STEP MOTORS

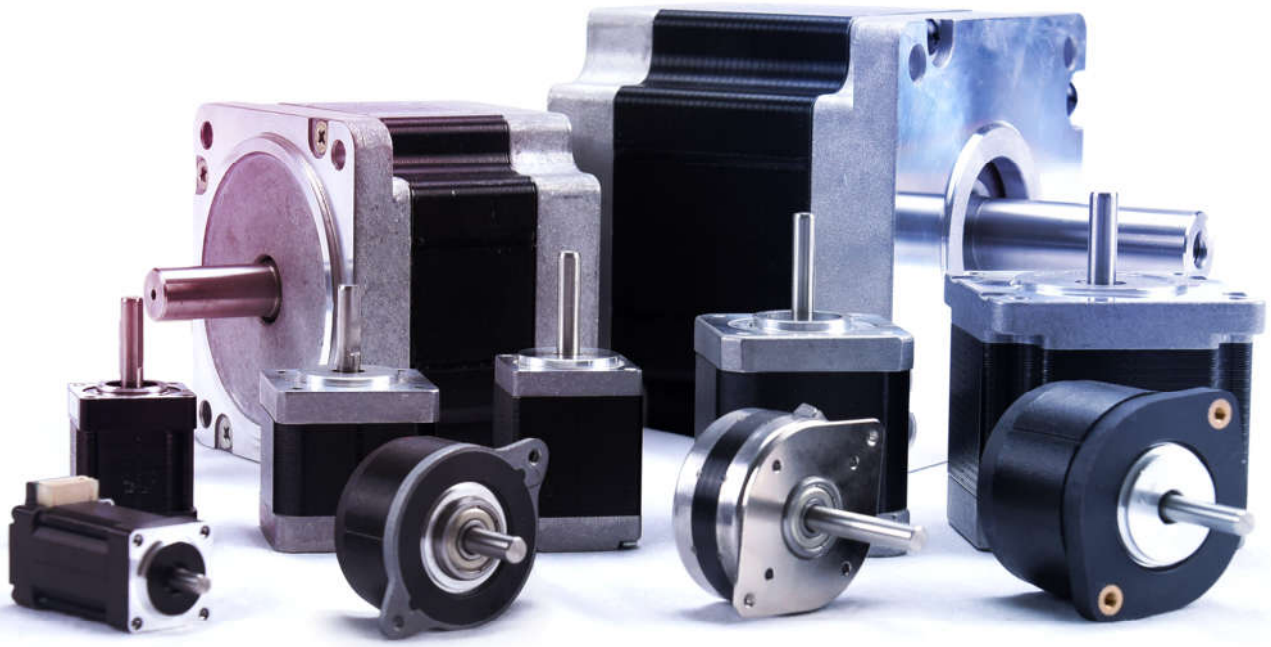
POWERPLUS

ENCAPSULATED

2 PHASE 0.9° HYBRID

2 PHASE 1.8° HYBRID

3 PHASE 1.2° HYBRID



MOONS'

moving in better ways

STEP MOTORS

Contents

PowerPlus Technology

MOONS' PowerPlus technology provides 25% to 40% more torque across the entire speed range of the motor. The increased torque is a result of higher motor efficiency, and is available without increasing the drive voltage or current.

Typical Applications:

Machine Upgrades: Changing existing machines to PowerPlus motors can be a quick path to new models with improved performance. Because the motor, drive and mechanical parts remain the same, benefits include:

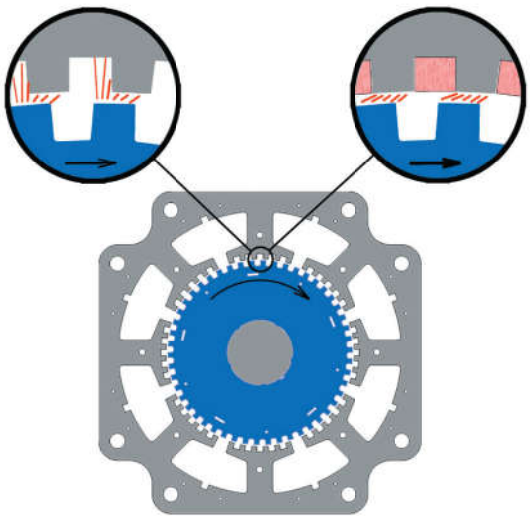
- Faster new product introduction
- Reduced engineering costs
- Easy production phase in
- Reduced spare parts inventory

Correct stalling problems with existing machines:
Problems with occasional machine stalling are often due to unexpected field conditions such as: low temperature, dirt, and customers using machines in unexpected ways. Using PowerPlus motors can be a quick effective solution.

Overcome drive or power supply limitations in new designs:
Often a higher current drive or higher voltage power supply can provide needed extra torque. However, in many designs the drive current cannot be increased without changing to a substantially more expensive drive. And increasing drive voltage can be impractical, expensive, or may not be allowed for safety reasons. In these cases using PowerPlus motors can be especially useful.

Conventional Motor

Some of the torque producing magnetic flux that links the rotor to the stator is outside the stator teeth. This stray flux adds little to motor torque.



PowerPlus Technology

Magnets placed between the stator teeth redirect most of the stray magnetic flux into the stator teeth. This produces additional torque with the same input power.

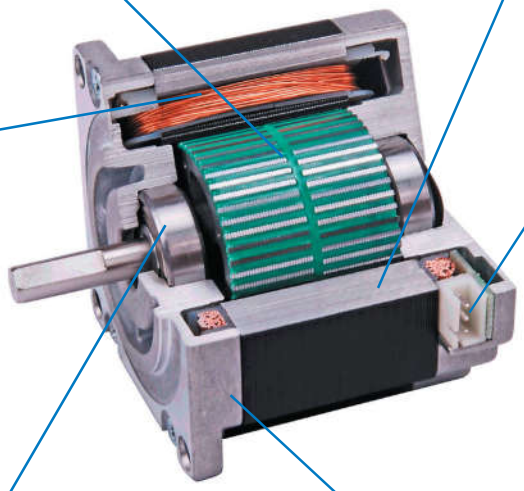
MOONS' Step Motor Advantages

These step motors from MOONS' include a number of improvements for even greater performance and value:

- Many refinements that increase torque by an average of 20%
- Complete range of sizes: 8, 10, 11, 14, 16, 17, 23, 24, 34, 42
- Size 17 and larger 2 phase motors are UL recognized
- 0.9 degree 2 phase motors, and 3 phase motors for extra smooth, quiet, performance
- PowerPlus technology: for maximum efficiency and performance at all speeds
- Lower inertia rotors provide faster acceleration
- High voltage insulation for use with high voltage, high performance drives
- Low loss stators have better high speed performance
- Standard windings with high fill for more torque
- Updated model numbering system includes a wider range of windings and standard options

Rare earth magnets and optimized rotors designed for maximum torque, and high efficiency

Laminations optimized for high torque, high accuracy and low losses.



Stators with maximum winding fill for lower temperatures, long life and maximum torque

Connectors integrated into motors for quick reliable connections.

Large ball bearings, also optimized for short repetitive moves to ensure long life.

Die cast endbells provide strength, precision, and help cool the motor.

Encapsulated Motors

Encapsulation Technology From MOONS' Offers Many Advantages

Ideal for Security Cameras

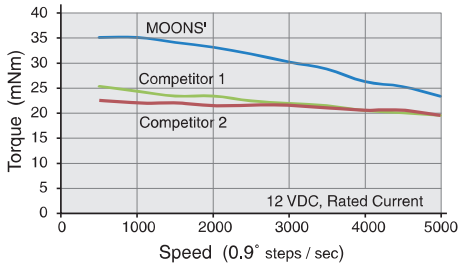
In addition to all the advantages of normal step motors, these new encapsulated motors can help achieve a breakthrough in miniaturization of security cameras. Small step motors are a core component in security camera systems. With MOONS' encapsulation technology, the 36mm diameter motor is now available with a thickness as little as 12.8mm.

Low Temperature Rise

The winding resistance of these new motors is nearly 30% lower than other motors with the same thickness and output-torque. In addition, the new encapsulation technology increases the heat-conducting property of these motors. The lower winding resistance and improved thermal conductivity combine to drastically lower the temperature of these motors to less than 80% of standard motors.

35% More Torque

Lower resistance coils allows these encapsulated motors to handle more power. With the same temperature rise. These motors can produce 35% more torque.



Quieter & Smoother

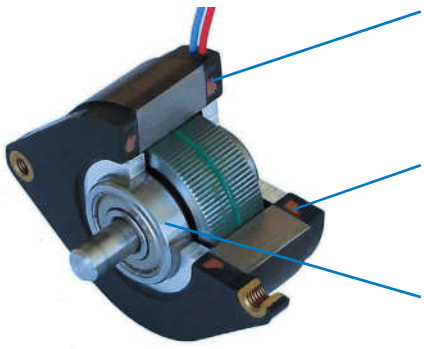
New materials and improved manufacturing processes, means these motors have a higher precision, more stable design. This controls vibration and reduces noise. It also makes the motor run smoothly.

More Load & Longer Life

MOONS' encapsulated stepping motors use large bearings that can handle large axial and radial loads, ensure long life.

RoHS

Encapsulated stepping motors are RoHS compliant.



Molded Construction

Encapsulated winding	Runs cooler – Longer life
Better sealing	Longer life
Reduced vibration	Smoother moves - Quieter

High Winding Fill

Larger wire size	More torque
Uses less energy	Longer battery life

Large Ball Bearings

Large shaft loads	Fewer design restrictions
Long Life	27 times with the same load

2 Phase and 3 Phase Motors

MOONS' offers several families of hybrid step motors with a different number of phases and step angles. Each has a combination of advantages that are better suited to specific applications.

- 2 Phase - 1.8 degree step angle

  This is the most popular step motor. It has a great combination of torque, speed and accuracy. Due to their high volumes, drives for 2 phase motors are very common and economical.

  The basic method of control is to have the motor make one full step as the drive applies full current to the motor windings. This causes the motor to move in full step increments. When the motor is stepped at different rates it may make a distinctive sound and can vibrate (resonate) at certain speeds. This is not a problem for most applications. If it is an issue, motors can be controlled with micro-stepping drives that smooth motor torque. And many times, resonate speeds can simply be avoided by programming the drive.

  MOONS' offers 2 phase 0.9 degree step motors, and three phase 1.2 degree step motors, for applications that need even more accuracy, or motion that is very smooth and quiet.

- 2 Phase - 0.9 degree step angle

  Because each step moves only ½ the distance of 1.8 degree motors, these motors have higher accuracy and very smooth movement. The drive for this motor is exactly the same as the 2 phase, 1.8 degree motors. For the same speed, these motors must have a step rate that is 2 times that of a 1.8 degree motor. This higher step rate leads to less torque at high speeds. However, for many applications high speed is not needed, or higher voltage drives can be used to increase torque at high speeds.

  14HK0 Shown Full Size

  An example of a good application for 0.9 degree motors are security cameras. These motors allow the camera to be precisely moved without "camera shake" which causes the picture to vibrate. MOONS' offers small encapsulated sizes that reduce camera package size, and helps withstand the outdoor environment.

- 3 Phase - 1.2 degree step angle

  The use of three phases inherently helps to reduce torque ripple and smooth motor performance. 3 phase motors require a 3 phase drive that is different than the drive for 2 phase motors. As compared to the 1.8 degree two phase motors, the low speed torque is somewhat less. But design improvements introduced by MOONS', minimizes this difference. High speed torque can also be comparable. In addition, MOONS' size 24 three phase motors are available with PowerPlus technology, for maximon torque.

  3 phase motors are used where maximum performance, and very quiet, smooth precise movement is need. An example of a good application for three phase motors is in performance lighting. These spotlights lights need quick movement, and quiet operation so as not disturb the performance.

Model Numbering System

Models starting with M or P — M S 17 HD 2 P 4 040 -M

Stator - Series

M	Standard Step Motor
P	PowerPlus Step Motor

Rotor

S	Standard Inertia	Size 8, 10, 11, 14, 16, 17, 23, 24
L	Lower Inertia	Size 23, 24, 34, 42

Frame Size

##	08, 10, 11, 14, 16, 17, 23, 24, 34, 42

Motor Technology

HA	Hybrid Step Motor, 2 Phase 0.9 degree
HY, HD, HS, HR	Hybrid Step Motor, 2 Phase 1.8 degree
HC	Hybrid Step Motor, 3 Phase 1.2 degree

Length Code

#	Non significant number or letter

Connection Construction / IP Rating

L	Leads	IP40
P, F, R	Plug In Connector - Standard	IP40

Number of connections / Winding Type

4	Bipolar
6	Unipolar (can be used bipolar)
8	Can be connected any way

Winding Current

###	Current rating x 100. 050 = 0.5 amps, 500 = 5 amps
X##	for 11 to 19 amps: X10= 11 amps, X40 = 14 amps

Options

Omit	No Options
-E	Standard English rear shaft
-M	Standard Metric rear shaft

Other Models - 14HK, 17HC & 34HC — 14 HK 0 4 05 N

Frame Size

##	14, 17,34

Motor Technology

HK	2 Phase 0.9 degree
HC	Hybrid Step Motor, 3 Phase 1.2 degree

Length Code

#	Non significant number or letter

Connection Construction / IP Rating

0	Plug In Connector - Standard	IP40
3, 4, 8	Number of Leads	IP40

Winding Current

##	Non significant number

Optional Construction Code

-##	
N	

Custom Motors

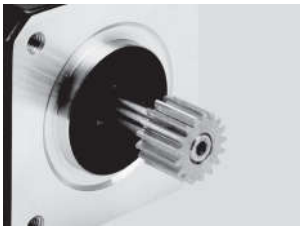
MOONS' provides motors to meet the needs of many applications.
Common modifications include:

- Corrosion resistant motors. These are often used in outdoor equipment where humidity and temperature changes can cause corrosion.
- Sealed motors to keep out dust and water
- Special shaft sizes and features
- Pulleys, gears and couplings mounted on the shaft
- Encoders and other feedback devices
- Special lead lengths or cables, with many different connectors

Press Fit Pulley & Gear

Metal Pulley

Plastic Pulley



Gear

Shaft Options

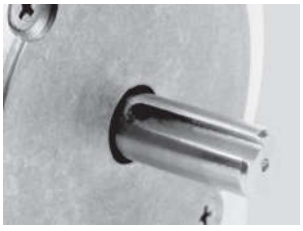
Dowel

Worm Shaft

Cross Drilled Shaft

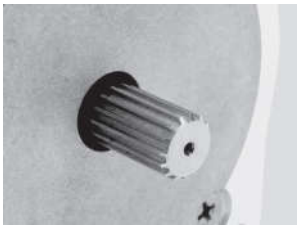
Single Flat

Double Flat

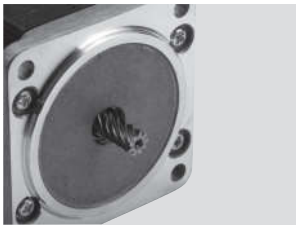


Key Way

Knurl



Hobbed Gear



Helical Cut

MS08HY Series: 1.8° - Size 8

- Phases 2
- Steps / Revolution 200
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial: 6 N (1.3 Lbs.) Push; 25 N (5.6 Lbs.) Pull
  - Radial: 18 N (4 Lbs.) At End of Shaft
- IP Rating 40
- Approvals RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

MS08HY 3 P 4 065

Basic Motor Length (Max)
1 29.5mm(1.16in.)
3 39.5mm(1.56in.)
5 46.5mm(1.83in.)

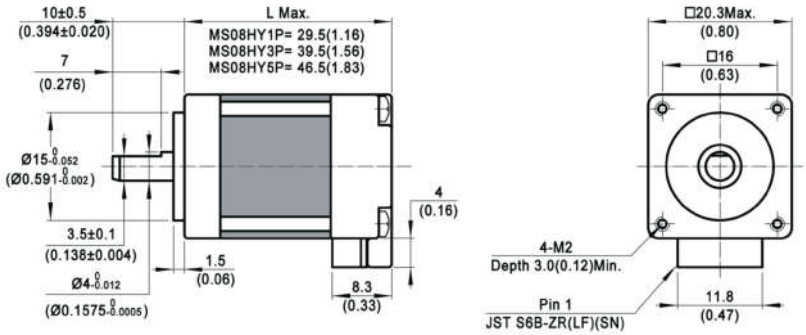
Electrical Connection
P Plug-In Connector(Side Facing)
F Font Facing Connector
R Rear Facing Connector

Number of Connections
4 4 Lead-Bipolar
6 6 Lead-Unipolar (or Bipolar)

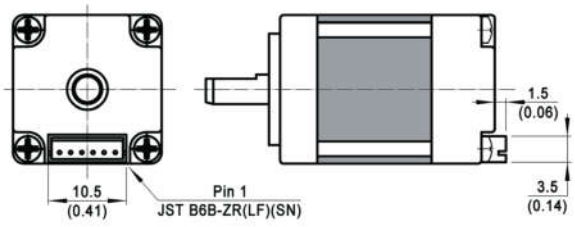
Winding
Current rating x 100

Dimensions: mm (in)

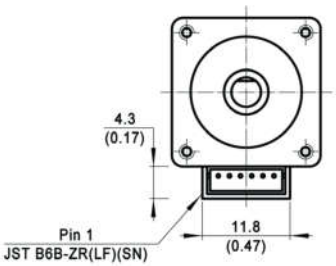
Mating Connector with 4 Leads: 300 (12) long
(order separately) Part Number: 4634 1402 03659



Motor with side facing "P" Plug



Rear facing "R" connector detail



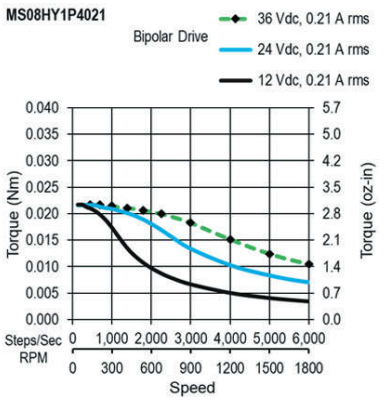
Font facing "F" connector detail

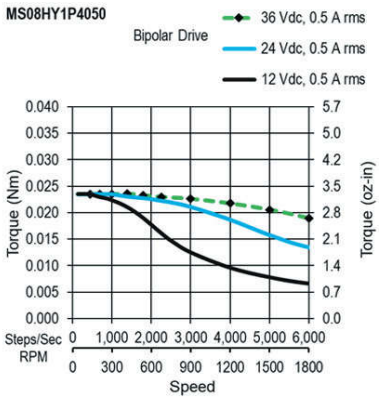
MS08HY - 4 Lead Bi-Polar

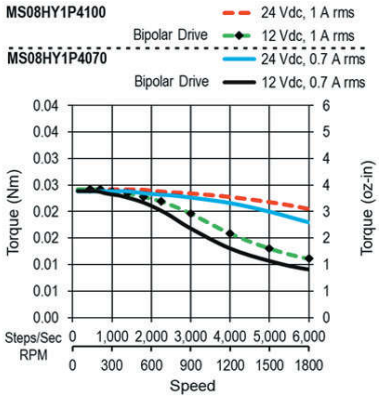
Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
29.5mm (1.16in.)	MS08HY1P4021	P	0.21	0.028	4.0	45	21	1.5	0.21	1.6	0.0088	0.04	0.088
	^ MS08HY1P4050	P	0.5	0.030	4.2	8.8	4.7						
	^ MS08HY1P4070	P	0.7	0.030	4.2	4.5	2.3						
	^ MS08HY1P4100	P	1	0.030	4.2	2.3	1.17						
39.5mm (1.56in.)	MS08HY3P4027	P	0.27	0.048	6.8	35	18.8	2	0.28	2.9	0.016	0.06	0.13
	^ MS08HY3P4045	P	0.45	0.050	7.1	13.1	7.6						
	^ MS08HY3P4065	P	0.65	0.050	7.1	6.6	3.6						
	^ MS08HY3P4090	P	0.9	0.050	7.1	3.4	1.91						
46.5mm (1.83in.)	MS08HY5P4028	P	0.28	0.057	8.1	34	24	2.5	0.35	4.2	0.023	0.08	0.18
	^ MS08HY5P4040	P	0.4	0.057	8.1	16.4	12						
	^ MS08HY5P4060	P	0.6	0.057	8.1	8.2	5.6						
	^ MS08HY5P4090	P	0.9	0.057	8.1	3.7	2.4						

^ Preferred model

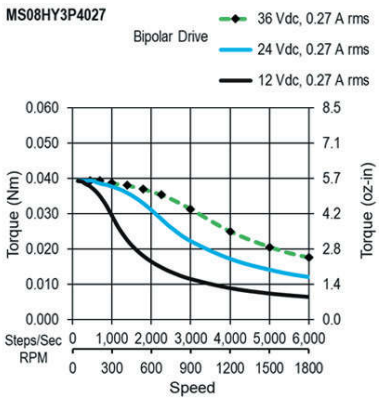
MS08HY1-Bipolar

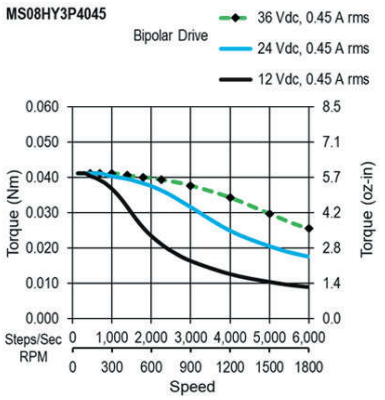


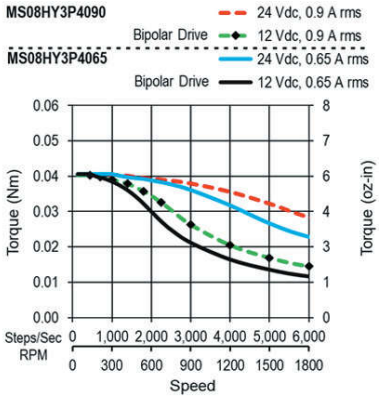




MS08HY3-Bipolar







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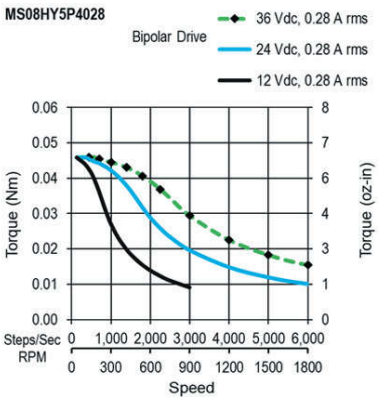
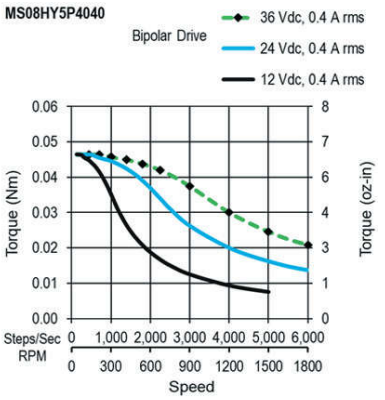
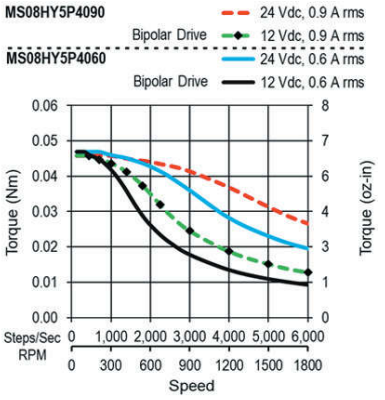






MS10HY Series: 1.8° - Size 10

- Phases 2
- Steps / Revolution 200
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial 15 N (3.4 Lbs.) Push
    25 N (5.6 Lbs.) Pull
  - Radial 30 N (6.5 Lbs.) At Flat of Shaft
- IP Rating 40
- Approvals RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

MS10HY 2 F 4 052

Basic Motor Length (Max)
- 0 23.5mm(0.92in.)
- 2 33mm(1.3in.)

Electrical Connection
- F Font Facing Connector

Number of Connections
- 4 4 Lead-Bipolar
- 6 6 Lead-Unipolar (or Bipolar)

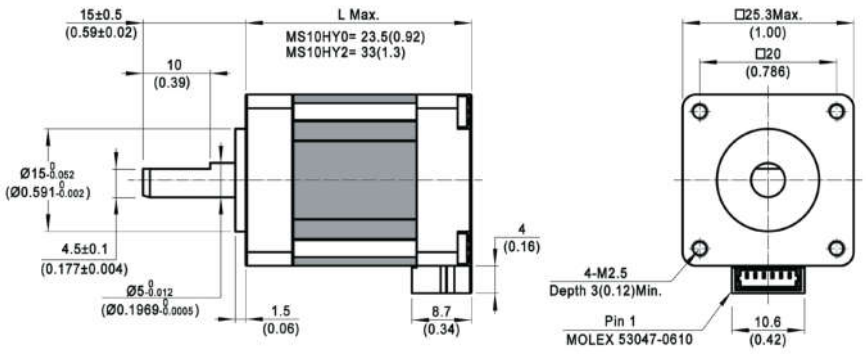
Winding
- ### Current rating x 100

MS10HY - 4 Lead Bi-Polar

Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
23.5 mm (0.92 in.)	MS10HY0F4025	F	0.25	0.045	6.4	44	29	2.5	0.35	2	0.011	0.05	0.11
	MS10HY0F4040	F	0.4	0.045	6.4	16.9	11.5						
	^ MS10HY0F4060	F	0.6	0.045	6.4	6.9	5.1						
	^ MS10HY0F4090	F	0.9	0.045	6.4	3.1	2.2						
33 mm (1.3 in.)	MS10HY2F4029	F	0.29	0.086	12.0	37	40	3.5	0.5	5	0.027	0.085	0.19
	^ MS10HY2F4052	F	0.52	0.086	12.0	11	12.8						
	^ MS10HY2F4070	F	0.7	0.086	12.0	6	6.9						
	^ MS10HY2F4100	F	1	0.086	12.0	3	3.5						

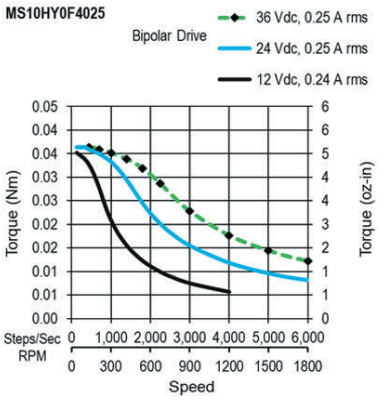
Dimensions: mm (in)

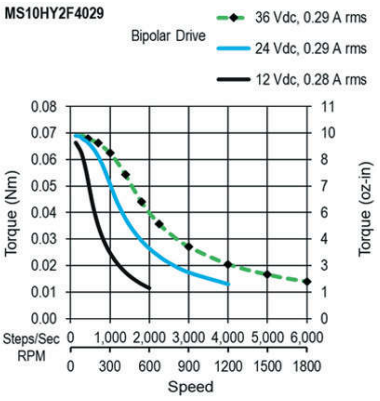
Mating Connector with 4 Leads: 300 (12) long
(order separately) Part Number: 4634 1402 07814

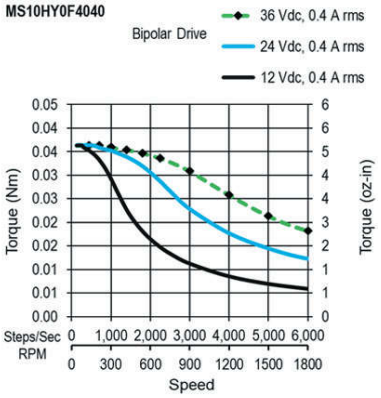


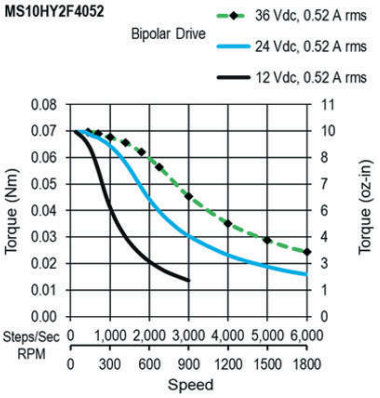
MS10HY0-Bipolar

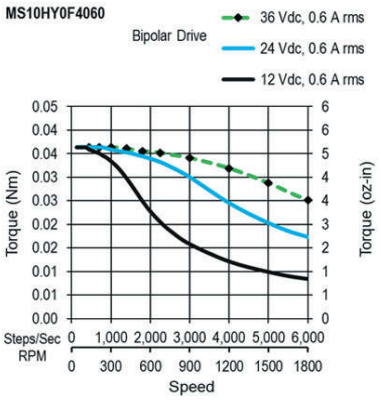
MS10HY2-Bipolar

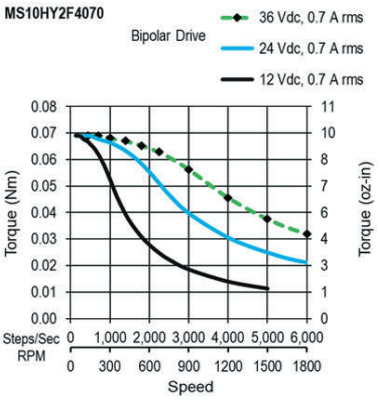


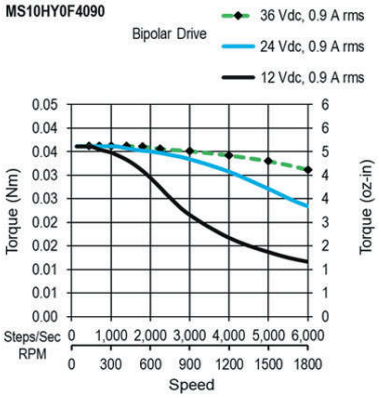


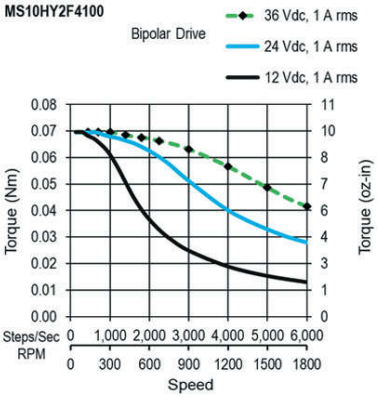












MS11HS Series: 1.8° - Size 11

- Phases 2
- Steps / Revolution 200
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial: 15 N (3.4 Lbs.) Push; 25 N (5.6 Lbs.) Pull
  - Radial: 30 N (6.5 Lbs.) At Flat Center
- IP Rating 40
- Approvals RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

MS11HS 3 P 4 040

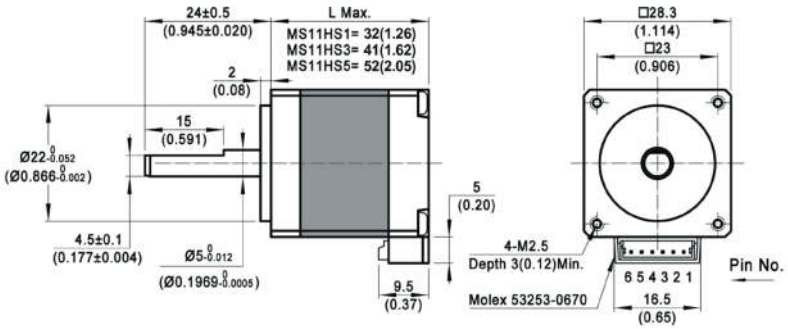
Basic Motor Length (Max)
- 1 32mm(1.26)
- 3 41mm(1.62)
- 5 52mm(2.05)

Electrical Connection
- P Plug-in Connector

Number of Connections
- 4 4 Lead-Bipolar
- 6 6 Lead-Unipolar (or Bipolar)

Winding
- ### Current rating x 100

Dimensions: mm (in)



MS11HS - 4 Lead Bi-Polar

Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
32 mm (1.26 in.)	MS11HS1P4024	P	0.24	0.09	13	49	38	5	0.71	9	0.049	0.1	0.22
	^ MS11HS1P4050	P	0.5	0.09	13	10.9	9.6						
	^ MS11HS1P4067	P	0.67	0.09	13	6.1	5.4						
	^ MS11HS1P4100	P	1	0.09	13	2.7	2.5						
41 mm (1.61 in.)	MS11HS3P4029	P	0.29	0.12	17	39	27	6	0.85	12	0.066	0.15	0.33
	^ MS11HS3P4067	P	0.67	0.12	17	7	5						
	^ MS11HS3P4095	P	0.95	0.12	17	3.7	2.7						
	^ MS11HS3P4140	P	1.4	0.12	17	1.8	1.2						
52 mm (2.05 in.)	MS11HS5P4030	P	0.3	0.16	23	40	31	8	1.1	18	0.098	0.2	0.44
	^ MS11HS5P4070	P	0.7	0.16	23	6.7	5.6						
	^ MS11HS5P4100	P	1	0.17	24	3.7	3						
	^ MS11HS5P4150	P	1.5	0.16	23	1.64	1.22						

^ Preferred model

MS11HS - 6 Lead Uni-Polar

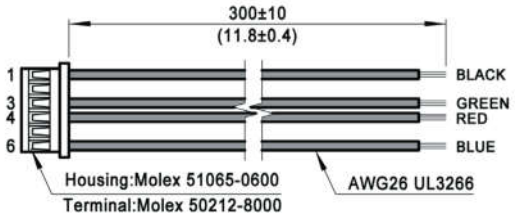
Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
32 mm (1.26 in.)	MS11HS1P6024	P	0.24	0.06	9	48	18.2	5	0.71	9	0.049	0.1	0.22
	MS11HS1P6050	P	0.5	0.07	9	10.9	4.5						
	MS11HS1P6070	P	0.7	0.07	9	5.5	2.3						
41 mm (1.61 in.)	MS11HS3P6026	P	0.26	0.09	12	49	15.7	6	0.85	12	0.066	0.15	0.33
	MS11HS3P6067	P	0.67	0.09	13	7.5	2.6						
	MS11HS3P6095	P	0.95	0.09	12	3.5	1.2						
52 mm (2.05 in.)	MS11HS5P6033	P	0.33	0.12	17	35	13.6	8	1.1	18	0.098	0.2	0.44
	MS11HS5P6067	P	0.67	0.12	17	8.1	3.2						
	MS11HS5P6095	P	0.95	0.12	17	4.3	1.6						

^ Preferred model

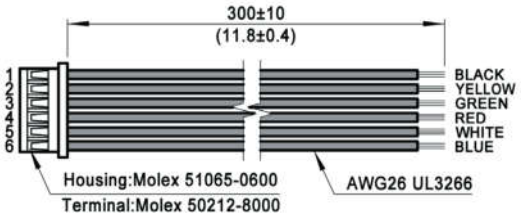
Mating Connector With Leads (order separately)

Dimensions: mm (in)

4 Lead Part Number 4634140204190

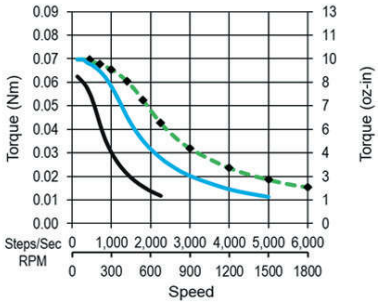


6 Lead Part Number 4634140204490

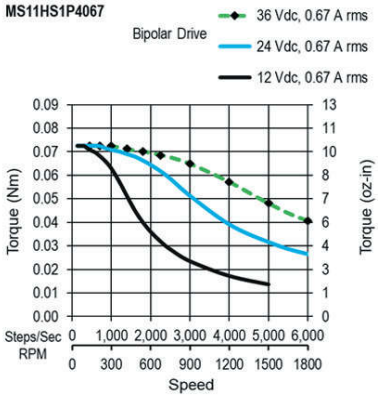


MS11HS1-Bipolar

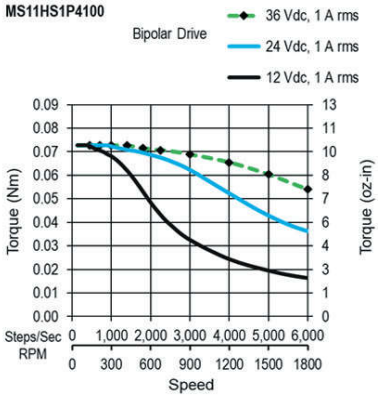
MS11HS1P4024



MS11HS1P4067

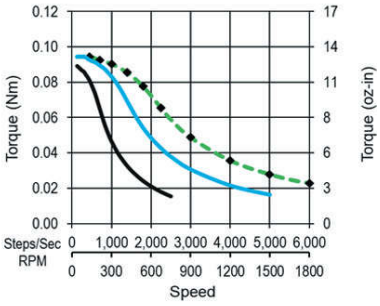


MS11HS1P4100

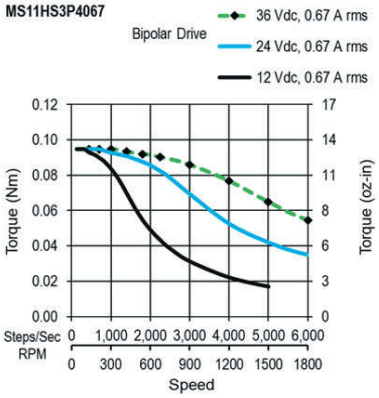


MS11HS3-Bipolar

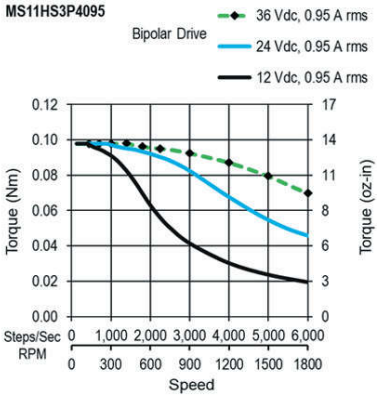
MS11HS3P4029



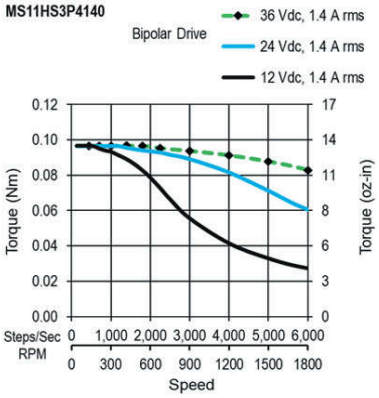
MS11HS3P4067



MS11HS3P4095

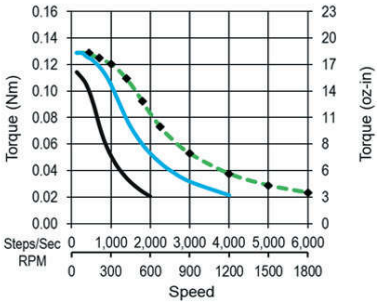


MS11HS3P4140

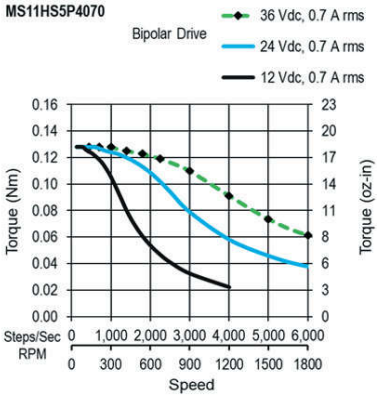


MS11HS5-Bipolar

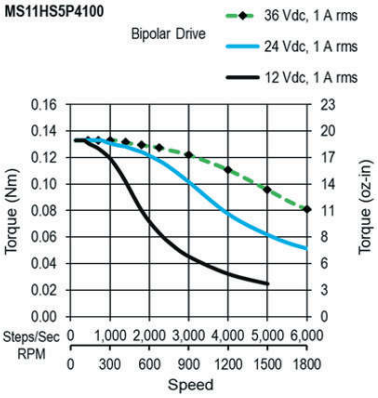
MS11HS5P4030



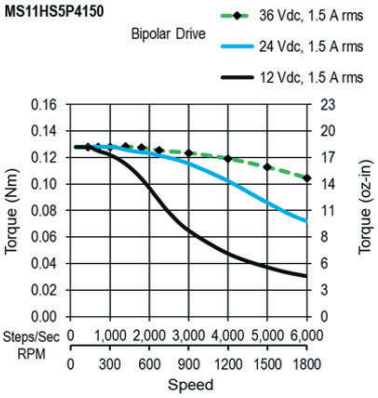
MS11HS5P4070



MS11HS5P4100

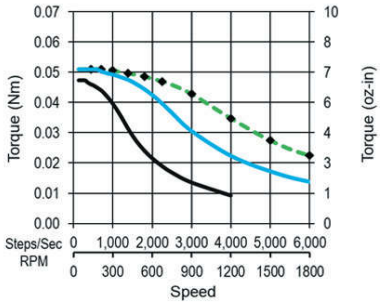


MS11HS5P4150

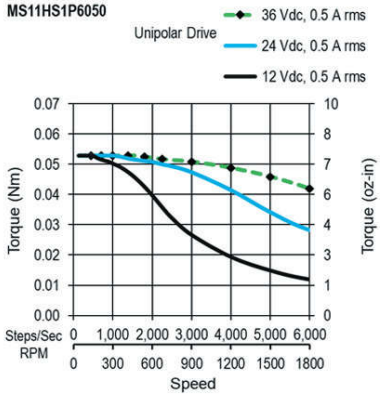


MS11HS1-Unipolar

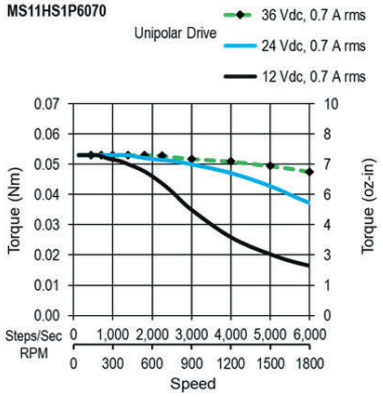
MS11HS1P6024



MS11HS1P6050

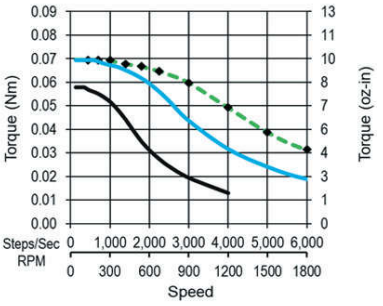


MS11HS1P6070

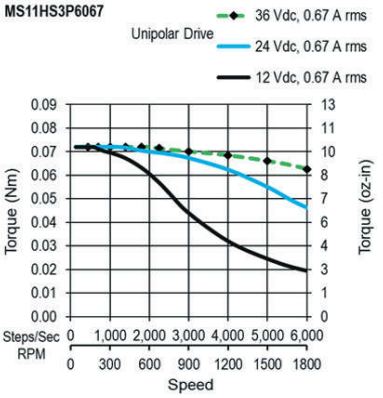


MS11HS3-Unipolar

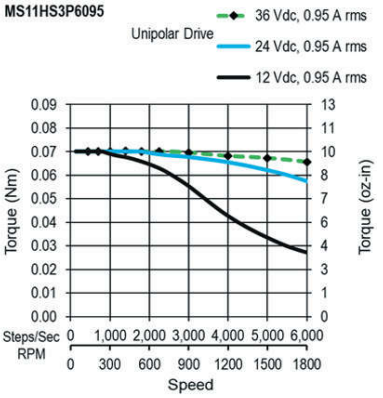
MS11HS3P6026



MS11HS3P6067

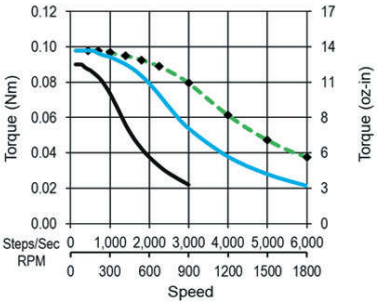


MS11HS3P6095



MS11HS5-Unipolar

MS11HS5P6033



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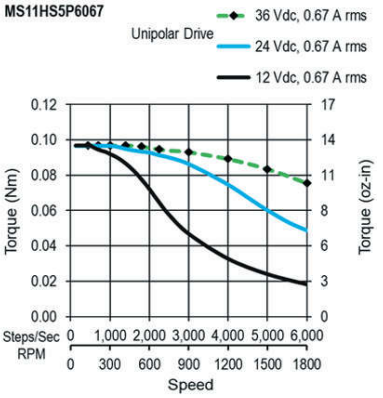

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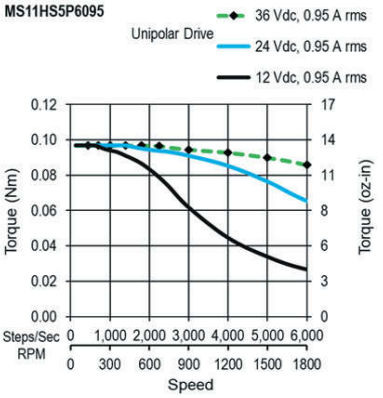


14HK Series: 0.9° - Size 14 Encapsulated

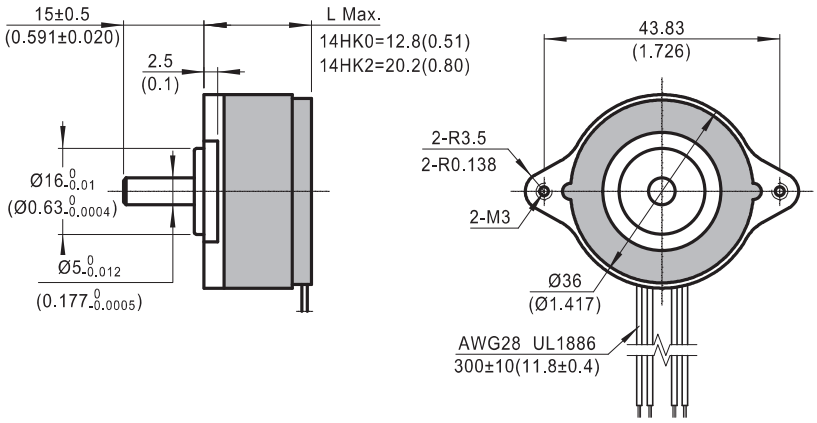
- Phases 2
- Steps / Revolution 400
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial: 25 N (5.6 Lbs.) Push; 65 N (15 Lbs.) Pull
  - Radial: 30 N (6.5 Lbs.) At End of Shaft
- IP Rating 40
- Approvals RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

14HK - 4 Lead Bipolar

Length		Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
		Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
12.8 mm (0.5 in.)		14HK0405N	L	0.3	0.044	6	16.3	8.5	4	0.57	4	0.022	0.05	0.11
	^	14HK0406N	L	0.5	0.044	6	6.3	3.1						
	^	14HK0407N	L	0.6	0.044	6	4.2	2.1						
	^	14HK0408N	L	0.8	0.044	6	2.6	1.21						
20.2 mm (0.8 in.)		14HK2404N	L	0.3	0.12	17	26	21	10	1.4	11	0.06	0.11	0.24
	^	14HK2405N	L	0.5	0.12	17	11.7	9.5						
	^	14HK2406N	L	0.6	0.12	17	7.1	5.4						
	^	14HK2407N	L	0.8	0.12	17	4.4	3.2						

^ Preferred model

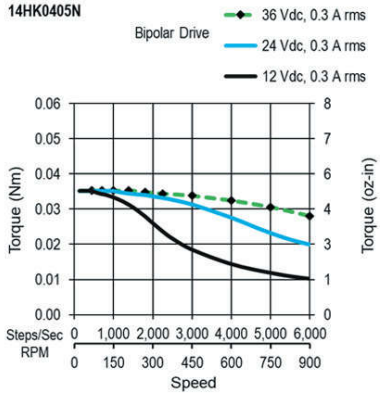
Dimensions: mm (in)



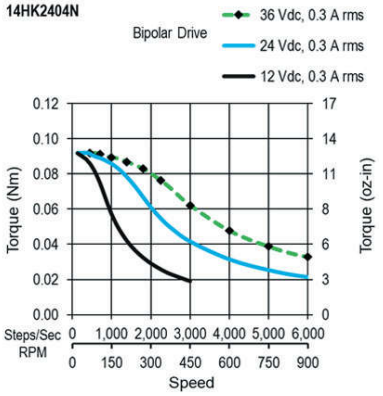
14HK0-0.9° Bipolar

14HK2-0.9° Bipolar

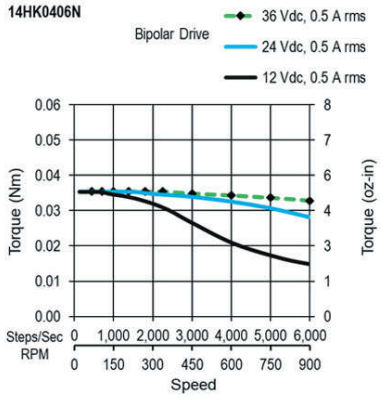
14HK0405N



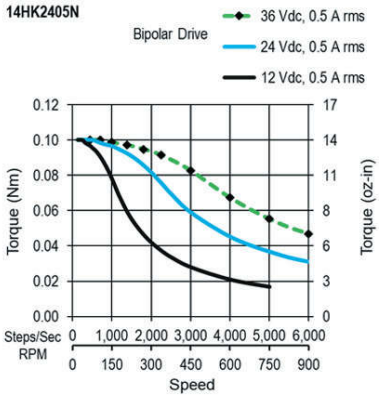
14HK2404N



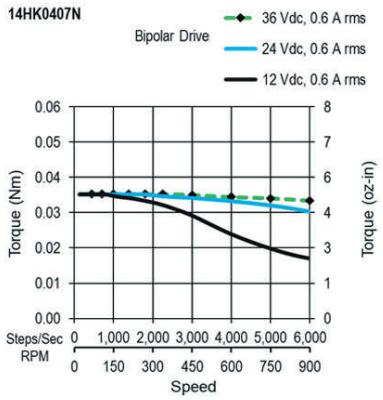
14HK0406N



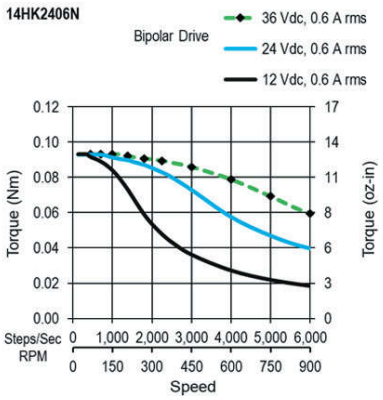
14HK2405N



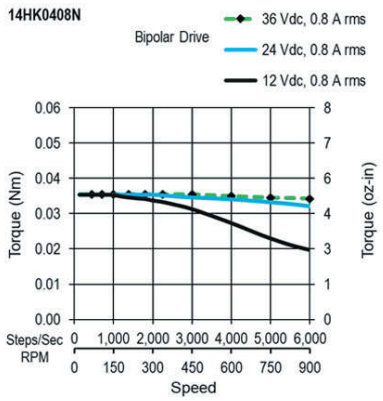
14HK0407N



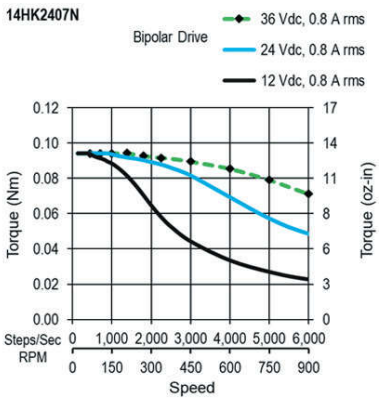
14HK2406N



14HK0408N



14HK2407N



MS14HA Series: 0.9° - Size 14

- Phases 2
- Steps / Revolution 400
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial: 25 N (5.6 Lbs.) Push; 65 N (15 Lbs.) Pull
  - Radial: 30 N (6.5 Lbs.) At Flat Center
- IP Rating 40
- Approvals RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

MS14HA 5 P 4 040

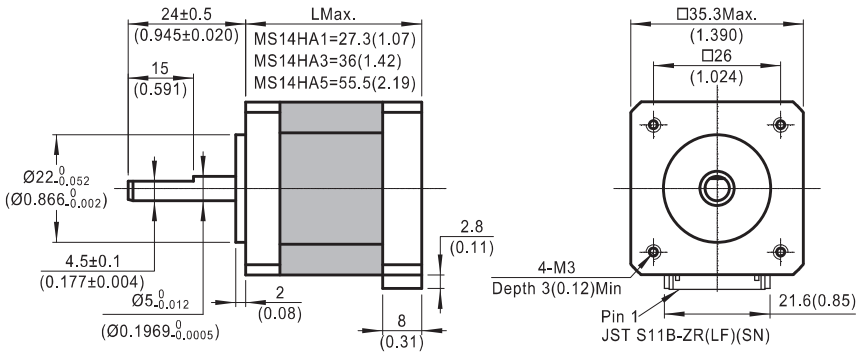
Basic Motor Length (Max)
- 1 27.3mm(1.07 in.)
- 3 36mm (1.42 in.)
- 5 55.5mm (2.19 in.)

Electrical Connection
- P Plug-in Connector

Number of Connections
- 4 4 Lead-Bipolar
- 6 6 Lead-Unipolar (or Bipolar)

Winding
- ### Current rating x 100

Dimensions: mm (in)



MS14HA - 4 Lead Bi-Polar

Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
27.3 mm (1.07 in.)	MS14HA1P4026	P	0.26	0.12	16	45	56	4	0.57	12	0.066	0.15	0.33
	^ MS14HA1P4070	P	0.7	0.12	17	6.1	8.2						
	^ MS14HA1P4100	P	1	0.12	17	3.1	3.9						
	^ MS14HA1P4150	P	1.5	0.12	17	1.43	1.8						
36 mm (1.42 in.)	MS14HA3P4032	P	0.32	0.19	27	37	51	8	1.1	20	0.11	0.21	0.46
	^ MS14HA3P4075	P	0.75	0.18	25	6	8.6						
	^ MS14HA3P4100	P	1	0.18	25	3.3	4.9						
	^ MS14HA3P4150	P	1.5	0.18	25	1.61	2.2						
55.5 mm (2.19 in.)	MS14HA5P4040	P	0.4	0.32	45	30	49	10	1.4	35	0.19	0.24	0.53
	^ MS14HA5P4100	P	1	0.32	45	5.1	8.2						
	^ MS14HA5P4150	P	1.5	0.32	45	2.1	3.6						
	^ MS14HA5P4200	P	2	0.32	45	1.34	2.1						

^ Preferred model

MS14HA - 6 Lead Uni-Polar

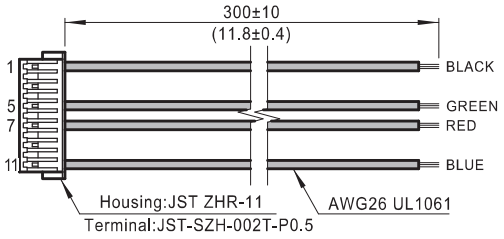
Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
27.3 mm (1.07 in.)	MS14HA1P6026	P	0.26	0.09	13	44	27	4	0.57	12	0.066	0.15	0.33
	MS14HA1P6060	P	0.6	0.09	13	8.2	5.3						
	MS14HA1P6100	P	1	0.09	13	3.1	2						
36 mm (1.42 in.)	MS14HA3P6032	P	0.32	0.13	18	37	21	8	1.1	20	0.11	0.21	0.46
	MS14HA3P6070	P	0.7	0.14	20	7.5	5.3						
	MS14HA3P6110	P	1.1	0.14	20	3	2						
55.5 mm (2.19 in.)	MS14HA5P6040	P	0.4	0.25	35	31	26	10	1.4	35	0.19	0.24	0.53
	MS14HA5P6085	P	0.85	0.26	37	7.1	6.1						
	MS14HA5P6120	P	1.2	0.25	35	3.5	2.9						

^ Preferred model

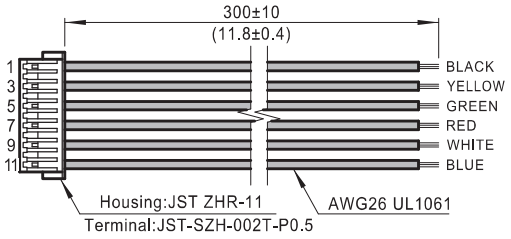
Mating Connector With Leads (order separately)

Dimensions: mm (in)

4 Lead Part Number 4634 1402 04581

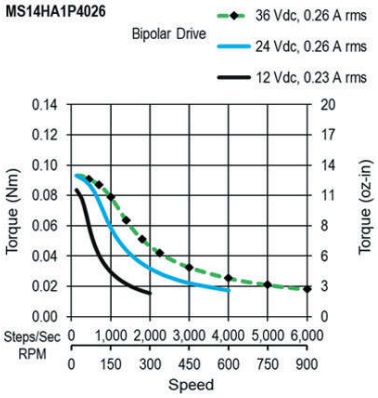


6 Lead Part Number 4634 1402 04489

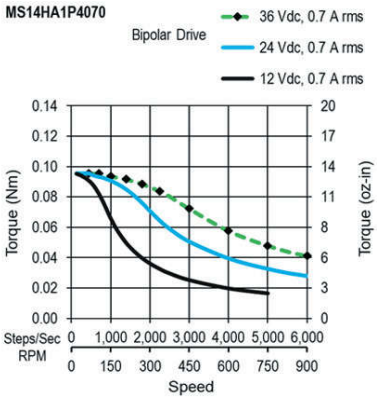


MS14HA1-0.9° Bipolar

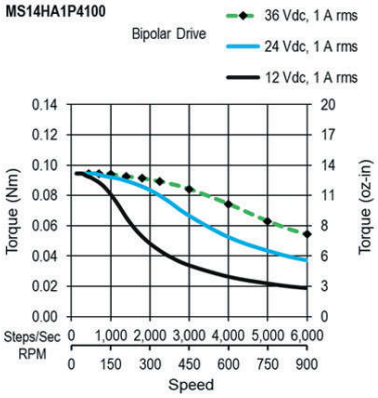
MS14HA1P4026



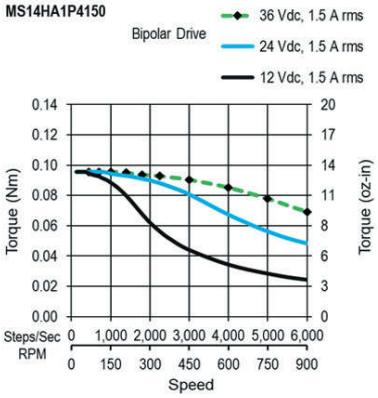
MS14HA1P4070



MS14HA1P4100

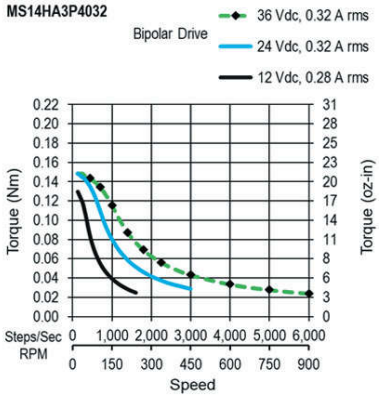


MS14HA1P4150

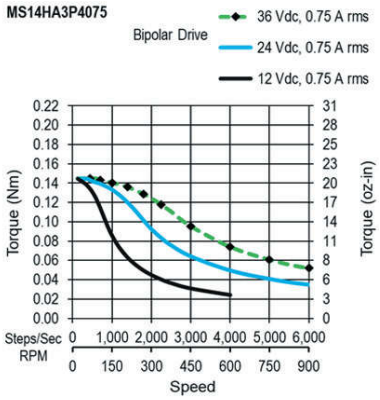


MS14HA3-0.9° Bipolar

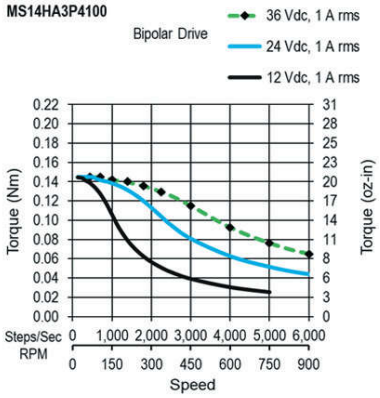
MS14HA3P4032



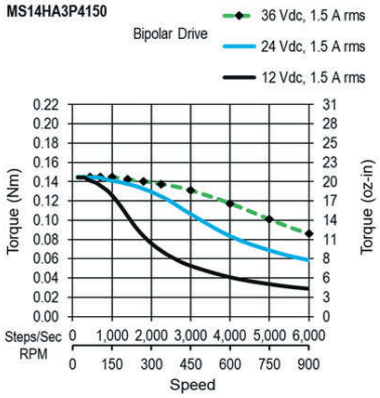
MS14HA3P4075



MS14HA3P4100

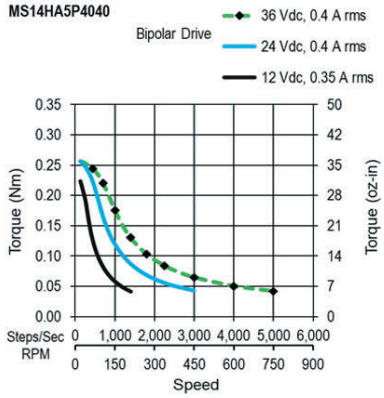


MS14HA3P4150

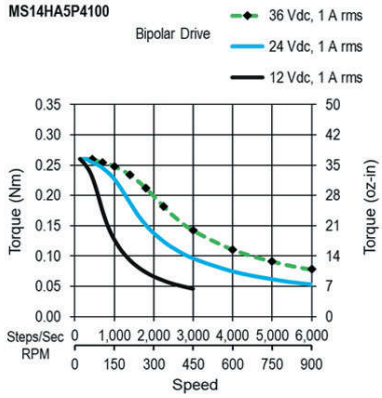


MS14HA5-0.9° Bipolar

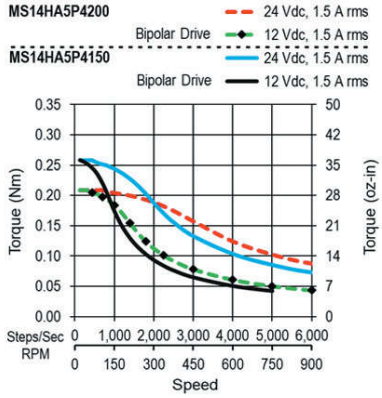
MS14HA5P4040



MS14HA5P4100



MS14HA5P4200
MS14HA5P4150

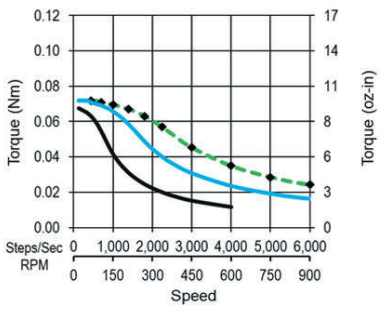


MS14HA1-0.9° Unipolar

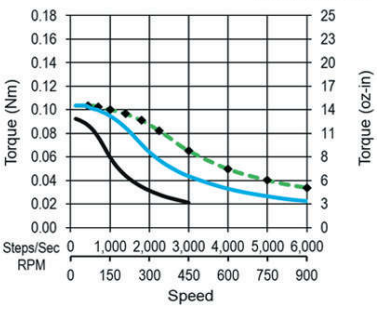
MS14HA3-0.9° Unipolar

MS14HA5-0.9° Unipolar

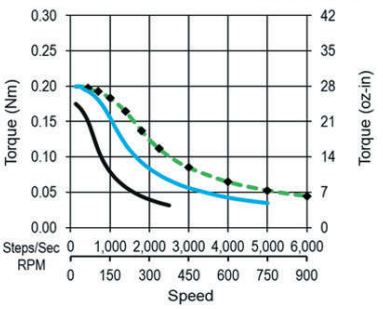
MS14HA1P6026



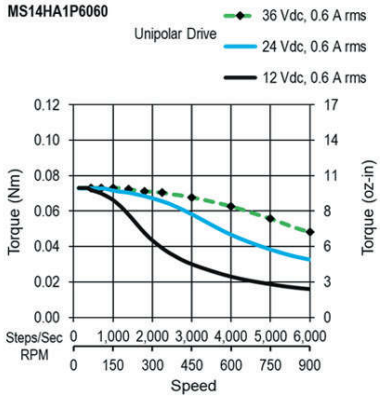
MS14HA3P6032



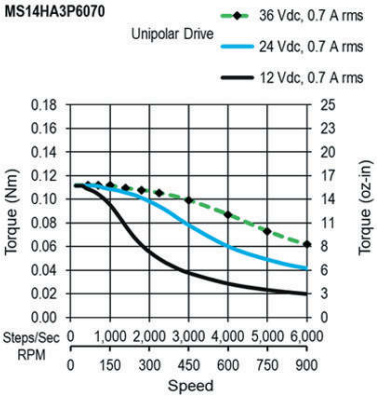
MS14HA5P6040



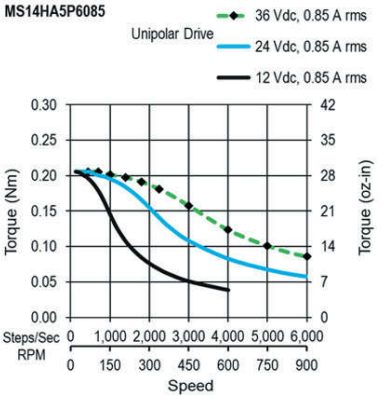
MS14HA1P6060



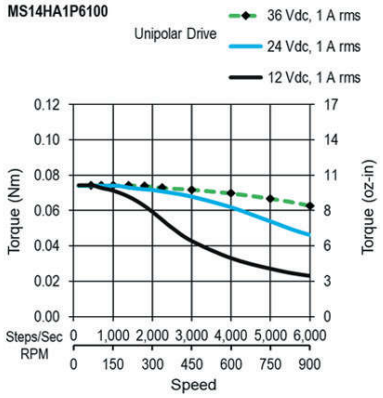
MS14HA3P6070



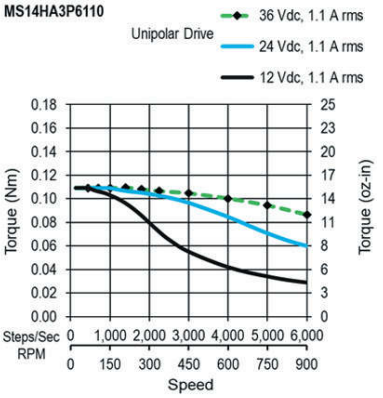
MS14HA5P6085



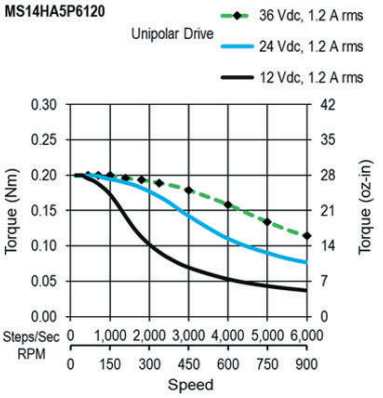
MS14HA1P6100



MS14HA3P6110



MS14HA5P6120



MS14HS Series: 1.8° - Size14

- Phases 2
- Steps / Revolution 200
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial: 25 N (5.6 Lbs.) Push; 65 N (15 Lbs.) Pull
  - Radial: 30 N (6.5 Lbs.) At Flat Center
- IP Rating 40
- Approvals RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

MS14HS 3 P 4 040

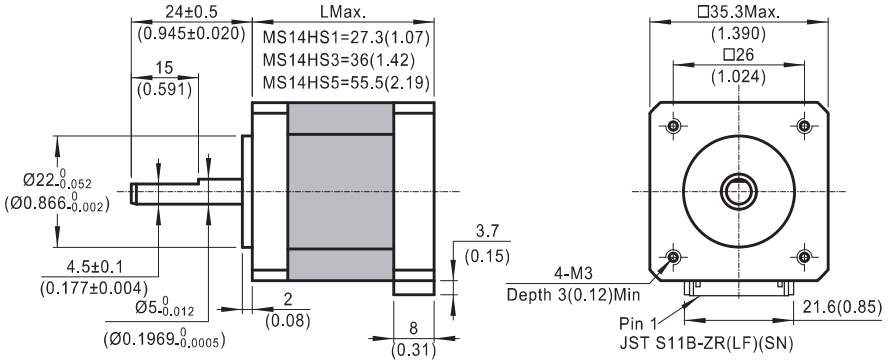
Basic Motor Length (Max)
- 1 27.3mm (1.07 in.)
- 3 36mm (1.42 in.)
- 5 55.5mm (2.19 in.)

Electrical Connection
- P Plug-in Connector

Number of Connections
- 4 4 Lead-Bipolar
- 6 6 Lead-Unipolar (or Bipolar)

Winding
- ### Current rating x 100

Dimensions: mm (in)



MS14HS - 4 Lead Bi-Polar

Length		Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
		Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 ℃	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
27.3 mm (1.07 in.)		MS14HS1P4026	P	0.26	0.14	20	49	50	10	1.4	12	0.066	0.15	0.33
	^	MS14HS1P4070	P	0.7	0.14	20	6.6	7.4						
	^	MS14HS1P4100	P	1	0.14	20	3.3	3.5						
	^	MS14HS1P4150	P	1.5	0.14	20	1.55	1.62						
36 mm (1.42 in.)		MS14HS3P4032	P	0.32	0.24	34	37	52	15	2.1	20	0.11	0.21	0.46
	^	MS14HS3P4075	P	0.75	0.23	33	6	8.9						
	^	MS14HS3P4100	P	1	0.23	33	3.4	5						
	^	MS14HS3P4150	P	1.5	0.23	33	1.62	2.2						
55.5 mm (2.19 in.)		MS14HS5P4040	P	0.4	0.39	55	30	50	18	2.5	35	0.19	0.24	0.53
	^	MS14HS5P4100	P	1	0.40	57	5.1	8.3						
	^	MS14HS5P4150	P	1.5	0.40	57	2.2	3.6						
	^	MS14HS5P4200	P	2	0.40	57	1.34	2.1						

^ Preferred model

MS14HS - 6 Lead Uni-Polar

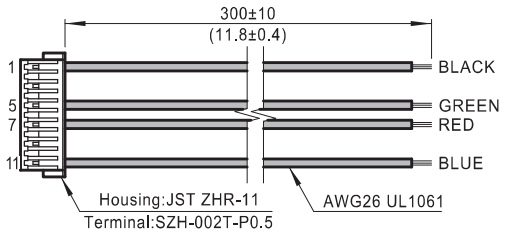
Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 ℃	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
27.3 mm (1.07 in.)	MS14HS1P6022	P	0.22	0.11	15	68	34	10	1.4	12	0.066	0.15	0.33
	MS14HS1P6060	P	0.6	0.11	15	8.9	4.8						
	MS14HS1P6100	P	1	0.11	16	3.3	1.81						
36 mm (1.42 in.)	MS14HS3P6032	P	0.32	0.17	24	37	22	15	2.1	20	0.11	0.21	0.46
	MS14HS3P6070	P	0.7	0.18	25	7.5	5.4						
	MS14HS3P6110	P	1.1	0.18	25	3	2.1						
55.5 mm (2.19 in.)	MS14HS5P6040	P	0.4	0.30	42	31	26	18	2.5	35	0.19	0.24	0.53
	MS14HS5P6085	P	0.85	0.31	44	7.1	6.2						
	MS14HS5P6120	P	1.2	0.30	42	3.5	2.9						

^ Preferred model

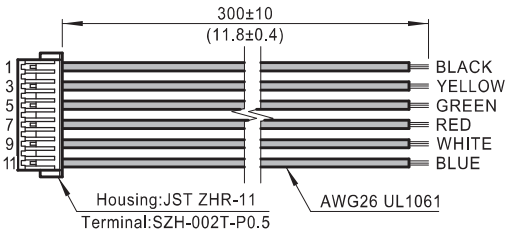
Mating Connector With Leads (order separately)

Dimensions: mm (in)

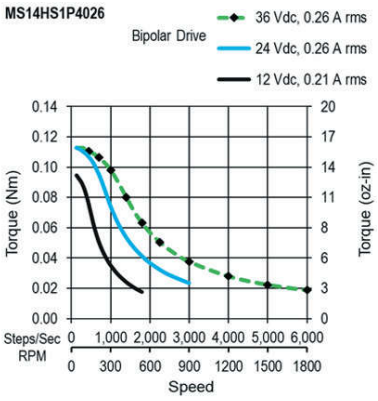
4 Lead Part Number 4634 1402 04581

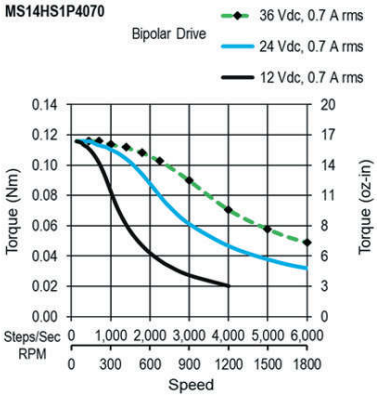


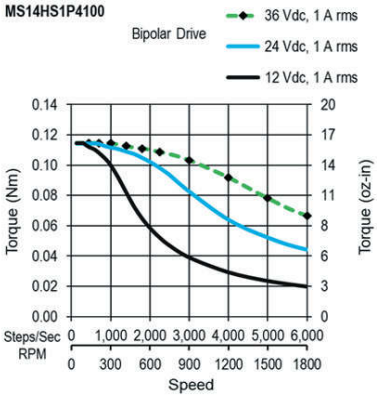
6 Lead Part Number 4634 1402 04489

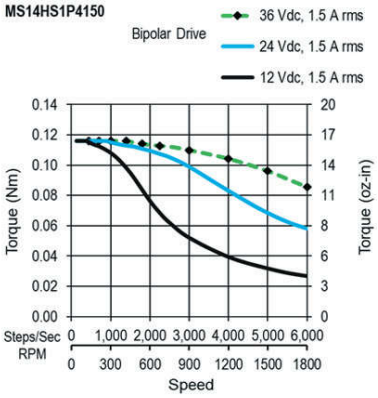


MS14HS1 - Bipolar

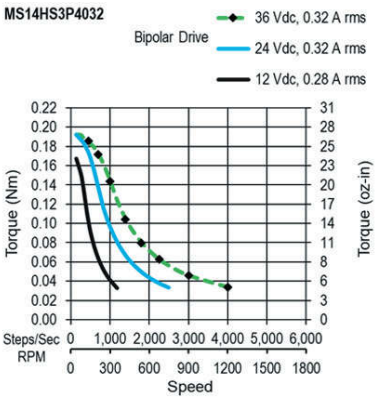


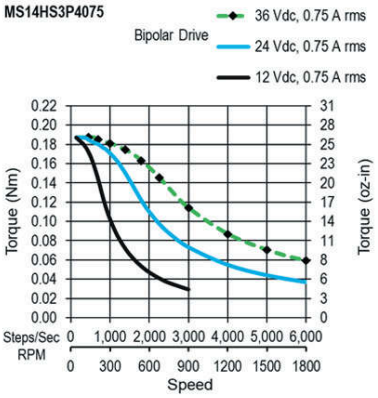


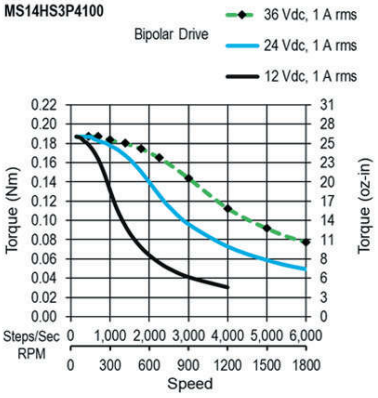


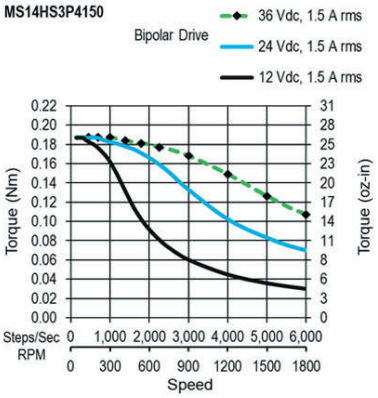


MS14HS3 - Bipolar

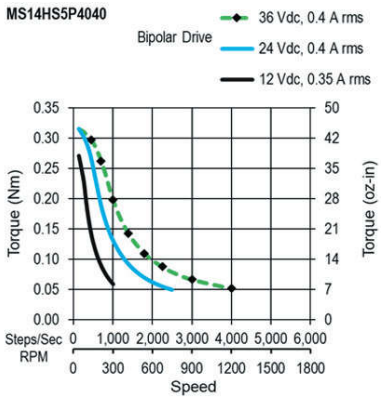


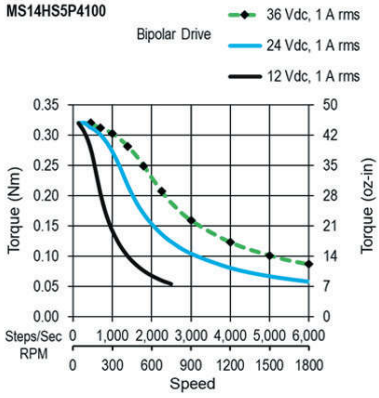


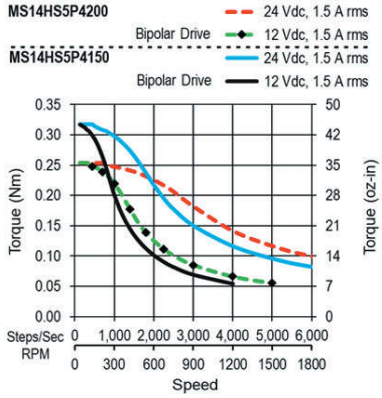




MS14HS5 - Bipolar



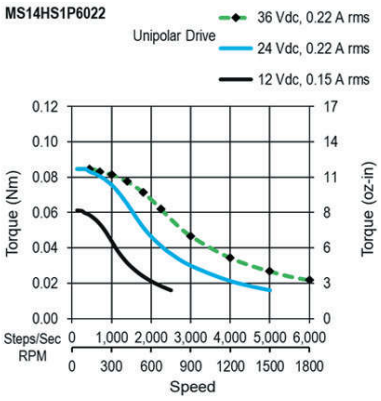


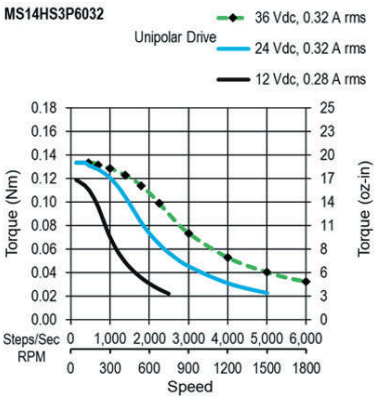


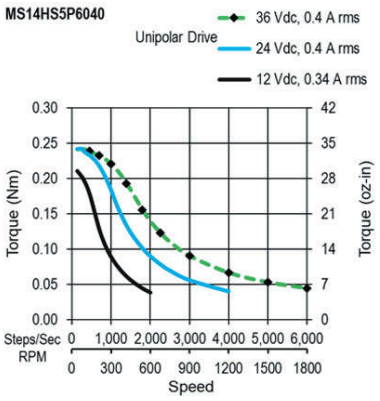
MS14HS1 - Unipolar

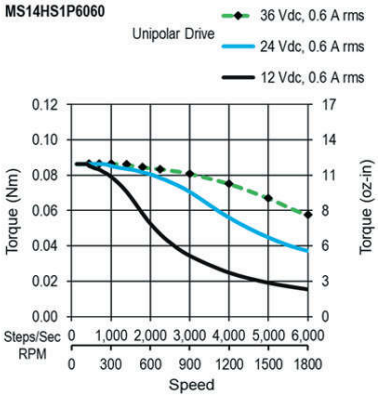
MS14HS3 - Unipolar

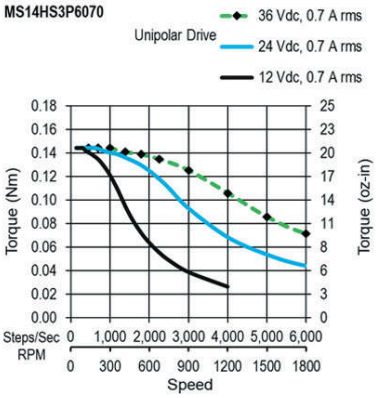
MS14HS5 - Unipolar

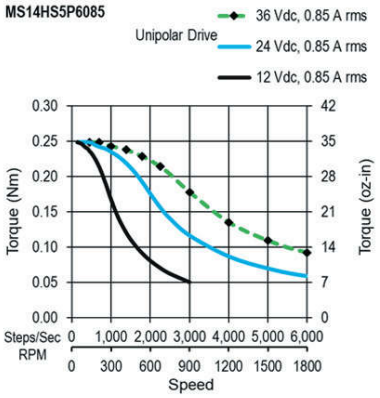


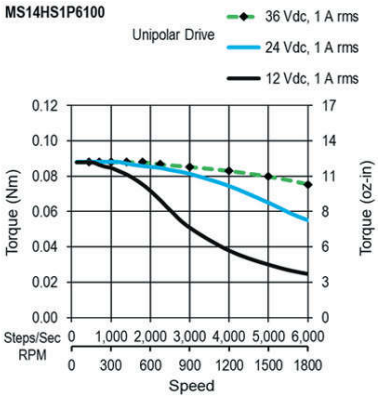


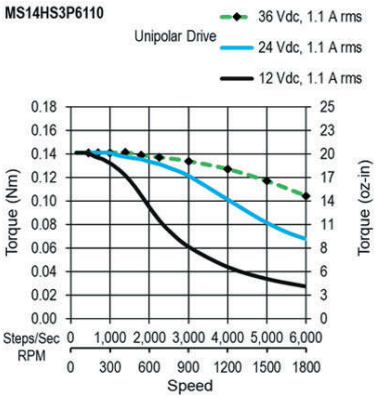


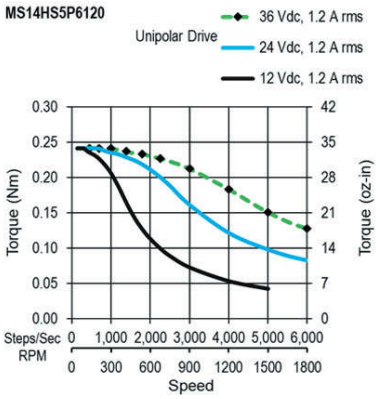












MS16HR Series: 1.8° - Size 16

- Phases 2
- Steps / Revolution 200
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial: 25 N (5.6 Lbs.) Push; 65 N (15 Lbs.) Pull
  - Radial: 30 N (6.5 Lbs.) At Flat Center
- IP Rating 40
- Approvals RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

MS16HR 7 P 4 070

Basic Motor Length (Max)
- 7 20.5mm (0.81 in.)
- 0 25.1mm (0.99 in.)
- 4 32mm (1.26 in.)

Electrical Connection
- P Plug-in Connector

Winding
- ### Current rating x 100

Number of Connections
- 4 4 Lead-Bipolar

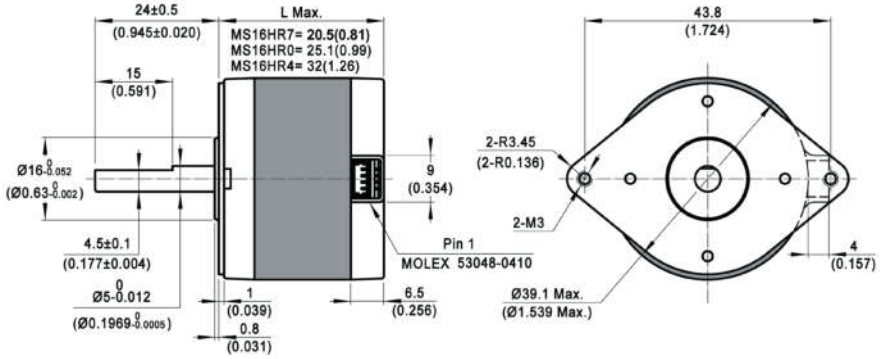
MS16HR - 4 Lead Bi-Polar

Length		Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	Winding mH	Detent Torque		Rotor Inertia		Motor Weight	
		Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
20.5 mm (0.81 in.)		MS16HR7P4021	P	0.21	0.10	14	55	49	7	0.99	16	0.088	0.1	0.22
	^	MS16HR7P4070	P	0.7	0.10	14	4.7	4.6						
	^	MS16HR7P4100	P	1	0.10	14	2.3	2.2						
	^	MS16HR7P4140	P	1.4	0.10	14	1.23	1.13						
25.1 mm (0.99 in.)		MS16HR0P4025	P	0.25	0.16	23	43	55	11	1.6	20	0.11	0.13	0.29
	^	MS16HR0P4070	P	0.7	0.16	23	5.2	7.1						
	^	MS16HR0P4100	P	1	0.15	21	2.4	3.3						
	^	MS16HR0P4140	P	1.4	0.15	21	1.43	1.69						
32 mm (1.26 in.)		MS16HR4P4030	P	0.3	0.23	33	34	43	20	2.8	30	0.16	0.18	0.4
	^	MS16HR4P4070	P	0.7	0.24	34	6.4	8.2						
	^	MS16HR4P4100	P	1	0.24	34	3	4.1						
	^	MS16HR4P4140	P	1.4	0.23	33	1.71	1.86						

^ Preferred model

Dimensions: mm (in)

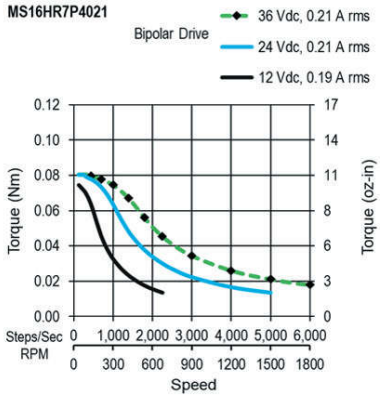
with 4 leads: 300mm (12) long(order separately)
Part Number: 4634 1402 07814

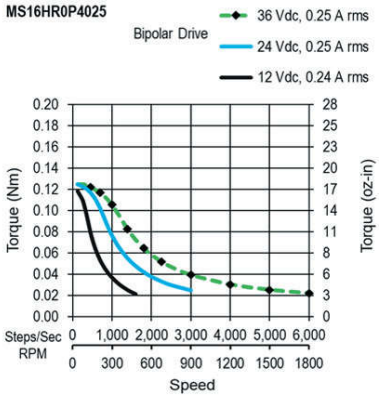


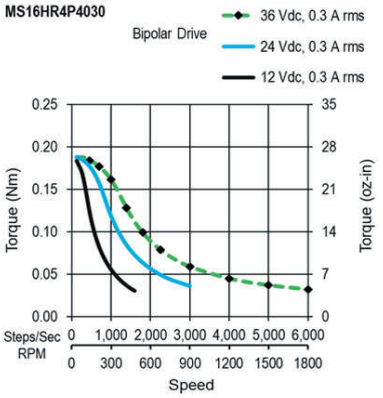
MS16HR7- Bipolar

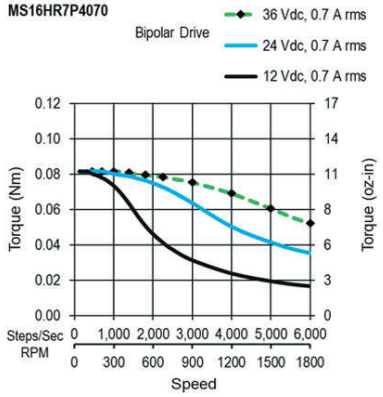
MS16HR0- Bipolar

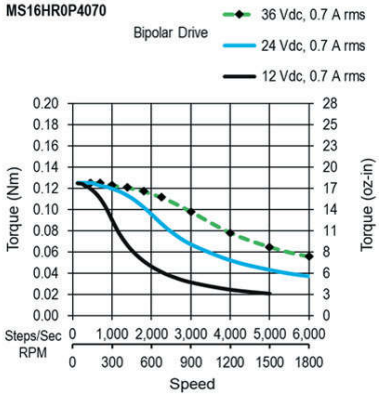
MS16HR4- Bipolar

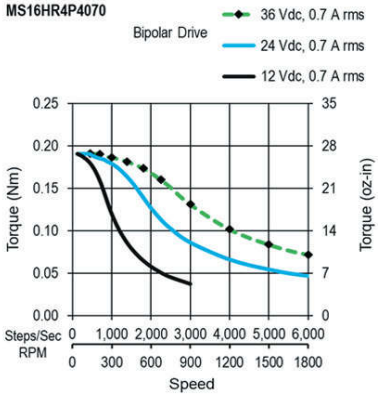


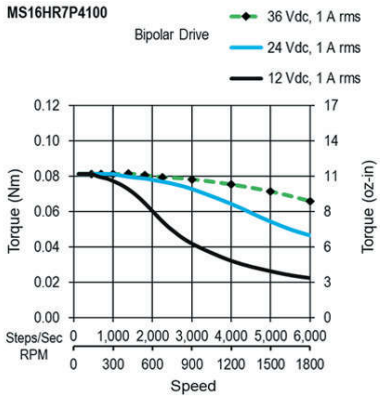


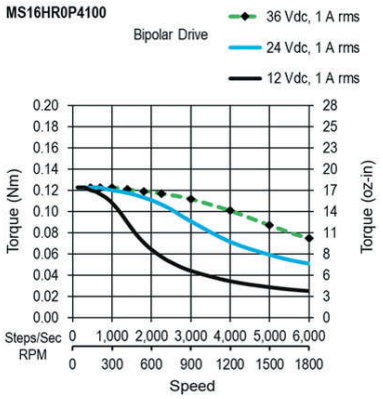


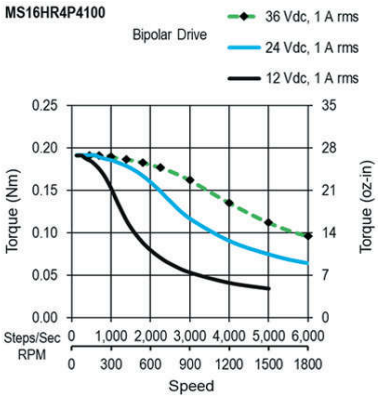


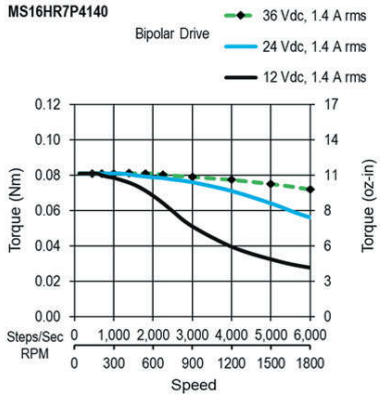


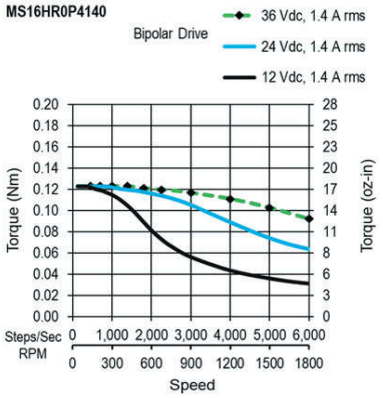


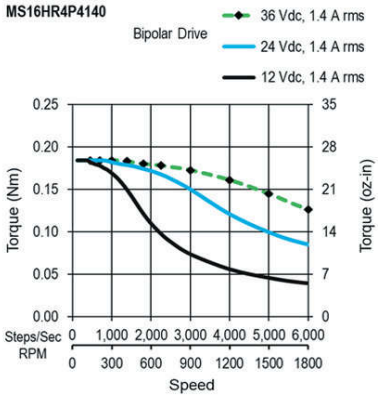












MS16HS Series: 1.8° - Size 16

- Phases 2
- Steps / Revolution 200
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial: 25 N (5.6 Lbs.) Push; 65 N (15 Lbs.) Pull
  - Radial: 30 N (6.5 Lbs.) At Flat Center
- IP Rating 40
- Approvals RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

MS16HS 7 P 4 040

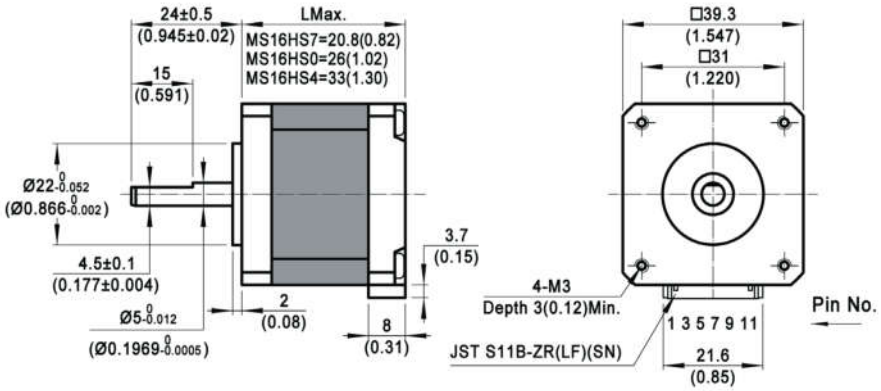
Basic Motor Length (Max)
- 7 20.8mm (0.82 in.)
- 0 26mm (1.02 in.)
- 4 33mm (1.30 in.)

Electrical Connection
- P Plug-in Connector

Number of Connections
- 4 4 Lead-Bipolar
- 6 6 Lead-Unipolar (or Bipolar)

Winding
- ### Current rating x 100

Dimensions: mm (in)



MS16HS - 4 Lead Bi-Polar

Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
20.8 mm (0.82 in.)	MS16HS7P4027	P	0.27	0.10	14	41	36	5	0.71	14	0.077	0.11	0.24
	^ MS16HS7P4070	P	0.7	0.10	14	5.6	5.6						
	^ MS16HS7P4100	P	1	0.10	14	3	2.8						
	^ MS16HS7P4150	P	1.5	0.10	14	1.45	1.28						
26 mm (1.02 in.)	MS16HS0P4029	P	0.29	0.20	28	40	52	8	1.1	20	0.11	0.15	0.33
	^ MS16HS0P4070	P	0.7	0.20	28	6.8	9.5						
	^ MS16HS0P4100	P	1	0.20	28	3.6	4.7						
	^ MS16HS0P4150	P	1.5	0.20	28	1.53	2						
33 mm (1.3 in.)	MS16HS4P4037	P	0.37	0.26	37	31	50	12	1.7	27	0.15	0.21	0.46
	^ MS16HS4P4070	P	0.7	0.26	37	8.4	14						
	^ MS16HS4P4100	P	1	0.27	38	4.4	7						
	^ MS16HS4P4150	P	1.5	0.27	38	1.89	3.1						

^ Preferred model

MS16HS - 6 Lead Uni-Polar

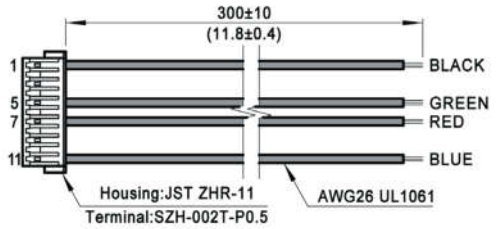
Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
20.8 mm (0.82 in.)	MS16HS7P6024	P	0.24	0.07	10	50	21	5	0.71	14	0.077	0.11	0.24
	MS16HS7P6070	P	0.7	0.07	10	5.5	2.6						
	MS16HS7P6100	P	1	0.07	10	2.7	1.23						
26 mm (1.02 in.)	MS16HS0P6027	P	0.27	0.15	21	45	27	8	1.1	20	0.11	0.15	0.33
	MS16HS0P6070	P	0.7	0.16	23	7	4.7						
	MS16HS0P6100	P	1	0.15	21	3.4	2.2						
33 mm (1.3 in.)	MS16HS4P6036	P	0.36	0.20	28	33	26	12	1.7	27	0.15	0.21	0.46
	MS16HS4P6085	P	0.85	0.20	28	5.8	4.7						
	MS16HS4P6120	P	1.2	0.20	28	3	2.3						

^ Preferred model

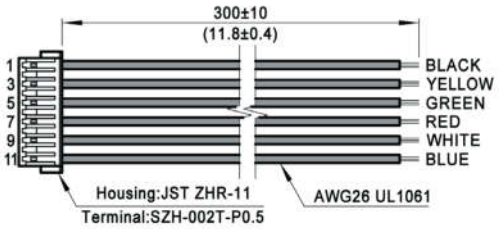
Mating Connector With Leads (order separately)

Dimensions: mm (in)

4 Lead Part Number 4634140204581



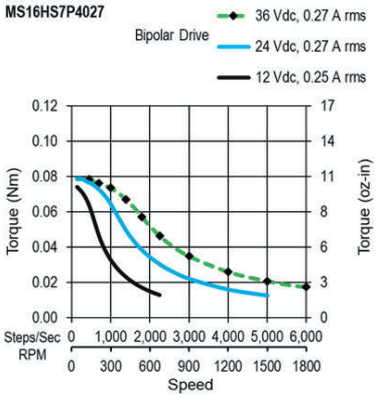
6 Lead Part Number 4634140204489

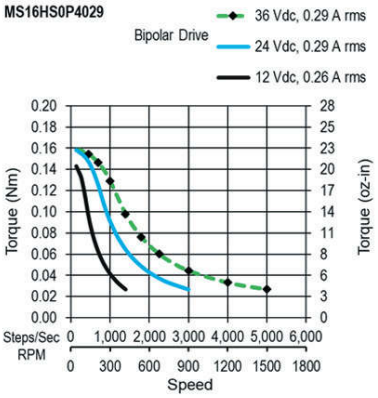


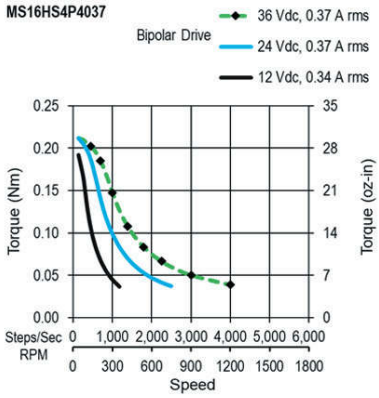
MS16HS7- Bipolar

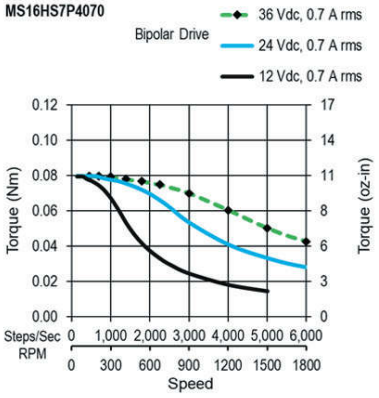
MS16HS0- Bipolar

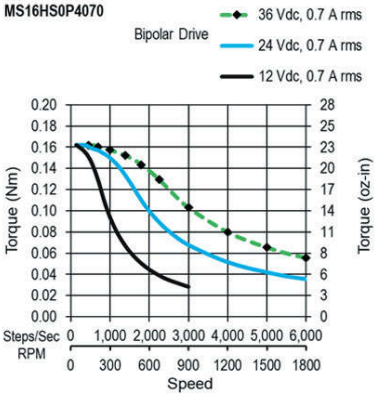
MS16HS4- Bipolar

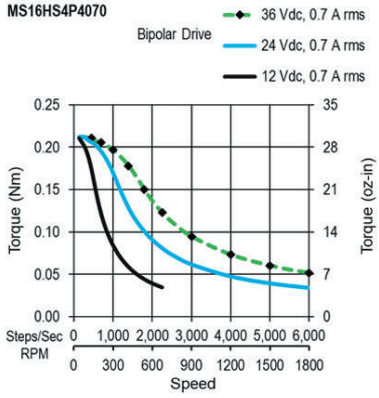


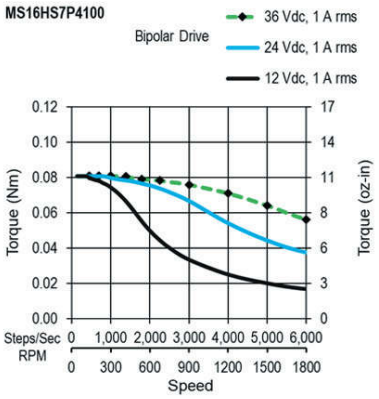


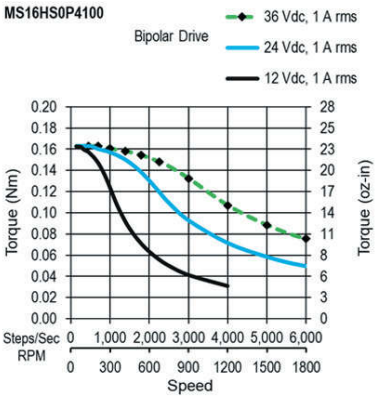


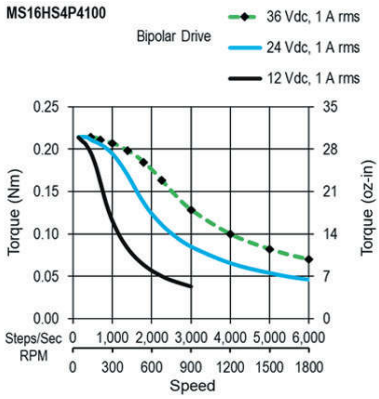


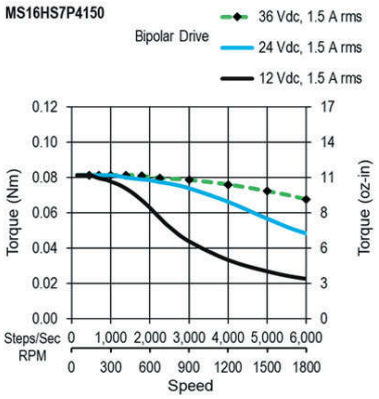


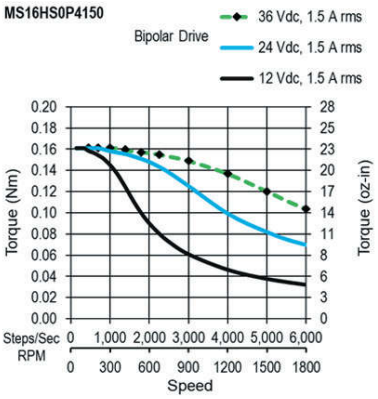


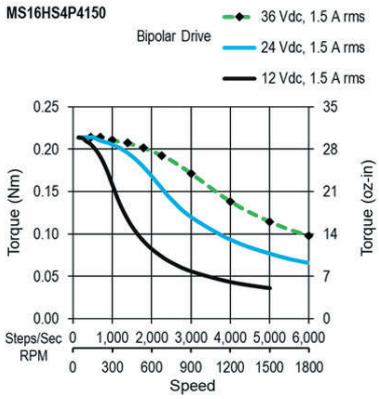








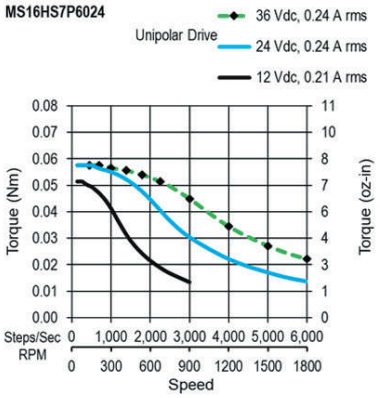


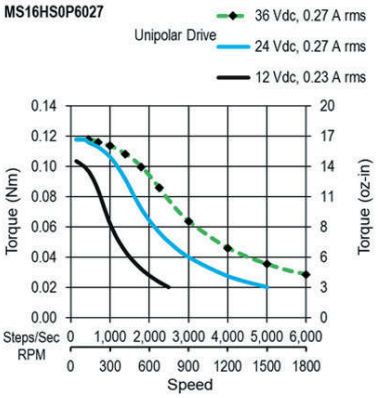


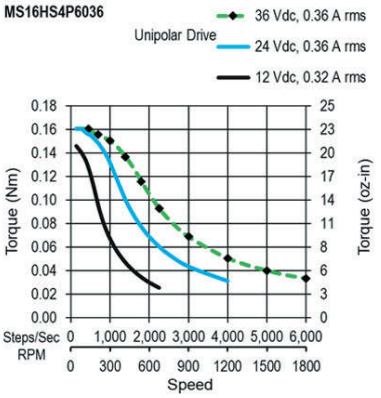
MS16HS7- Unipolar

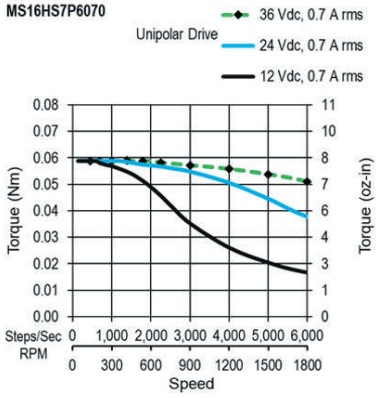
MS16HS0- Unipolar

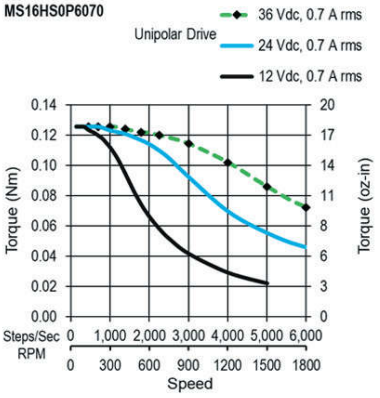
MS16HS4- Unipolar

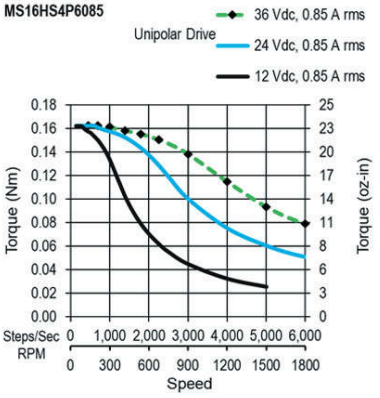


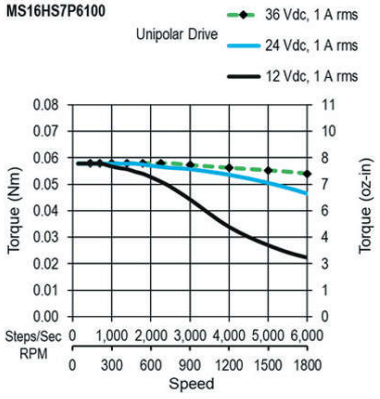


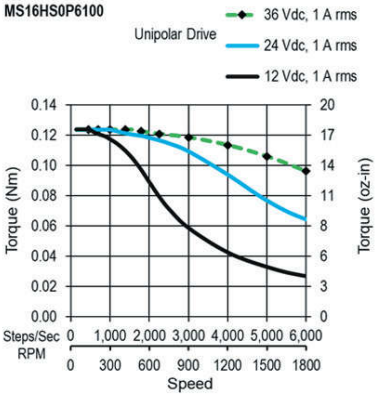


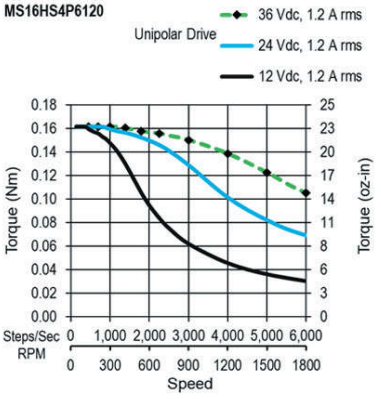












MS17HA Series: 0.9° - Size 17

- Phases 2
- Steps / Revolution 400
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial: 25 N (5.6 Lbs.) Push; 65 N (15 Lbs.) Pull
  - Radial: 30 N (6.5 Lbs.) At Flat Center
- IP Rating 40
- Approvals UL Recognized File E465363, RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

MS17HA 4 P 4 040 -M

Basic Motor Length (Max)

4	34.3mm (1.35 in.)	Short
2	39.8mm (1.57 in.)	1 Stack
6	48.3mm (1.90 in.)	2 Stack

Electrical Connection

P Plug-in Connector

Number of Connections

4 4 Lead-Bipolar

6 6 Lead-Unipolar(or Bipolar)

Winding

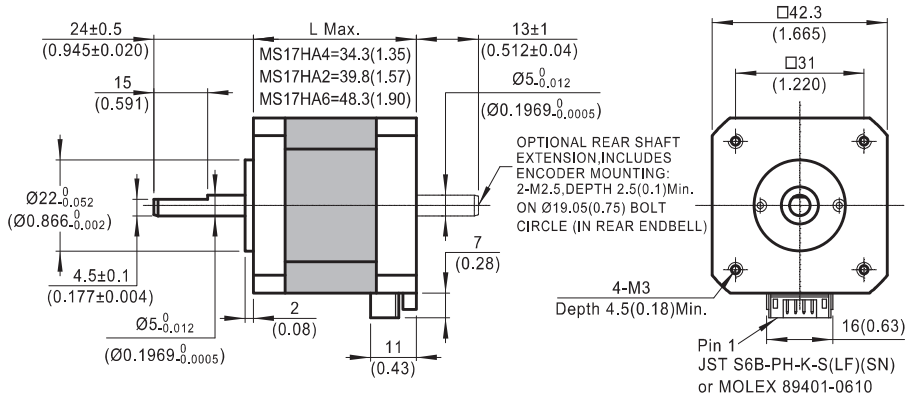
Current rating x 100

Options

Omit No Options

-M 5 mm Diameter Rear Shaft With Encoder Mounting Holes

Dimensions: mm (in)



MS17HA - 4 Lead Bi-Polar

Length		Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
		Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
34.3 mm (1.35 in.)		MS17HA4P4040	P	0.4	0.31	44	28	76	12	1.7	38	0.21	0.21	0.46
	^	MS17HA4P4100	P	1	0.30	42	4	11.4						
	^	MS17HA4P4150	P	1.5	0.29	41	1.63	4.4						
	^	MS17HA4P4200	P	2	0.30	42	1.06	2.7						
39.8 mm (1.57 in.) 1 Stack		MS17HA2P4040	P	0.4	0.41	58	24	73	16	2.3	57	0.31	0.28	0.62
	^	MS17HA2P4100	P	1	0.41	58	3.9	11.7						
	^	MS17HA2P4150	P	1.5	0.42	59	1.98	5.7						
	^	MS17HA2P4200	P	2	0.41	58	1.05	2.9						
48.3 mm (1.9 in.) 2 Stack		MS17HA6P4050	P	0.5	0.58	82	24	81	25	3.5	82	0.45	0.35	0.77
	^	MS17HA6P4100	P	1	0.56	79	4.9	17.6						
	^	MS17HA6P4150	P	1.5	0.55	78	2.2	7.5						
	^	MS17HA6P4200	P	2	0.56	79	1.31	4.4						

^ Preferred model

MS17HA - 6 Lead Uni-Polar

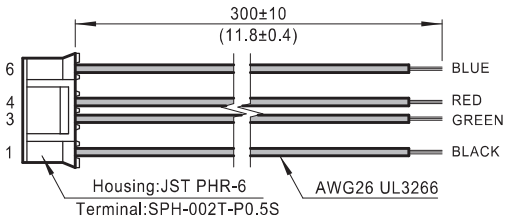
Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
34.3 mm (1.35 in.)	MS17HA4P6038	P	0.38	0.25	35	30	41	12	1.7	38	0.21	0.21	0.46
	MS17HA4P6085	P	0.85	0.23	33	4.9	6.7						
	MS17HA4P6120	P	1.2	0.24	34	2.7	3.8						
39.8 mm (1.57 in.) 1 Stack	MS17HA2P6040	P	0.4	0.34	48	28	41	16	2.3	57	0.31	0.28	0.62
	MS17HA2P6085	P	0.85	0.34	48	6	8.7						
	MS17HA2P6130	P	1.3	0.33	47	2.5	3.7						
48.3 mm (1.9 in.) 2 Stack	MS17HA6P6040	P	0.4	0.43	61	29	50	25	3.5	82	0.45	0.35	0.77
	MS17HA6P6080	P	0.8	0.44	62	7.6	13.1						
	MS17HA6P6130	P	1.3	0.45	64	3.2	5.5						
	MS17HA6P6200	P	2	0.44	62	1.3	2.1						

^ Preferred model

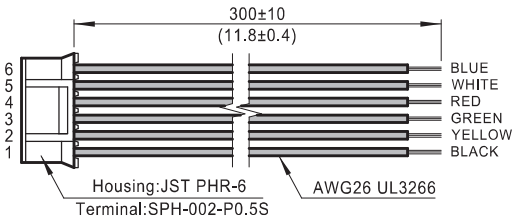
Mating Connector With Leads (order separately)

Dimensions: mm (in)

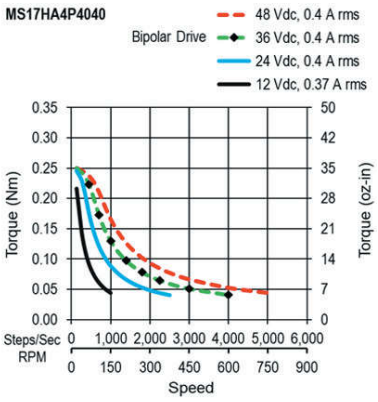
4 Lead Part Number 4634 1402 00723

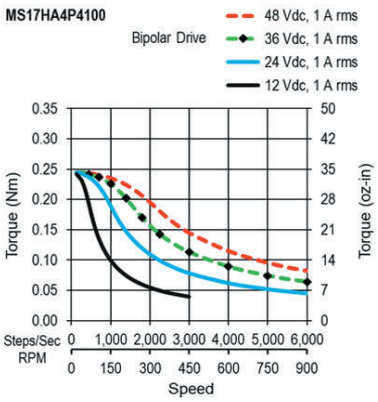


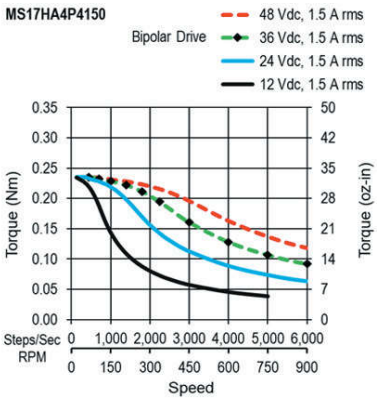
6 Lead Part Number 4634 1402 00922

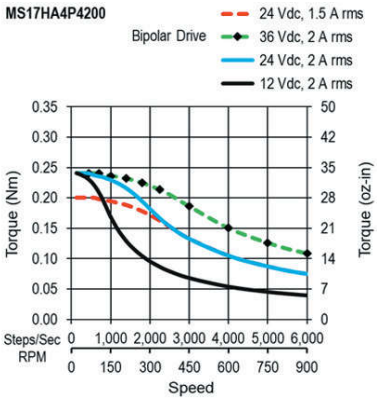


MS17HA4-0.9° Bipolar

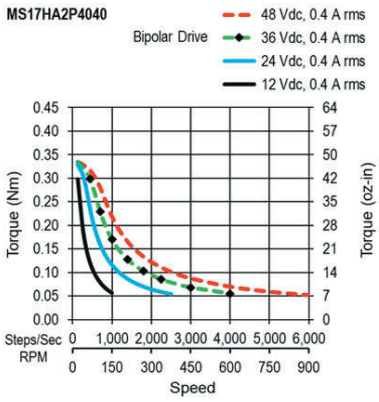


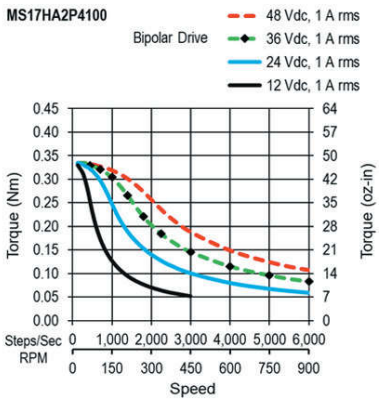


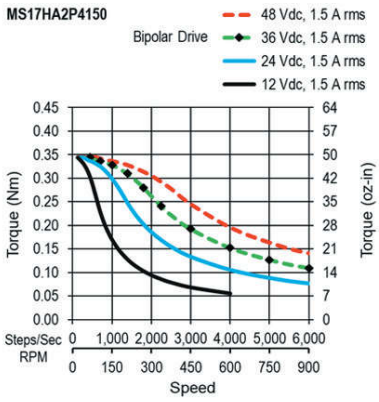


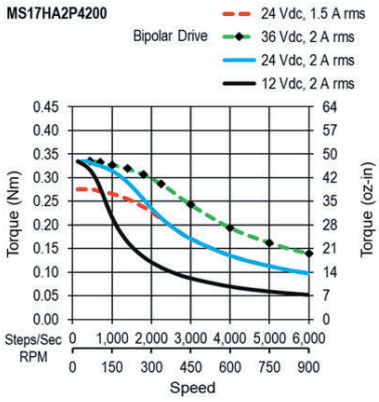


MS17HA2-0.9° Bipolar

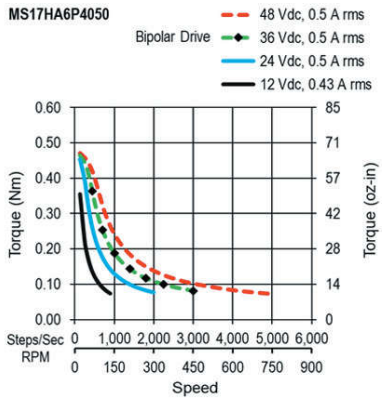


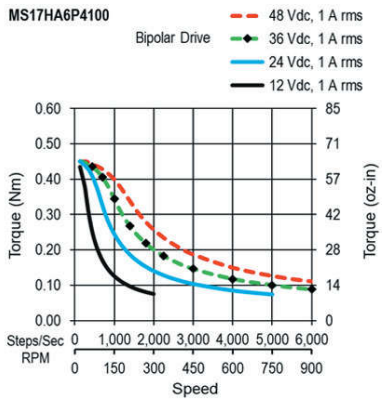


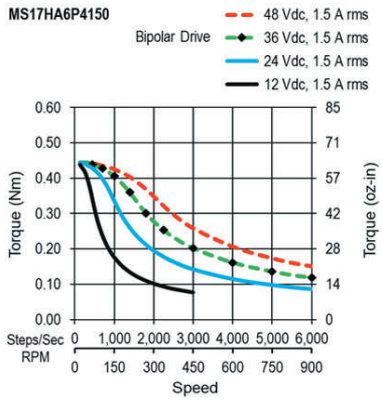


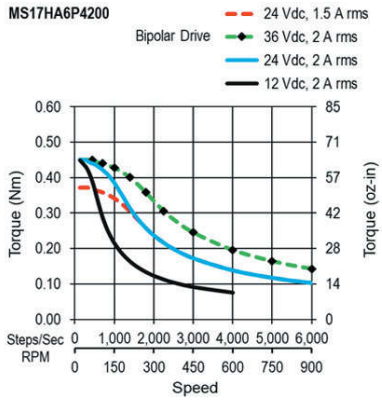


MS17HA6-0.9° Bipolar







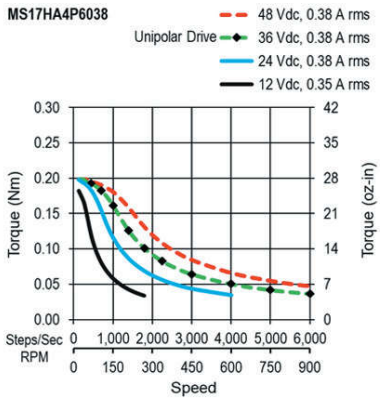


MS17HA4-0.9° Unipolar

MS17HA2-0.9° Unipolar

MS17HA6-0.9° Unipolar

MS17HA4P6038



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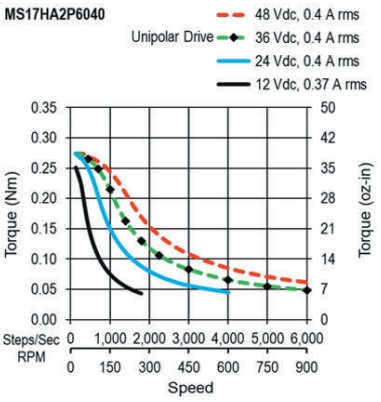

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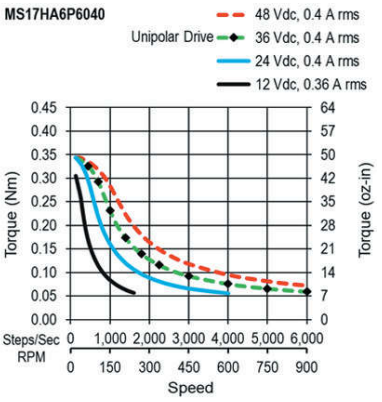

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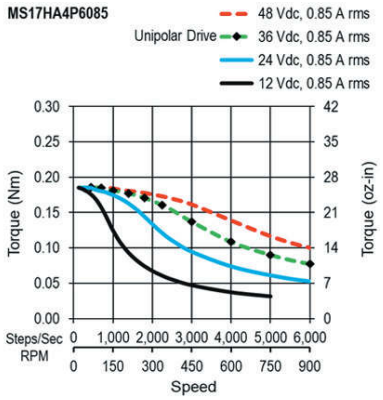

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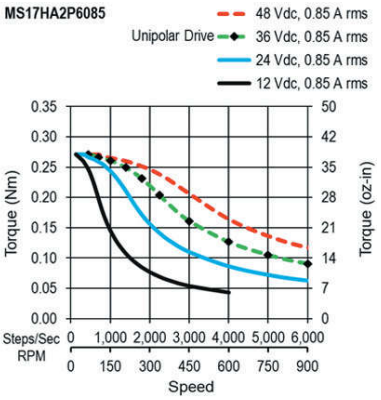

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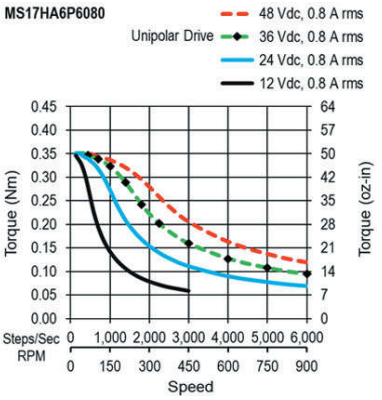

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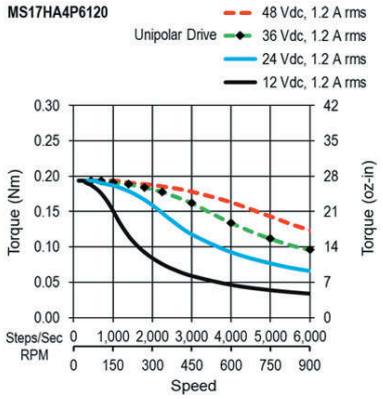

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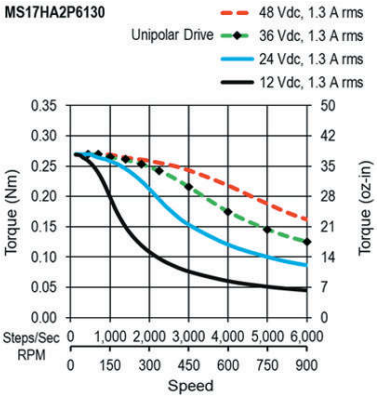

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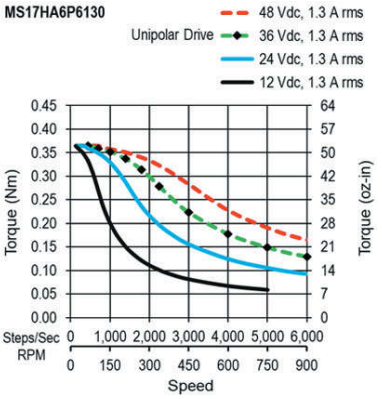

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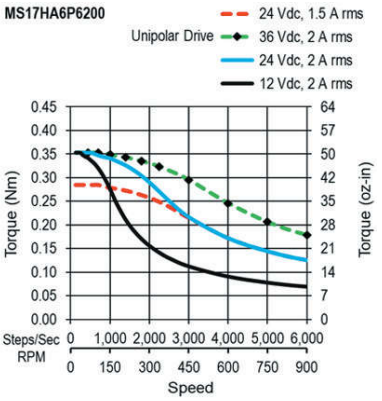


MS17HD Series: 1.8° - Size 17

- Phases 2
- Steps / Revolution 200
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial: 25 N (5.6 Lbs.) Push; 65 N (15 Lbs.) Pull
  - Radial: 29 N (6.5 Lbs.) At Flat Center
- IP Rating 40
- Approvals UL Recognized File E465363, RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

MS17HD 4 P 4 040 -M

Basic Motor Length (Max)

5	25.3mm (1.0 in.)	
4	34.3mm (1.35 in.)	
2	39.8mm (1.57 in.)	1 Stack
6	48.3mm (1.90 in.)	2 Stack
B	62.8mm (2.47 in.)	3 Stack

Electrical Connection

P Plug-in Connector

Number of Connections

4 4 Lead-Bipolar
6 6 Lead-Unipolar(or Bipolar)

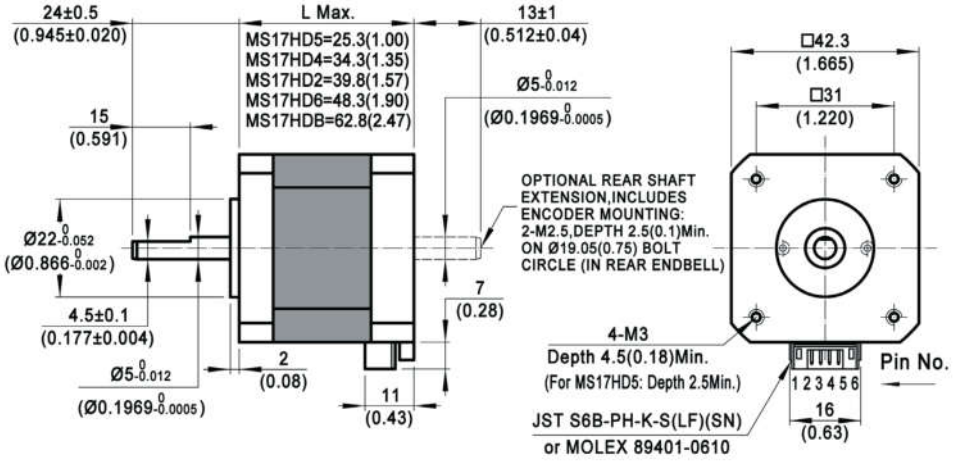
Winding

Current rating x 100

Options

Omit No Options
-M 5 mm Diameter Rear Shaft With Encoder Mounting Holes

Dimensions: mm (in)



MS17HD - 4 Lead Bi-Polar

Length		Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
		Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20℃	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
25.3 mm (1 in.)		MS17HD5P4027	P	0.27	0.20	28	42	50	5	0.71	20	0.11	0.15	0.33
	^	MS17HD5P4070	P	0.7	0.21	30	6.2	8.3						
	^	MS17HD5P4100	P	1	0.21	30	3.1	4						
	^	MS17HD5P4150	P	1.5	0.20	28	1.25	1.56						
34.3 mm (1.35 in.)		MS17HD4P4040	P	0.4	0.34	48	30	51	12	1.7	38	0.21	0.21	0.46
	^	MS17HD4P4065	P	0.65	0.32	45	8.7	15.4						
	^	MS17HD4P4100	P	1	0.33	47	4.2	7.5						
	^	MS17HD4P4150	P	1.5	0.32	45	1.7	2.9						
39.8 mm (1.57 in.) 1 Stack		MS17HD2P4040	P	0.4	0.48	68	24	56	15	2.1	57	0.31	0.28	0.62
	^	MS17HD2P4100	P	1	0.48	68	3.9	8.9						
	^	MS17HD2P4150	P	1.5	0.50	71	1.98	4.3						
	^	MS17HD2P4200	P	2	0.48	68	1.04	2.2						
48.3 mm (1.9 in.) 2 Stack		MS17HD6P4050	P	0.5	0.67	95	24	53	25	3.5	82	0.45	0.36	0.79
	^	MS17HD6P4100	P	1	0.63	89	4.9	11.5						
	^	MS17HD6P4150	P	1.5	0.62	88	2.2	4.9						
	^	MS17HD6P4200	P	2	0.63	89	1.3	2.9						
62.8 mm (2.47 in.) 3 Stack	^	MS17HDBP4100	P	1	0.82	120	5.6	14.6	30	4.2	123	0.67	0.6	1.3
	^	MS17HDBP4150	P	1.5	0.88	120	3	7.7						
	^	MS17HDBP4200	P	2	0.83	120	1.49	3.8						

^ Preferred model

MS17HD - 6 Lead Uni-Polar

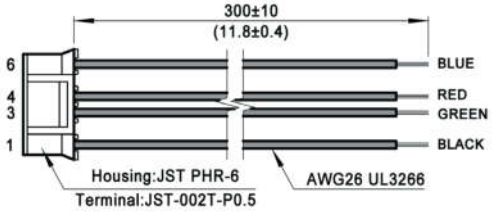
Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20℃	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
25.3 mm (1 in.)	MS17HD5P6030	P	0.3	0.16	23	38	23	5	0.71	20	0.11	0.15	0.33
	MS17HD5P6070	P	0.7	0.16	23	6.3	4.2						
	MS17HD5P6100	P	1	0.16	23	3.2	2.1						
34.3 mm (1.35 in.)	MS17HD4P6038	P	0.38	0.26	37	31	27	12	1.7	38	0.21	0.21	0.46
	MS17HD4P6085	P	0.85	0.24	34	5.1	4.5						
	MS17HD4P6120	P	1.2	0.25	35	2.9	2.5						
39.8 mm (1.57 in.) 1 Stack	MS17HD2P6040	P	0.4	0.38	54	28	31	15	2.1	57	0.31	0.28	0.62
	MS17HD2P6085	P	0.85	0.38	54	6	6.7						
	MS17HD2P6130	P	1.3	0.38	54	2.5	2.8						
48.3 mm (1.9 in.) 2 Stack	MS17HD6P6040	P	0.4	0.48	68	29	33	25	3.5	82	0.45	0.36	0.79
	MS17HD6P6080	P	0.8	0.49	69	7.6	8.6						
	MS17HD6P6130	P	1.3	0.51	72	3.2	3.6						
	MS17HD6P6200	P	2	0.50	71	1.3	1.4						

^ Preferred model

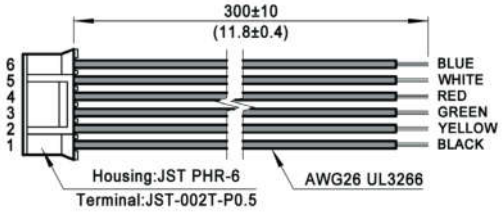
Mating Connector With Leads (order separately)

Dimensions: mm (in)

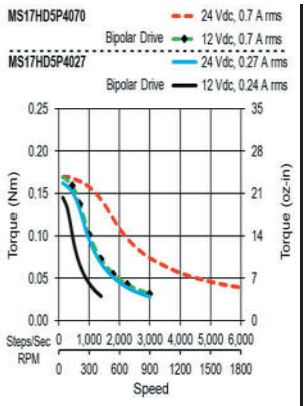
4 Lead Part Number 4634140200723

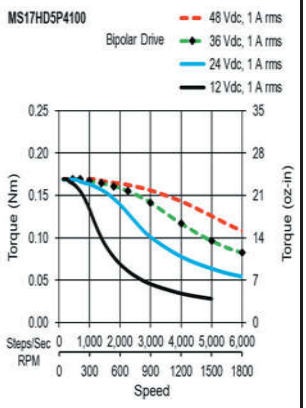


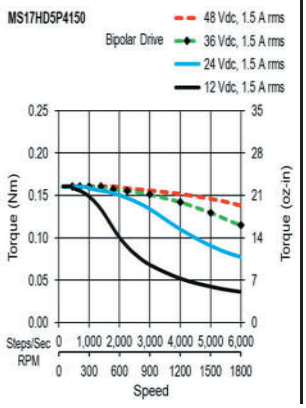
6 Lead Part Number 4634140200922



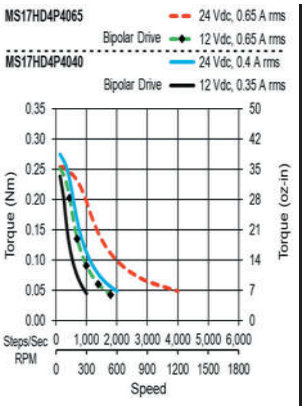
MS17HD5 - Bipolar

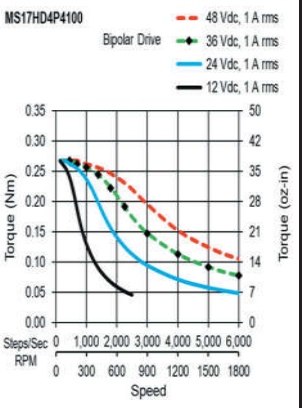


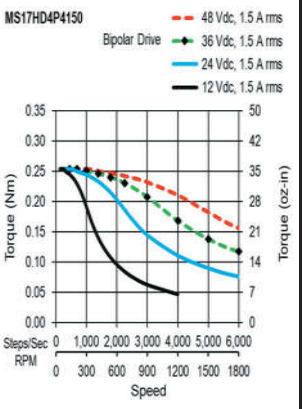




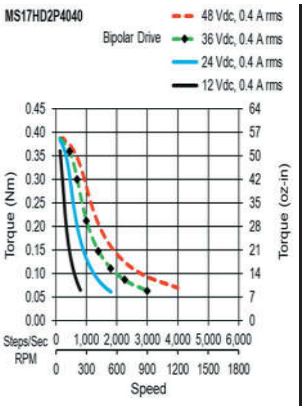
MS17HD4 - Bipolar

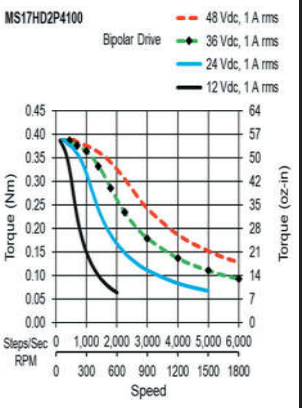


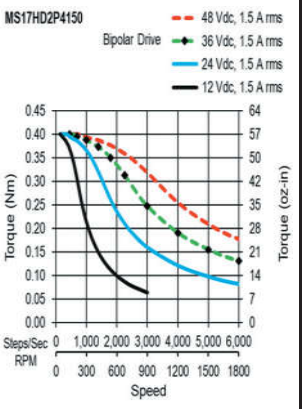


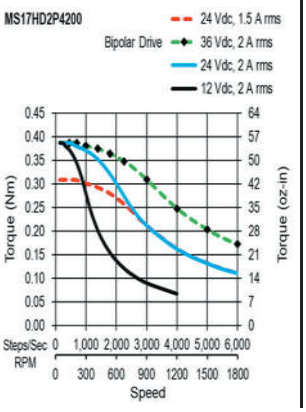


MS17HD2 - Bipolar

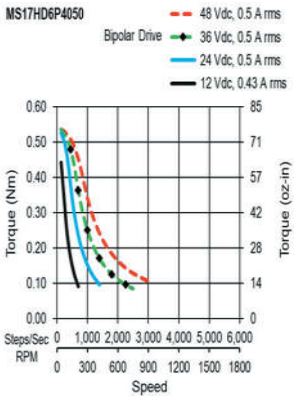


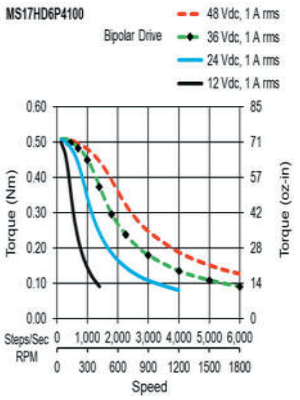


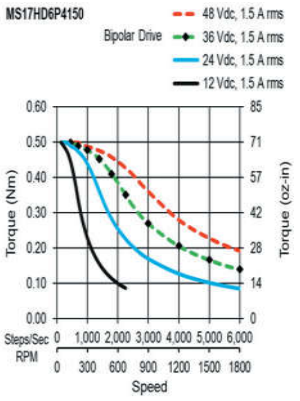


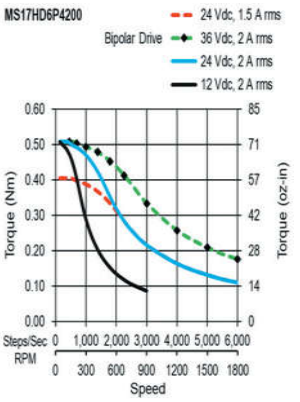


MS17HD6 - Bipolar

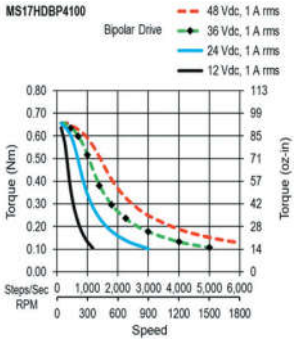


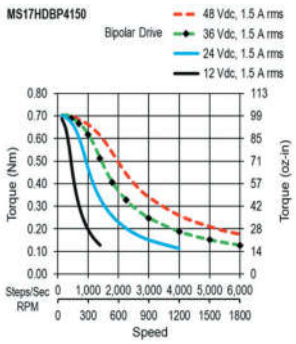


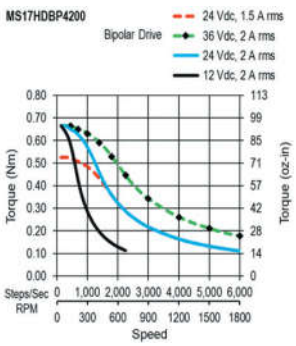




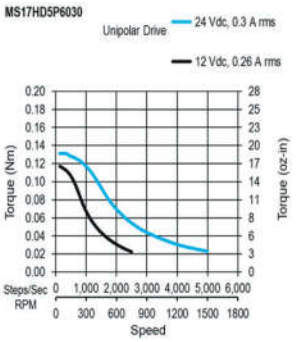
MS17HDB - Bipolar

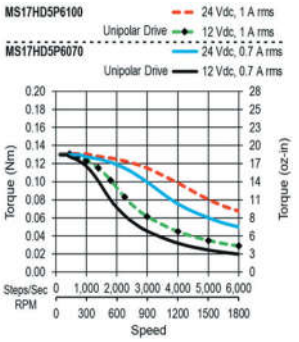




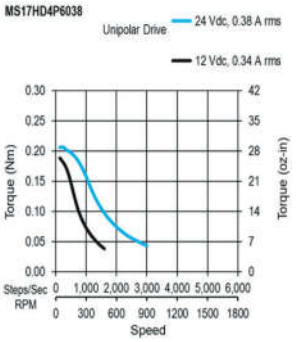


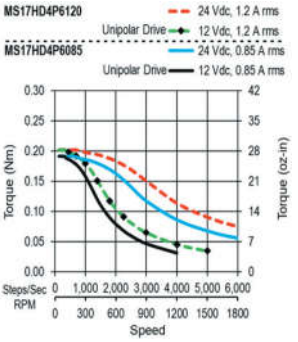
MS17HD5 - Unipolar



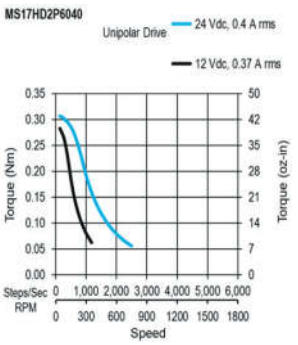


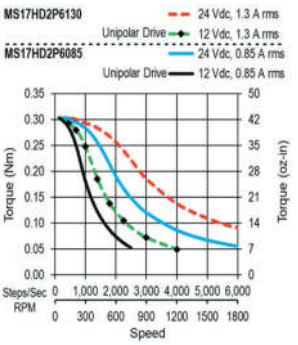
MS17HD4 - Unipolar



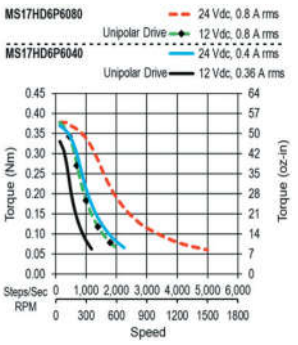


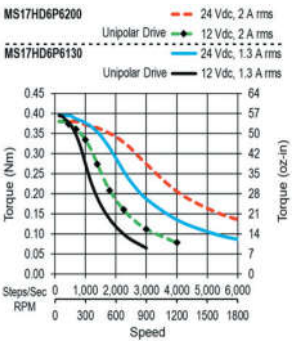
MS17HD2 - Unipolar





MS17HD6 - Unipolar





MS23HA Series: 0.9° - Size 23

- Phases 2
- Steps / Revolution 400
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial: 40 N (9 Lbs.) Push; 130 N (30 Lbs.) Pull
  - Radial: 70 N (15.5 Lbs.) At Flat Center
- IP Rating 40
- Approvals UL Recognized File E465363, RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

MS23HA 0 P 4 100 -E

Basic Motor Length (Max)
- 0 39mm (1.54 in.)
- 8 55mm (2.17 in.) 1 Stack
- A 77mm (3.03 in.) 2 Stack

Electrical Connection
- P Plug-in Connector

Number of Connections
- 4 4 Lead-Bipolar
- 6 6 Lead-Unipolar(or Bipolar)

Winding
- ### Current rating x 100

Options
- Omit No Options
- -E 0.25 inch diameter rear shaft With Encoder Mounting Holes

MS23HA - 4 Lead Bi-Polar

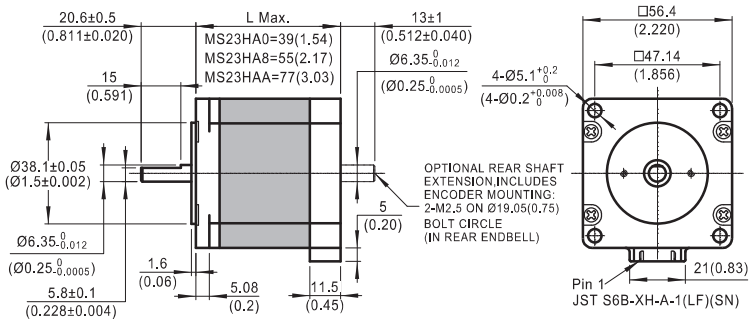
Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20℃	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
39 mm (1.54 in.)	^ MS23HA0P4100	P	1	0.70	99	6.3	23	24	3.4	121.5	0.66	0.42	0.93
	^ MS23HA0P4160	P	1.6	0.71	100	2.6	9.2						
	^ MS23HA0P4220	P	2.2	0.71	100	1.39	4.9						
	^ MS23HA0L4350	L	3.5	0.70	99	0.56	1.85						
55 mm (2.17 in.) 1 Stack	^ MS23HA8P4100	P	1	1.50	210	7.6	50	45	6.4	221	1.2	0.6	1.3
	^ MS23HA8P4150	P	1.5	1.40	200	3.1	21						
	^ MS23HA8P4220	P	2.2	1.50	210	1.6	10.5						
	^ MS23HA8L4360	L	3.6	1.50	210	0.63	3.9						
	^ MS23HA8L4550	L	5.5	1.50	210	0.28	1.56						
77 mm (3.03 in.) 2 Stack	^ MS23HAAP4100	P	1	2.30	330	8.8	61	70	9.9	391	2.1	1	2.2
	^ MS23HAAP4150	P	1.5	2.40	340	4.3	29						
	^ MS23HAAP4200	P	2	2.30	330	2.3	15.2						
	^ MS23HAAP4300	P	3	2.40	340	1.1	6.9						
	^ MS23HAAL4500	L	5	2.30	330	0.39	2.4						

^ Preferred model

Dimensions: mm (in)

Mating Connector with 4 Leads: 300 ±10 (12 ±.5) long (order separately) Part Number: 4634 1402 01891

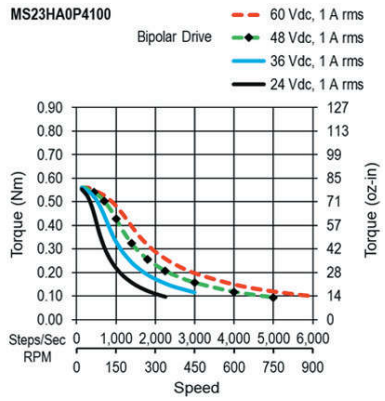
Motors with leads: Lead wire is 22 AWG UL3266, 300 ±10 (12 ±.5) long

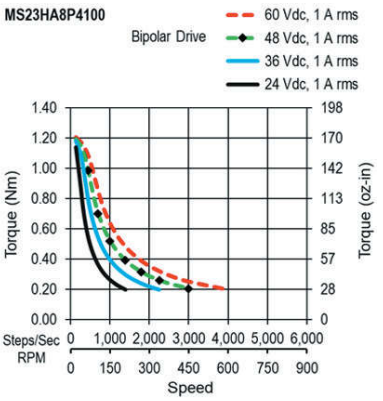


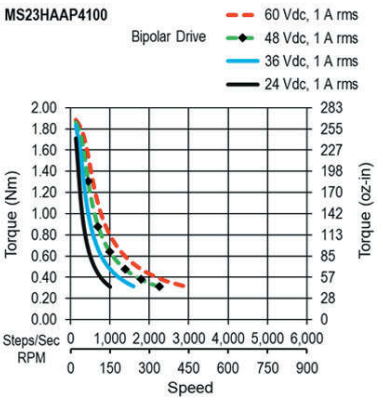
MS23HA0

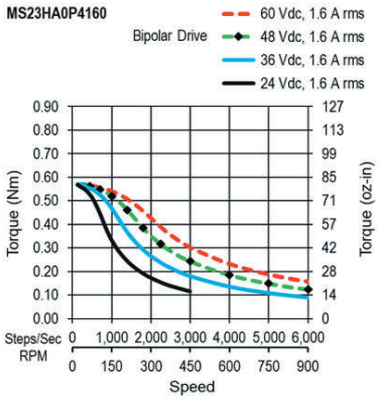
MS23HA8

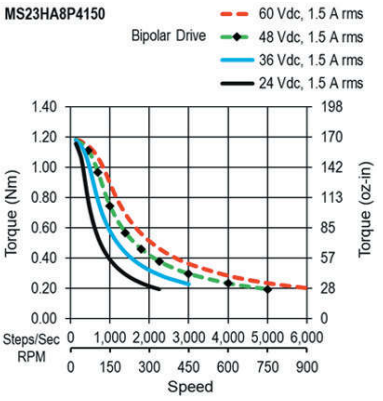
MS23HAA

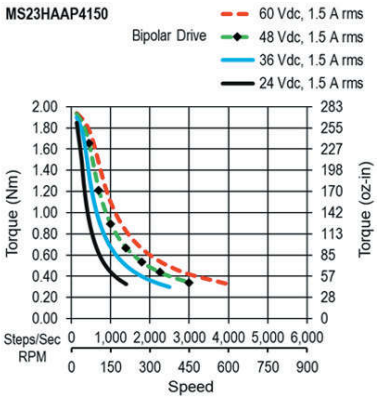


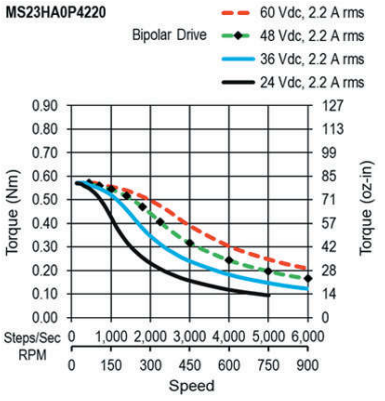


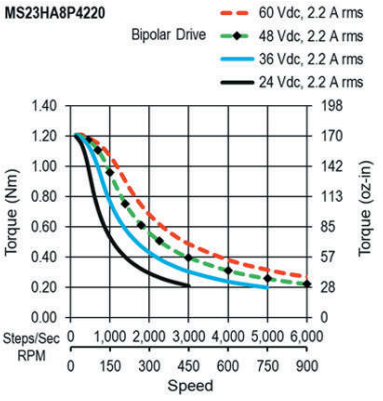


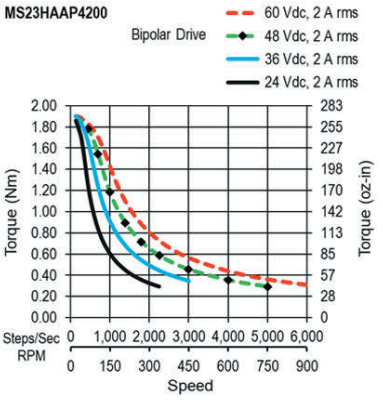


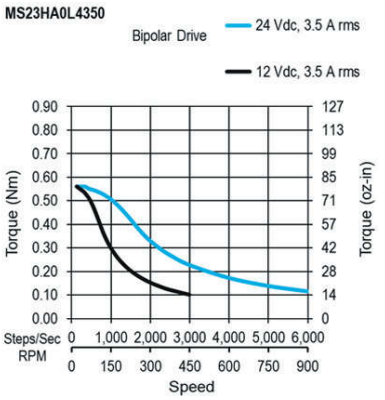


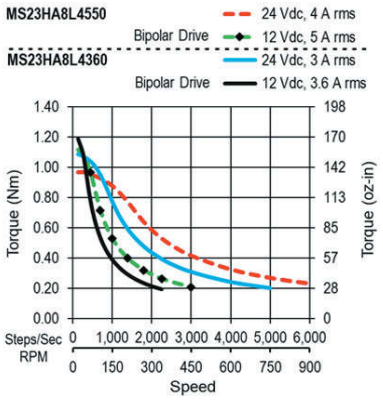


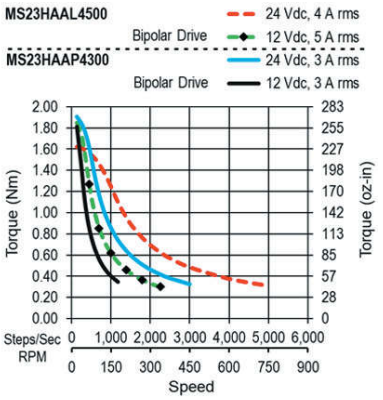












ML23HS / PL23HS Series: 1.8° - Size 23

- Phases 2
- Steps / Revolution 200
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial: 40 N (9 Lbs.) Push; 130 N (30 Lbs.) Pull
  - Radial: 70 N (15.5 Lbs.) At Flat Center
- IP Rating 40
- Approvals UL Recognized File E465363, RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

M L23HS 0 P 4 100 -E

Motor Technology
- M High Torque Step Motor
- P PowerPlus Step Motor

Basic Motor Length (Max)
- 0 39mm (1.54 in.)
- 4 45mm (1.77 in.)
- 8 55mm (2.17 in.) 1 Stack
- A 77mm (3.03 in.) 2 Stack
- C 112mm (4.41 in.) 3 Stack

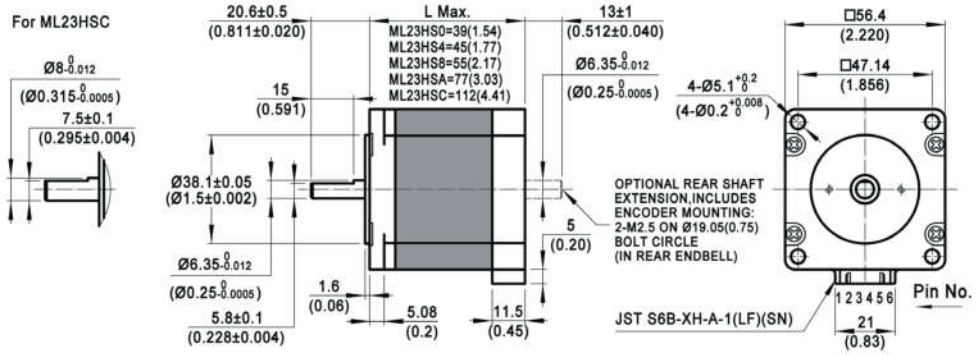
Electrical Connection
- L Leads
- P Plug-in Connector

Number of Connections
- 4 4 Lead-Bipolar
- 6 6 Lead-Unipolar(or Bipolar)

Winding
- ### Current rating x 100

Options
- Omit No Options
- -E 0.25 inch Diameter Rear Shaft with Encoder Mounting Holes

Dimensions: mm (in)



ML23HS - 4 Lead Bi-Polar

Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 ℃	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
39 mm (1.54 in.)	^ ML23HS0P4100	P	1	0.82	120	6.3	15.9	24	3.4	105	0.57	0.42	0.93
	^ ML23HS0P4160	P	1.6	0.83	120	2.6	6.5						
	^ ML23HS0P4220	P	2.2	0.84	120	1.39	3.5						
	^ ML23HS0L4350	L	3.5	0.82	120	0.56	1.3						
45 mm (1.77 in.)	^ ML23HS4P4100	P	1	1.20	170	7.3	22	28	4	135	0.74	0.48	1.1
	^ ML23HS4P4150	P	1.5	1.20	170	3.1	9.2						
	^ ML23HS4P4210	P	2.1	1.20	170	1.62	4.8						
	^ ML23HS4L4340	L	3.4	1.20	170	0.65	1.8						
55 mm (2.17 in.) 1 Stack	^ ML23HS8P4100	P	1	1.50	210	7.6	33	45	6.4	215	1.18	0.6	1.3
	^ ML23HS8P4150	P	1.5	1.50	210	3.1	13.6						
	^ ML23HS8P4220	P	2.2	1.50	210	1.6	6.9						
	^ ML23HS8L4360	L	3.6	1.50	210	0.63	2.6						
	^ ML23HS8L4550	L	5.5	1.50	210	0.28	1.03						
77 mm (3.03 in.) 2 Stack	^ ML23HSAP4100	P	1	2.30	330	8.8	39	75	11	365	2.0	1	2.2
	^ ML23HSAP4150	P	1.5	2.30	330	4.3	18.5						
	^ ML23HSAP4200	P	2	2.30	330	2.3	9.8						
	^ ML23HSAP4300	P	3	2.30	330	1.1	4.5						
	^ ML23HSAL4500	L	5	2.30	330	0.39	1.53						
112 mm (4.41 in.) 3 Stack	^ ML23HSCP4150	P	1.5	3.20	450	5.1	27	120	17	750	4.1	1.5	3.3
	^ ML23HSCP4200	P	2	3.20	450	2.7	13.7						
	^ ML23HSCP4300	P	3	3.20	450	1.29	6.4						
	^ ML23HSCL4500	L	5	3.20	450	0.51	2.1						

^ Preferred model

PL23HS - PowerPlus - 4 Lead Bi-Polar

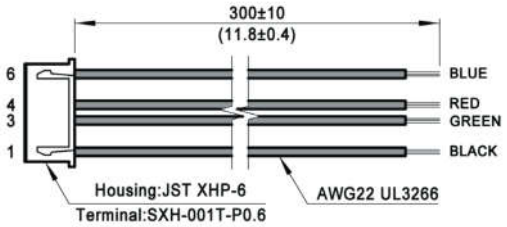
Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 ℃	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
55 mm (2.17 in.) 1 Stack	^ PL23HS8P4100	P	1	2.30	330	7.6	26	100	14	215	1.18	0.65	1.4
	^ PL23HS8P4150	P	1.5	2.20	310	3.1	10.7						
	^ PL23HS8P4220	P	2.2	2.30	330	1.6	5.4						
	^ PL23HS8L4360	L	3.6	2.30	330	0.63	2						
	^ PL23HS8L4550	L	5.5	2.20	310	0.28	0.8						
77 mm (3.03 in.) 2 Stack	^ PL23HSAP4100	P	1	3.30	470	8.8	32	150	21	365	2.0	1.1	2.4
	^ PL23HSAP4150	P	1.5	3.40	480	4.3	15.2						
	^ PL23HSAP4200	P	2	3.30	470	2.3	8.1						
	^ PL23HSAP4300	P	3	3.30	470	1.1	3.7						
	^ PL23HSAL4500	L	5	3.30	470	0.39	1.27						

^ Preferred model

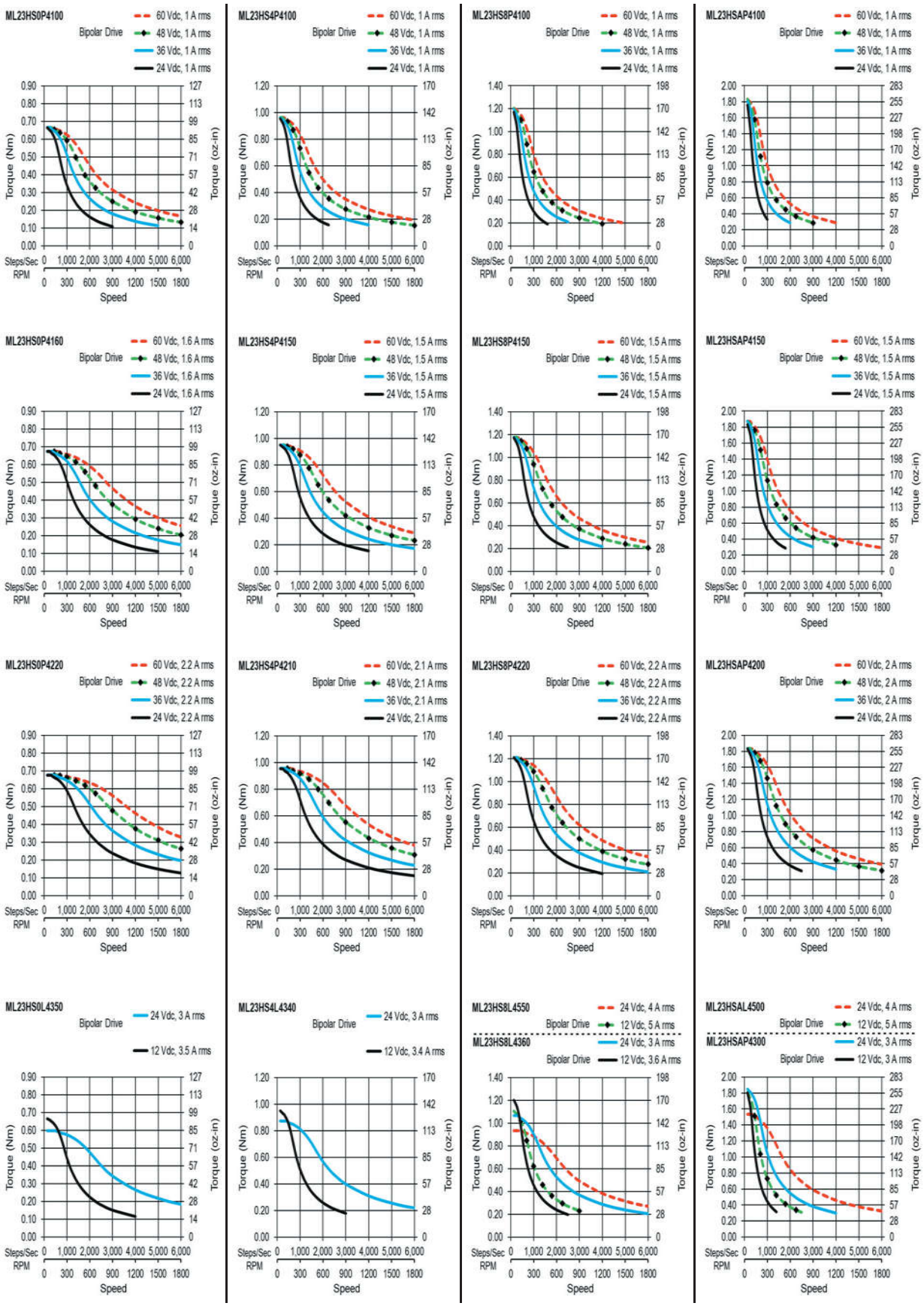
Mating Connector With Leads (order separately)

Dimensions: mm (in)

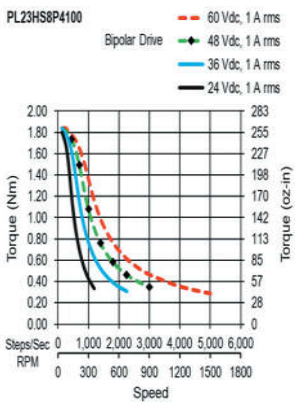
4 Lead Part Number 4634140201891

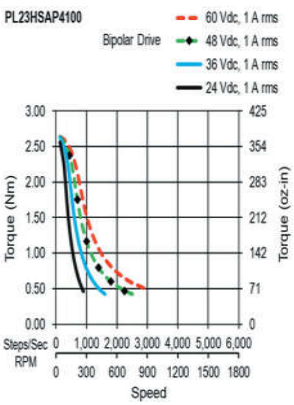


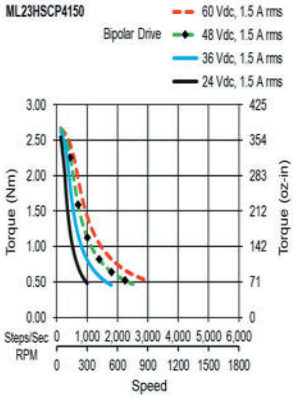
ML23HS0	ML23HS4	ML23HS8	ML23HSA
ML23HS0P4100	ML23HS4P4100	ML23HS8P4100	ML23HSAP4100
ML23HS0P4160	ML23HS4P4150	ML23HS8P4150	ML23HSAP4150
ML23HS0P4220	ML23HS4P4210	ML23HS8P4220	ML23HSAP4200
ML23HS0L4350	ML23HS4L4340	ML23HS8L4550 ML23HS8L4360	ML23HSAL4500 ML23HSAP4300

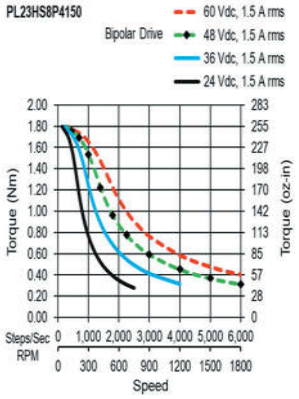


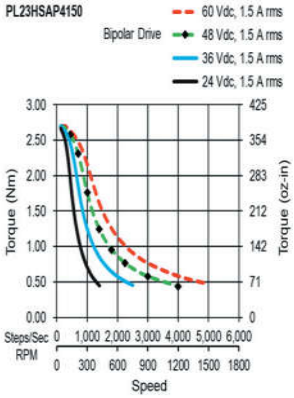
ML23HSC	PowerPlus PL23HS8	PowerPlus PL23HSA

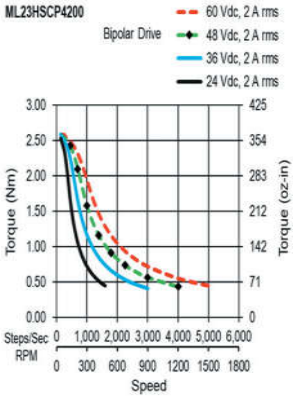


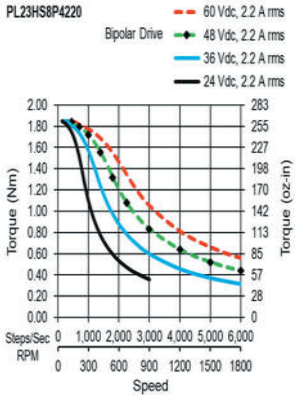


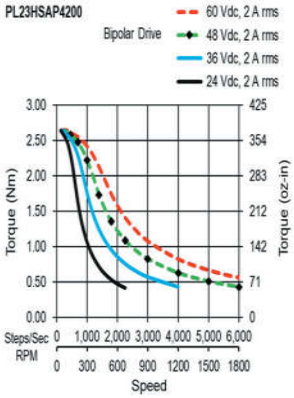


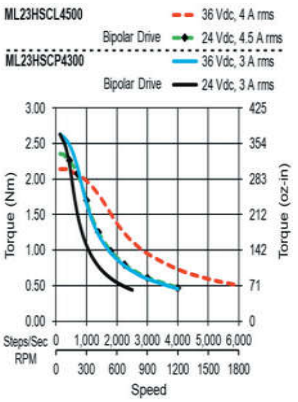


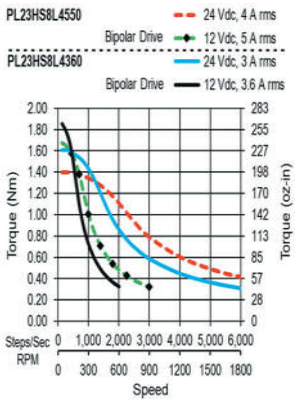


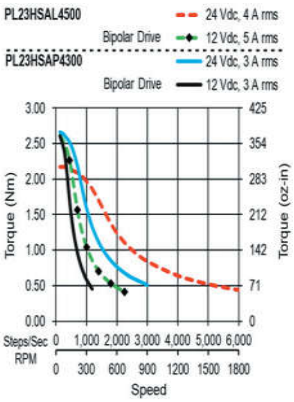












MS24HS Series: 1.8° - Size 24

- Phases 2
- Steps / Revolution 200
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial: 40 N (9 Lbs.) Push; 130 N (30 Lbs.) Pull
  - Radial: 70 N (15.5 Lbs.) At Flat Center
- IP Rating 40
- Approvals UL Recognized File E465363, RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

MS24HS 1 P 4 150 -E

Basic Motor Length (Max)
- 1 46mm (1.81 in.)
- 2 56mm (2.21 in.)
- 3 67mm (2.64 in.)
- 5 87MM (3.43IN.)

Electrical Connection
- L Leads
- P Plug-in Connector

Number of Connections
- 4 4 Lead-Bipolar
- 6 6 Lead-Unipolar(or Bipolar)

Winding
- ### Current rating x 100

Options
- Omit No Options
- -E 0.25 inch diameter rear shaft With Encoder Mounting Holes

MS24HS – 4 Lead Bi-Polar

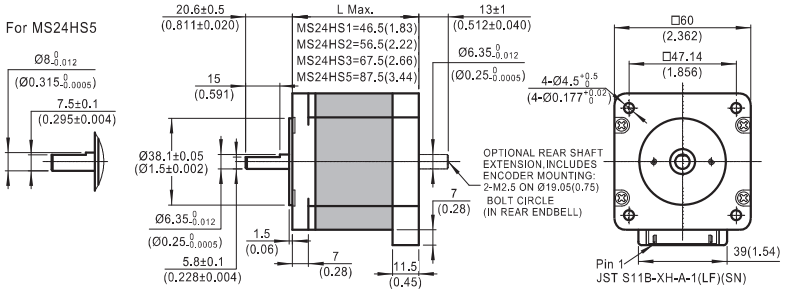
Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
46 mm (1.81 in.)	^ MS24HS1P4150	P	1.5	1.28	180	3.2	7.1	40	5.7	280	1.5	0.6	1.3
	^ MS24HS1P4200	P	2	1.26	180	1.69	3.9						
	^ MS24HS1P4300	P	3	1.23	170	0.73	1.61						
56 mm (2.2 in.)	^ MS24HS2P4150	P	1.5	1.90	270	4	12.5	90	13	450	2.5	0.83	1.8
	^ MS24HS2P4200	P	2	1.90	270	2.1	6.8						
	^ MS24HS2P4300	P	3	1.80	250	0.92	2.8						
	^ MS24HS2L4420	L	4.2	1.80	250	0.47	1.35						
67 mm (2.64 in.)	^ MS24HS3P4150	P	1.5	2.40	340	4.2	12.1	95	13	560	3.1	1.05	2.3
	^ MS24HS3P4200	P	2	2.30	330	2.2	6						
	^ MS24HS3P4300	P	3	2.40	340	1.1	3						
	^ MS24HS3L4420	L	4.2	2.30	330	0.56	1.44						
87 mm (3.43 in.)	^ MS24HS5P4150	P	1.5	3.20	450	4.6	15.8	100	14	900	4.9	1.4	3.1
	^ MS24HS5P4200	P	2	3.30	470	2.8	9.2						
	^ MS24HS5P4300	P	3	3.30	470	1.21	4.1						
	^ MS24HS5L4420	L	4.2	3.20	450	0.61	1.97						

^ Preferred model

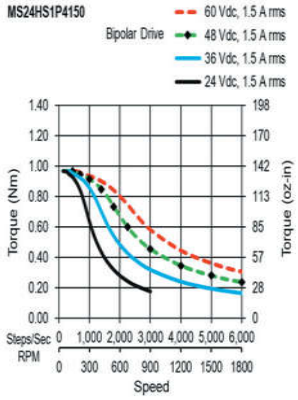
Dimensions: mm (in)

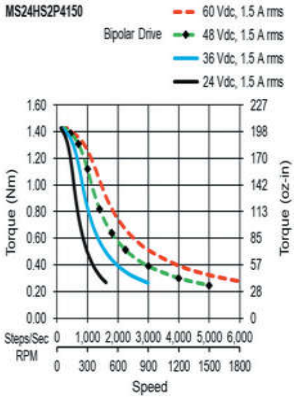
Mating Connector with 4 Leads: 300 ±10 (12 ±.5) long (order separately) Part Number: 4634 1402 01393

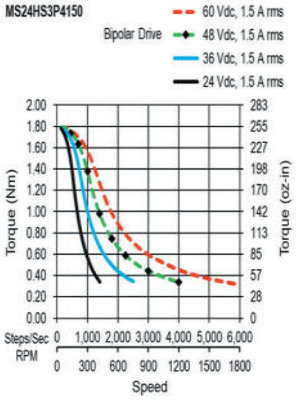
Motors with leads: Lead wire is 22 AWG UL3266, 300 ±10 (12 ±.5) long

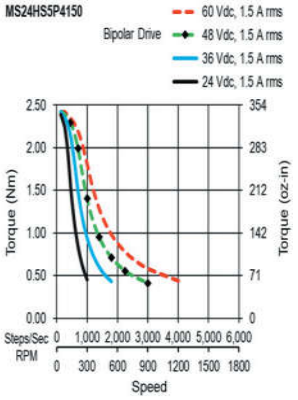


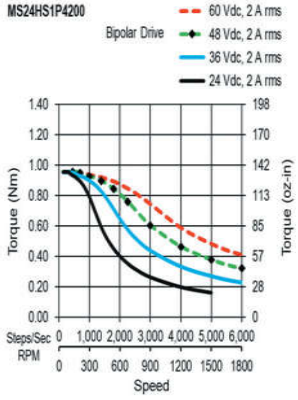
MS24HS1	MS24HS2	MS24HS3	MS24HS5

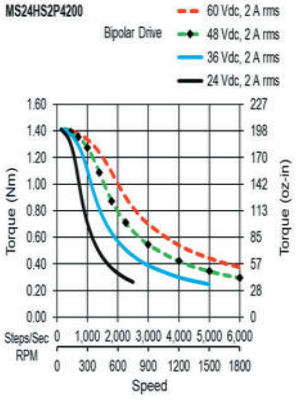


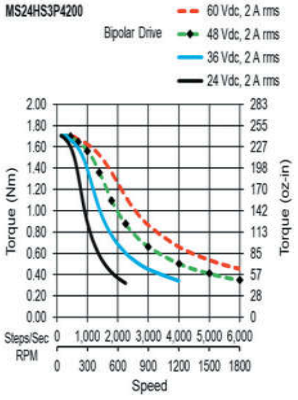


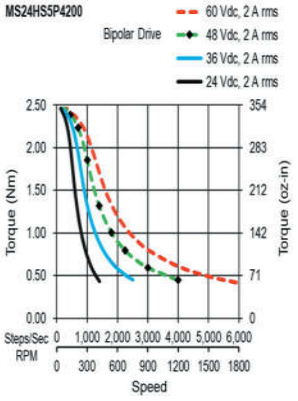


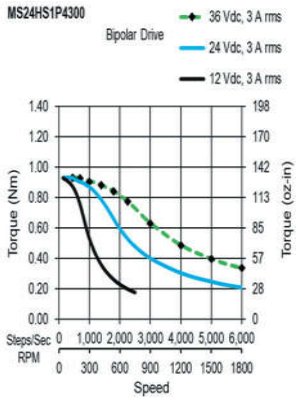


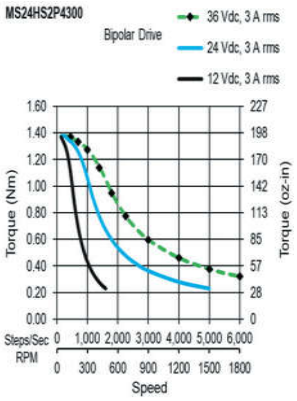


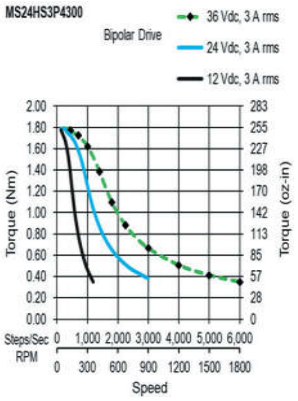


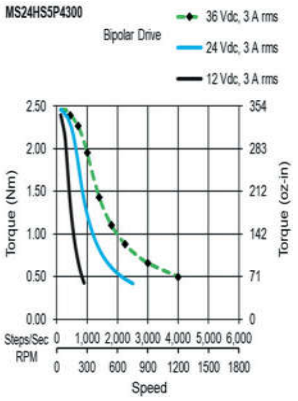


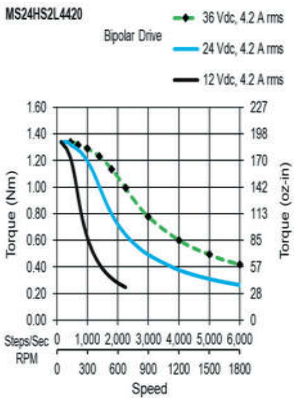


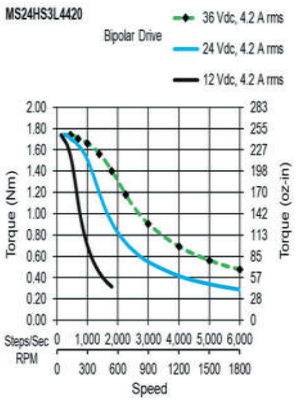


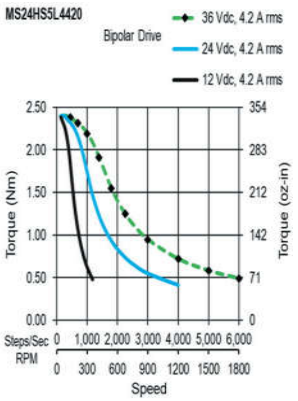












ML34HD / PL34HD Series: 1.8° - Size 34

- Phases 2
- Steps / Revolution 200
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial 65 N (15 Lbs.) Push
    155 N (35 Lbs.) Pull
  - Radial 220 N (50 Lbs.) At Flat Center
- IP Rating 40
- Approvals UL Recognized File E465363, RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C

M L34HD 0 L 8 350 -E

Motor Technology
- M High Torque Step Motor
- P PowerPlus Step Motor

Basic Motor Length (Max)
- 0 67mm (2.64 in.) 1 Stack
- 1 97mm (3.82 in.) 2 Stack
- 2 126mm (4.96 in.) 3 Stack
- 3 157mm (6.18 in.) 4 Stack

- L Leads

Number of Connections
- 4 4 Lead-Bipolar
- 8 8 Lead-Unipolar(or Bipolar)

Winding
- ### Current rating x 100
- X## for 11 to 19 amps:
  X10= 11 amps, X40 = 14 amps

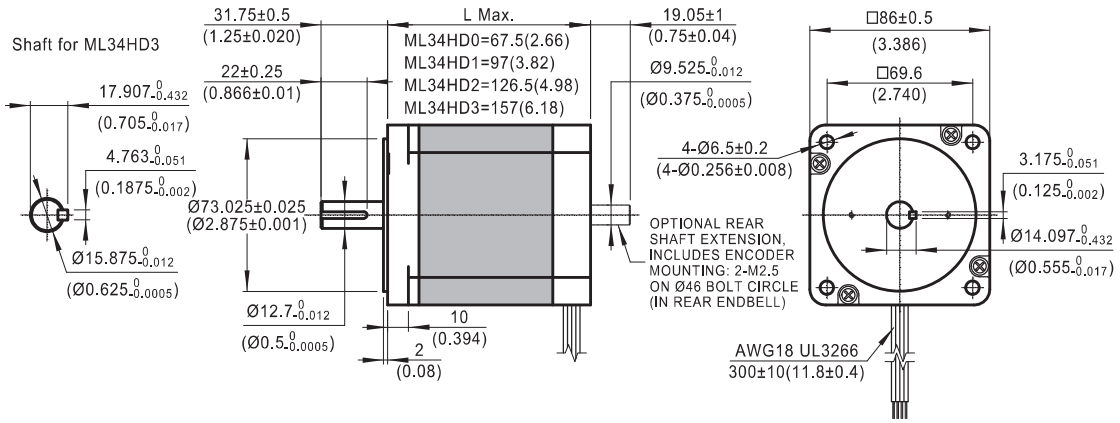
Options
- Omit No Options
- -E 0.375 inch Diameter Rear Shaft with Encoder Mounting Holes

MS34HD – 4 Lead & 8 Lead

Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	Winding mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
67 mm (2.64 in.) 1 Stack	^ ML34HD0L4160	L	1.6	3.70	520	3.9	42	90	13	915	5	1.6	3.5
	ML34HD0L4350	L	3.5	3.80	540	0.95	9.5						
	ML34HD0L4500	L	5	3.80	540	0.48	4.5						
	ML34HD0L4700	L	7	3.80	540	0.26	2.4						
	ML34HD0L4X00	L	10	3.80	540	0.14	1.13						
97 mm (3.82 in.) 2 Stack	^ ML34HD1L4200	L	2	7.20	1,000	3.6	50	150	21	1480	8.1	2.7	6
	ML34HD1L4350	L	3.5	7.20	1,000	1.34	15.9						
	ML34HD1L4500	L	5	7.20	1,000	0.61	8						
	ML34HD1L4700	L	7	7.20	1,000	0.36	4						
	ML34HD1L4X00	L	10	7.20	1,000	0.19	2						
126 mm (4.96 in.) 3 Stack	^ ML34HD2L4200	L	2	10.00	1,400	4.1	59	200	28	2200	12	3.8	8.4
	ML34HD2L4350	L	3.5	9.90	1,400	1.44	18.7						
	ML34HD2L4500	L	5	9.80	1,400	0.72	8.7						
	ML34HD2L4700	L	7	9.90	1,400	0.38	4.7						
	ML34HD2L4X00	L	10	9.80	1,400	0.22	2.2						
157 mm (6.18 in.) 4 Stack	^ ML34HD3L4230	L	2.3	13.20	1,900	3.9	58	250	35	3740	20.4	4.9	11
	ML34HD3L4350	L	3.5	13.20	1,900	1.81	25						
	ML34HD3L4500	L	5	13.20	1,900	0.9	11.7						
	ML34HD3L4700	L	7	13.20	1,900	0.47	6.3						
	ML34HD3L4X00	L	10	13.20	1,900	0.24	2.9						
67 mm (2.64 in.) 1 Stack	^ ML34HD0L8350	L Series	3.5	3.80	540	0.98	9.5	90	13	915	5	1.6	3.5
		L Parallel	7	3.80	540	0.25	2.4						
	^ ML34HD0L8500	L Series	5	3.80	540	0.5	4.5						
		L Parallel	10	3.80	540	0.126	1.13						
97 mm (3.82 in.) 2 Stack	^ ML34HD1L8350	L Series	3.5	7.20	1,000	1.37	15.9	150	21	1480	8.1	2.7	6
		L Parallel	7	7.20	1,000	0.34	4						
	^ ML34HD1L8500	L Series	5	7.20	1,000	0.71	8						
		L Parallel	10	7.20	1,000	0.177	2						
126 mm (4.96 in.) 3 Stack	^ ML34HD2L8350	L Series	3.5	9.90	1,400	1.48	18.7	200	28	2200	12	3.8	8.4
		L Parallel	7	9.90	1,400	0.37	4.7						
	^ ML34HD2L8500	L Series	5	9.80	1,400	0.82	8.7						
		L Parallel	10	9.80	1,400	0.21	2.2						
157 mm (6.18 in.) 4 Stack	^ ML34HD3L8350	L Series	3.5	13.20	1,900	1.85	23	250	35	3740	20.4	4.9	11
		L Parallel	7	13.20	1,900	0.46	5.9						
	^ ML34HD3L8500	L Series	5	13.20	1,900	0.92	10.9						
		L Parallel	10	13.20	1,900	0.23	2.7						

^ Preferred model

Dimensions: mm (in)

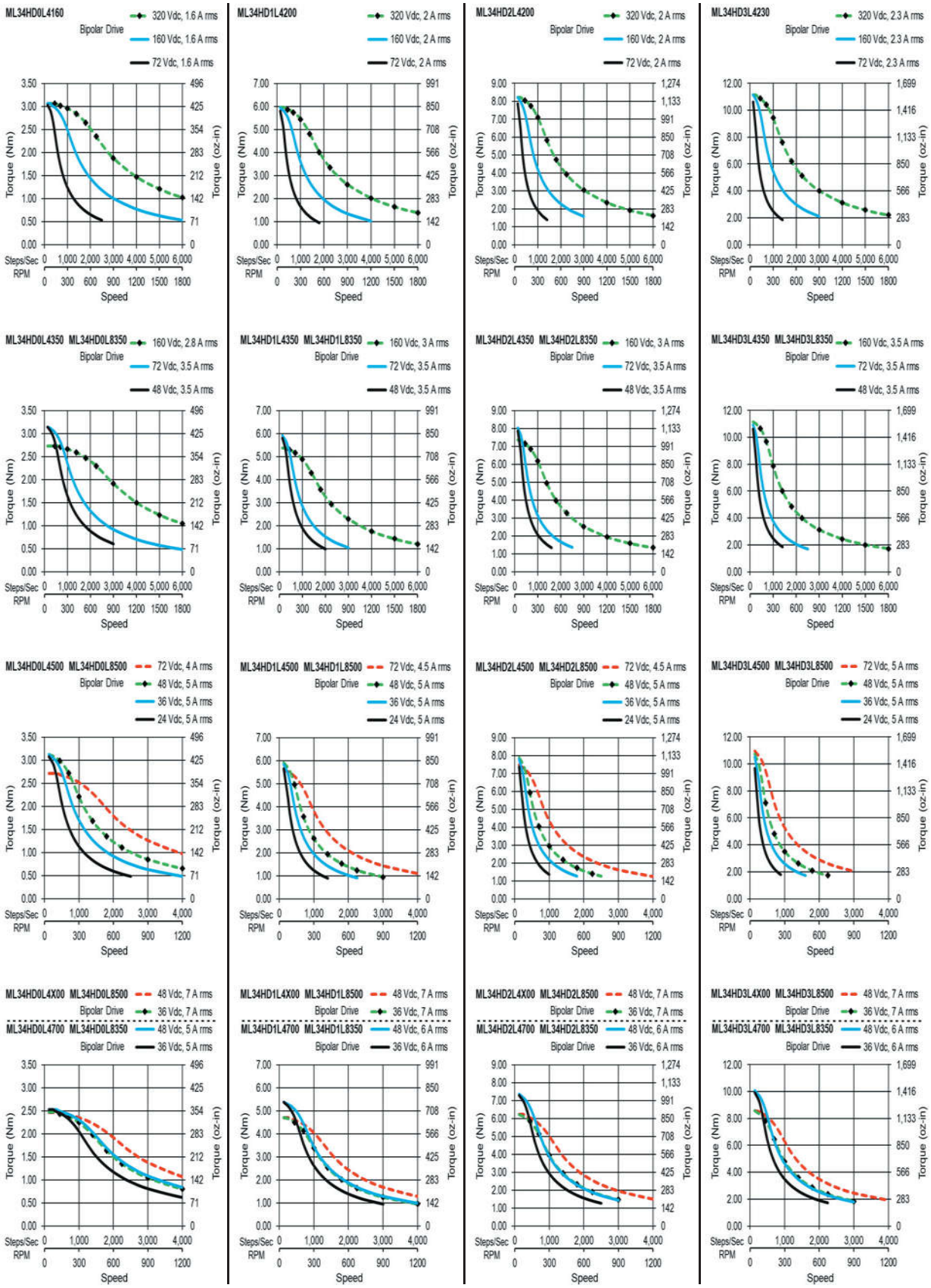


PL34HD – PowerPlus – 4 Lead & 8 Lead

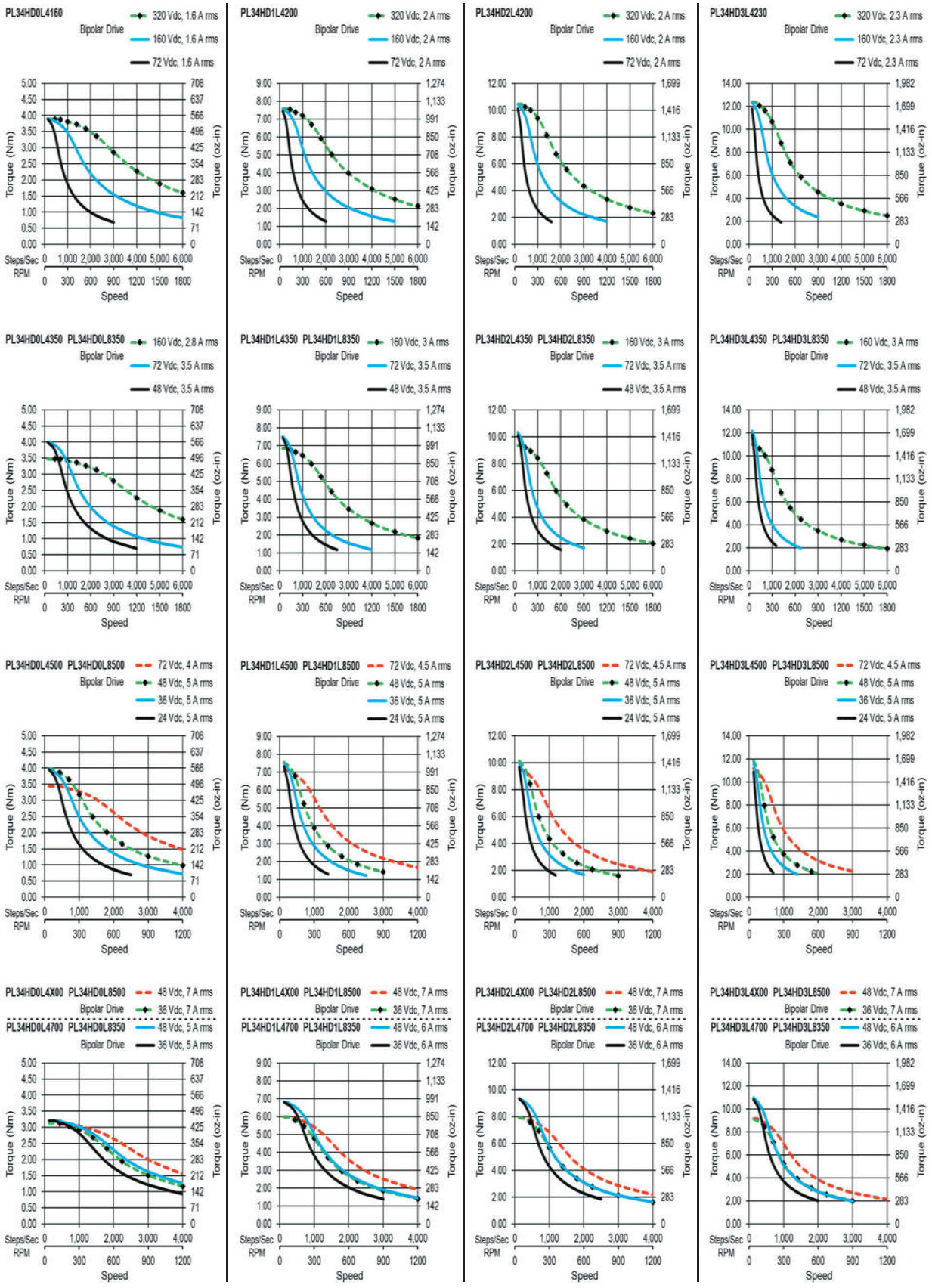
Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	Winding mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20℃	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
67 mm (2.64 in.) 1 Stack	^ PL34HD0L4160	L	1.6	4.70	670	3.9	33	120	17	915	5	1.6	3.5
	PL34HD0L4350	L	3.5	4.75	670	0.95	7.6						
	PL34HD0L4500	L	5	4.75	670	0.48	3.6						
	PL34HD0L4700	L	7	4.75	670	0.26	1.89						
	PL34HD0L4X00	L	10	4.75	670	0.138	0.91						
97 mm (3.82 in.) 2 Stack	^ PL34HD1L4200	L	2	9.20	1,300	3.6	40	250	35	1480	8.1	2.7	6
	PL34HD1L4350	L	3.5	9.00	1,300	1.34	12.8						
	PL34HD1L4500	L	5	9.00	1,300	0.61	6.4						
	PL34HD1L4700	L	7	9.00	1,300	0.36	3.2						
	PL34HD1L4X00	L	10	9.00	1,300	0.188	1.6						
126 mm (4.96 in.) 3 Stack	^ PL34HD2L4200	L	2	12.30	1,700	4.1	44	300	42	2200	12	3.8	8.4
	PL34HD2L4350	L	3.5	12.30	1,700	1.44	14						
	PL34HD2L4500	L	5	12.30	1,700	0.72	6.5						
	PL34HD2L4700	L	7	12.30	1,700	0.38	3.5						
	PL34HD2L4X00	L	10	12.30	1,700	0.22	1.62						
157 mm (6.18 in.) 4 Stack	^ PL34HD3L4230	L	2.3	15.00	2,100	3.9	47	375	53	3740	20.4	4.9	11
	PL34HD3L4350	L	3.5	15.00	2,100	1.81	20						
	PL34HD3L4500	L	5	15.00	2,100	0.9	9.4						
	PL34HD3L4700	L	7	15.00	2,100	0.47	5						
	PL34HD3L4X00	L	10	15.00	2,100	0.24	2.3						
67 mm (2.64 in.) 1 Stack	^ PL34HD0L8350	L Series	3.5	4.75	670	0.98	7.6	120	17	915	5	1.6	3.5
		L Parallel	7	4.75	670	0.25	1.89						
	^ PL34HD0L8500	L Series	5	4.75	670	0.5	3.6						
		L Parallel	10	4.75	670	0.126	0.91						
97 mm (3.82 in.) 2 Stack	^ PL34HD1L8350	L Series	3.5	9.00	1,300	1.37	12.8	250	35	1480	8.1	2.7	6
		L Parallel	7	9.00	1,300	0.34	3.2						
	^ PL34HD1L8500	L Series	5	9.00	1,300	0.71	6.4						
		L Parallel	10	9.00	1,300	0.177	1.6						
126 mm (4.96 in.) 3 Stack	^ PL34HD2L8350	L Series	3.5	12.30	1,700	1.48	14	300	42	2200	12	3.8	8.4
		L Parallel	7	12.30	1,700	0.37	3.5						
	^ PL34HD2L8500	L Series	5	12.30	1,700	0.82	6.5						
		L Parallel	10	12.30	1,700	0.21	1.62						
157 mm (6.18 in.) 4 Stack	^ PL34HD3L8350	L Series	3.5	15.00	2,100	1.85	20	375	53	3740	20.4	4.9	11
		L Parallel	7	15.00	2,100	0.46	5						
	^ PL34HD3L8500	L Series	5	15.00	2,100	0.92	9.4						
		L Parallel	10	15.00	2,100	0.23	2.3						

^ Preferred model

ML34HD0	ML34HD1	ML34HD2	ML34HD3



PL34HD0	PL34HD1	PL34HD2	PL34HD3



ML42HS Series: 1.8° - Size 42

- Phases 2
- Steps / Revolution 200
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial 250 N (56 Lbs.) Push & Pull
  - Radial 450 N (100 Lbs.) At Keyway Center
- IP Rating 40
- Approvals UL Recognized File E465363, RoHS
- Operating Temp. - 20°C to +40°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

M L42HS 0 L 8 350

Motor Technology
- M High Torque Step Motor
- P PowerPlus Step Motor

Basic Motor Length (Max)
- 0 100mm (3.94 in.) 1 Stack
- 2 151mm (5.95 in.) 2 Stack
- 3 202mm (7.95 in.) 3 Stack

Electrical Connection
- L Leads

Winding
- ### Current rating x 100
- X## for 11 to 19 amps:
  X10= 11 amps, X40 = 14 amps

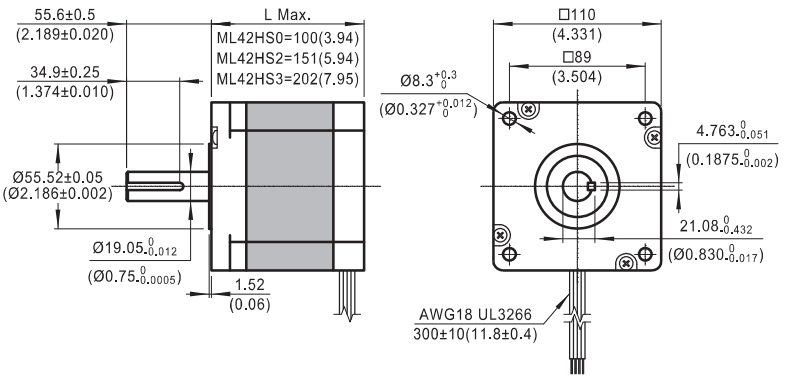
Number of Connections
- 4 4 Lead-Bipolar
- 8 8 Lead-Unipolar(or Bipolar)

ML42HS – 4 Lead & 8 Lead

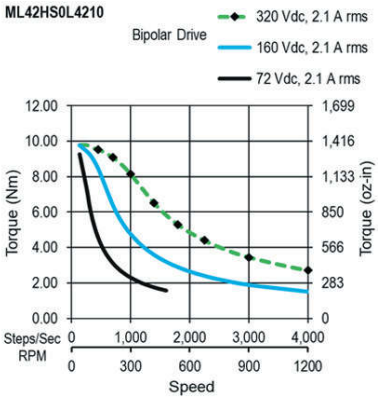
Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
100 mm (3.94 in.) 1 Stack	^ ML42HS0L4210	L	2.1	12.10	1,700	4.1	69	500	71	5500	30	4.8	11
	ML42HS0L4420	L	4.2	12.20	1,700	1.16	17.4						
	ML42HS0L4600	L	6	12.30	1,700	0.61	8.9						
	ML42HS0L4840	L	8.4	12.20	1,700	0.31	4.4						
	ML42HS0L4X20	L	12	12.30	1,700	0.167	2.2						
151 mm (5.94 in.) 2 Stack	^ ML42HS2L4240	L	2.4	22.00	3,100	4.2	78	650	92	10900	60	8	18
	ML42HS2L4600	L	6	22.00	3,100	0.75	12.4						
	ML42HS2L4800	L	8	22.00	3,100	0.41	7.3						
	ML42HS2L4X20	L	12	22.00	3,100	0.177	3.1						
	ML42HS2L4X60	L	16	22.00	3,100	0.116	1.82						
202 mm (7.95 in.) 3 Stack	^ ML42HS3L4270	L	2.7	31.00	4,400	4.2	84	800	110	16200	89	11.6	26
	ML42HS3L4600	L	6	31.00	4,400	1.02	18.6						
	ML42HS3L4800	L	8	32.00	4,500	0.55	10.9						
	ML42HS3L4X20	L	12	31.00	4,400	0.24	4.7						
	ML42HS3L4X60	L	16	32.00	4,500	0.152	2.7						
100 mm (3.94 in.) 1 Stack	ML42HS0L8420	L Series	4.2	12.20	1,700	1.19	17.4	500	71	5500	30	4.8	11
		L Parallel	8.4	12.20	1,700	0.3	4.4						
	ML42HS0L8600	L Series	6	12.30	1,700	0.64	8.9						
		L Parallel	12	12.30	1,700	0.159	2.2						
151 mm (5.94 in.) 2 Stack	ML42HS2L8600	L Series	6	22.00	3,100	0.68	12.4	650	92	10900	60	8	18
		L Parallel	12	22.00	3,100	0.17	3.1						
	ML42HS2L8800	L Series	8	22.00	3,100	0.43	7.3						
		L Parallel	16	22.00	3,100	0.108	1.82						
202 mm (7.95 in.) 3 Stack	ML42HS3L8600	L Series	6	31.00	4,400	0.91	18.6	800	110	16200	89	11.6	26
		L Parallel	12	31.00	4,400	0.23	4.7						
	ML42HS3L8800	L Series	8	32.00	4,500	0.58	10.9						
		L Parallel	16	32.00	4,500	0.144	2.7						

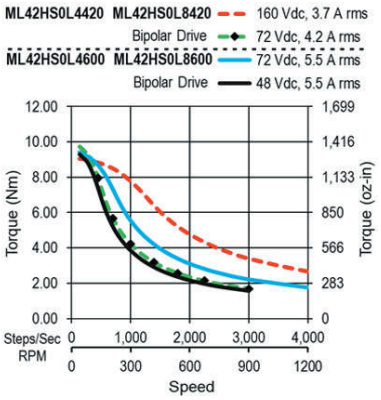
^ Preferred model

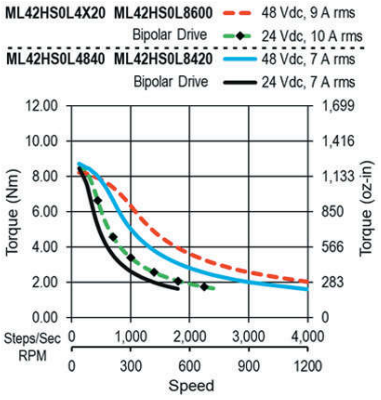
Dimensions: mm (in)



ML42HS0







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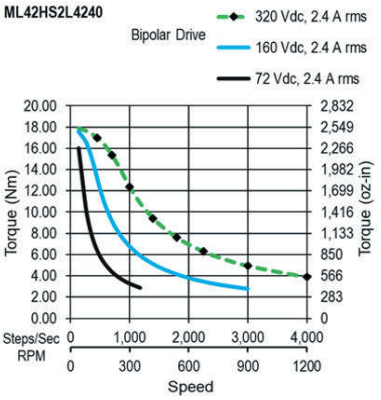

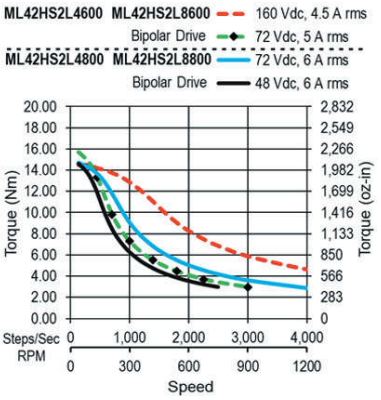

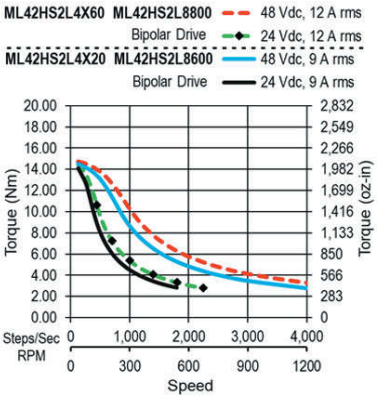

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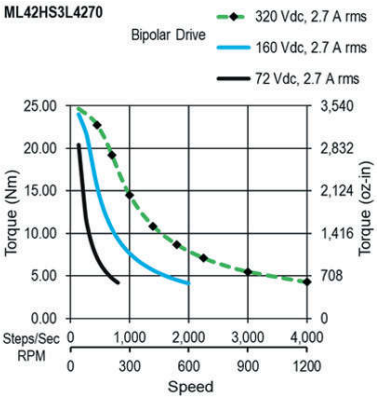
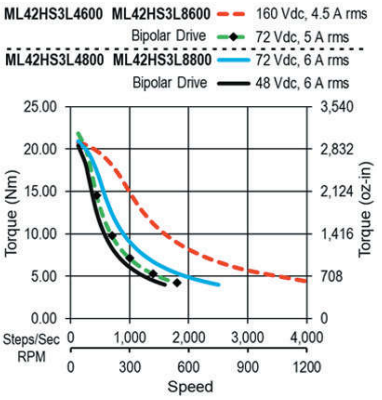
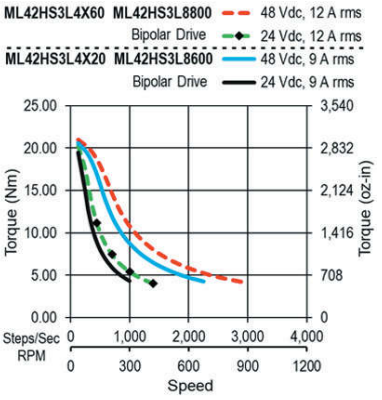






17HC Series: 1.2° - Size 17, 3 Phase Encapsulated

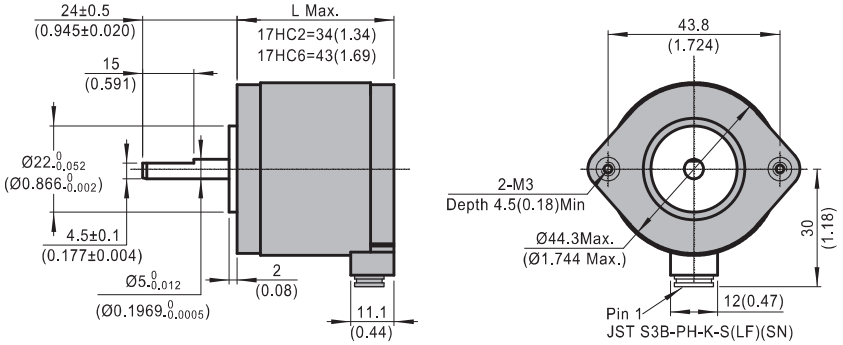
- Phases 3
- Steps / Revolution 300
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial: 25 N (5.6 Lbs.) Push; 65 N (15 Lbs.) Pull
  - Radial: 29 N (6.5 Lbs.) At Flat Center
- IP Rating 40
- Approvals RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

17HC – 3 Phase

Length		Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	Winding mH	Detent Torque		Rotor Inertia		Motor Weight	
		Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
34 mm (1.34 in.)	^	17HC2005N	P	0.8	0.36	51	10.6	14.5						
	^	17HC2006N	P	1.5	0.36	51	3.5	4.8	14	2	57	0.31	0.245	0.54
	^	17HC2002N	P	2.3	0.36	51	1.67	1.99						
43 mm (1.69 in.)	^	17HC6003N	P	0.82	0.46	65	13.8	21						
	^	17HC6004N	P	1.5	0.46	65	4.4	6.5	25	3.5	82	0.45	0.35	0.77
	^	17HC6005N	P	2.3	0.46	65	1.88	2.7						

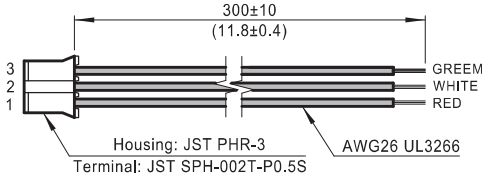
^ Preferred model

Dimensions: mm (in)



Mating Connector With Leads (order separately)
Dimensions: mm (in)

3 Lead Part Number 4634 1402 04496



MOONS' 17HC, 3 phase step motors, offer numerous advantages:

- More Torque
- Low Noise
- Low Vibration
- Low Resonance
- Encapsulated Construction

Molded Stator

Encapsulated winding	>>>>	Runs cooler – Longer life
Better sealing	>>>>	Longer life
Reduced vibration	>>>>	Smoother moves – Quieter

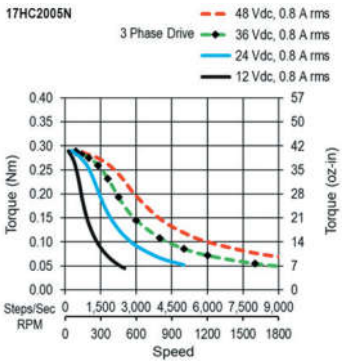
Large Ball Bearings

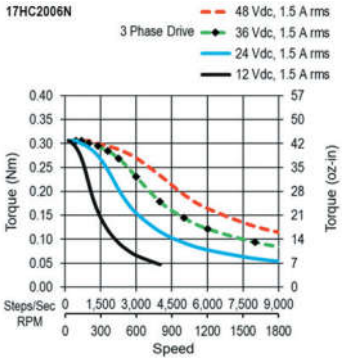
Large shaft loads	>>>>	Fewer design restrictions
Long Life	>>>>	Less down time

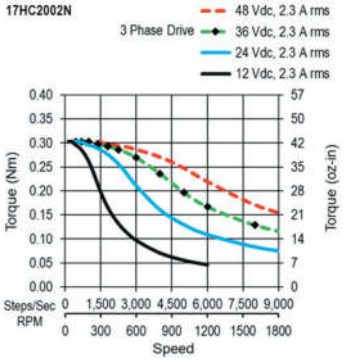
High Winding Fill

Larger wire size	>>>>	More torque
Uses less energy	>>>>	Longer battery life

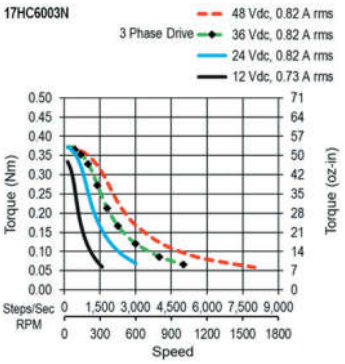
17HC2

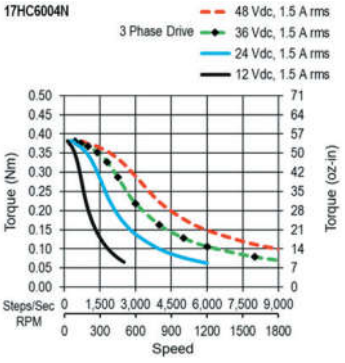


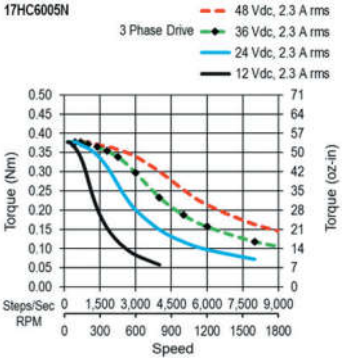




17HC6







ML24HC / PL24HC Series: 1.2° - Size 24, 3 Phase

- Phases 3
- Steps / Revolution 300
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial: 40 N (9 Lbs.) Push; 130 N (30 Lbs.) Pull
  - Radial: 70 N (15.5 Lbs.) At Flat Center
- IP Rating 40
- Approvals RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

M L24HC 4 P 3 150 -E

Motor Technology
- M High Torque Step Motor
- P PowerPlus Step Motor

Basic Motor Length (Max)
- 4 45.5mm (1.79 in.)
- 8 55.5mm (2.19 in.) 1 Stack
- A 77.5mm (3.05 in.) 2 Stack

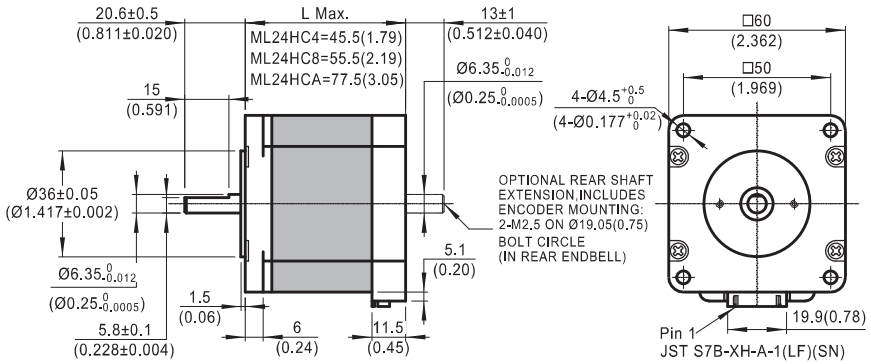
Electrical Connection
- L Leads
- P Plug-In Connector

Number of Connections
- 3 3 Lead-Bipolar

Winding
- ### Current rating x 100

Options
- Omit No Options
- -E 0.25 inch Diameter Rear Shaft with Encoder Mounting Holes

Dimensions: mm (in)



ML24HC – 3 Phase

Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
45.5 mm (1.79 in.)	^ ML24HC4P3150	P	1.5	0.72	100	4.8	7.9	28	4	159	0.87	0.65	1.4
	^ ML24HC4P3230	P	2.3	0.72	100	2.1	3.4						
	^ ML24HC4L3410	L	4.1	0.72	100	0.67	1.06						
55.5 mm (2.19 in.) 1 Stack	^ ML24HC8P3150	P	1.5	0.97	140	6	15.1	45	6.4	221	1.2	0.85	1.9
	^ ML24HC8P3220	P	2.2	0.97	140	2.7	6.9						
	^ ML24HC8L3350	L	3.5	0.97	140	1.09	2.7						
	^ ML24HC8L3550	L	5.5	0.97	140	0.52	1.1						
77.5 mm (3.05 in.) 2 Stack	^ ML24HCAP3150	P	1.5	1.60	230	7.7	19.6	75	11	391	2.1	1.35	3
	^ ML24HCAP3220	P	2.2	1.60	230	3.9	9.3						
	^ ML24HCAL3340	L	3.4	1.60	230	1.57	3.7						
	^ ML24HCAL3550	L	5.5	1.60	230	0.64	1.44						

^ Preferred model

PL24HC - PowerPlus – 3 Phase

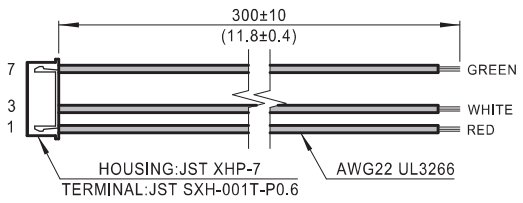
Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20 C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
45.5 mm (1.79 in.)	^ PL24HC4P3150	P	1.5	0.87	120	4.8	7	55	7.8	159	0.87	0.73	1.6
	^ PL24HC4P3230	P	2.3	0.87	120	2.1	3						
	^ PL24HC4L3410	L	4.1	0.87	120	0.67	0.94						
55.5 mm (2.19 in.) 1 Stack	^ PL24HC8P3150	P	1.5	1.40	200	6	12.2	90	13	221	1.2	0.93	2.1
	^ PL24HC8P3220	P	2.2	1.40	200	2.7	5.5						
	^ PL24HC8L3350	L	3.5	1.40	200	1.09	2.2						
	^ PL24HC8L3550	L	5.5	1.40	200	0.52	0.88						
77.5 mm (3.05 in.) 2 Stack	^ PL24HCAP3150	P	1.5	2.10	300	7.7	15.7	150	21	391	2.1	1.45	3.2
	^ PL24HCAP3220	P	2.2	2.10	300	3.9	7.4						
	^ PL24HCAL3340	L	3.4	2.10	300	1.57	3						
	^ PL24HCAL3550	L	5.5	2.10	300	0.64	1.15						

^ Preferred model

Mating Connector With Leads (order separately)

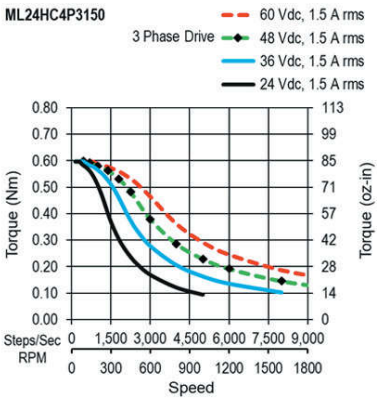
Dimensions: mm (in)

3 Lead Part Number 4634 1402 04485



ML24HC4

ML24HC4P3150



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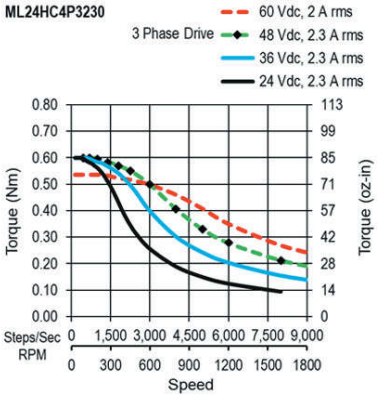

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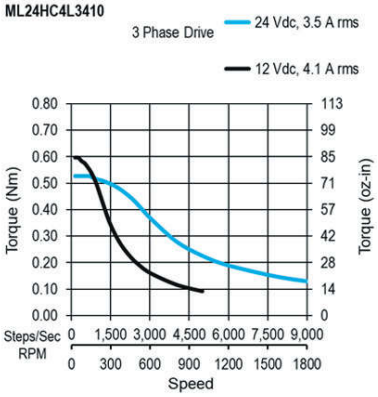
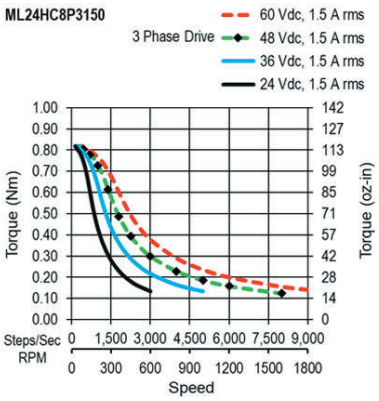


ML24HC8

ML24HC8P3150



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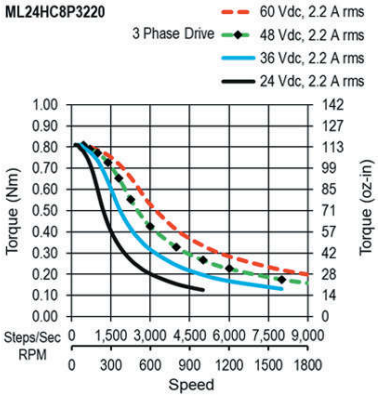

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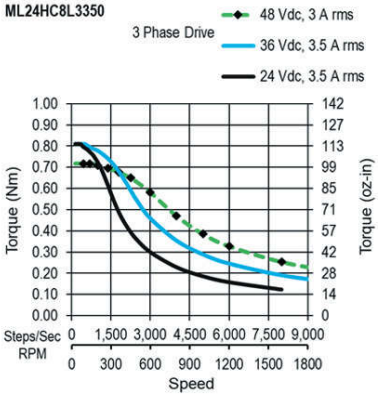

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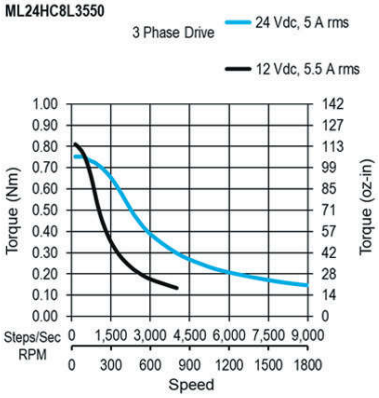

ML24HCA

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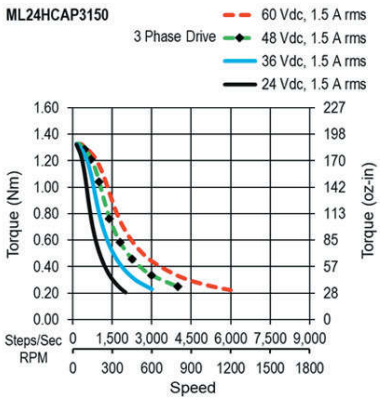

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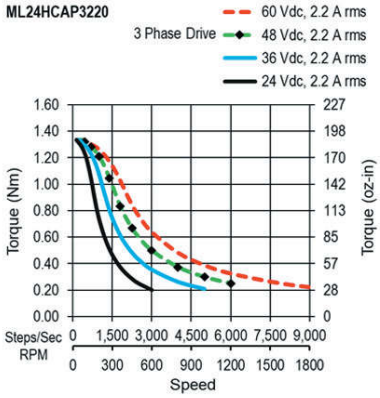

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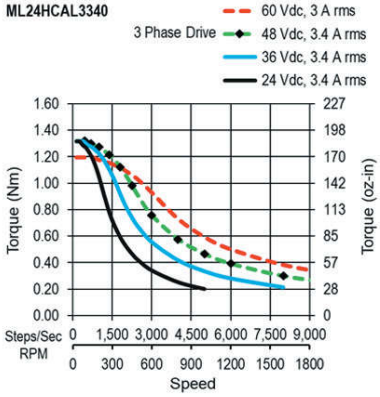

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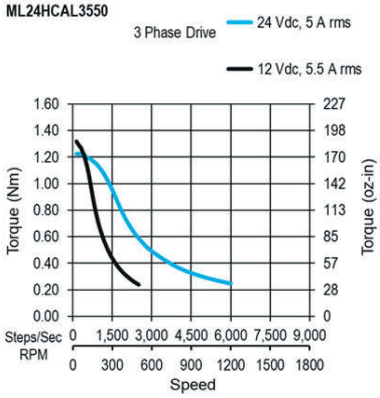
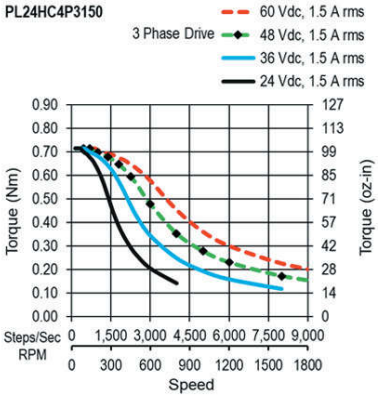
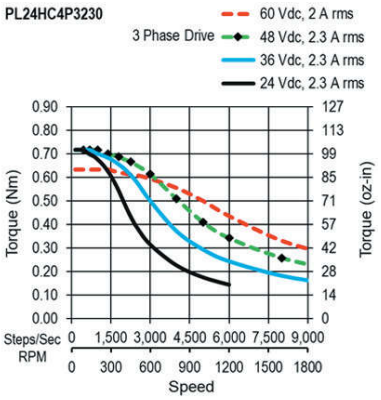
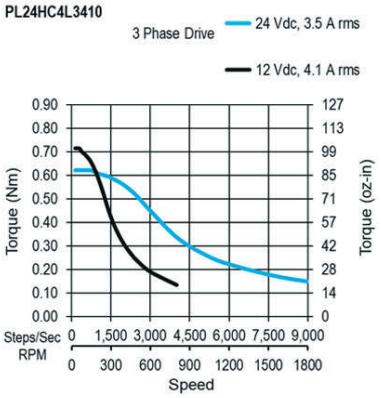


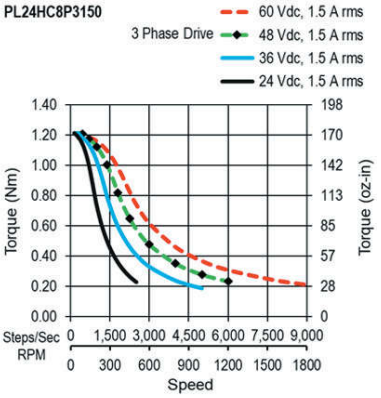
PowerPlus PL24HC4

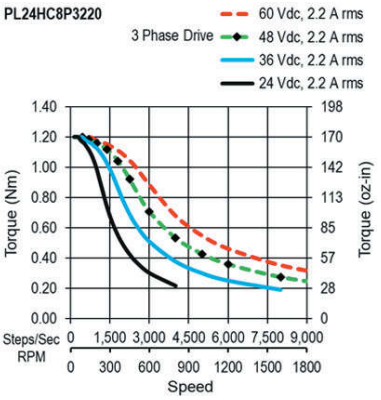


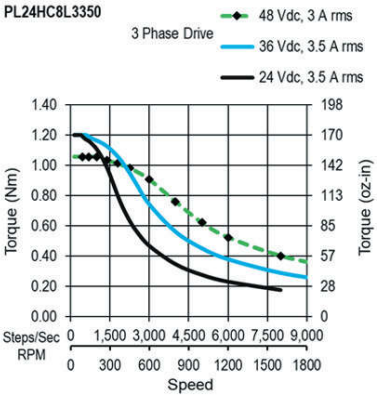


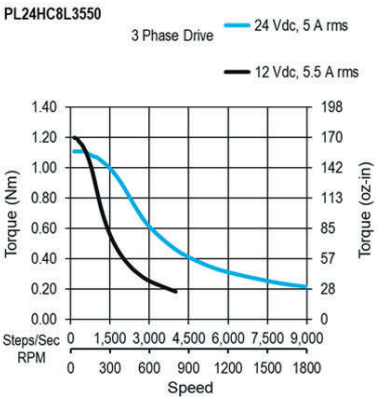


PowerPlus PL24HC8

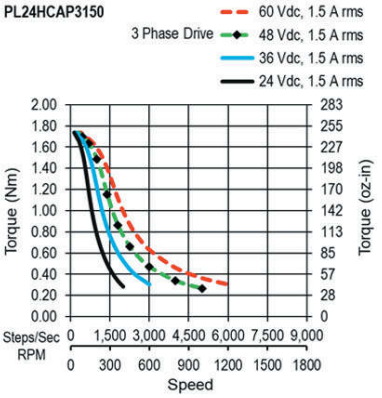


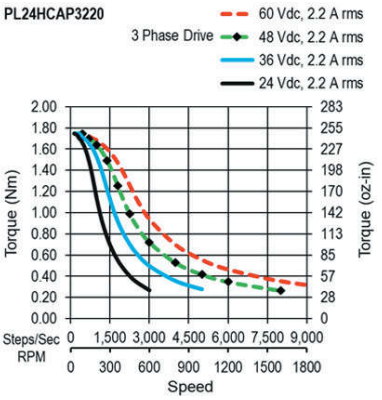


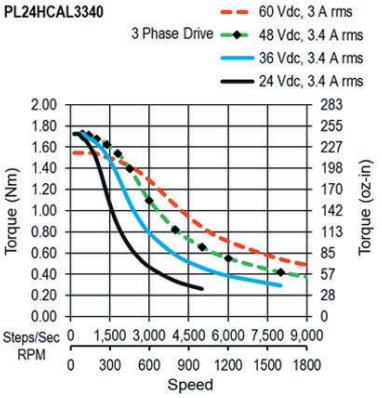


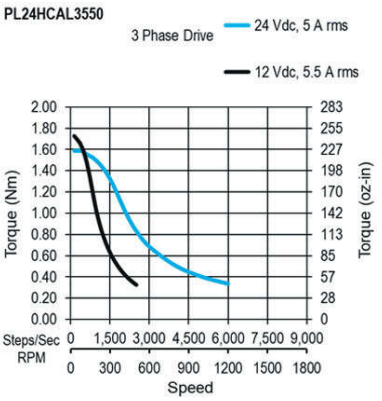


PowerPlus PL24HCA









34HC Series: 1.2° - Size 34, 3 Phase

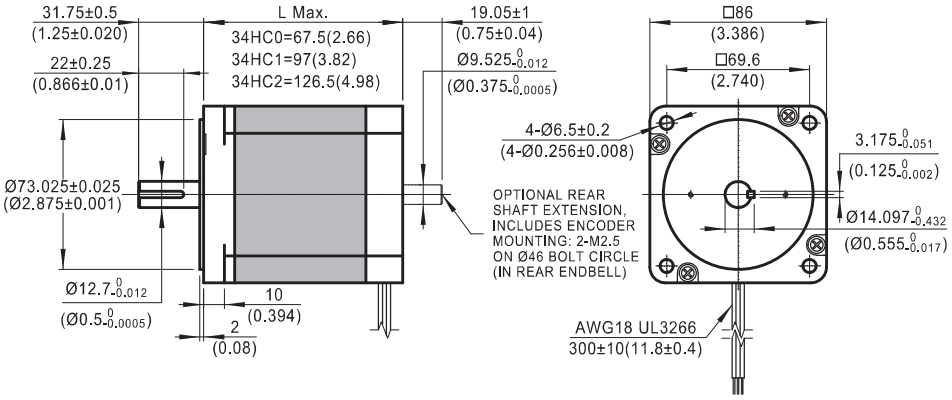
- Phases 3
- Steps / Revolution 300
- Step Accuracy ±5%
- Shaft Load (20,000 Hours at 1000 RPM)
  - Axial: 65 N (15 Lbs.) Push; 155 N (35 Lbs.) Pull
  - Radial: 220 N (50 Lbs.) At Flat Center
- IP Rating 40
- Approvals RoHS
- Operating Temp. -20°C to +50°C
- Insulation Class B, 130°C
- Insulation Resistance 100 MegOhms

34HC - 3 Phase

Length	Model Number	Connect	Rated Current	Holding Torque		Winding Ohms	Winding mH	Detent Torque		Rotor Inertia		Motor Weight	
	Single Shaft	P=Plug L=Leads	Amps (mounted)	Nm Typ.	oz-in TYP.	@20°C	Typ.	mNm	oz-in	g cm²	oz-in²	kg	Lbs
67.5 mm (2.66 in.) 1 Stack	^ 34HC0309	L	2	2.80	400	5	19.1	100	14	1100	6	1.6	3.5
	^ 34HC0310	L	3	2.80	400	2.3	8.4						
	^ 34HC0305	L	5.8	2.70	380	0.54	1.95						
97 mm (3.82 in.) 2 Stack	^ 34HC1308	L	2	5.40	760	6	28	230	33	1850	10	2.7	6
	^ 34HC1309	L	3	5.30	750	2.5	12						
	^ 34HC1305	L	5.8	5.00	710	0.62	2.7						
126.5 mm (4.98 in.) 3 Stack	^ 34HC2310	L	2	6.70	950	6.8	36	350	50	2750	15	3.8	8.4
	^ 34HC2311	L	3	6.80	960	3.3	16.8						
	^ 34HC2306	L	5.8	6.80	960	0.88	4.5						

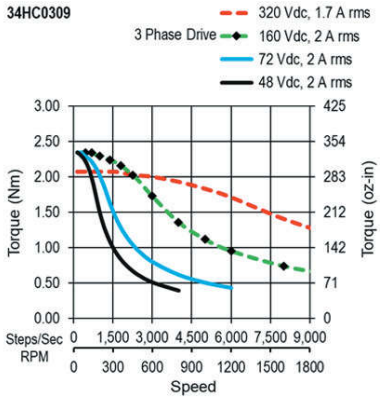
^ Preferred model

Dimensions: mm (in)



34HC0 | 34HC1 | 34HC2

34HC0309



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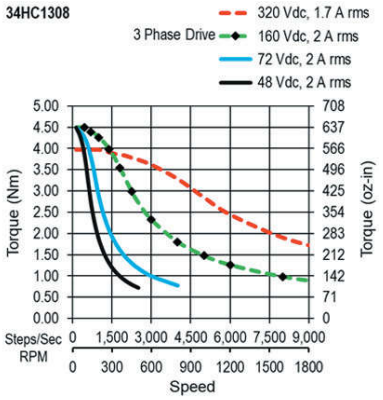

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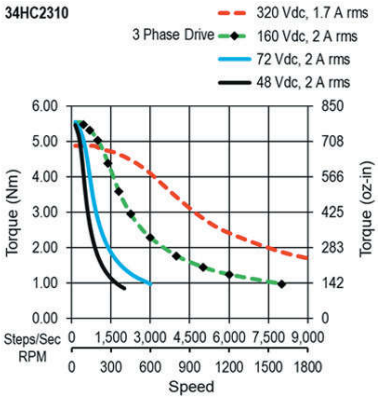
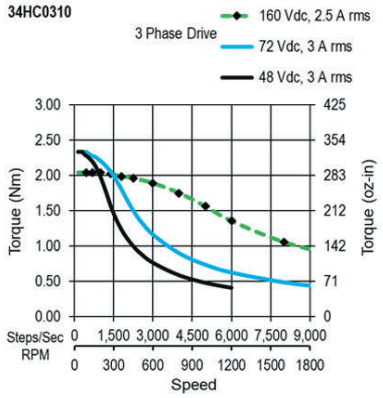


34HC0310



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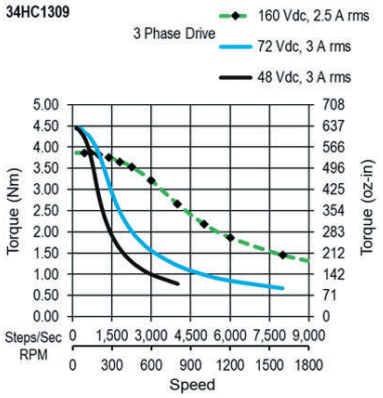

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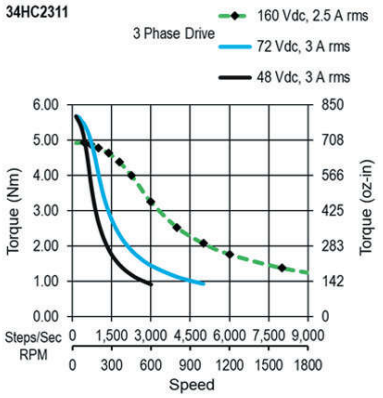

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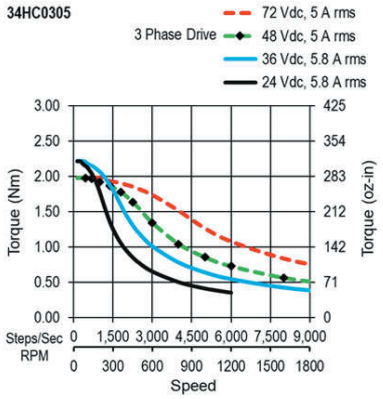
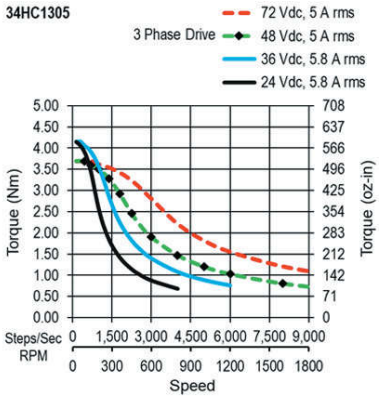
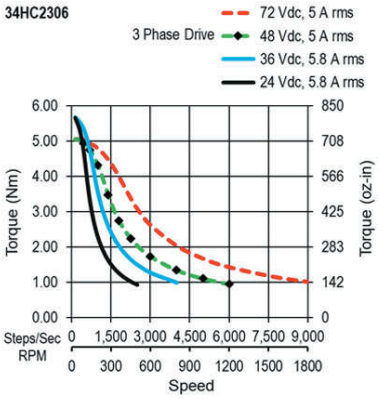


34HC1305



34HC2306



Step Motor Basics – Applicatons

- Applications
  MOONS' stepping motors are widely used to create the motion needed in many types of equipment. Examples include:
  - office automation: printers, scanners, copy machines
  - stage lighting: pointing, focus, color changes, spot size, special effects
  - banking: check processing, credit card manufacturing, money scanners & counters
  - medical: body scanning, blood analyzers, chemical analysis
  - industrial: textile, packaging, robotics, conveyers, assembly, labeling
  - telecommunication: phase shift, Tuning, mobile antenna positioning
  - security: camera movement
  - automotive: fuel metering, steering control

- What Is A Stepping Motor
  Stepping Motors provide precise position and speed control, without the need for feedback devices to sense position. The operation of step motors is controlled through electrical pulses that the drive converts to current flowing through the windings of the motor. As the current is switched the motor rotates in precise steps of a fixed angle. The motor and drive constitutes a low cost control system that is precise and simple to construct.

- Performance Features of MOONS' Stepping Motors
  - Accurate Position Control
    The number of control pulses defines the motor shaft position. Position error is very small (less than 1/10th of a degree), and non cumulative.

  - Precise Motor Speed
    Step motor running speed, is exactly determined by the frequency of the control pulses. Because the speed is very precise and easy to control, step motors are often used where coordinated motion control is needed.

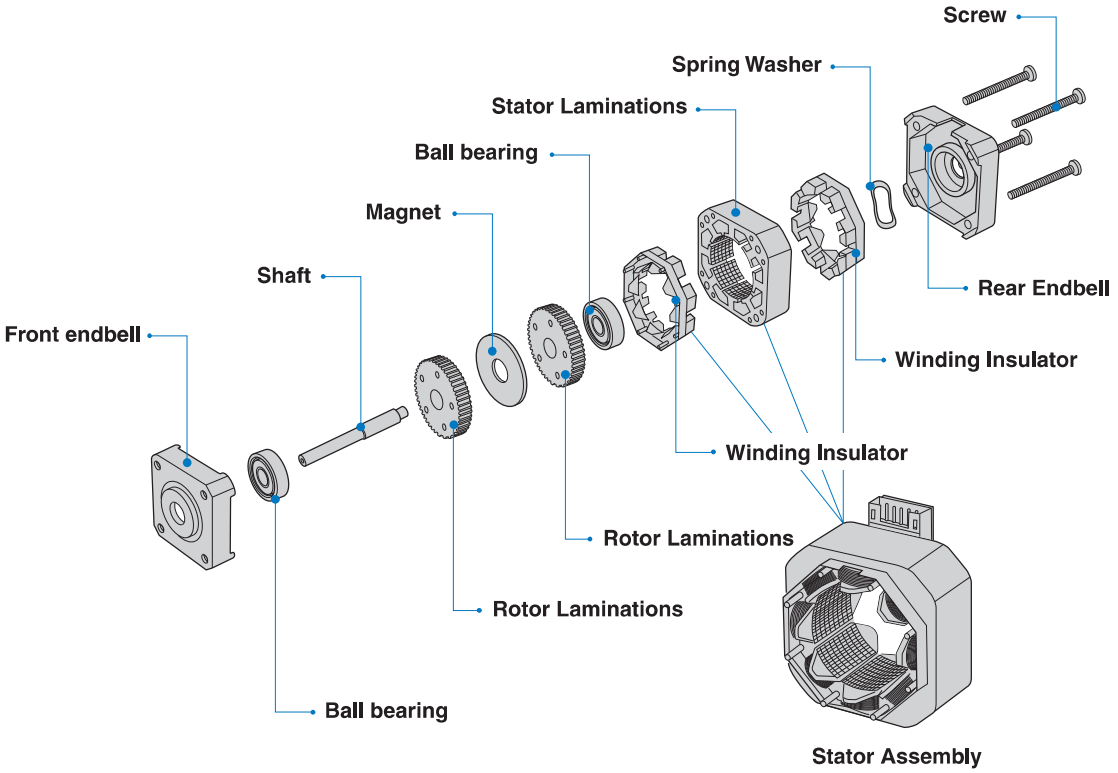
  - Forward & Reverse, Pause and Holding Function
    Motor torque and position control is effective throughout the entire speed range, including zero speed holding torque. The zero speed holding torque locks the shaft at the desired position to hold the load in place.

  - Low Speed Operation
    Step motors produce a large amount of torque, and are easy to control, at low speeds. This often eliminates the need for speed reduction gearboxes, reduces costs and saves space.

  - Long Life
    The brushless design of step motors leads to motors with a very long life. Step motor life is usually determined by the life of the bearings.

Step Motor Basics – Structure & Operation

- Basic Structure

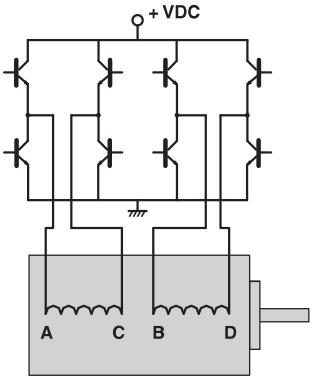


- Operating Principles

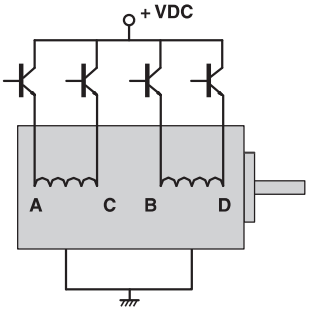
In response to each individual control pulse and direction signal, the drive applies power to the motor windings to cause the rotor to take a step forward, a step in reverse, or hold in position. For example, in a 1.8 degree two phase step motor: When both phases are energized with DC current, the motor will stop rotating and hold in position. The maximum torque the motor can hold in place with rated DC current, is the rated holding torque. If the current in one phase is reversed, the motor will move 1 step (1.8 degrees) in a known direction.

If the current in the other phase had been reversed, the motor would move 1 step (1.8 degrees) in the other direction. As current is reversed in each phase in sequence, the motor continues to step in the desired direction. These steps are very accurate. For a 1.8 degree step motor, there are exactly 200 steps in one revolution.

Two phase stepping motors are furnished with two types of windings: bipolar or unipolar. In a bipolar motor there is one winding on each phase. The motor moves in steps as the current in each winding is reversed. This requires a drive with eight electronic switches. In a unipolar motor there are two windings on each phase. The two windings on each phase are connected in opposite directions. Phase current is reversed by turning on alternate windings on the same phase. This requires a drive with only four electronic switches. Bipolar operation typically provides 40% more holding torque than unipolar, because 100% of the winding is energized in the bipolar arrangement.



2 phase step motor with bipolar driver

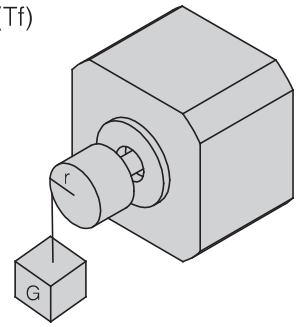


2 phase step motor with unipolar driver

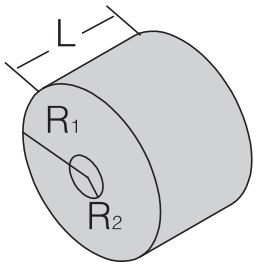
Load Calculations & Tips for Using Step Motors

- Load Calculations

Torque load (Tf)
Tf = G * r
G: weight
r: radius



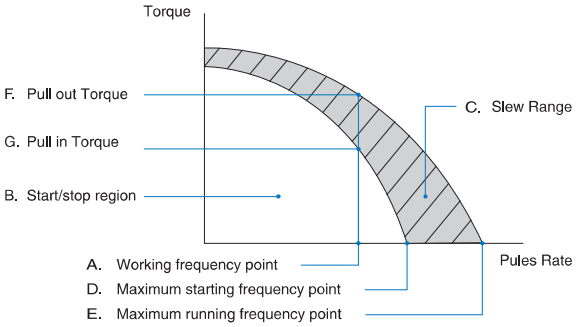
Inertia load (TJ)
TJ = J * dw/dt
J = M * (R1^2+R2^2) / 2
(Kg * cm)
M: mass
R1: outside radius
R2: inside radius
dw/dt: angular acceleration



- Speed-Torque Characteristics
The dynamic torque curve is an important aspect of stepping motor's output performance. The followings are some keyword explanations.

A. Working frequency point express the stepping motors rotational speed versus the drive pulse rate.
n = q * Hz / (360 * D)
n: rev/sec
Hz: the frequency value or the driver pulse rate.
D: the subdividing value of motor driver
q: the step angle of stepping motor

E.g.: 1.8° stepping motor, in the condition of I/2 subdividing (each step 0.9°) runs at 500Hz its speed is 1.25r/s.



B. Start/Stop region: the region in which a stepping motor can be directly started or stopped.

C. Slew Range: the motor cannot be started directly in this area. It must be started in the start/stop region first and then accelerated to this area. In this area, the motor can not be directly stopped, either. Otherwise this will lead to losing-step. The motor must be decelerated back to the start/stop region before it can be stopped.

D. Maximum starting frequency point at this point, the stepping motor can reach its maximum starting speed under unloaded condition.

E. Maximum running frequency point at this point the stepping motor can reach its maximum running speed under an unloaded condition.

F. Pull-in Torque: the maximum dynamic torque value that a stepping motor can load directly at the particular operating frequency point.

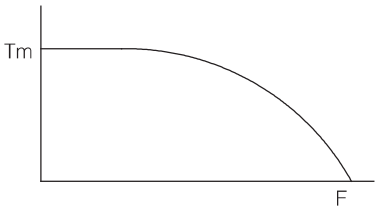
G. Pull-out Torque: the maximum dynamic torque value that a stepping motor can load at the particular operating frequency point when the motor has been started. Because of the inertia of rotation the Pull-Out Torque is always larger than the Pull-In Torque.

Load Calculations & Tips for Using Step Motors

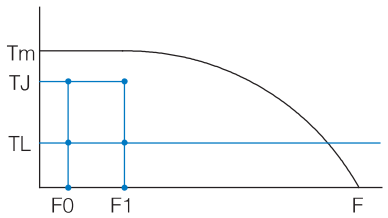
- **Calculate the Acceleration Torque**

  The torque meeded to accelerate the system inertia is often larger than the friction torque of the load. This limits how quickly the load can be accelerated.

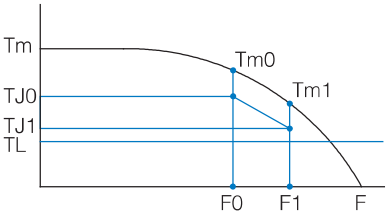
  As shown by the following graph: the dynamic torque performance of a stepping motor is constant at low speeds. But at higher speeds, the torque drops as speed increases (influenced by the motor inductance and drive voltage).



  A. Accelerated Motion of Straight Line
  Motor's load value is known as TL, it has to be accelerated from F0 to F1 in the shortest time (tr), what is the value of tr?
  (1). Generally TJ = 70%Tm
  (2). tr = 1.8 * 10 -5 * J * q * (F1-F0)/(TJ-TL)
  (3). F (t) = (F1-F0) * t/tr + F0, 0<t<tr



  B. Exponential Acceleration
  (1). Generally
  TJ0 = 70%Tm0,
  TJ1 = 70%Tm1,
  TL = 60%Tm1
  (2). tr = F4 * In [(TJ0-TL)/(TJ1-TL)]
  (3). F (t) = F2 * [1 – e^(-t/F4)] + F0, 0<t<tr
  F2 = (TL-TJ0) * (F1-F0)/(FJ1-TJ0)
  F4 = 1.8 * 10-5 * J * q * F2/(TJ0-TL)



  Note: J is the rotational inertia of motor rotor plus the load, q is the angle of each step, it equals the step angle of stepping motor when motor runs in full step.

- **Reduction of Vibration and Noise**

  In a non-loading condition, stepping motors may appear to have vibration or even lose steps when the motor is running at or close to resonant frequency. Solutions for these conditions include:

  A. Have the motor operate outside of this speed range.

  B. Micro-step is used for increasing a motor's step resolution. By adopting the micro-step driving method, you can divide one step into multiple steps thereby reducing the vibration. This is accomplished by controlling the motor's phase current ratio. Micro-step does not increase step accuracy. However it will allow a motor to run more smoothly and with less noise. When the motor runs in half step mode the motor torque will be 15% less than running in full step mode. If the motor is controlled by sine wave current the motor torque will be reduced by 30% if using the same peak current.

  C. Use 0.9° 2 phase step motor, or a three phase step motor.

Step Sequence & Schematic Diagrams

- 2 Phase Motors

Bipolar, Full Step

STEP	Phase 1		Phase 2	
	A	C	B	D
1	+	-	+	-
2	-	+	+	-
3	-	+	-	+
4	+	-	-	+

CW CCW

CW & CCW rotation when seen from flange side of the motor.

Unipolar, Full step

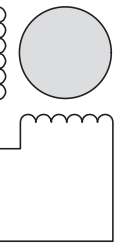
STEP	Phase 1			Phase 2		
	A	O	C	B	M	D
1	-	+		-	+	
2		+	-	-	+	
3		+	-		+	-
4	-	+			+	-

CW CCW

CW & CCW rotation when seen from flange side of the motor.

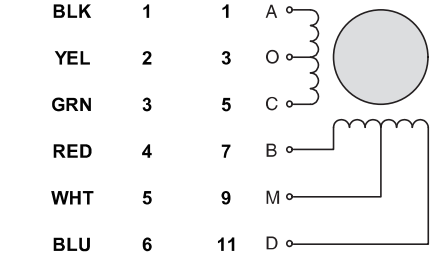
- 4 Lead (bipolar)

Lead Color	Connector Pin # Motor Size 8, 11, 17	Motor Size 14,16	
BLK	1	1	A
GRN	3	5	C
RED	4	7	B
BLU	6	11	D



- 6 Lead (unipolar)

Lead Color	Connector Pin # Motor Size 8, 11, 17	Motor Size 14,16	
BLK	1	1	A
YEL	2	3	O
GRN	3	5	C
RED	4	7	B
WHT	5	9	M
BLU	6	11	D



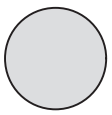
- 8 Lead

8 Lead Connection Options

Bipolar Series	Bipolar Parallel	Unipolar
A	A	A
		O
C	C	C
B	B	B
		M
D	D	D

8 lead Motors

Lead Color	Connector Pin #	
BLK	3	A
YEL	7	$\overline{A}$
ORG	4	$\overline{C}$
GRN	8	C
RED	6	B
WHT	2	$\overline{B}$
BRN	5	$\overline{D}$
BLU	1	D



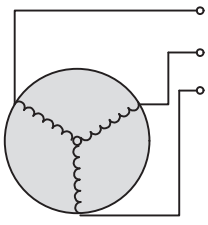
- 3 Phase Motors

STEP	Phase		
	A	B	C
1	+	-	
2		-	+
3	-		+
4	-	+	
5		+	-
6	+		-

CW CCW

CW & CCW rotation when seen from flange side of the motor.

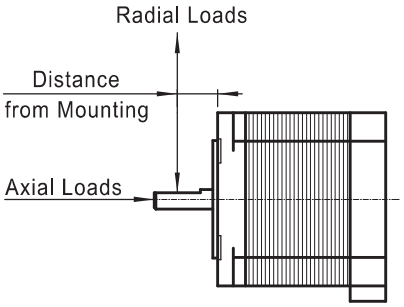
	Connector Pin # Size 17	Size 23	Lead Color
A	1	1	RED
B	2	3	WHT
C	3	7	GRN



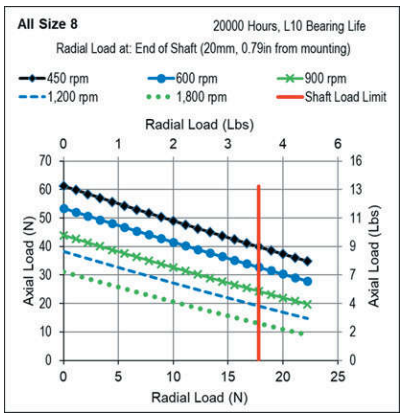
Bearing Life & Shaft Loading

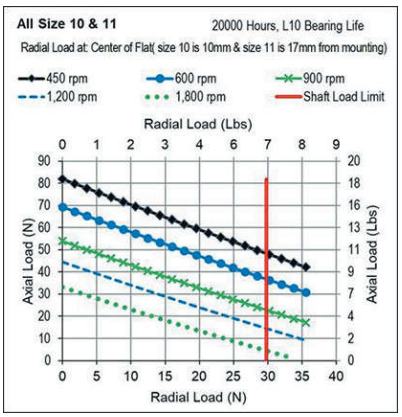
Moons' uses high quality bearings optimized for step motors for long life from every motor. To meet the most demanding applicatons. Most motors can also be provided with larger bearings shafts and custom construction.

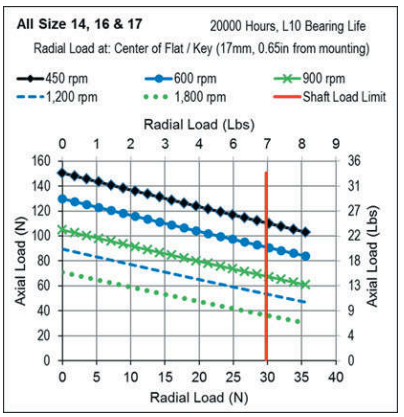
These bearing life curves represent the maximum axial and radial loads for 20,000 hours L10 bearing life at various speeds. The shaft radial load limit (and bearing load ratings) are highly dependent on the the distance from the mounting face where the load is applied. These curves were calculated with the radial load applied at the distance from the mounting face shown on the curve (usually the center of the flat / keyway).

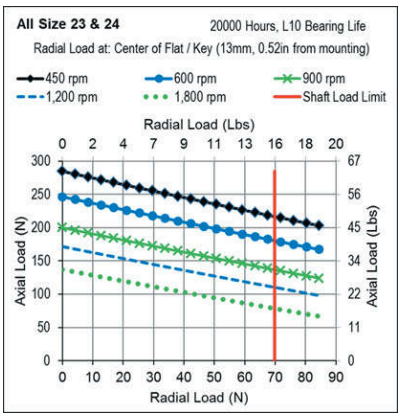


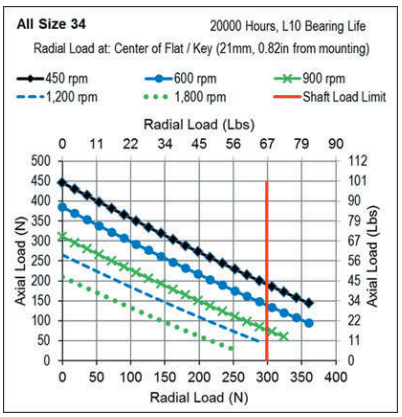
A common cause for shaft (and bearing) failure, are high radial loads that are created when a pulley is attached to the motor shaft at a large distance from the motor mounting face, and the belt has high tension. To avoid this condition mount pulleys and gears as close to the face of the motor as possible, and avoid over tightening belts. This will dramatically reduce the shaft stress, and increases the life of the bearings.

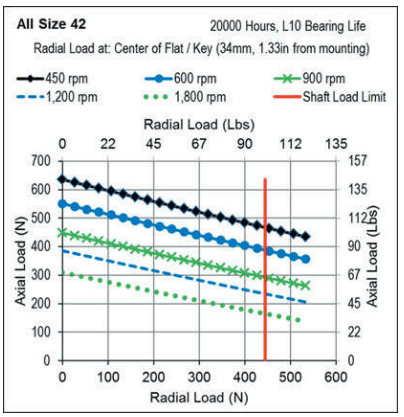












Conversion Factors

- Length

A \ B	mm	cm	m	inch	feet
mm	--	0.1	0.001	0.03937	0.003281
cm	10	--	0.01	0.3937	0.03281
m	1,000	100	--	39.37	3.281
inch	25.4	2.54	0.0254	--	0.08333
feet	304.8	30.48	0.348	12	--

Multiply "A" units by conversion factor to obtain "B" units

- Force

A \ B	g	kgf	oz	lb	Newton
g	--	0.001	0.03527	0.002205	0.0098
kgf	1,000	--	35.27	22.05	9.807
oz	28.35	0.02835	--	0.0625	0.278
lb	453.6	0.4536	16	--	4.448
Newton	102	0.102	3.597	0.2248	--

- Torque

A \ B	Nm	Ncm	mNm	kgm*	kgcm*	gcm*	oz-in	lb-ft	lb-in
Nm	--	100	1,000	0.102	10.2	10,200	141.6	0.7376	8.851
Ncm	0.01	--	10	0.00102	0.102	102	1.416	0.007376	0.08851
mNm	0.001	0.1	--	0.000102	0.0102	10.2	0.1416	0.000738	0.008851
kgm*	9.807	980.7	9807	--	100	100,000	1,389	7.233	86.8
kgcm*	0.09807	9.807	98.07	0.01	--	1,000	13.89	0.07233	0.868
gcm*	9.81E-05	0.009807	0.09807	0.00001	0.001	--	0.01389	7.23E-05	0.000868
oz-in	0.007062	0.7062	7.062	0.00072	0.07201	72.01	--	0.00521	0.0625
lb-ft	1.356	135.6	135.6	0.1383	13.83	13,830	192	--	12
lb-in	0.113	11.3	113	0.01152	1.152	1,152	16	0.0833	--

- Inertia

A \ B	kgm^2	$kgcm^2$	gcm^2	$oz\text{-}in^2$	oz-in-sec^2	$lb\text{-}in^2$	lb-in-sec^2	$lb\text{-}ft^2$	lb-ft-sec^2 (slug ft^2)
kgm^2	--	10,000	10,000,000	54,700	142	3,420	8.85	23.7	0.738
$kgcm^2$	0.0001	--	1,000	5.47	0.0142	0.342	0.000885	0.00237	7.38E-05
gcm^2	1E-07	0.001	--	0.00547	1.42E-05	0.000342	8.85E-07	2.37E-06	7.38E-08
$oz\text{-}in^2$	1.83E-05	0.1829	183	--	0.00259	0.0625	0.000162	0.000434	1.35E-05
oz-in-sec^2	0.00706	70.62	70,600	386	--	24.1	0.0625	0.168	0.00521
$lb\text{-}in^2$	0.000293	2.926	2,930	16	0.0414	--	0.00259	0.00694	0.000216
lb-in-sec^2	0.113	1,130	1,130,000	6,180	1.6	386	--	2.68	0.0833
$lb\text{-}ft^2$	0.0421	421.4	421,000	2,300	5.97	144	0.373	--	0.318
lb-ft-sec^2 (slug ft^2)	1.36	13,600	13,600,000	74,100	192	4,630	12	32.2	--

MOONS' Headquarter

168 Mingjia Road, Minhang District,
Shanghai 201107,P.R. China
Tel: +86 (0)21 52634688
Fax:+86 (0)21 52634098

Domestic Sales Offices

Shenzhen

Room 2209, 22/F, Kerry Center,
2008 Renminnan Road, Luohu District,
Shenzhen 518001, P.R. China
Tel: +86 (0)755 25472080
Fax:+86 (0)755 25472081

Beijing

Room 1206,Jing Liang Mansion, No.16
Middle Road of East 3rd Ring, Chaoyang
District, Beijing 100022, P.R. China
Tel: +86 (0)10 87661889
Fax:+86 (0)10 87661880

Nanjing

Room 1101-1102, Building 2, New Town
Development Center, No.126 Tianyuan
Road , Moling Street, Jiangning District,
Nanjing 211106, P.R. China
Tel: +86 (0)25 52785841
Fax:+86 (0)25 52785485

Qingdao

Room 1012, Zhuoyue Tower,
No.16 Fengcheng Road, Shibei District,
Qingdao 26000, P.R. China
Tel: +86 (0)532 80969935
Fax:+86 (0)532 80919938

Wuhan

Room 3001, World Trade Tower,
686 Jiefang Avenue, Jianghan District,
Wuhan 430022, P.R. China
Tel: +86 (0)27 85448742
Fax:+86 (0)27 85448355

Chengdu

Room 1917, Western Tower, 19, 4th
Section of South PeopleRoad, Wuhou
District, Chengdu 610041, P.R. China
Tel: +86 (0)28 85268102
Fax:+86 (0)28 85268103

Xi'an

Room 1006, Tower D, Wangzuo
International City, 1 Tangyan Road,
Xi'an 710065, P.R. China
Tel: +86 (0)29 81870400
Fax:+86 (0)29 81870340

Chongqing

Rm. 2108, South yuanzhu Buliding 20,
No.18 Fuquan Rd. , Jiangbei District,
Chongqing 400000, P.R. China.
Tel: +86 (0)23 67601782
Fax:+86 (0)23 67085997

Ningbo

Room 309, Tower B, Taifu Plaza,
565 Jiangjia Road,Jiangdong District,
Ningbo, 315040, P.R. China
Tel: +86 (0)574 87052739
Fax:+86 (0)574 87052365

Guangzhou

Room 4006, Tower B, China Shine Plaza,
9 Linhe Xi Road, Tianhe District,
Guangzhou 510610, P.R. China
Tel: +86 (0)20 38010153
Fax:+86 (0)20 38103661

MOONS' International Trading Company

4/F, Building 30, 69 Guiqing Road,
Cao He Jin Hi-Tech Park,
Shanghai 200233, P.R. China
Tel: +86 (0)21 64952755
Fax:+86 (0)21 64951993

Changzhou Yunkong Electronic Co., Ltd.

BLDC.2, Henglin Technology Innovation
Center No. 88 East Changhong Road Wujin
District, Changzhou, Jiangsu Province
213100, P.R. China
Tel：+86 (0)519 88700355
Fax：+86 (0)519 88700229

Lin Engineering At Nanjing

No. 1 Xinke 1st Road, Pukou High-tech
Development Zone, Nanjing
Tel：+86 (025) 58844665
Fax：+86 (025) 58690086

North America

MOONS' INDUSTRIES (AMERICA), INC.
Head Office
1113 North Prospect Avenue, Itasca, IL 60143 USA
Tel: +1 630 8335940
Fax: +1 630 8335946

Boston Office
36 Cordage Park Circle, Suite 310
Plymouth, MA 02360 USA

APPLIED MOTION PRODUCTS, INC.
404 Westridge Dr. Watsonville, CA 95076, USA
Tel: +1 831 7616555

LIN ENGINEERING, INC.
16245 Vineyard Blvd., Morgan Hill, CA 95037
Tel: +1 408 9190200
Fax:+1 408 9190201

Europe

MOONS' INDUSTRIES (EUROPE) S.R.L.
Via Torri Bianche n.1 20871
Vimercate(MB) Italy
Tel: +39 039 6260521
Fax: +39 039 9631409

AMP & MOONS' AUTOMATION (GERMANY) GMBH
Börsenstraße 14
60313 Frankfurt am Main Germany

Technosoft Motion AG
Industriestrasse 47, 6300 Zug, Switzerland
Tel: +41 032 732 55 00
Fax: +41 032 732 55 04

South-East Asia

MOONS' INDUSTRIES (SOUTH-EAST ASIA) PTE. LTD.
33 Ubi Avenue 3 #08-23
Vertex Singapore 408868
Tel: +65 66341198
Fax: +65 66341138

Japan

MOONS' INDUSTRIES JAPAN CO., LTD.
Room 601, 6F, Shin Yokohama Koushin
Building, 2-12-1, Shin-Yokohama,
Kohoku-ku, Yokohama,Kanagawa,
222-0033, Janpan
Tel: +81 (0)45 4755788
Fax: +81 (0)45 4755787

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http:// www.moons.com.cn
E-mail: info@moons.com.cn
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