

# M2 / P2 Series Stepper Motors

## General Specifications



- NEMA Size 23
- Standard (P) and enhanced (M) using SIGMAX technology
- Standard laminated and low inertia “-J” rotors for maximum acceleration
- Standard NEMA mounting
- Oversized 30 mm bearings
- CE compliant
- Unipolar or Bipolar windings
- Features: integral electrical receptacle, smooth or flat shaft
- Options: leadwire connection, rear shaft extension, encoder mounting provisions, 500 or 512 ppr encoder
- Custom Motors

Phases	2 and 4
Full Steps per Revolution	200
Step Angle	1.8°
Step Accuracy (of one full step, no load)	± 1.5 % M ± 3 % P
Operating Temperature	-20°C to +40°C
Insulation Class	Class B, 130°C
Insulation Voltage Rating	340 Vdc
Insulation Resistance	100 Megohms

### Rotor Inertia Characteristics

Single and double stack motors are available with both standard and low inertia “-J” rotors. Choose low inertia to produce the highest acceleration rates possible. Low inertia motors are most effective for operation below 2,000 RPM. Choose standard to generate maximum torque.

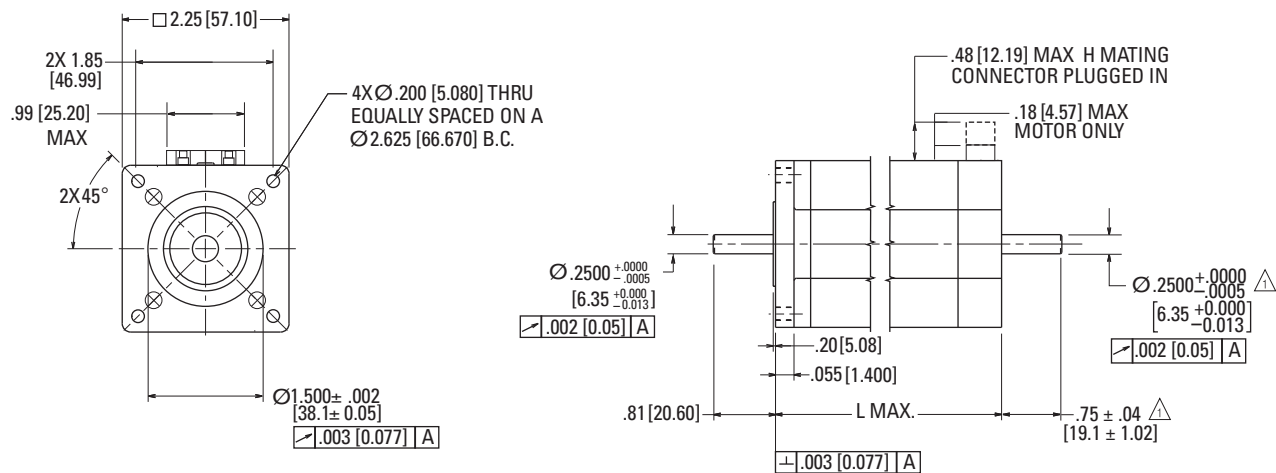


Low Inertia Rotor

Standard Rotor

## M2 / P2 Series Outline Drawings

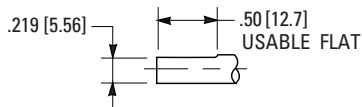
### M2 / P2 Regular Construction Hookup



Motor Model	L Max.
P2H	1.60 [40.7]
P or M21	2.06 [52.3]
P or M22	3.10 [78.7]

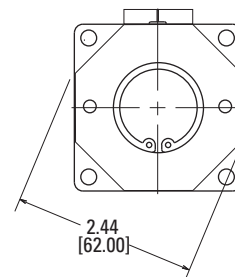
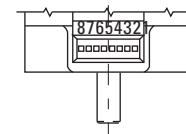
Dimensions in inches [mm]

### Standard Shaft Options

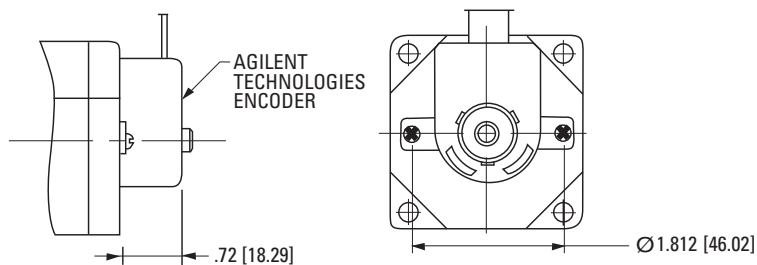


△ Optional rear shaft extension available as shown. Same diameter as front shaft extension.

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



### Encoder Option



Dimensions in inches [mm]

# M2 / P2 Series Stepper Motors

## M2 / P2 Performance Data

	Motor Model Number	Config.			Holding Torque (2 phases on) oz-in (Nm) +/-10%	Rated Current/ Phase Amps DC	Phase Resistance Ohms +/-10%	Phase Inductance mH Typical	Detent Torque oz-in (Nm)	Thermal Resistance Mounted °C/Watt	Rotor Inertia oz-in-s <sup>2</sup> (kg-m <sup>2</sup> x10 <sup>-3</sup> )	Weight lb (kg)	Shaft Loading*	
		Parallel	Series	Unipolar									Radial Force	Axial Force
												lb (N)	lb (N)	
Short Stack	P2HxxxH-L	•			59 (0.42)	5.2	0.22	0.50	2.5 (0.018)	6.6	0.0010 (0.0071)	1.0 (0.45)	20 (89)	13 (58)
	P2HxxxH-L		•			2.6	0.90	1.9						
	P2HxxxB-L	•				2.6	0.76	1.9						
	P2HxxxB-L		•		59 (0.42)	1.3	3.04	7.6						
	P2HxxxC-L	•				2.5	0.84	2.3						
	P2HxxxC-L		•			1.25	3.36	9.2						
	P2HxxxF-L	•			60 (0.42)	1.61	1.92	5.1						
	P2HxxxF-L		•			0.8	7.68	20.4						
	P2HxxxH-L			•		3.68	0.44	0.50						
	P2HxxxB-L			•	42 (0.30)	1.84	1.52	1.9						
	P2HxxxC-L			•		1.77	1.68	2.3						
P2HxxxF-L			•	1.1		3.84	5.1							
1Stack	P21xxxA-L	•			114 (0.81)	5.6	0.23	0.80	4.0 (0.028)	5.5	0.0017 (0.012)	1.5 (0.68)	20 (89)	13 (58)
	P21xxxA-L		•			2.8	0.92	3.2						
	P21xxxB-L	•			111 (0.78)	4.6	0.32	1.1						
	P21xxxB-L		•			2.3	1.28	4.4						
	P21xxxC-L	•			116 (0.82)	3.5	0.53	2.3						
	P21xxxC-L		•			1.75	2.12	9.2						
	P21xxxD-L	•			109 (0.77)	1.51	2.61	10.3						
	P21xxxD-L		•			0.76	10.4	41.2						
	P21xxxA-L			•	81 (0.57)	4.0	0.46	0.80						
	P21xxxB-L			•	79 (0.56)	3.3	0.64	1.1						
	P21xxxC-L			•	82 (0.58)	2.5	1.06	2.3						
	P21xxxD-L			•	77 (0.54)	1.07	5.22	10.3						
	Low Inertia	P21xxxA-J	•			111 (0.78)	5.6	0.23						
P21xxxA-J			•		2.8		0.92	3.6						
P21xxxA-J				•	79 (0.56)		4.0	0.46	0.90					
Enhanced 1 Stack	M21xxxA-L	•			142 (1.00)	5.6	0.23	0.70	9.4 (0.66)	5.5	0.0017 (0.012)	1.5 (0.68)	20 (89)	13 (58)
	M21xxxA-L		•			2.8	0.92	2.8						
	M21xxxB-L	•			137 (0.97)	4.6	0.32	1.0						
	M21xxxB-L		•			2.3	1.28	4.0						
	M21xxxC-L	•			144 (1.02)	3.5	0.53	2.0						
	M21xxxC-L		•			1.75	2.12	8.0						
	M21xxxD-L	•			135 (0.95)	1.51	2.61	8.7						
	M21xxxD-L		•			0.76	10.4	34.8						
	M21xxxA-L			•	100 (0.71)	4.0	0.46	0.70						
	M21xxxB-L			•	97 (0.68)	3.3	0.64	1.0						
	M21xxxC-L			•	102 (0.72)	2.5	1.06	2.0						
	M21xxxD-L			•	95 (0.67)	1.07	5.22	8.7						
	Low Inertia	M21xxxA-J	•			140 (0.99)	5.6	0.23						
M21xxxA-J			•		2.8		0.92	2.8						
M21xxxA-J				•	99 (0.70)		4.0	0.46	0.70					

Note: \*Maximum shaft loading based on 20,000 hours of operation at 1500 rpm.

Continued on page 45.

### M2 / P2 Performance Data (continued)

	Motor Model Number	Config.			Holding Torque (2 phases on)	Rated Current/ Phase	Phase Resistance	Phase Inductance	Detent Torque	Thermal Resistance	Rotor Inertia	Weight	Shaft Loading*	
		Parallel	Series	Unipolar	oz-in (Nm) +/-10%	Amps DC	Ohms +/-10%	mH Typical	oz-in (Nm)	Mounted °C/Watt	oz-in-s <sup>2</sup> (kg-m <sup>2</sup> x 10 <sup>-3</sup> )	lb (kg)	lb (N)	lb (N)
2 Stack	P22xxxA-L	•			197 (1.39)	6.5	0.21	0.80	17 (0.12)	4.5	0.0036 (0.025)	2.5 (1.13)	20 (89)	13 (58)
	P22xxxA-L		•			3.3	0.84	3.2						
	P22xxxB-L	•			214 (1.51)	4.6	0.38	2.1						
	P22xxxB-L		•			2.3	1.52	8.4						
	P22xxxC-L	•			203 (1.43)	3.1	0.78	3.9						
	P22xxxC-L		•			1.55	3.12	15.6						
	P22xxxD-L	•			203 (1.43)	2.5	1.22	6.2						
	P22xxxD-L		•			1.25	4.88	24.8						
	P22xxxE-L	•			195 (1.38)	1.64	2.7	12.6						
	P22xxxE-L		•			0.82	10.8	50.4						
	P22xxxA-L			•	139 (0.98)	4.6	0.42	0.80						
	P22xxxB-L			•	151 (1.07)	3.3	0.76	2.1						
	P22xxxC-L			•	144 (1.01)	2.2	1.56	3.9						
	P22xxxD-L			•	144 (1.01)	1.77	2.44	6.2						
	P22xxxE-L			•	138 (0.97)	1.16	5.4	12.6						
Low Inertia	P22xxxB-J	•			201 (1.42)	4.6	0.38	1.8	17 (0.12)	4.5	0.0026 (0.018)	2.5 (1.13)	20 (89)	13 (58)
	P22xxxB-J		•			2.3	1.52	7.2						
	P22xxxB-J			•	142 (1.00)	3.3	0.76	1.8						
Enhanced 2 Stack	M22xxxA-L	•			230 (1.62)	6.5	0.21	0.70	17 (0.12)	4.5	0.0036 (0.025)	2.5 (1.13)	20 (89)	13 (58)
	M22xxxA-L		•			3.3	0.84	2.8						
	M22xxxB-L	•			253 (1.79)	4.6	0.38	1.7						
	M22xxxB-L		•			2.3	1.52	6.8						
	M22xxxC-L	•			238 (1.68)	3.1	0.78	3.1						
	M22xxxC-L		•			1.55	3.12	12.4						
	M22xxxD-L	•			238 (1.68)	2.5	1.22	5.0						
	M22xxxD-L		•			1.25	4.88	20						
	M22xxxE-L	•			227 (1.60)	1.64	2.71	10.1						
	M22xxxE-L		•			0.82	10.8	40.4						
	M22xxxA-L			•	163 (1.15)	4.6	0.42	0.70						
	M22xxxB-L			•	179 (1.26)	3.3	0.76	1.7						
	M22xxxC-L			•	168 (1.19)	2.2	1.56	3.1						
	M22xxxD-L			•	168 (1.19)	1.77	2.44	5.0						
	M22xxxE-L			•	161 (1.14)	1.16	5.42	10.1						
Low Inertia	M22xxxB-J	•			252 (1.78)	4.6	0.38	1.5	17 (0.12)	4.5	0.0026 (0.018)	2.5 (1.13)	20 (89)	13 (58)
	M22xxxB-J		•			2.3	1.52	6.0						
	M22xxxB-J			•	178 (1.26)	3.3	0.76	1.5						

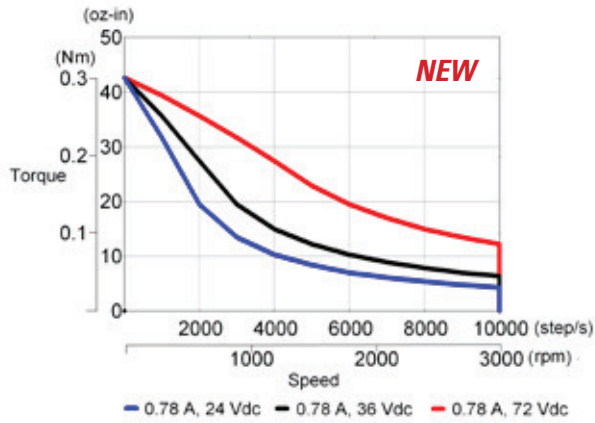
Note: \*Maximum shaft loading based on 20,000 hours of operation at 1500 rpm.  
See page 91 for M&P series connector diagrams and switching sequence.

# M2 / P2 Series Stepper Motors

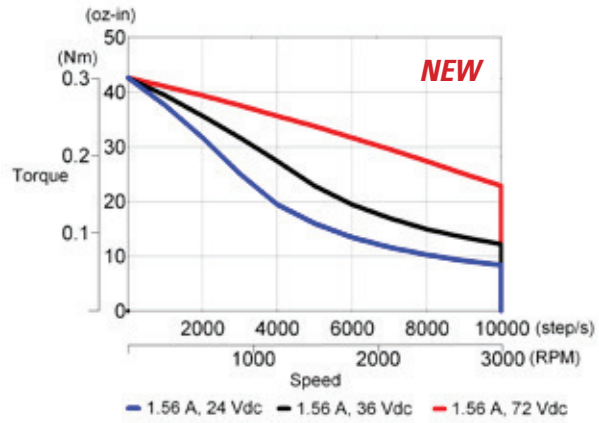
## M2 / P2 Performance Curves

M 2 / P 2 S E R I E S S T E P P E R M O T O R S

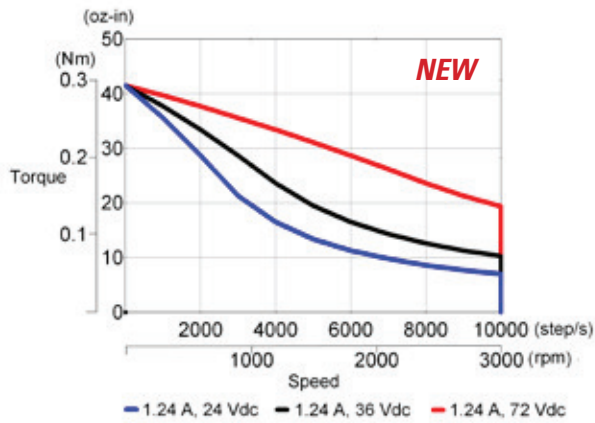
**P2HxxxF-L (S) w/ P5000**



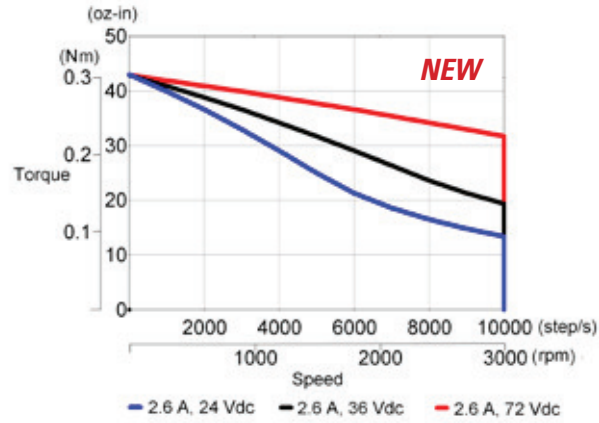
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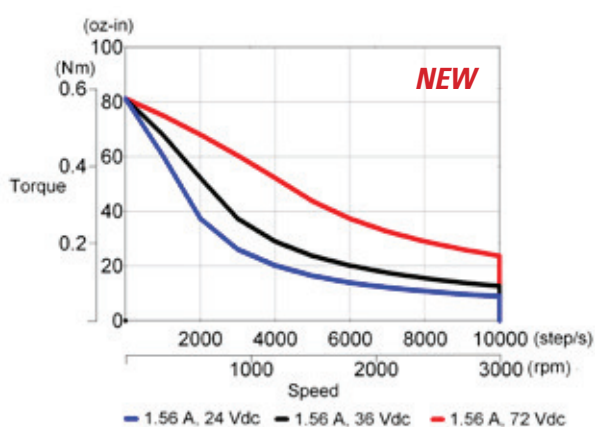
**P2HxxxB-L (S) w/ P5000**



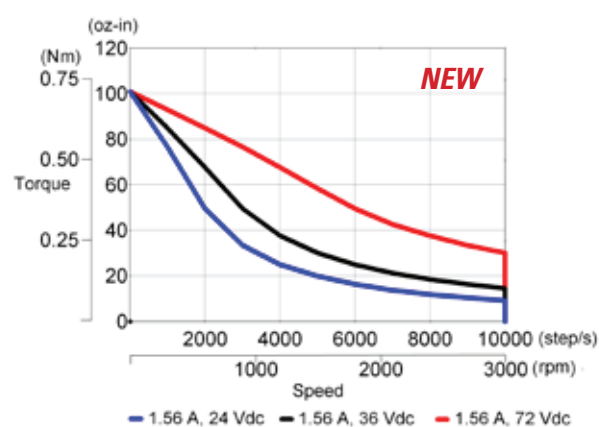
**P2HxxxB-L (P) w/ P5000**



**P21xxxD-L (P) w/ P5000**

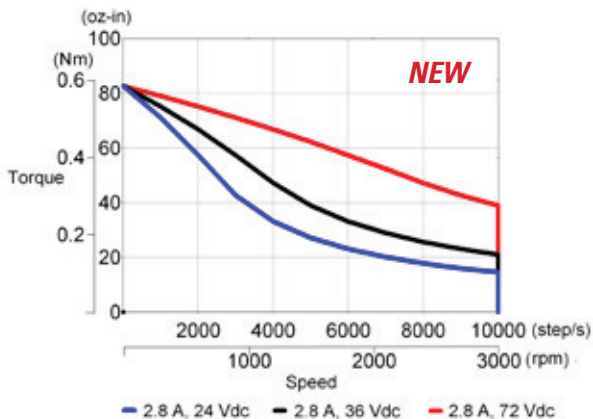


**M21xxxD-L (P) w/ P5000**

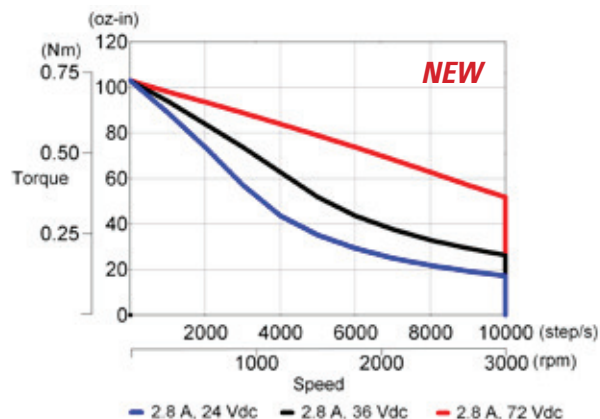


## M2 / P2 Performance Curves

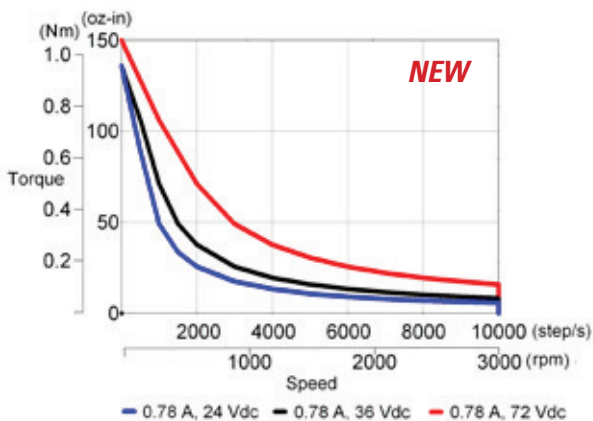
**P21xxxA-L (S) w/ P5000**



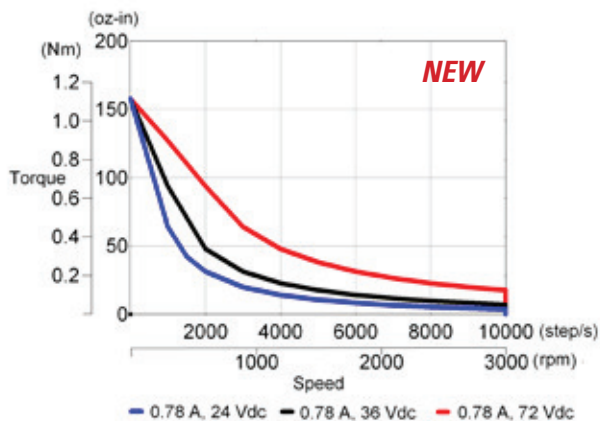
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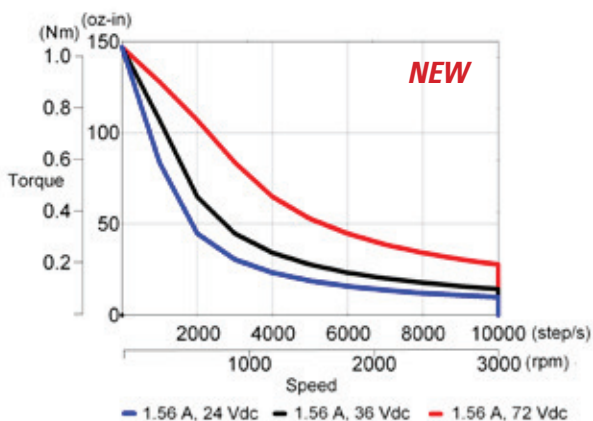
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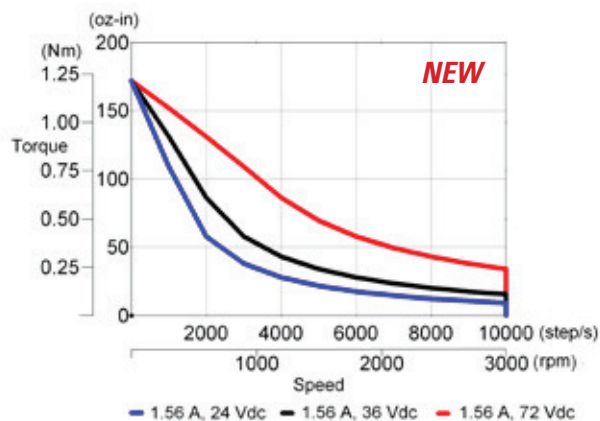
**M22xxxE-L (S) w/ P5000**



**P22xxxC-L (S) w/ P5000**



**M22xxxC-L (S) w/ P5000**



# M2 / P2 Series Stepper Motors

M 2 / P 2 S E R I E S S T E P P E R M O T O R S

## M2 / P2 Performance Curves

