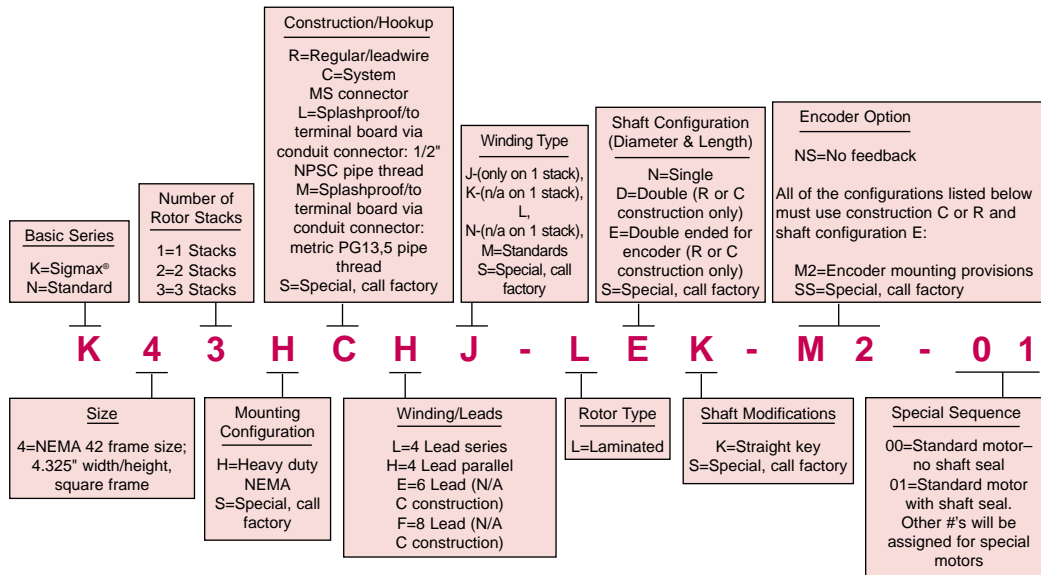


POWERPAC™ HYBRIDS

NEMA 42 Frame (4.325" Square)

MODEL NUMBER CODE



The example model number above indicates a K series (Sigmax®) NEMA 42 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, a shaft seal and encoder mounting provisions.

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.

POWERPAC HYBRIDS

Also see:

- Torque and Acceleration Comparisons, p. 19, 29
- Torque Linearity, p. 29
- Performance Curves, p. 30-31

NEMA 42 FRAME (4.325" Square)—Ratings and Characteristics

Review the Model Number Code, page 25, to assure that all options are designated. Connections, encoders and phasing diagrams start on page 34. Motor dimensions start on page 32. In addition to those below, motors with characteristics for specific performance requirements are offered. Contact factory for more details.

| Rated currents are in descending order | Motor Model Number Δ | Connection Δ | | Holding Torque Δ (2 phases on) oz-in (Nm) $\pm 10\%$ | Rated Current/Phase Δ (amps DC) | Phase Resistance (ohms) $\pm 10\%$ | Phase Inductance Δ (mH) Typical | Detent Torque oz-in (Nm) | Thermal Resistance Δ (°C/watt) | Rotor Inertia oz-in-S ² (kgm ² x 10 ⁻³) | Weight lbs (kg) |
|---|-----------------------------|---------------------|----------|--|---|------------------------------------|---|--------------------------|--|---|-----------------|
| | | Parallel Series | Unipolar | | | | | | | | |
| Torque range: 1480-2135 oz-in. 92.5-133.4 lb-in. 10.45-15.07 Nm | K41HXHM-LXK-XX-XX | • | | 2135(15.07) | 10.7 | 0.16 | 2.2 | ↑ | ↑ | ↑ | ↑ |
| | K41HXL M-LXK-XX-XX | • | | 2135(15.07) | 5.3 | 0.63 | 8.7 | | | | |
| | K41HXEM-LXK-XX-XX | | • | 1510(10.66) | 7.5 | 0.31 | 2.2 | | | | |
| K Series - SIGMAX® 1 rotor stack | K41HXHL-LXK-XX-XX | • | | 2090(14.75) | 8.7 | 0.23 | 3.1 | 65 (0.46) | 1.9 | 0.0783 (0.55) | 11 (4.98) |
| | K41HXLL-LXK-XX-XX | • | | 2090(14.75) | 4.4 | 0.93 | 12.3 | | | | |
| | K41HXEL-LXK-XX-XX | | • | 1480(10.45) | 6.2 | 0.47 | 3.1 | | | | |
| | K41HXHJ-LXK-XX-XX | • | | 2095(14.79) | 5.5 | 0.58 | 7.8 | | | | |
| | K41HXLJ-LXK-XX-XX | • | | 2095(14.79) | 2.7 | 2.33 | 31.4 | | | | |
| | K41HXEJ-LXK-XX-XX | | • | 1480(10.45) | 3.9 | 1.16 | 7.8 | | | | |
| Torque range: 1150-1655 oz-in. 78.1-103.4 lb-in. 8.12-11.68 Nm | N41HXHM-LXK-XX-XX | • | | 1655(11.68) | 10.7 | 0.16 | 2.8 | ↑ | ↑ | ↑ | ↑ |
| | N41HXL M-LXK-XX-XX | • | | 1655(11.68) | 5.3 | 0.63 | 11.1 | | | | |
| | N41HXEM-LXK-XX-XX | | • | 1170(8.26) | 7.5 | 0.31 | 2.8 | | | | |
| N Series - Standard 1 rotor stack | N41HXHL-LXK-XX-XX | • | | 1625(11.47) | 8.7 | 0.23 | 3.9 | 42 (0.30) | 1.9 | 0.0783 (0.55) | 11 (4.98) |
| | N41HXLL-LXK-XX-XX | • | | 1625(11.47) | 4.4 | 0.93 | 15.8 | | | | |
| | N41HXEL-LXK-XX-XX | | • | 1150(8.12) | 6.2 | 0.47 | 3.9 | | | | |
| | N41HXHJ-LXK-XX-XX | • | | 1630(11.50) | 5.5 | 0.58 | 10.1 | | | | |
| | N41HXLJ-LXK-XX-XX | • | | 1630(11.50) | 2.7 | 2.33 | 40.4 | | | | |
| | N41HXEJ-LXK-XX-XX | | • | 1150(8.12) | 3.9 | 1.16 | 10.1 | | | | |

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

Δ An "X" in the Model Number Code indicates an undefined option. Colored letter indicates winding. See Model Number Code on page 25.

Δ Motor connections are determined by the Windings/Leads designation in the Model Number Code on page 25. 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.

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

Δ 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.**

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

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

POWERPAC HYBRIDS

Also see:

- Torque and Acceleration Comparisons, p. 19, 29
- Torque Linearity, p. 29
- Performance Curves, p. 30-31

NEMA 42 FRAME (4.325" Square)—Ratings and Characteristics (Con't)

Review the Model Number Code, page 25, to assure that all options are designated. Connections, encoders and phasing diagrams start on page 34. Motor dimensions start on page 32. In addition to those below, motors with characteristics for specific performance requirements are offered. Contact factory for more details.

| Rated currents are in descending order | Motor Model Number Δ | Connection Δ | | | Holding Torque Δ (2 phases on) oz-in (Nm) $\pm 10\%$ | Rated Current/Phase Δ (amps DC) | Phase Resistance (ohms) $\pm 10\%$ | Phase Inductance Δ (mH) Typical | Detent Torque oz-in (Nm) | Thermal Resistance Δ (°C/watt) | Rotor Inertia oz-in-S ² (kgm ² x 10 ⁻³) | Weight lbs (kg) |
|--|-----------------------------|---------------------|--------|----------|--|---|------------------------------------|---|--------------------------|--|---|-----------------|
| | | Parallel | Series | Unipolar | | | | | | | | |
| Torque range: 2785-4025 oz-in. 174.0-251.5 lb-in. 19.66-28.41 Nm | K42HXHN-LXK-XX-XX | • | | | 4000(28.23) | 15.8 | 0.1 | 1.6 | ↑ | ↑ | ↑ | ↑ |
| | K42HXLN-LXK-XX-XX | • | | | 4000(28.23) | 7.9 | 0.41 | 6.5 | | | | |
| | K42HXEN-LXK-XX-XX | | • | | 2830(19.97) | 11.2 | 0.21 | 1.6 | | | | |
| K Series - SIGMAX® 2 rotor stacks | K42HXHM-LXK-XX-XX | • | | | 4025(28.41) | 9.9 | 0.25 | 4.2 | 126 (0.89) | 1.3 | 0.1546 (1.09) | 18.4 (8.34) |
| | K42HXLN-LXK-XX-XX | • | | | 4025(28.41) | 4.9 | 1.02 | 16.9 | | | | |
| | K42HXEM-LXK-XX-XX | | • | | 2845(20.08) | 7 | 0.51 | 4.2 | | | | |
| | K42HXHL-LXK-XX-XX | • | | | 3935(27.77) | 8.1 | 0.38 | 6 | | | | |
| | K42HXLN-LXK-XX-XX | • | | | 3935(27.77) | 4 | 1.51 | 23.9 | | | | |
| | K42HXEL-LXK-XX-XX | | • | | 2785(19.66) | 5.7 | 0.75 | 6 | | | | |
| N Series - Standard 2 rotor stacks | K42HXHK-LXK-XX-XX | • | | | 3965(27.99) | 6.4 | 0.6 | 9.8 | ↓ | ↓ | ↓ | ↓ |
| | K42HXLK-LXK-XX-XX | • | | | 3965(27.99) | 3.2 | 2.41 | 39.2 | | | | |
| | K42HXEK-LXK-XX-XX | | • | | 2805(19.80) | 4.5 | 1.2 | 9.8 | | | | |
| | N42HXHN-LXK-XX-XX | • | | | 3130(22.09) | 15.8 | 0.1 | 2.1 | | | | |
| | N42HXLN-LXK-XX-XX | • | | | 3130(22.09) | 7.9 | 0.41 | 8.4 | | | | |
| | N42HXEN-LXK-XX-XX | | • | | 2215(15.63) | 11.2 | 0.21 | 2.1 | | | | |
| N Series - Standard 2 rotor stacks | N42HXHM-LXK-XX-XX | • | | | 3145(22.20) | 9.9 | 0.25 | 5.5 | 84 (0.59) | 1.3 | 0.1546 (1.09) | 18.4 (8.34) |
| | N42HXLN-LXK-XX-XX | • | | | 3145(22.20) | 4.9 | 1.02 | 22 | | | | |
| | N42HXEM-LXK-XX-XX | | • | | 2225(15.70) | 7 | 0.51 | 5.5 | | | | |
| | N42HXHL-LXK-XX-XX | • | | | 3085(21.77) | 8.1 | 0.38 | 7.8 | | | | |
| | N42HXLN-LXK-XX-XX | • | | | 3085(21.77) | 4 | 1.51 | 31.2 | | | | |
| | N42HXEL-LXK-XX-XX | | • | | 2185(15.42) | 5.7 | 0.75 | 7.8 | | | | |
| | N42HXHK-LXK-XX-XX | • | | | 3105(21.92) | 6.4 | 0.6 | 12.8 | ↓ | ↓ | ↓ | ↓ |
| | N42HXLK-LXK-XX-XX | • | | | 3105(21.92) | 3.2 | 2.41 | 51.1 | | | | |
| | N42HXEK-LXK-XX-XX | | • | | 2200(15.53) | 4.5 | 1.2 | 12.8 | | | | |

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

- Δ An "X" in the Model Number Code indicates an undefined option. Colored letter indicates winding. See Model Number Code on page 25.
- Δ Motor connections are determined by the Windings/Leads designation in the Model Number Code on page 25. 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.

- Δ With rated current applied. Windings at 130°C and motor unmounted and in still air at 40°C.
- Δ 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.**
- Δ Small signal inductance as measured with impedance bridge at 1kHz, 1 amp.
- Δ Thermal resistance measured with motor hanging in still air (unmounted).

POWERPAC HYBRIDS

Also see:

- Torque and Acceleration Comparisons, p. 19, 29
- Torque Linearity, p. 29
- Performance Curves, p. 30-31

NEMA 42 FRAME (4.325" Square)—Ratings and Characteristics (Con't)

Review the Model Number Code, page 25, to assure that all options are designated. Connections, encoders and phasing diagrams start on page 34. Motor dimensions start on page 32. In addition to those below, motors with characteristics for specific performance requirements are offered. Contact factory for more details.

| Rated currents are in descending order | Motor Model Number Δ | Connection Δ | | | Holding Torque Δ (2 phases on) oz-in (Nm) $\pm 10\%$ | Rated Current/Phase Δ (amps DC) | Phase Resistance (ohms) $\pm 10\%$ | Phase Inductance Δ (mH) Typical | Detent Torque oz-in (Nm) | Thermal Resistance Δ (°C/watt) | Rotor Inertia oz-in-S ² (kgm ² x 10 ⁻³) | Weight lbs (kg) |
|--|--|---------------------|--------|----------|--|---|------------------------------------|---|--------------------------|--|---|-----------------|
| | | Parallel | Series | Unipolar | | | | | | | | |
| Torque range: 3910-5700 oz-in. 244.3-356.0 lb-in. 27.60-40.23 Nm | K43HXHN-LXK-XX-XX | • | | | 5700(40.23) | 15.4 | 0.14 | 2.5 | ↑ | ↑ | ↑ | ↑ |
| | K43HXLN-LXK-XX-XX | • | | | 5700(40.23) | 7.7 | 0.55 | 10 | | | | |
| | K43HXEN-LXK-XX-XX | • | | | 4030(28.44) | 10.9 | 0.28 | 2.5 | | | | |
| K Series - SIGMAX® 3 rotor stacks | K43HXHM-LXK-XX-XX | • | | | 5630(39.74) | 9.9 | 0.33 | 5.9 | | | | |
| | K43HXLN-LXK-XX-XX | • | | | 5630(39.74) | 4.9 | 1.32 | 23.7 | | | | |
| | K43HXEM-LXK-XX-XX | • | | | 3985(28.13) | 7 | 0.66 | 5.9 | | | | |
| | K43HXHL-LXK-XX-XX | • | | | 5530(39.03) | 8 | 0.5 | 8.5 | | | | |
| | K43HXLN-LXK-XX-XX | • | | | 5530(39.03) | 4 | 1.98 | 34.1 | | | | |
| | K43HXEL-LXK-XX-XX | • | | | 3910(27.60) | 5.7 | 0.99 | 8.5 | | | | |
| K Series - Standard 3 rotor stacks | K43HXHK-LXK-XX-XX | • | | | 5655(39.91) | 6.2 | 0.82 | 15.2 | | | | |
| | K43HXLN-LXK-XX-XX | • | | | 5655(39.91) | 3.1 | 3.29 | 60.7 | | | | |
| | K43HXEK-LXK-XX-XX | • | | | 4000(28.23) | 4.4 | 1.65 | 15.2 | | | | |
| | Torque range: 3010-4365 oz-in. 188.1-272.8 lb-in. 21.24-30.81 Nm | N43HXHN-LXK-XX-XX | • | | | 4365(30.81) | 15.4 | 0.14 | 3.2 | | | |
| | | N43HXLN-LXK-XX-XX | • | | | 4365(30.81) | 7.7 | 0.55 | 13 | | | |
| | | N43HXEN-LXK-XX-XX | • | | | 3090(21.81) | 10.9 | 0.28 | 3.2 | | | |
| N Series - Standard 3 rotor stacks | N43HXHM-LXK-XX-XX | • | | | 4320(30.49) | 9.9 | 0.33 | 7.7 | | | | |
| | N43HXLN-LXK-XX-XX | • | | | 4320(30.49) | 4.9 | 1.32 | 30.7 | | | | |
| | N43HXEM-LXK-XX-XX | • | | | 3055(21.56) | 7 | 0.66 | 7.7 | | | | |
| | N43HXHL-LXK-XX-XX | • | | | 4250(30.00) | 8 | 0.5 | 11 | | | | |
| | N43HXLN-LXK-XX-XX | • | | | 4250(30.00) | 4 | 1.98 | 44.2 | | | | |
| | N43HXEL-LXK-XX-XX | • | | | 3010(21.24) | 5.7 | 0.99 | 11 | | | | |
| N Series - Standard 3 rotor stacks | N43HXHK-LXK-XX-XX | • | | | 4340(30.63) | 6.2 | 0.82 | 19.6 | | | | |
| | N43HXLN-LXK-XX-XX | • | | | 4340(30.63) | 3.1 | 3.29 | 78.5 | | | | |
| | N43HXEK-LXK-XX-XX | • | | | 3070(21.67) | 4.4 | 1.65 | 19.6 | | | | |

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

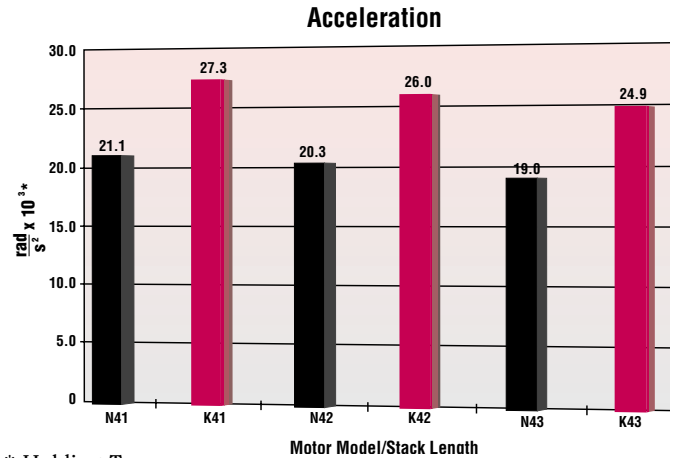
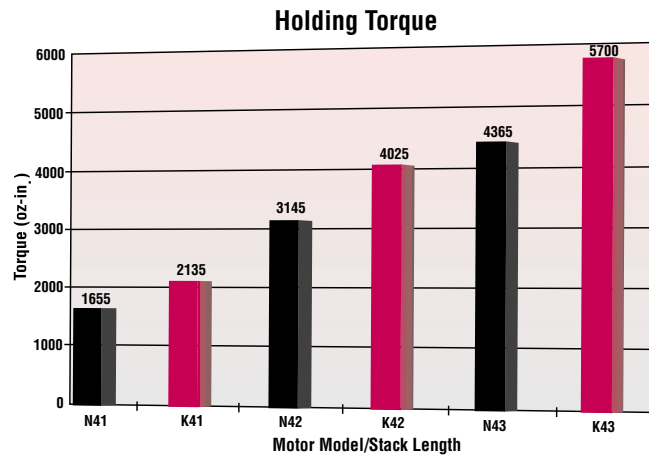
- Δ An "X" in the Model Number Code indicates an undefined option. Colored letter indicates winding. See Model Number Code on page 25.
- Δ Motor connections are determined by the Windings/Leads designation in the Model Number Code on page 25. Note that the F designation, although not shown in the above 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.

- Δ With rated current applied. Windings at 130°C and motor unmounted and in still air at 40°C.
- Δ 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.**
- Δ Small signal inductance as measured with impedance bridge at 1kHz, 1 amp.
- Δ Thermal resistance measured with motor hanging in still air (unmounted).

POWERPAC HYBRIDS

NEMA 42 FRAME (4.325" Square)—Torque and Acceleration Comparisons

For comparison with size 34 motor, see page 19.

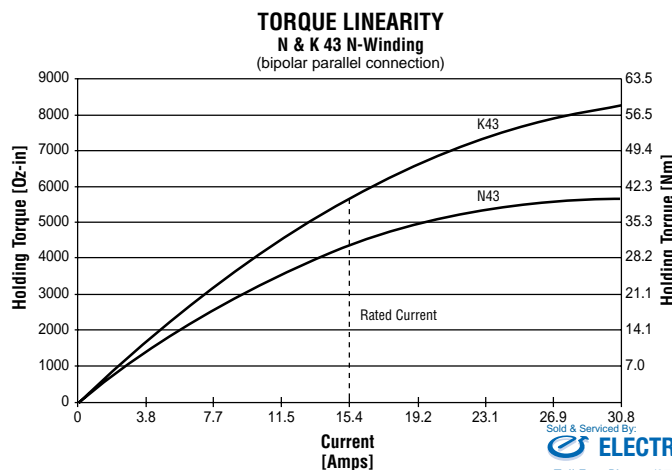
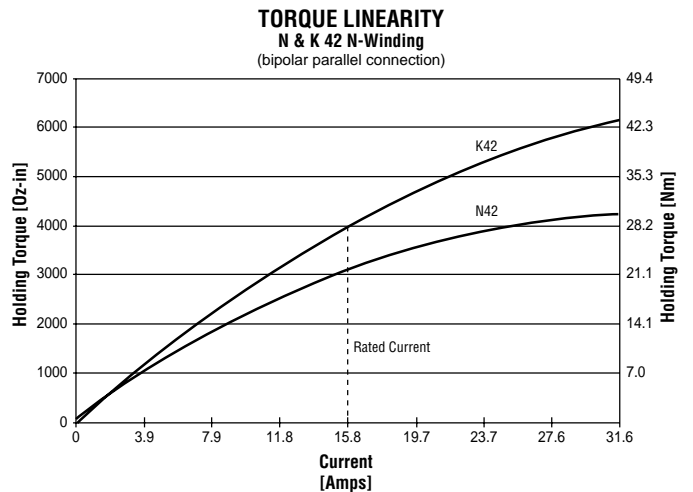
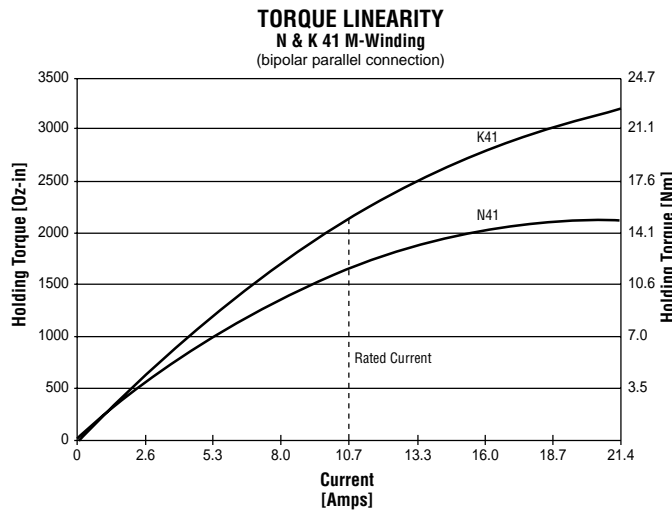


* $\frac{\text{Holding Torque}}{\text{Rotor Inertia}}$...a figure of merit for acceleration capability

NEMA 42 FRAME (4.325" Square)—Torque Linearity

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

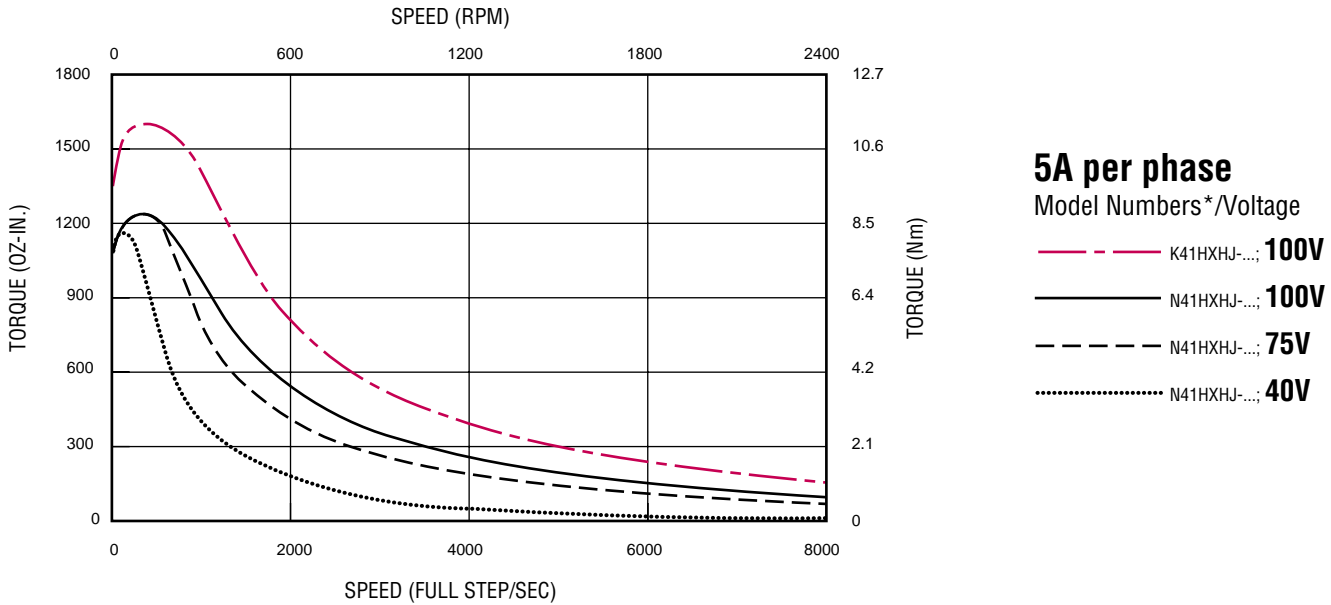
NEMA 42 FRAME (4.325" Square)—Performance

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 42 FRAME – ONE ROTOR STACK

5A per phase; K41* and N41*

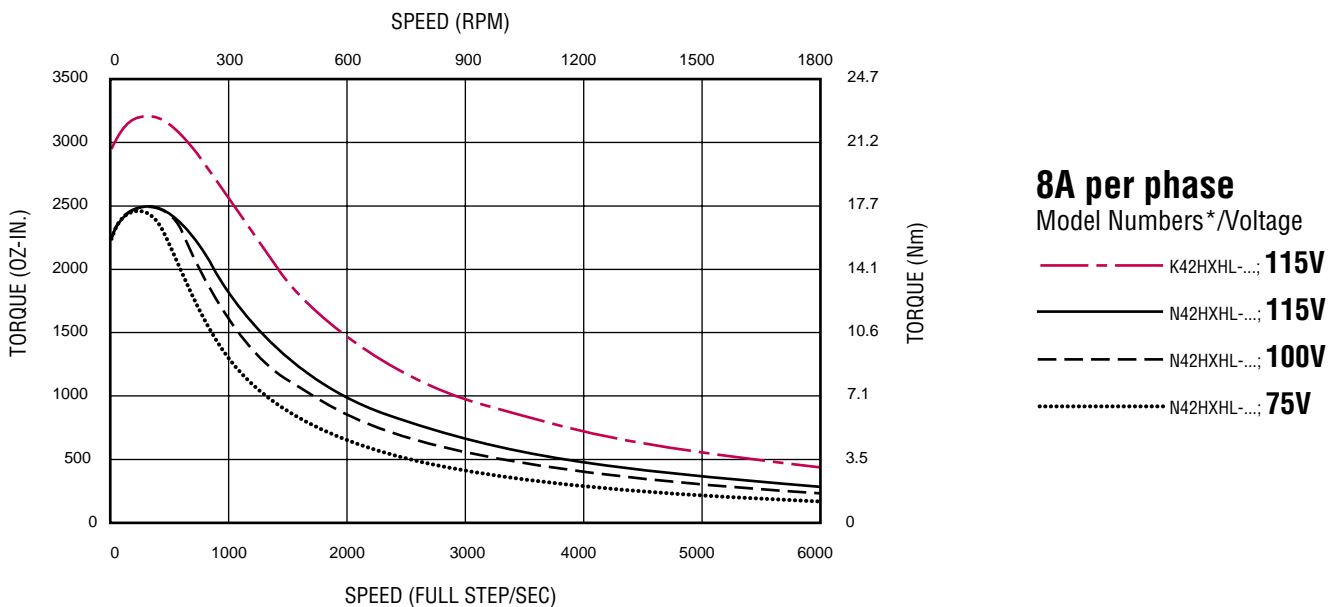
J winding, parallel connection, See Ratings and Characteristics, p. 26.



NEMA 42 FRAME – TWO ROTOR STACKS

8A per phase; K42* and N42*

L winding, parallel connection, See Ratings and Characteristics, p. 27.



*See Model Number Code on page 25 for clarification.

POWERPAC HYBRIDS

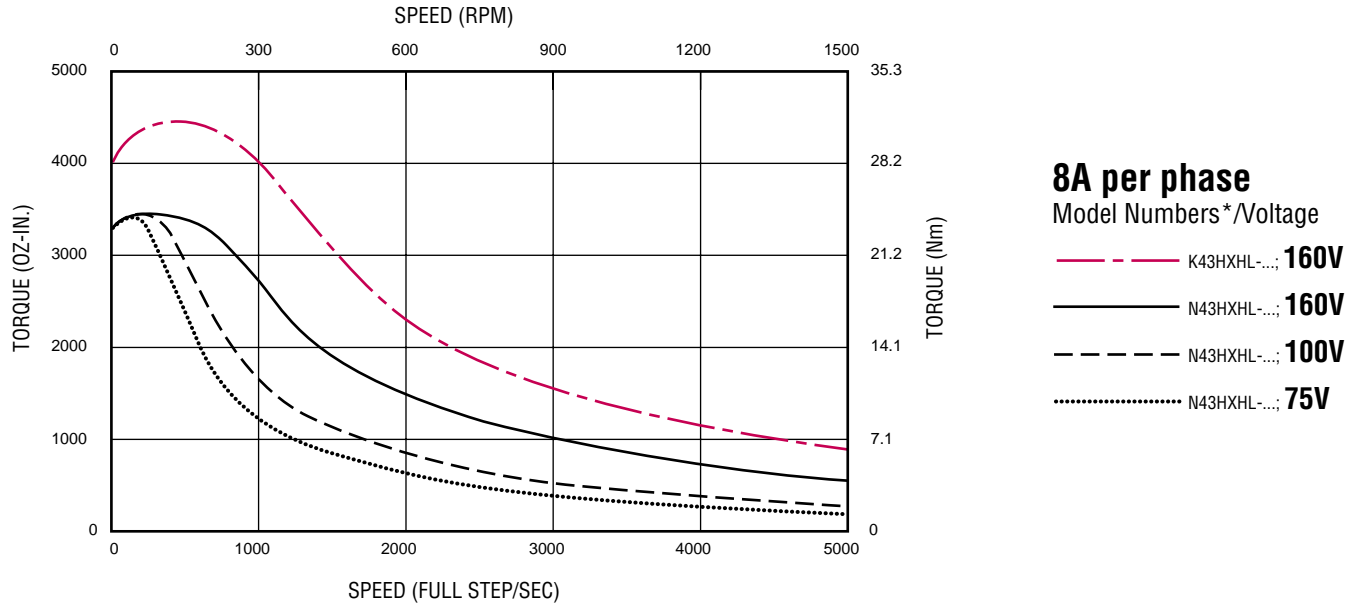
NEMA 42 FRAME (4.325" Square)—Performance

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 42 FRAME – THREE ROTOR STACKS

8A per phase; K43* and N43*

L winding, parallel connection, See Ratings and Characteristics, p. 28.



*See Model Number Code on page 25 for clarification.

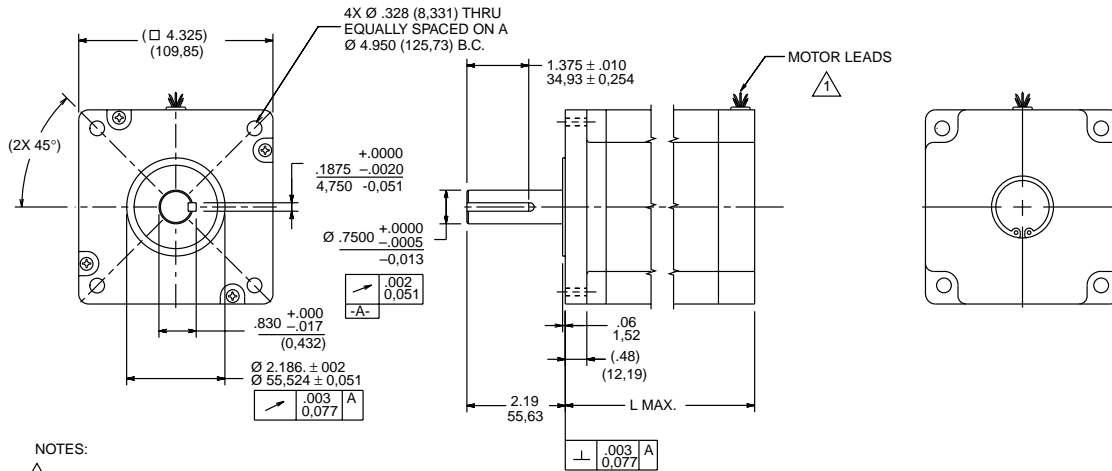
DIMENSIONS . . . POWERPAC HYBRIDS

in. (metric dimensions for ref. only)
mm

NEMA 42 FRAME: All motors have a heavy duty NEMA front end bell and large diameter shaft to support the higher output torques

LEADWIRE HOOKUP

Model Number Code designation R (Construction/Hookup), p. 25.



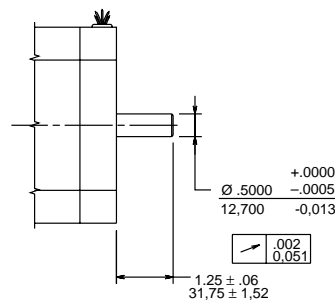
NOTES:
1 MOTOR LEADS 12.0 MIN.

| MOTOR | L MAX |
|-------|----------------|
| 41 HR | 3.89 98.81 |
| 42 HR | 5.91 150.11 |
| 43 HR | 7.92 201.17 |

* See Model Number Code, p. 25.

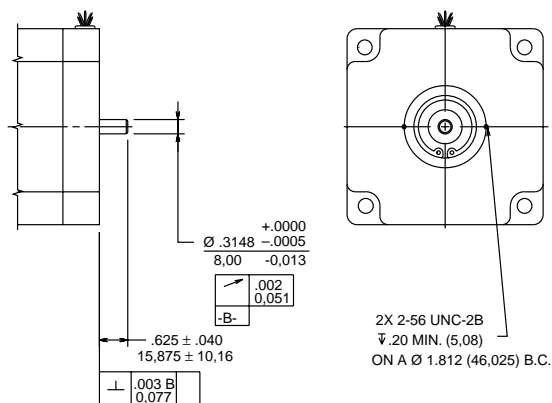
LEADWIRE HOOKUP DOUBLE SHAFT CONFIGURATION

Model Number Code designation D (Shaft Configuration), p. 25.
Available on R construction only.



LEADWIRE HOOKUP ENCODER MOUNTING PROVISION

Model Number Code designation M2
(Encoder Mounting Option), p. 25.



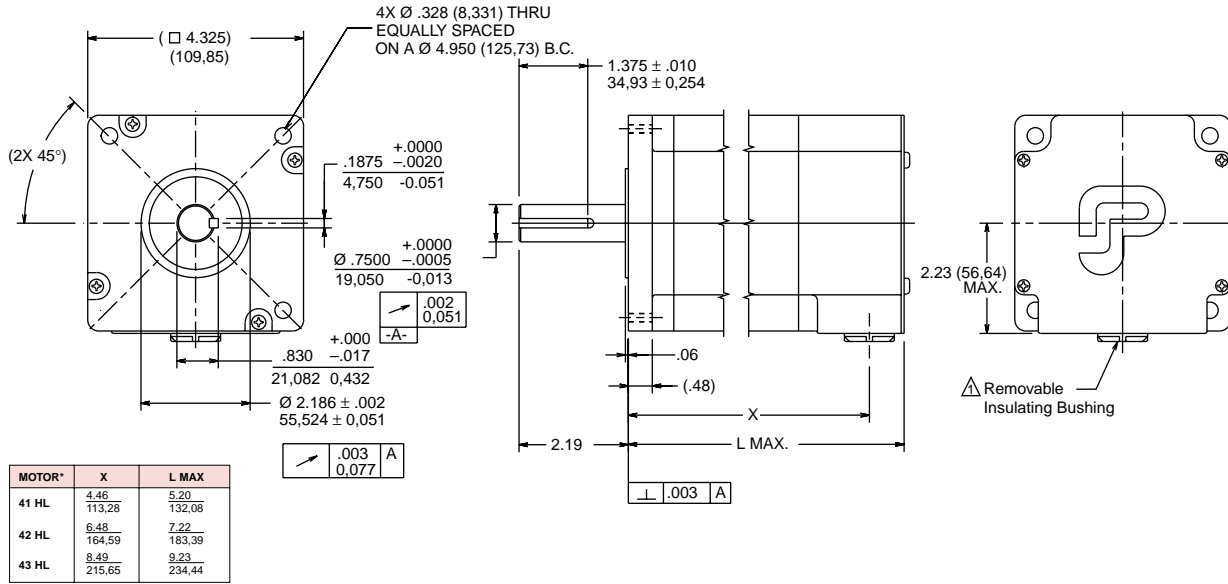
DIMENSIONS . . . POWERPAC HYBRIDS

in. (metric dimensions for ref. only)
mm

NEMA 42 FRAME: All motors have a heavy duty NEMA front end bell and large diameter shaft to support the higher output torques

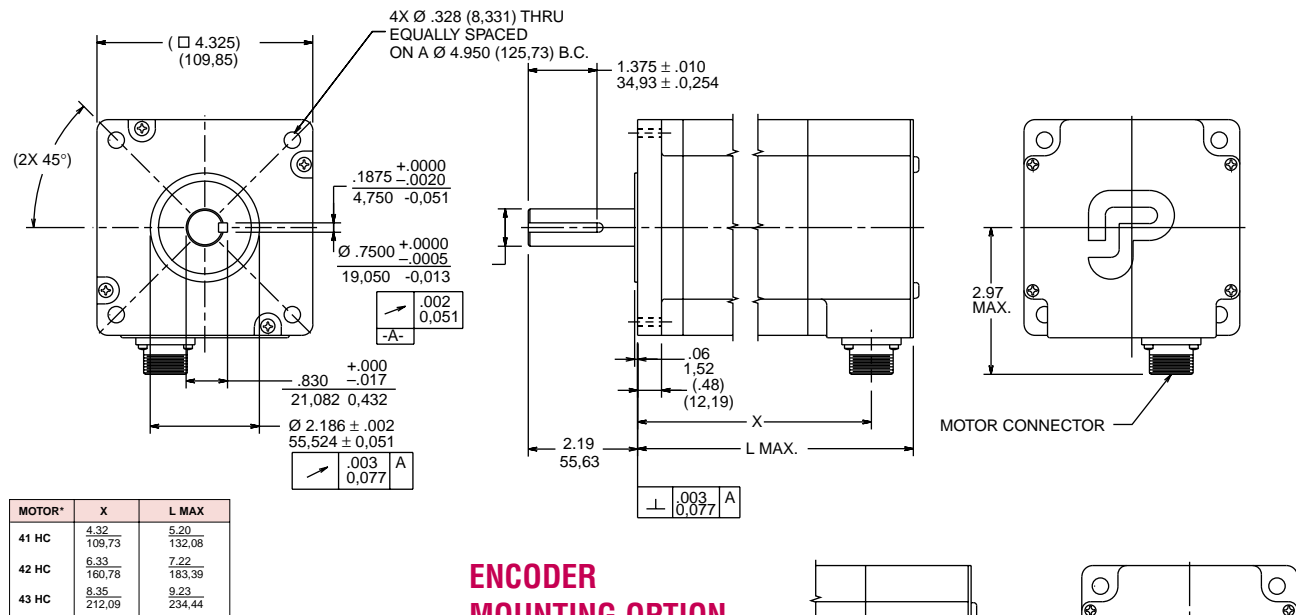
SPLASHPROOF CONSTRUCTION/TERMINAL BOARD CONNECTIONS

(via English or Metric thread for conduit) Model Number Code designation L or M (Construction/Hookup), p. 25



SPLASHPROOF CONSTRUCTION/MS CONNECTOR(S)— ENCODER OPTION

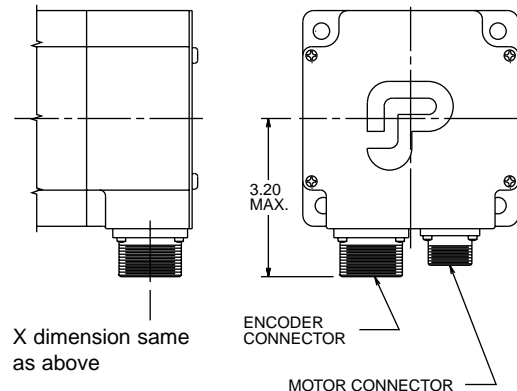
Model Number Code designation C/System (Construction/Hookup) and Encoder Mounting Option, p. 25.



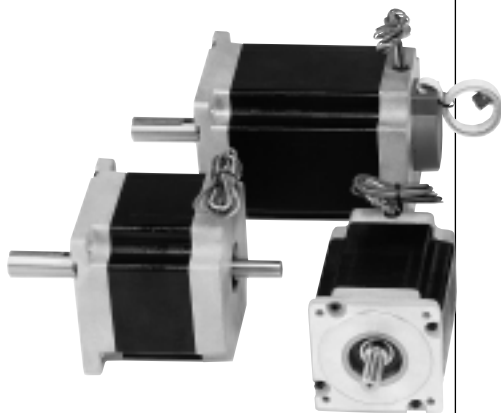
ENCODER MOUNTING OPTION

NOTES:

- △ L Construction = Conduit connection (1/2 NPSC TAP) with $\frac{56}{14.2}$ I.D. removable insulating bushing
- M Construction = Conduit connection (PG 13, 5 TAP). (No insulating bushing supplied)

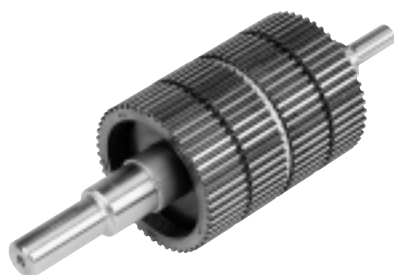


POWERPAC™ HYBRID STEP MOTORS

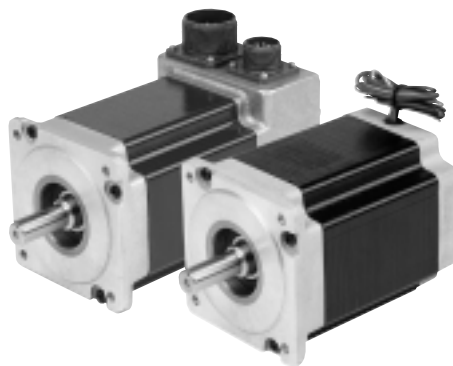


Holding Torques to 5700 oz-in. (356 lb-in.)

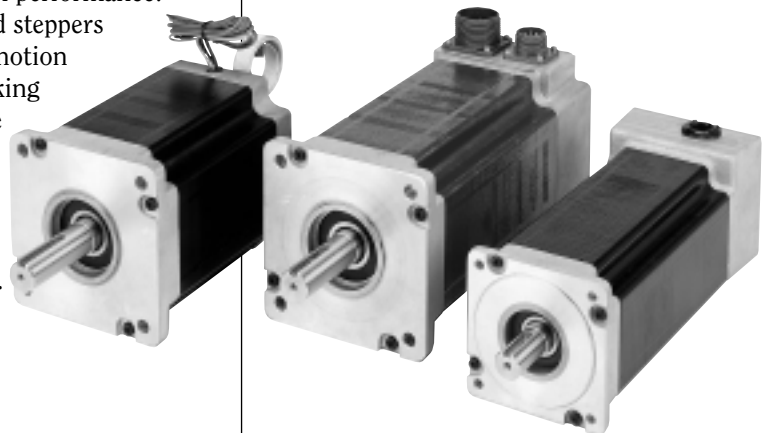
New POWERPAC rugged NEMA 34 and 42 frame hybrid steppers provide the highest torques per frame size in the industry. Optimal magnetics in a “housingless” frame combine with a large diameter rotor and new rotor/stator design to produce more torque and provide high acceleration capabilities. This unique design also features low detent torque for smoother microstepping. In addition, POWERPAC runs cooler than comparable size steppers.



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!

MORE POWER IN A SMALLER PACKAGE - POWERPAC

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

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® 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

