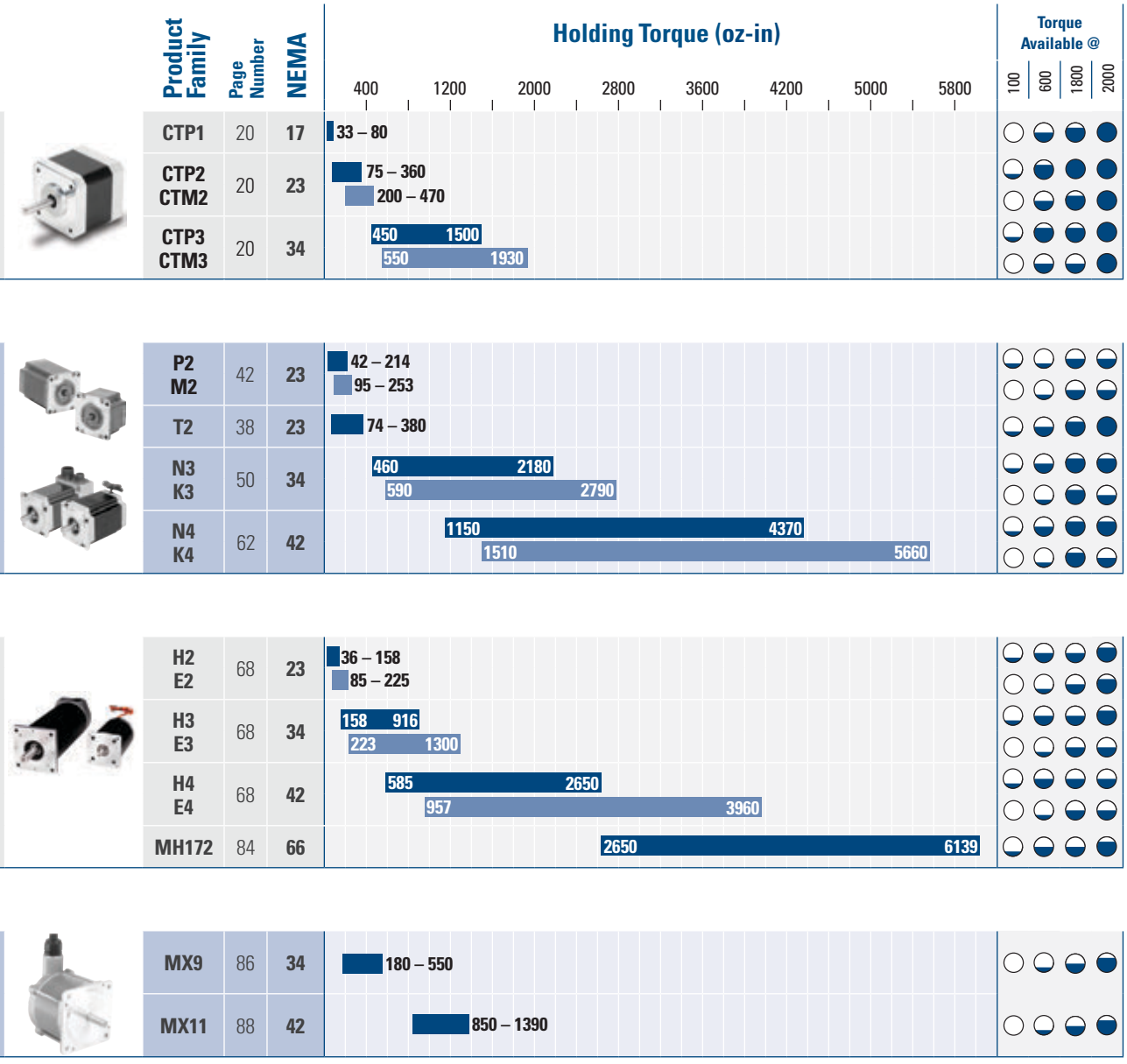
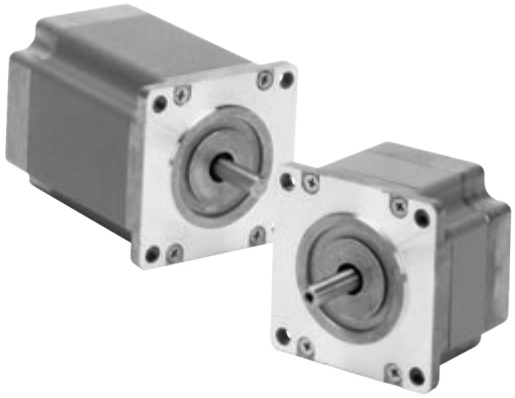
Kollmorgen Stepper Motor Overview

Kollmorgen offers a comprehensive range of stepper motor products including continous torque, high torque and hybrid options to meet a wide range of application requirements. For other Kollmorgen stepper products or information not included in this catalog go to www.kollmorgen.com.



T2 Series Stepper Motors

General Specifications

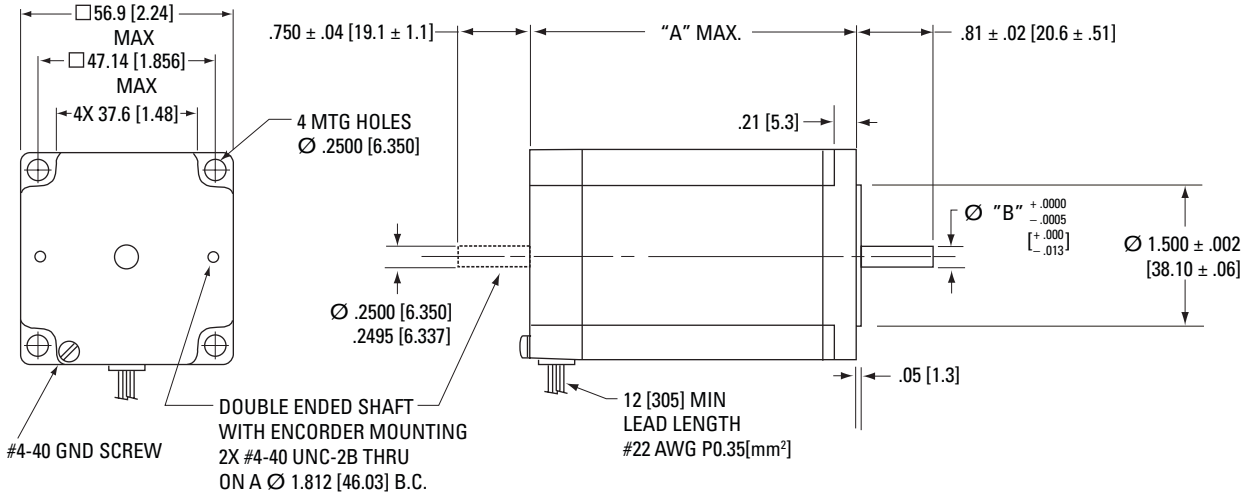


- NEMA Size 23
- High Torque at moderate speeds
- Inch standard mounting
- CE cUR and UR compliant
- Unipolar or Bipolar windings
- Features: leadwire connection, flat or smooth shaft
- Options: MS connector, terminal boxes, encoder mounting provisions, 200 LPR, 400 LPR encoders with line drivers
- Custom Motors

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

T2 Outline Drawings

Leadwire Hookup Models

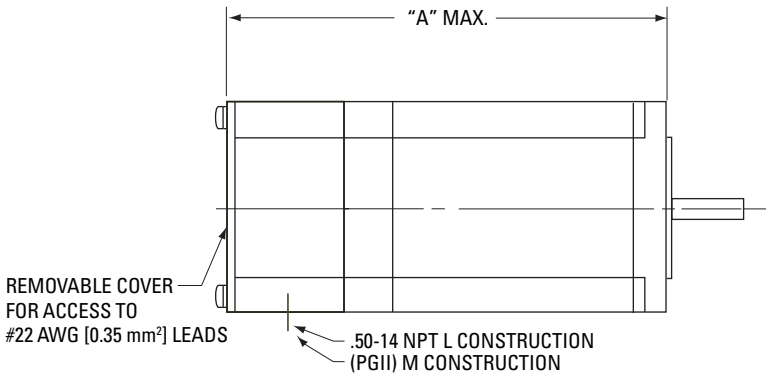


Dimensions in inches [mm]

Model	"A" Max	"B" Max
T2H	1.64 (41.6)	0.2500 (6.35)
T21	2.21 (56.1)	
T22	3.06 (77.7)	
T23	4.06 (103.1)	0.3125 (7.94)

Terminal Box Construction

Model	"A" Max
T2H	2.84 (72.1)
T21	3.41 (86.6)
T22	4.26 (108.2)
T23	5.26 (133.6)



Dimensions in inches [mm]

T2 Series Stepper Motors

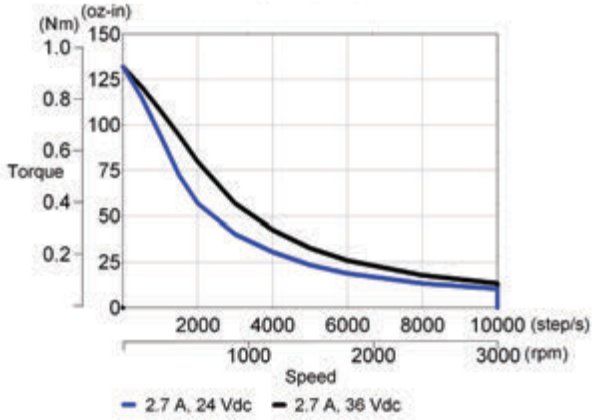
T2 Performance Data

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	oz-in (Nm) +/-10%	Amps DC	Ohms +/-10%	mH Typical	oz-in (Nm)	Mounted °C/Watt	oz-in-s^2 (kg-m^2 x 10^{-3})	lb (kg)	Radial Force lb (N)	Axial Force lb (N)
Short Stack	T2HxxHK	•		74 (0.52)	5.3	0.19	0.63	2.0 (0.014)	6.14	0.00154 (0.0109)	1.1 (0.50)	15 (67)	25 (111)
	T2HxxHJ	•			4.0	0.28	1.0						
	T2HxxLH		•		2.7	0.64	2.5						
	T2HxxLD		•		1.1	3.6	16						
1 Stack	T21xxHK	•		180 (1.27)	5.4	0.23	1.1	3.0 (0.021)	4.64	0.0034 (0.024)	1.5 (0.68)	15 (67)	25 (111)
	T21xxHJ	•			4.1	0.33	1.8						
	T21xxLC		•		0.4	42.9	209						
	T21xxLH		•		2.7	0.85	4.6						
	T21xxLE		•		1.4	3.0	16						
	T21xxLD		•		1.1	4.9	30						
2 Stack	T22xxHK	•		280 (1.98)	6.6	0.20	0.85	6.0 (0.042)	3.69	0.0056 (0.040)	2.2 (1.0)	15 (67)	25 (111)
	T22xxHJ	•			4.1	0.49	2.5						
	T22xxLC		•		0.46	41.4	209						
	T22xxLH		•		3.3	0.75	3.4						
	T22xxLG		•		2.5	1.3	7.1						
	T22xxLE		•		1.5	2.9	17						
3 Stack	T23xxHK	•		380 (2.68)	6.0	0.28	1.5	7.0 (0.049)	3.04	0.0084 (0.059)	3.3 (1.5)	15 (67)	25 (111)
	T23xxHJ	•			3.8	0.64	3.9						
	T23xxLC		•		0.67	23.5	136						
	T23xxLH		•		3.0	1.0	6.2						
	T23xxLF		•		1.8	2.8	17						
	T23xxLE		•		1.5	4.1	24						

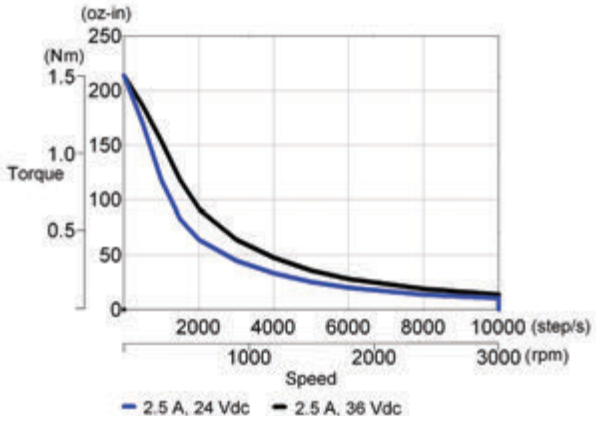
Note: *Maximum shaft loading based on 20,000 hours of operation at 1500 rpm.
See page 90 for T series connector diagrams and switching sequence.

T2 Performance Curves - DC Drive Models

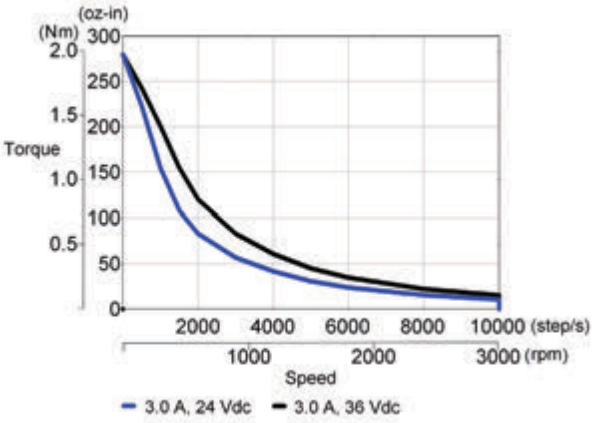
T21xxLH w/ P70530



T22xxLG w/ P70530

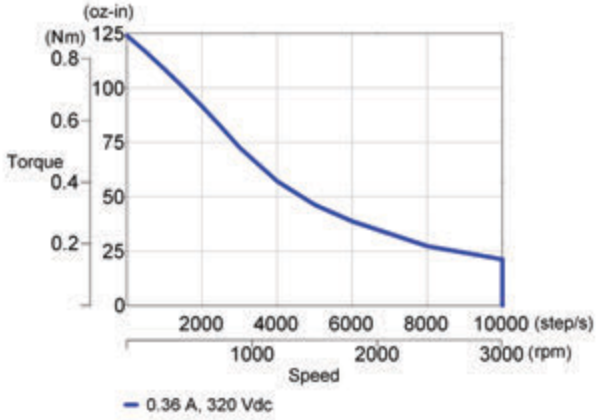


T23xxLH w/ P70530

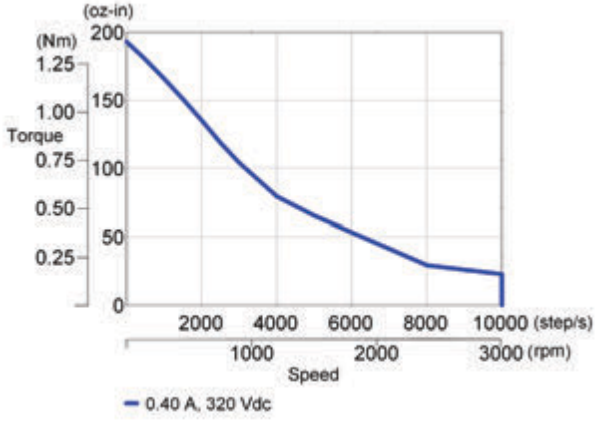


T2 Performance Curves - AC Drive Models

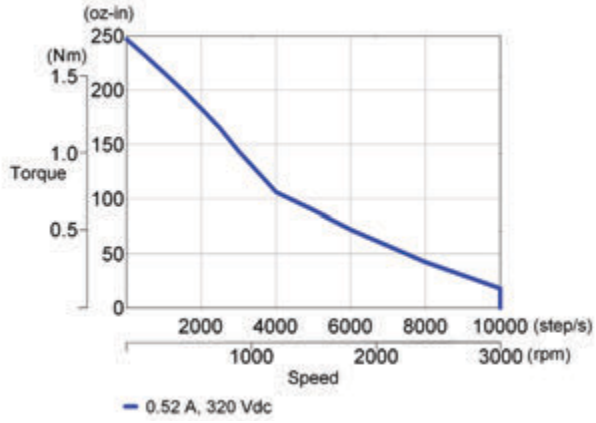
T21xxLC w/ P70360



T22xxLC w/ P70360

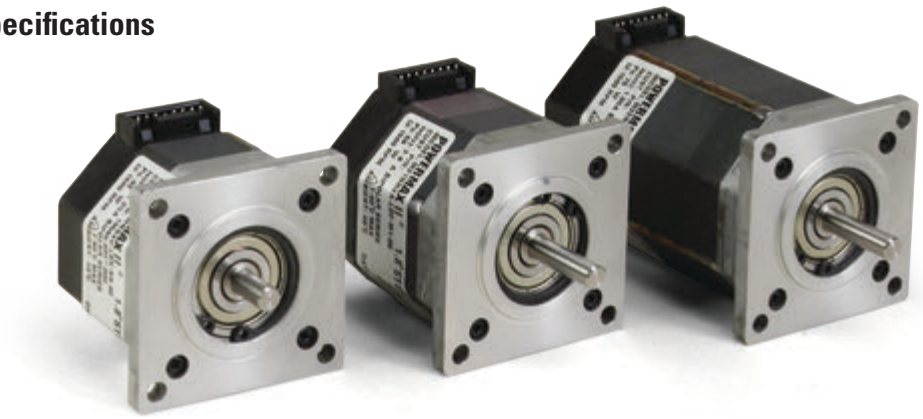


T23xxLC w/ P70360



M2 / P2 Series Stepper Motors

General Specifications

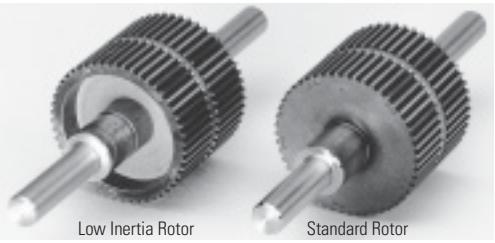


- NEMA Size 23
- Standard (P) and enchaned (M) using SIGMAX technology
- Standard laminated and low inertia "-J" rotors for maximum acceleration
- Standard NEMA mounting
- Oversized 30 mm bearings
- CE compliant
- Unipolar or Bipolar windings
- Features: integral electrical receptacle, smooth or flat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

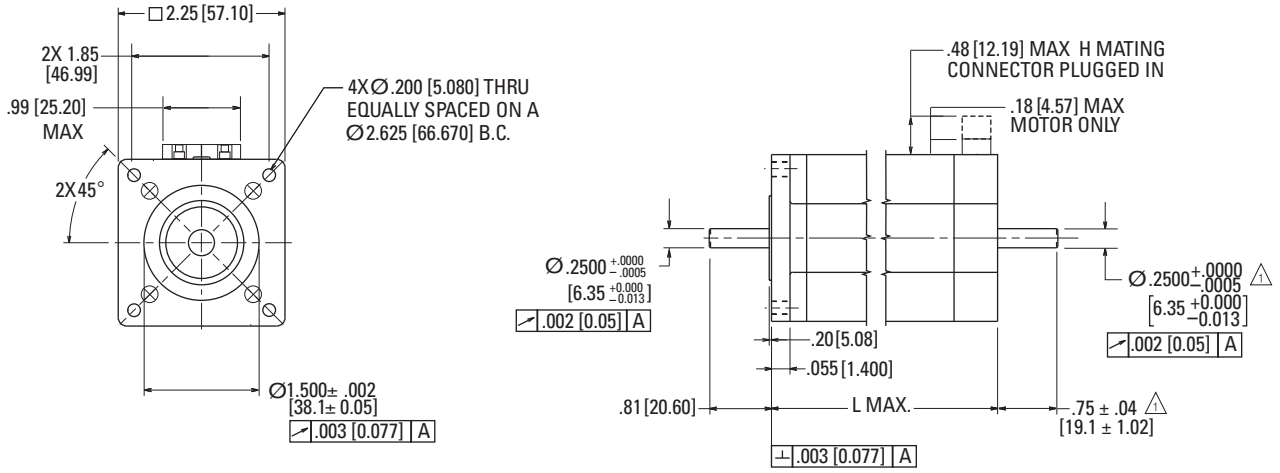
Single and double stack motors are available with both standard and low inertia "-J" rotors. Choose low inertia to produce the highest acceleration rates possible. Low inertia motors are most effective for operation below 2,000 RPM. Choose standard to generate maximum torque.



Low Inertia Rotor Standard Rotor

M2 / P2 Series Outline Drawings

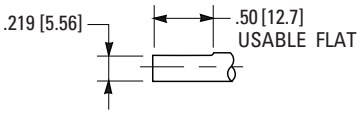
M2 / P2 Regular Construction Hookup

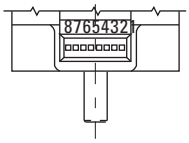


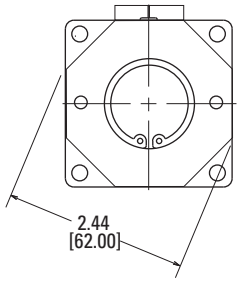
Motor Model	L Max.
P2H	1.60 [40.7]
P or M21	2.06 [52.3]
P or M22	3.10 [78.7]

Dimensions in inches [mm]

Standard Shaft Options



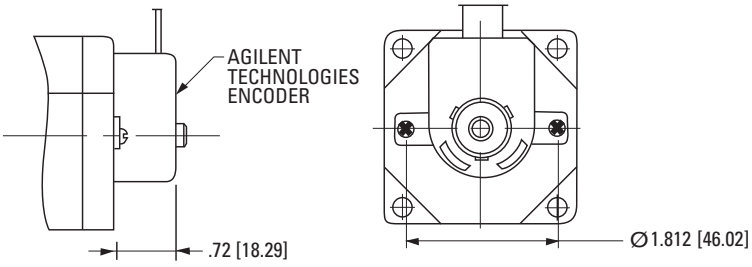




⚠1 Optional rear shaft extension available as shown. Same diameter as front shaft extension.

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)	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-s² (kg-m² x10⁻³)	lb (kg)	Radial Force lb (N)	Axial Force 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	•			59 (0.42)	2.6	0.76	1.9						
	P2HxxxB-L		•			1.3	3.04	7.6						
	P2HxxxC-L	•			61 (0.43)	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			•	42 (0.30)	3.68	0.44	0.50						
	P2HxxxB-L			•		1.84	1.52	1.9						
	P2HxxxC-L			•	43 (0.30)	1.77	1.68	2.3						
	P2HxxxF-L			•	42 (0.30)	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	0.90			0.0013 (0.0092)			
	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	0.70			0.0013 (0.0092)			
	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.
See page 93 for M&P series connector diagrams and switching sequence.

Continued on page 45.

M2 / P2 Performance Data (continued)

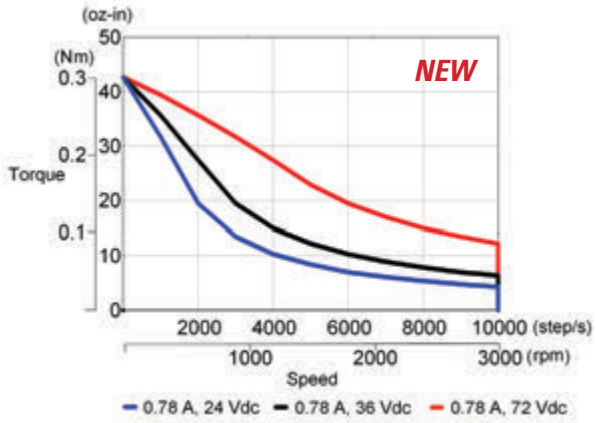
	Motor Model Number	Config.			Holding Torque (2 phases on)	Rated Current/ Phase	Phase Resistance	Phase Inductance	Detent Torque	Thermal Resistance	Rotor Inertia	Weight	Shaft Loading*	
		Parallel	Series	Unipolar	oz-in (Nm) +/-10%	Amps DC	Ohms +/-10%	mH Typical	oz-in (Nm)	Mounted °C/Watt	oz-in-s² (kg-m² x 10⁻³)	lb (kg)	Radial Force lb (N)	Axial Force 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			0.0026 (0.018)			
	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			0.0026 (0.018)			
	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 93 for M&P series connector diagrams and switching sequence.

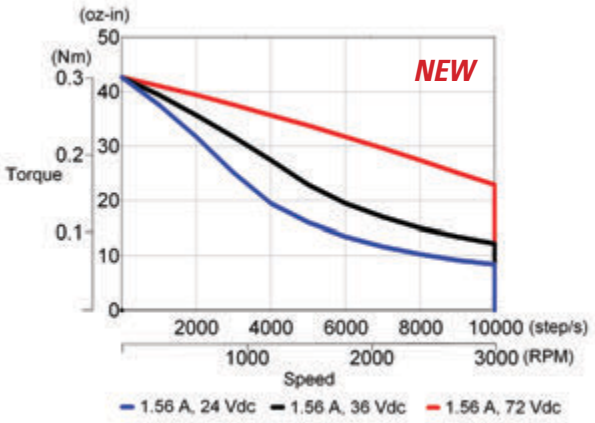
M2 / P2 Series Stepper Motors

M2 / P2 Performance Curves

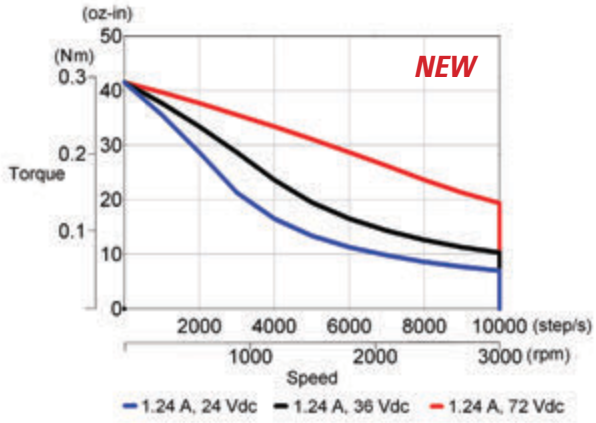
P2HxxxF-L (S) w/ P5000



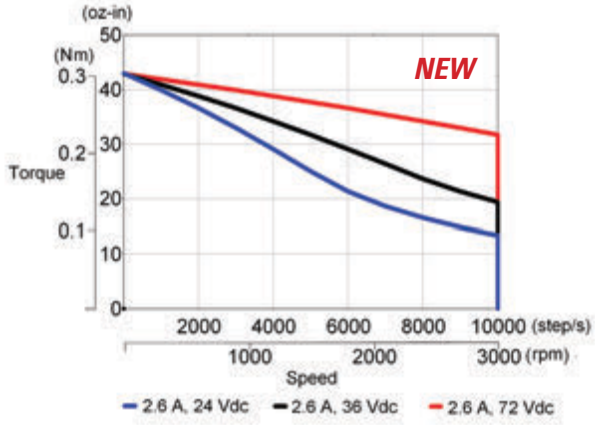
P2HxxxF-L (P) w/ P5000



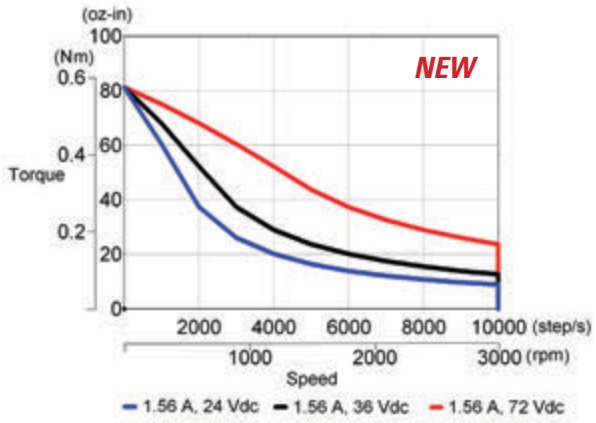
P2HxxxB-L (S) w/ P5000



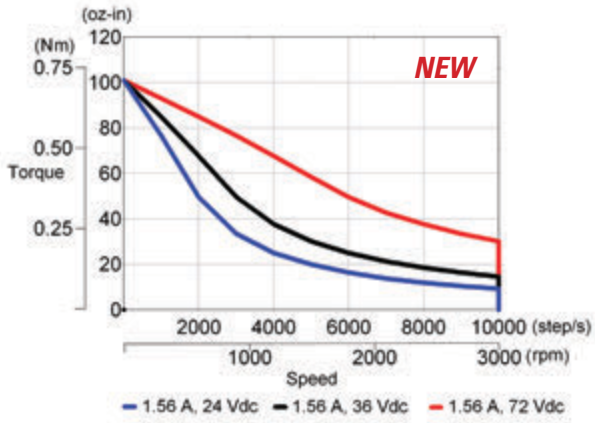
P2HxxxB-L (P) w/ P5000



P21xxxD-L (P) w/ P5000

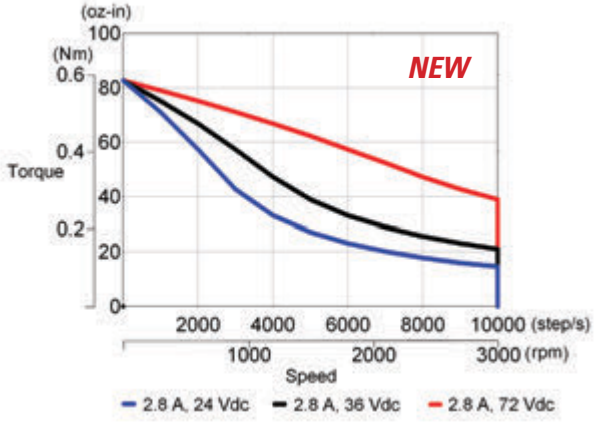


M21xxxD-L (P) w/ P5000

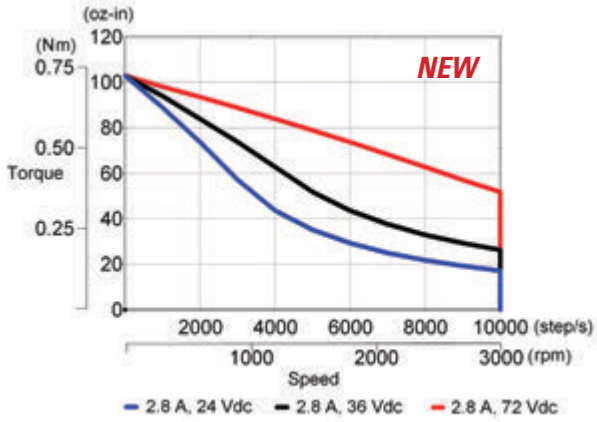


M2 / P2 Performance Curves

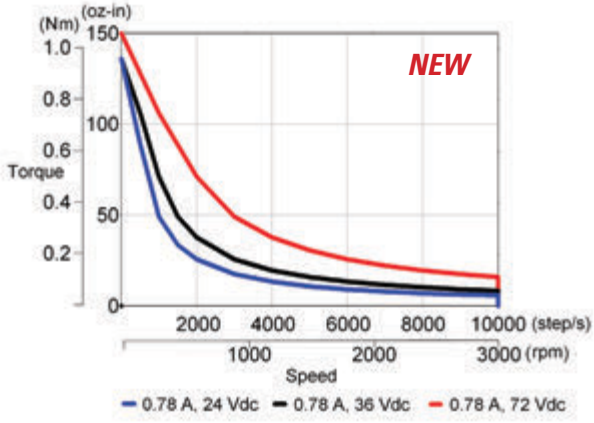
P21xxxA-L (S) w/ P5000



M21xxxA-L (S) w/ P5000



P22xxxE-L (S) w/ P5000



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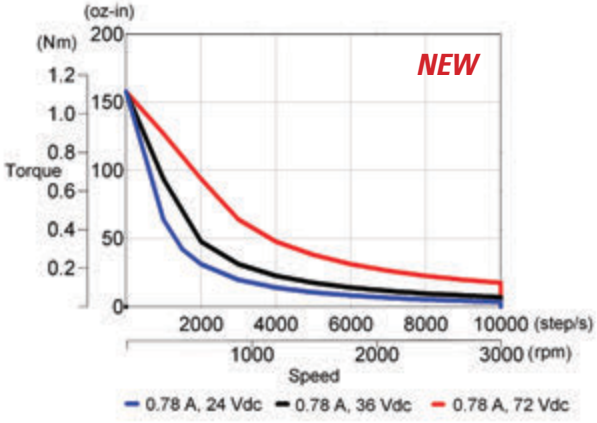
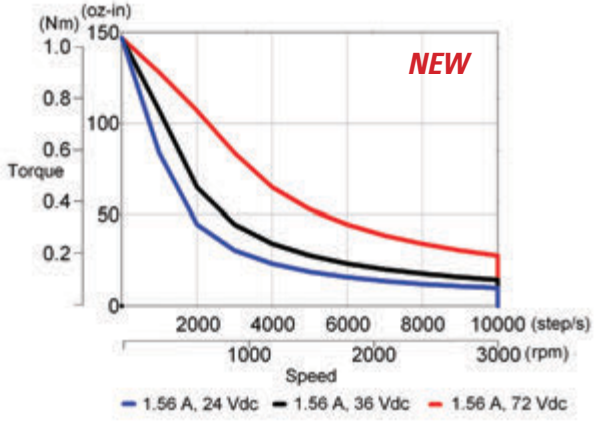
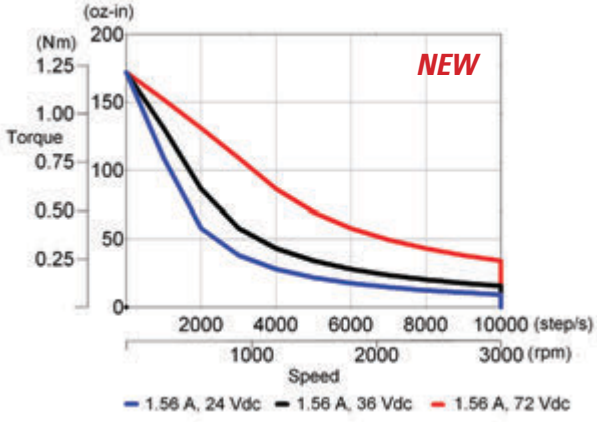


P22xxxC-L (S) w/ P5000



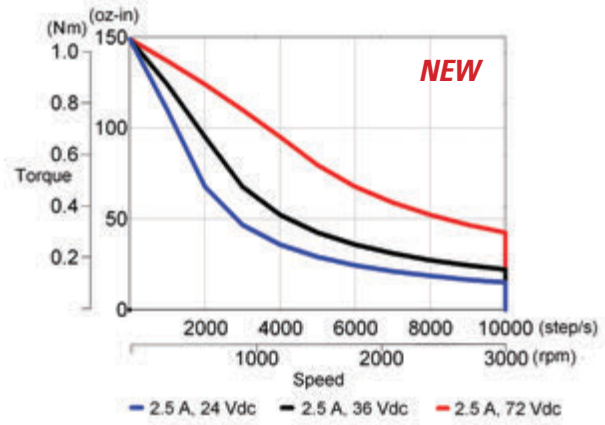
M22xxxC-L (S) w/ P5000



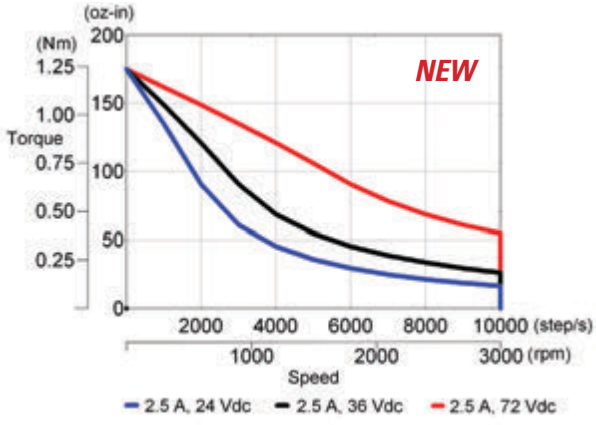
M2 / P2 Series Stepper Motors

M2 / P2 Performance Curves

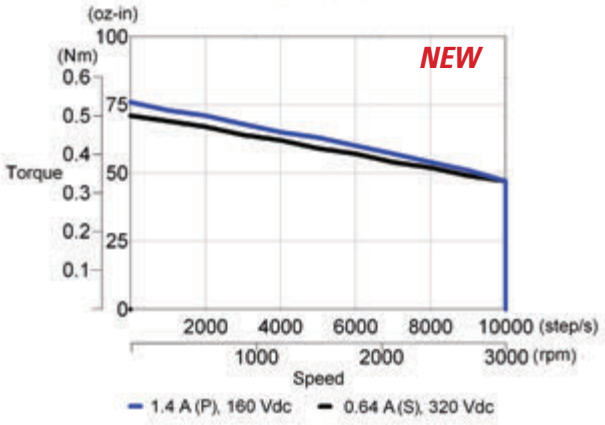
P22xxxD-L (P) w/ P5000



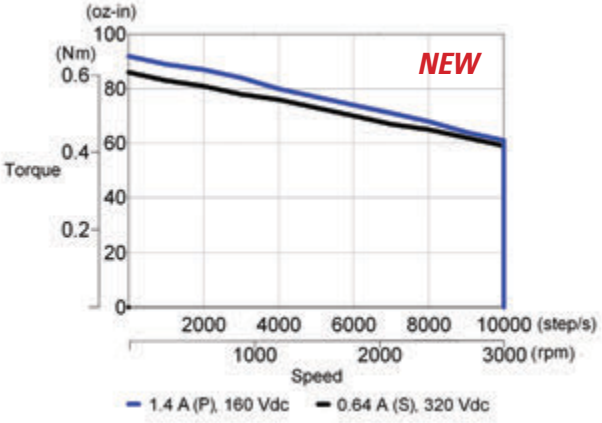
M22xxxD-L (P) w/ P5000



P21xxxD-L (P) w/ P6000



M21xxxD-L (P) w/ P6000



Model Nomenclature

T2 Series Stepper Motor

T 2 3 N R H J – L N N – N – 00

T Series

Motor Frame Size
2 = NEMA 23 (2.25" square)

Rotor Stack Length
H = Half stack
1 = 1 stack
2 = 2 stacks
3 = 3 stacks

Mounting Configuration
N = NEMA 23
S = Special, contact factory

Construction / Hookup
C = MS connector
L = Terminal box via 1/2" NPT pipe thread
M = Terminal box via metric PG11 pipe thread
R = Regular - leadwire
S = Special, contact factory

Windings / Leads
E = 6 leads (Unipolar)[1]
H = 4 leads (Parallel connected)
L = 4 leads (Series connected)
S = Special, contact factory

Winding Type
D, E, F, G, H, J, K
S = Special, contact factory

Special Sequence
Insert 00 if all parts are standard. Any other numbers are factory assigned

Ecoder Option
C2 = Encoder 200 LPR w/line driver[3]
C4 = Encoder 400 LPR w/line driver[3]
C5 = Encoder 500 LPR w/line driver[3]
M4 = Encoder mtg. provisions[3]
NS = No Feedback
SS = Special, contact factory

Shaft Modifications
F = Flat
N = Smooth
S = Special, contact factory

Shaft Configuration
D = Rear shaf extension[2]
N = No rear shaft extension
S = Special, contact factory

Rotor Type
L = Laminated

Notes:
1. N/A with "C" Construction / Hookup option
2. "R" Construction / Hookup only, required for motors with encoders
3. Requires "R" Construction / Hookup option and "D" Shaft Configuration option

M & P Series Stepper Motor

P 2 1 N R X A – L N N – N S – 00

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

Size
2 = NEMA 23
(2.25" across flat)

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

Mounting
N = NEMA
S = Special, contact customer support

Construction
R = Regular
S = Special, contact customer support

Termination
X = Receptacle
F = 8 flying leads
S = Special, contact customer support
For X (receptacle) designation, Mating leaded connectors may be ordered seperately. Optional GRN/YEL ground wire available.

Winding Type
A, B, C, D
S = Special, contact customer support

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

Shaft Modifications
N = Smooth
F = Flat
S = Special, contact customer support

Shaft Configuration (Diameter & Length)
N = Single
D = Double
S = Special, contact customer support

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 stepper motor controls.
M1 = Encoder mounting provisions
HD = Encoder 500 LPR
HJ = Encoder 512 LPR
SS = Special, contact customer support

Sequence Number
Insert 00 if all parts are standard.
Other numbers will be assigned for special motors.

Note: Options shown in bold blue text are considered standard.