUCTION/MS CONNECTOR(S)— ENCODER OPTION
Model Number Code designation C/System (Construction/Hookup) and Encoder Mounting Option, p 14.

NOTES:

Δ L Construction = Conduit connection (1/2 NPSIC TAP) with 0.010 I.D. removable insulating bushing

M Construction = Conduit connection (PG 11 TAP) (No insulating bushing supplied)

MOTOR D K T X L MAX
.5000 .1250 .555 3.70 4.44
31 HL 12,700 3,175 14,097 93,98 112,78
.5000 .1250 .555 5.22 5.96
32 HL 12,700 3,175 14,097 132,59 151,38
.6250 .1875 .705 6.74 7.48
33 HL 15,875 4,763 17,907 171,20 189,99
.6250 .1875 .705 8.25 8.99
34 HL 15,875 4,763 17,907 209,55 228,35

* See Model Number Code, p 14.
New POWERPAC rugged NEMA 34 and 42 frame hybrid step motors provide the highest holding torques per frame size in the industry. Optimal magnetics in a "housingless" frame combine with a large diameter rotor and new rotor/stator design to produce more torque and provide high acceleration capabilities. This unique design also features low detent torque for smoother microstepping. In addition, POWERPAC runs cooler than comparable size step motors.

### N and K Series

POWERPAC is available in two different designs; the N and K Series. Both provide exceptionally high holding torques. In addition, both have high torque-to-inertia ratios and therefore high acceleration capabilities. The K Series incorporates our patented Sigmax® flux focusing technology and provides 25% more torque than the N Series plus even higher acceleration performance!

POWERPAC hybrid steppers meet demanding motion requirements, making them cost effective alternatives to servo motors in applications with moderate speed requirements.

### Options

Combinations of standard options are routinely provided to customize the motor for your specific requirements. For termination, select from terminal board connections (via conduit - sealed construction), MS connectors (sealed construction) or flying leads. Rear shaft extensions include one with end bell mounting provisions for a user installed encoder. Factory mounted encoders are installed inside the rear end bell in a sealed construction...or outside, mounted to the rear end bell. Front shaft modifications may be specified. A configuration such as an integral spline is furnished as a special option. Bipolar or unipolar phase sequencing is readily available. In addition to the standard selection of windings, special windings are also provided. Just call us!
Sizing and Selection

Our OPTIMIZER™ Version 3.0 for Windows is a powerful motor sizing and selection software program. It provides a simple, time-saving method to specify the best POWERPAC motor for your specific requirements. Contact your Pacific Scientific distributor for a copy or visit us on the web at www.pacsci.com.

**FEATURES**

- Improved torque linearity (above rated current) provides high peak torque capability (duty cycle dependent, contact factory).
- High torque at moderate speeds
- Low detect torque harmonic
- K Series uses patented Sigmax® 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
- Optional encoder mounting provisions
- Optimizes control scheme

---

**MORE POWER IN A SMALLER PACKAGE - POWERPAC**

**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.

**Benefits:**

- Rare earth rotor magnets provide high demagnetization resistance
- Sigmax® technology in K Series adds flux concentrating rare earth stator magnets for even higher torque and acceleration than N series
- NEMA connector termination for motor and optical encoder. Flying leads and terminal board via conduit termination also standard
- 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
- Optional encoder mounting provisions
- Optimizes control scheme

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**Specifications:**

- Standard NEMA mounting
- Optional shaft sizes and special designs (options, for example available)
- Long life bearings withstand high radial and axial forces
- Large diameter rotor coupled with optimum magnetic design produces highest torque and acceleration—fully NEMA, fully K series.