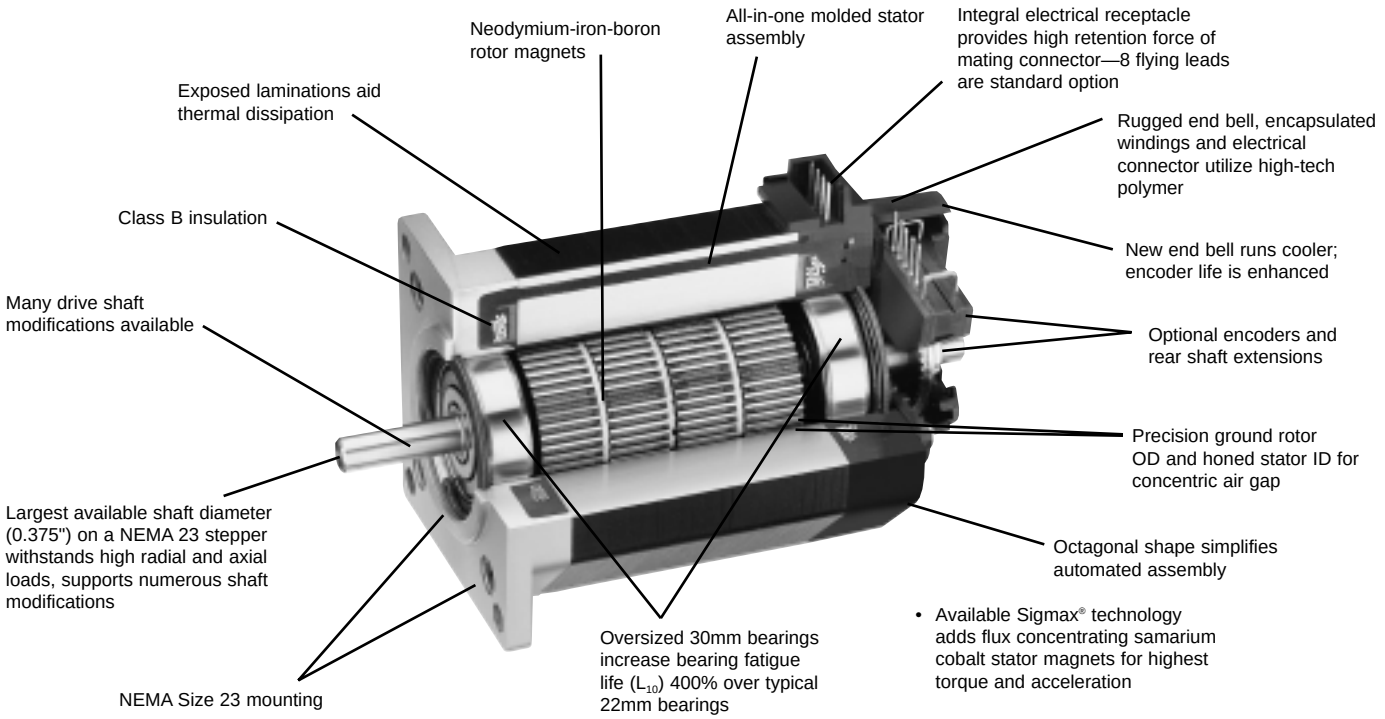
POWERMAX II®



MODEL NUMBER CODE POWERMAX II® motors

P 2 1 N R X A - L N N - N S - 0 0

Type
P=Standard
M=Enhanced
(n/a half stack)

Size
2=NEMA 23
(2.25"across flats)

Number of Stacks
H=Half stack
1=1 Stack
2=2 Stacks

Mounting
N=NEMA
S=Special

Construction
R=Regular
S=Special

Termination
X=Receptacle
F=8 Flying leads
S=Special
For X (receptacle) designation, mating leaded connectors may be ordered separately.
Optional GRN/YEL ground wire available. See p. 52

Winding Type
A...per assigned letter
S=Special

Rotor Type
L=Standard
J=Low inertia
(n/a half stack)

Shaft Configuration (Diameter & Length)
N=Single
D=Double
S=Special

Shaft Modifications
N=Smooth
F=Flat
S=Special

Sequence Number
Insert 00 if all parts are standard. Factory assigned if any parts are custom.

Encoder Option
NS=No Feedback
Use encoders below. You must specify shaft configuration D (double ended)

Caution: An encoder with line driver output may be required for use with some step motor controls.

M1=Encoder mounting provisions
HD=Encoder 500ppr
HJ=Encoder 512ppr
SS=Special, call factory

The example model number above indicates a standard NEMA 23 frame motor with a one stack rotor. This motor is equipped with a standard NEMA mount, regular construction, receptacle and an A winding. It also has a standard rotor, a smooth single-ended shaft and no encoder or encoder mounting provisions.

HOW TO ORDER

Review the Motor Model Number Code to assure that all options are designated. Dimensions, connections and phasing diagrams start on page 49. Encoder mounting options are on page 53.

POWERMAX II® MOTOR TECHNOLOGY

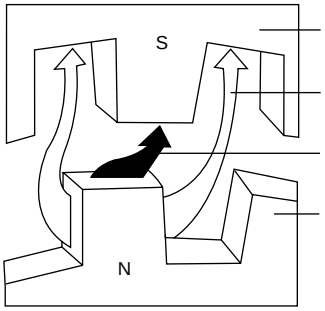
Pacific Scientific developed POWERMAX II® to be the best cost/performance value available in hybrid step motors.

That's why you'll find so many standard POWERMAX II models in the universal NEMA 23 frame size. With POWERMAX II, you can tailor motor torque, acceleration and inertia to every axis of your design. And you can do this economically too, using a single mounting configuration and the driver of your choice.

Does your application require that extra measure of performance? Then consider the POWERMAX II M Series, featuring the patented Sigmax® technology.*

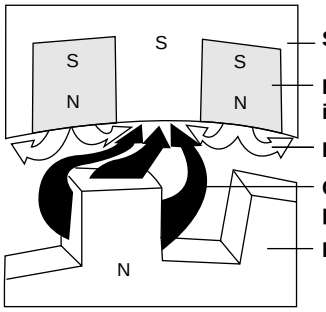
Samarium cobalt magnets in M Series motors concentrate magnetic flux at desired points between the rotor and stator. Sigmax technology optimizes flux paths to increase torque production and current utilization over conventional hybrid designs.

P SERIES STANDARD HYBRID



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

M SERIES ENHANCED HYBRID 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.

TECHNICAL OVERVIEW

Types	
POWERMAX II M Series	Hybrid step motors with rare earth magnets in the stator teeth
POWERMAX II P Series	Hybrid step motors
Rotor construction	
POWERMAX II M and P Series; with "L" rotor designates	Laminated (high speed efficiency)
POWERMAX II M and P Series; with "J" rotor designates	Low mass/low inertia (fast start/stop, high acceleration)
Windings	
A, B, C, D, E, F, G	Standard winding to match any application
Phases	2
Full steps per revolution	200
Full step angle	1.8°
Angular accuracy	
POWERMAX II M and M "J"	±1.5% of one step, no load, non-cumulative
POWERMAX II P and P "J"	±3% of one step, no load, non-cumulative
Operating temperature	-20 to 40°C
Insulation	NEMA Class B, 130°C
Insulation resistance	100 Megohms @500V dc and 25°C
Shaft load ratings	
Max. radial load (at center of std. shaft extension)	20 lb.
Max. axial load (on front shaft extension toward motor)	13 lb.
Bearing life	Since large bearings (30 mm) are used, life is typically about 4 times that of 22 mm or smaller bearings used on other NEMA Size 23 motors. POWERMAX II bearing fatigue life (L_{10}) exceeds 10,000 hours at any rotational speed up to 10,000 full steps/second if operated within the max. radial and axial loads specified above.
Encoder options	See page 53.

NEMA 23 FRAME (2.3")—Ratings and Characteristics (Con't.)

Review the Model Number Code, page 39, to assure that all options are designated. Dimensions, connections and phasing diagrams are on page 49. 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 △1	Connection △2 Parallel	Connection △2 Series	Connection △2 Unipolar	Holding Torque △3 (2 phases on) oz-in (Nm) ±10%	Rated Current/ Phase △4 (amps DC)	Phase Resistance (ohms) ±10%	Phase Inductance △5 (mH) Typical	Detent Torque oz-in (Nm)	Thermal Resistance △6 (°C/watt)	Rotor Inertia oz-in-S² (kgm² x 10⁻³)	Weight lbs (kg)
Torque range: 161-253 oz-in. 1.13-1.79 Nm	M22NXXA-LXX-XX-00	•			230 (1.62)	6.5	0.21	0.7	17 (0.12)	4.5	0.0036 (0.025)	2.5 (1.13)
	M22NXXA-LXX-XX-00		•		230 (1.62)	3.3	0.84	2.8				
	M22NXXA-LXX-XX-00			•	163 (1.15)	4.6	0.42	0.7				
SIGMAX® M22 Series 2 rotor stack	M22NXXB-LXX-XX-00	•			253 (1.79)	4.6	0.38	1.7				
	M22NXXB-LXX-XX-00		•		253 (1.79)	2.3	1.52	6.8				
	M22NXXB-LXX-XX-00			•	179 (1.26)	3.3	0.76	1.7				
	M22NXXC-LXX-XX-00	•			238 (1.68)	3.1	0.78	3.1				
	M22NXXC-LXX-XX-00		•		238 (1.68)	1.55	3.12	12.4				
	M22NXXC-LXX-XX-00			•	168 (1.19)	2.2	1.56	3.1				
	M22NXXD-LXX-XX-00	•			238 (1.68)	2.5	1.22	5.0				
	M22NXXD-LXX-XX-00		•		238 (1.68)	1.25	4.88	20.0				
	M22NXXD-LXX-XX-00			•	168 (1.19)	1.77	2.44	5.0				
	M22NXXE-LXX-XX-00	•			227 (1.60)	1.64	2.71	10.1				
	M22NXXE-LXX-XX-00		•		227 (1.60)	0.82	10.8	40.4				
	M22NXXE-LXX-XX-00			•	161 (1.13)	1.16	5.42	10.1				
Torque range: 138-214 oz-in. .97-1.51 Nm	P22NXXA-LXX-XX-00	•			197 (1.39)	6.5	0.21	0.8	7 (0.049)	4.5	0.0036 (0.025)	2.5 (1.13)
	P22NXXA-LXX-XX-00		•		197 (1.39)	3.3	0.84	3.2				
	P22NXXA-LXX-XX-00			•	139 (0.98)	4.6	0.42	0.8				
STANDARD P22 Series 2 rotor stack	P22NXXB-LXX-XX-00	•			214 (1.51)	4.6	0.38	2.1				
	P22NXXB-LXX-XX-00		•		214 (1.51)	2.3	1.52	8.4				
	P22NXXB-LXX-XX-00			•	151 (1.07)	3.3	0.76	2.1				
	P22NXXC-LXX-XX-00	•			203 (1.43)	3.1	0.78	3.9				
	P22NXXC-LXX-XX-00		•		203 (1.43)	1.55	3.12	15.6				
	P22NXXC-LXX-XX-00			•	144 (1.01)	2.2	1.56	3.9				
	P22NXXD-LXX-XX-00	•			203 (1.43)	2.5	1.22	6.2				
	P22NXXD-LXX-XX-00		•		203 (1.43)	1.25	4.88	24.8				
	P22NXXD-LXX-XX-00			•	144 (1.01)	1.77	2.44	6.2				
	P22NXXE-LXX-XX-00	•			195 (1.38)	1.64	2.7	12.6				
	P22NXXE-LXX-XX-00		•		195 (1.38)	0.82	10.8	50.4				
	P22NXXE-LXX-XX-00			•	138 (0.97)	1.16	5.4	12.6				

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

△1 An "X" in the Model Number Code indicates an undefined option. Colored letter indicates winding. See Model Number Code on page 39.

△2 See Model Number Code on page 39 optional leaded connectors on page 52 and connection information on page 52.

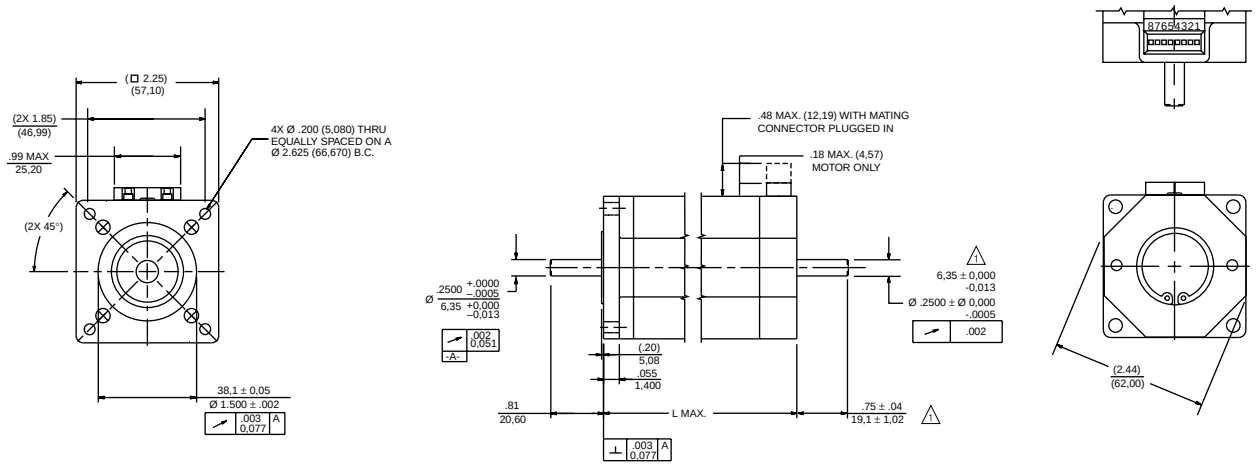
△3 With rated current applied. Windings at 130°C and motor unmounted and in still air at 40°C (without heat sink).

△4 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.

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

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

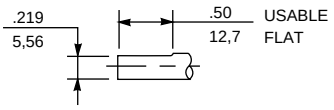
DIMENSIONS. . .(POWERMAX II® HYBRIDS) in. / mm (metric dim. for ref. only)



Motor Model	L Max.
P2H	1.60 / 40,7
P or M21	2.06 / 52,3
P or M22	3.10 / 78,7

STANDARD SHAFT OPTIONS

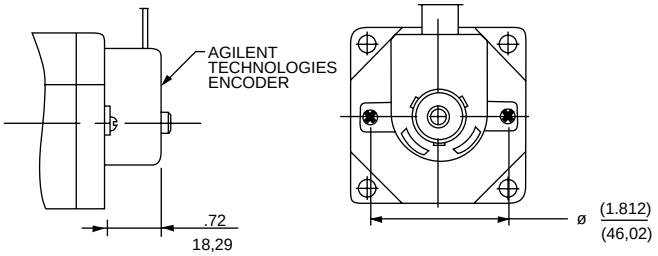
1. Shaft modifications also available. See page 39.
2. Optional flat available on front shaft as shown.



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

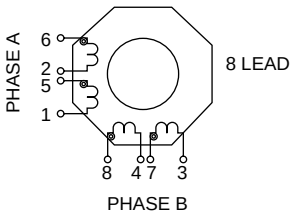
ENCODER OPTION

See page 53 for encoder/mounting specifications.



CONNECTION INFORMATION . . .Terminations and phase sequencing

NOTE: Phase sequencing direction of rotation as viewed from mounting end of motor.

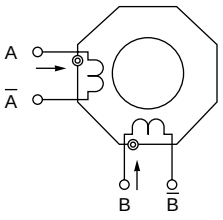


DRIVER CONNECTION △2

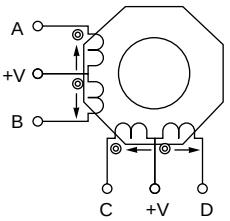
STEP	A	$\overline{A}$	B	$\overline{B}$
1	+	−	−	+
2	−	+	−	+
3	−	+	+	−
4	+	−	+	−
1	+	−	−	+

CCW ↓ ↑ CW

Bipolar full step



4-Lead connection (Bipolar)



6-Lead connection (Unipolar)

DRIVER CONNECTION △1

STEP	A	B	C	D
1	GND	O	GND	O
2	O	GND	GND	O
3	O	GND	O	GND
4	GND	O	O	GND
1	GND	O	GND	O

CCW ↓ ↑ CW

Unipolar full step

△2 Notes:

0 = off or open
\+ = positive current flow
\- = negative current flow
GND = ground