21000 Series
Size 8 Hybrid Linear Actuators

Size 8 Hybrid Precision Stepper Motor is part of our extensive, award winning miniature motor product line and is one of the world's smallest linear actuators.

More Compact Option for Motion Applications

The 21000 Series Size 8 Linear Actuator occupies a minimal 0.8" (21 mm) space and includes numerous patented innovations that provide customers high performance and endurance in a very small package.

3 Available Designs

– Captive
– Non-Captive
– External Linear

The 21000 Series is available in a wide variety of resolutions - from 0.00006" (.0015mm) per step to 0.00157" (0.0 mm) per step.

The Size 8 Actuator delivers thrust of up to 10 lbs (44 N).

Specifications

Size 8: 21 mm (0.8-in) Hybrid Linear Actuator (1.8° Step Angle)			
Part No.	**Captive**	21H4 □ – □ □ – □ □ □ †	
	Non-Captive	21F4 □ – □ □ – □ □ □ †	
	External Linear	E21H4 □ – □ □ – □ □ □ †	
Wiring	Bipolar		
Winding Voltage	2.5 VDC	5 VDC	7.5 VDC
Current (RMS)/phase	.49 A	.24 A	.16 A
Resistance/phase	5.1 Ω	20.4 Ω	45.9 Ω
Inductance/phase	1.5 mH	5.0 mH	11.7 mH
Power Consumption	2.45 W Total		
Rotor Inertia	1.4 gcm^2		
Insulation Class	Class B (Class F available)		
Weight	1.5 oz (43 g)		
Insulation Resistance	20 MΩ		

†Part numbering information on page 4

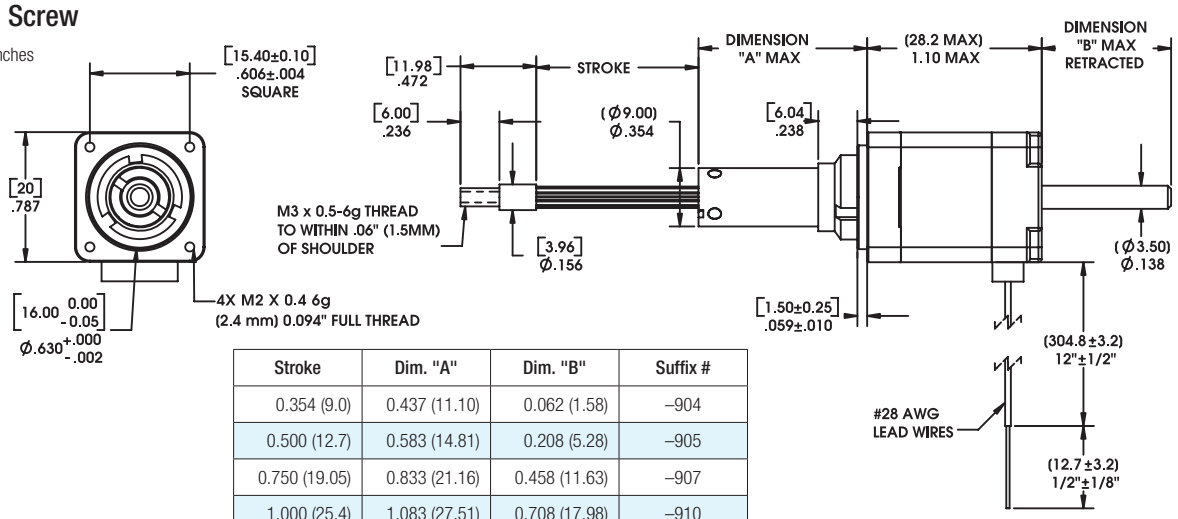
Linear Travel / Step Screw Ø.14-in (3.56mm)		Order Code I.D.
inches	mm	
.00006	.0015*	U**
.000098*	.0025	AA**
.00012	.0030*	N
.00019*	.005	AB
.00024	.006*	K
.00039*	.01	AC
.00048	.0121*	J
.00078*	.02	AD
.00157	.04	AE

*Values truncated
**TFE coating not available
Standard motors are Class B rated for maximum temperature of 130°C.

Special drive considerations may be necessary when leaving shaft fully extended or fully retracted.

Captive Lead Screw

Dimensions = (mm) inches

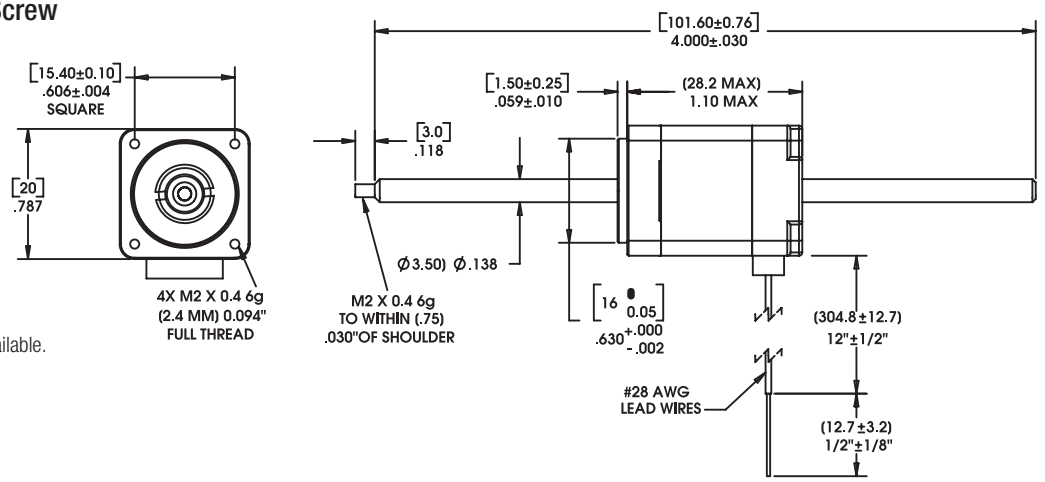


Stroke	Dim. "A"	Dim. "B"	Suffix #
0.354 (9.0)	0.437 (11.10)	0.062 (1.58)	–904
0.500 (12.7)	0.583 (14.81)	0.208 (5.28)	–905
0.750 (19.05)	0.833 (21.16)	0.458 (11.63)	–907
1.000 (25.4)	1.083 (27.51)	0.708 (17.98)	–910
1.250 (31.8)	1.333 (33.86)	0.958 (24.33)	–912
1.500 (38.1)	1.583 (40.21)	1.208 (30.68)	–915

Non-Captive Lead Screw

Dimensions = (mm) inches

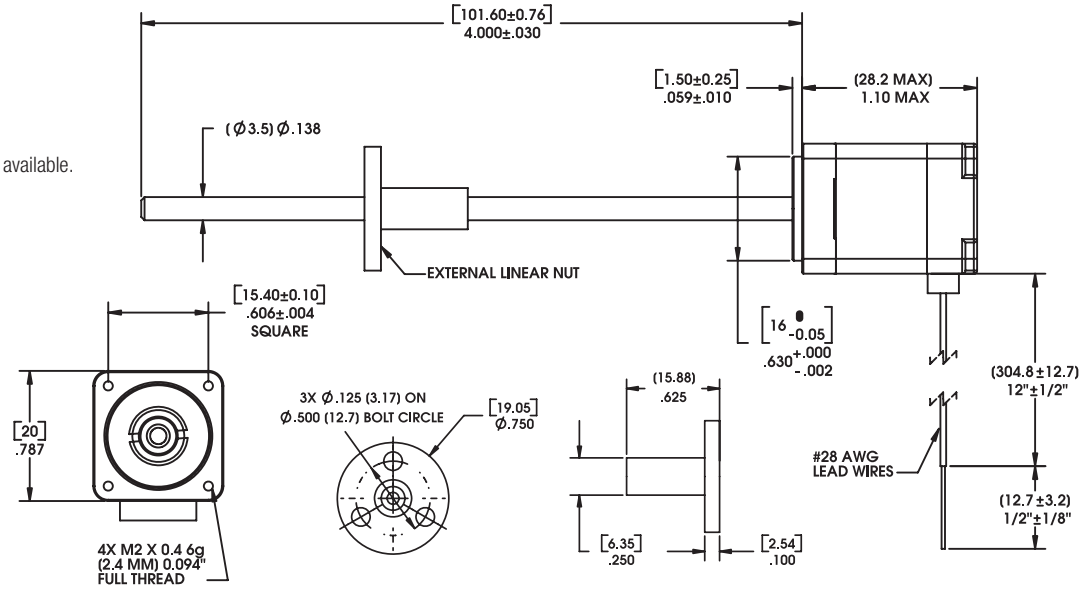
4-in [101.6 mm]
standard screw lengths.
Longer screw lengths are available.



External Linear

Dimensions = (mm) inches

4-in [101.6 mm]
standard screw lengths.
Longer screw lengths are available.



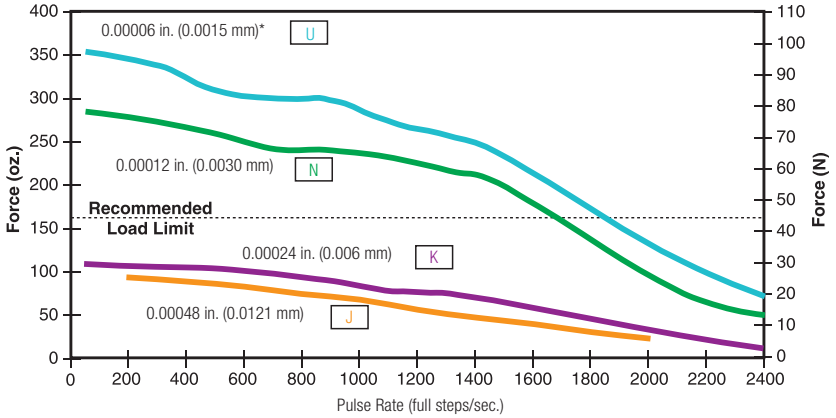
FORCE vs. PULSE RATE

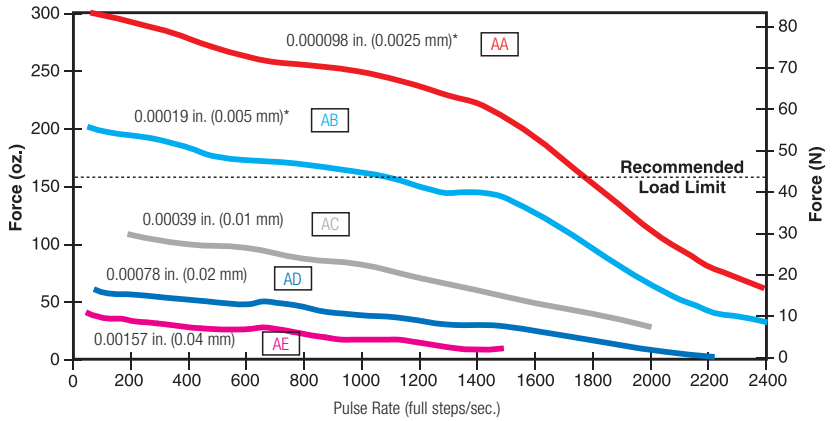
– Chopper

– Bipolar

– 100% Duty Cycle

– Ø .14 (3.56) Lead Screw





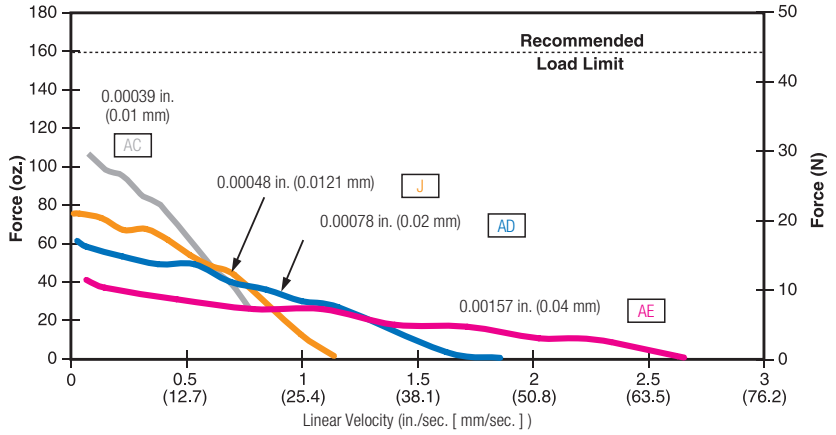
FORCE vs. LINEAR VELOCITY

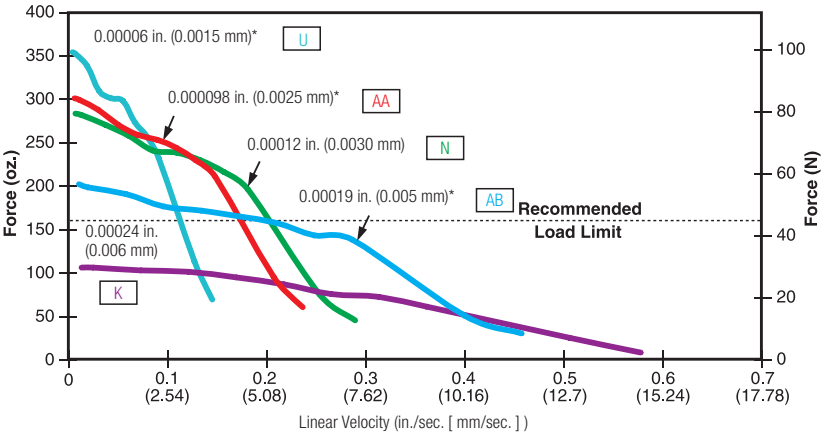
– Chopper

– Bipolar

– 100% Duty Cycle

– Ø .14 (3.56) Lead Screw





*Care should be taken when utilizing these screw pitches to ensure that the physical load limits of the motor are not exceeded. Please consult the factory for advice in selecting the proper pitch for your application.

NOTE: All chopper drive curves were created with a 5 volt motor and a 40 volt power supply.

Ramping can increase the performance of a motor either by increasing the top speed or getting a heavier load accelerated up to speed faster. Also, deceleration can be used to stop the motor without overshoot.

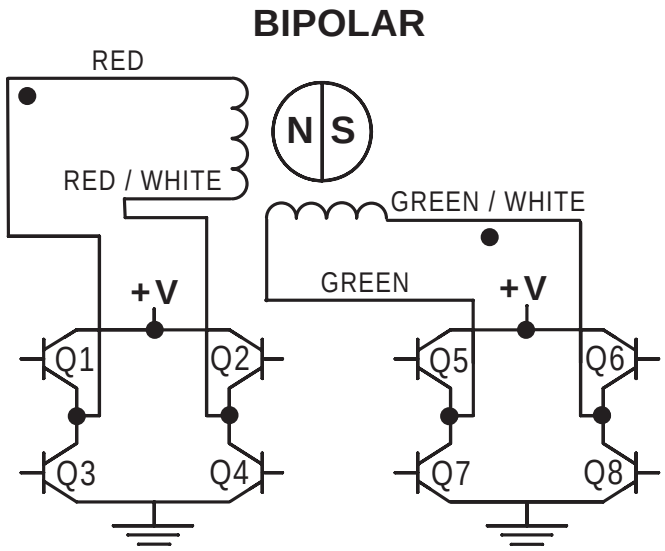
With L/R drives peak force and speeds are reduced, using a unipolar drive will yield a further 30% force reduction.

Identifying the Hybrid Part Number Codes when Ordering

E	21	H	4	AB	—	7.5	—	910
Prefix (include only when using the following) **E** = External **K** = External with 40° thread form **P** = Proximity Sensor **S** = Home Position Switch	**Series Number Designation** **21 = 21000** (Series numbers represent approximate width of motor body)	**Style** **F** = 1.8° Non-captive **H** = 1.8°Captive or External (use "E" or "K" Prefix for External version)	**Coils** **4** = Bipolar (4 wire)	**Code ID Resolution Travel/Step** **U*** = .00006-in (.0015) **AA*** = .000098-in (.0025) **N** = .00012-in (.0030) **AB** = .00019-in (.005) **K** = .00024-in (.006) **AC** = .00039-in (.01) **J** = .00048-in (.0121) **AD** = .00078-in (.02) **AE** = .00157-in (.04) *TFE not available		**Voltage** **2.5** = 2.5 VDC **05** = 5 VDC **7.5** = 7.5 VDC Custom V available		**Suffix** **Stroke** Example: –910 = 1-in (Refer to Stroke chart on Captive motor series product page.) **Suffix also represents**: –800 = Metric –900 = External Linear with grease and flanged nut –XXX = Proprietary suffix assigned to a specific customer application. The identifier can apply to either a standard or custom part.

NOTE: Dashes must be included in Part Number (–) as shown above. For assistance call our Engineering Team at 203 756 7441.

Hybrids: **Wiring**



Hybrids: **Stepping Sequence**

Bipolar	Q2-Q3	Q1-Q4	Q6-Q7	Q5-Q8
Step				
1	ON	OFF	ON	OFF
2	OFF	ON	ON	OFF
3	OFF	ON	OFF	ON
4	ON	OFF	OFF	ON
1	ON	OFF	ON	OFF

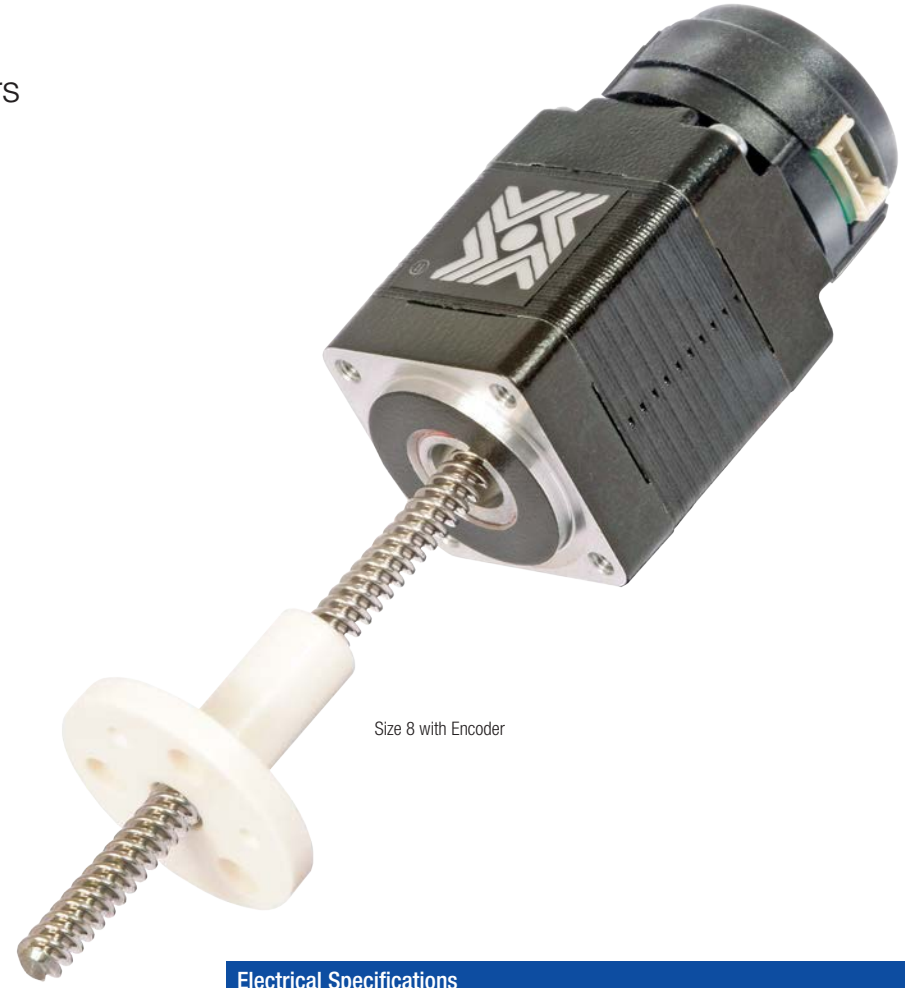
EXTEND CW ↓ ↑ RETRACT CCW

Note: Half stepping is accomplished by inserting an off state between transitioning phases.

Encoders Designed for All Sizes of Hybrid Linear Actuators

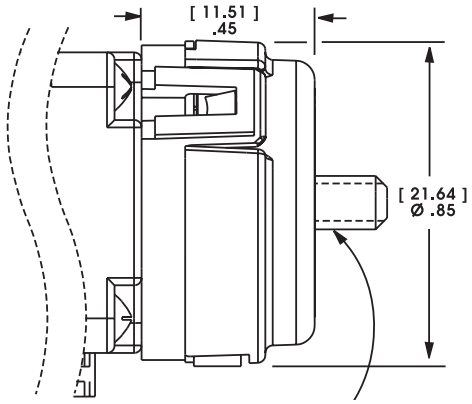
All Haydon Hybrid Linear Actuators are available with specifically designed encoders for applications that require feedback. The compact optical incremental encoder design is available with two channel quadrature TTL squarewave outputs. An optional index is also available as a 3rd channel. The Size 8 Encoder provides resolutions for applications that require 250 and 300 counts per revolution. Encoders are available for all motor configurations – captive, non-captive and external linear.

Simplicity and low cost make Encoders ideal for both high and low volume motion control applications. The internal monolithic electronic module converts the real-time shaft angle, speed, and direction into TTL compatible outputs. The encoder module incorporates a lensed LED light source and monolithic photo-detector array with signal shaping electronics to produce the two channel bounceless TTL outputs.



Size 8 with Encoder

21mm 21000 Series Size 8



NOTE: Lead Screw extends beyond encoder on specific captive and non-captive motors. External linear shaft extension is available upon request.

Single Ended Encoder - Pinout - Size 8	
Connector Pin #	**Description**
1	+5 VDC Power
2	Channel A
3	Ground
4	Channel B

Electrical Specifications				
	Minimum	**Typical**	**Maximum**	**Units**
Input Voltage	4.5	5.0	5.5	VDC
Output Signals	4.5	5.0	5.5	VDC

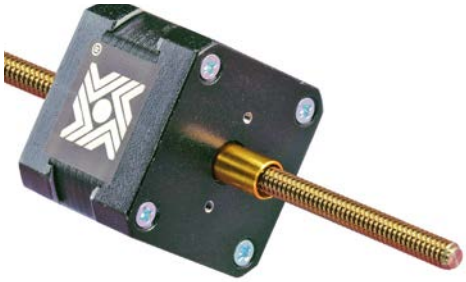
2 channel quadrature TTL squarewave outputs.
Channel B leads A for a clockwise rotation of the rotor viewed from the encoder cover.
Tracks at speeds of 0 to 100,000 cycles/sec.
Optional index available as a 3rd channel (one pulse per revolution).

Operating Temperature		
Size 8	**Minimum**	**Maximum**
	- 10°C (14°F)	85°C (185°F)

Mechanical Specifications	
	Maximum
Acceleration	250,000 rad/sec2
Vibration (5 Hz to 2 kHz)	20 g

Resolution			
4 Standard Cycles Per Revolution (CPR) or Pulses Per Revolution (PPR)			
Size 8	**CPR**	250	300
	PPR	1000	1200

Encoder Ready Option Shown 34000 Series Size 17



Extended Rotor Journal Shown 34000 Series Size 17

End of Stroke Proximity Sensor

TFE Coated Lead Screw

Integrated Anti-Backlash Nut

Encoder Ready Option for all Hybrid Sizes

Our Hybrid Linear Actuators can now be manufactured as an Encoder Ready Actuator. Encoder Ready Actuators can be used to install several popular hollow shaft encoders. Available with an extended rotor journal and a threaded rear housing. The motor uses a proprietary manufacturing process which incorporates engineering thermoplastics in the rotor drive nut and a stainless steel Acme Lead Screw that allows the motor to be much more efficient and durable than today's more commonly used V-thread bronze nut configurations.

Extended Rotor Journal for all Hybrid Sizes

Available with an extended rotor journal. The extended rotor journal can be used for encoder installation, manual adjustment, or flag installation for a positioning sensor.

Home Position Switch for Hybrids

A miniature electronic Home Position Switch capable of monitoring the home positions of linear actuators. The switch mounts on the rear sleeve of captive linear motors and allows the user to identify start, stop or home positions.

When ordering motors with the home position switch the part number should be preceded by an "S" prefix.

End of Stroke Proximity Sensor for all Hybrid Sized

The Sensor incorporates a hall effect device, which is activated by a rare earth magnet embedded in the end of the internal screw. The compact profile of the sensor allows for installation in limited space applications. The sensor has a virtually unlimited cycle life. Special cabling and connectors can also be provided.

When ordering motors with the proximity sensor, the part number should be preceded by a "P" prefix.

Black Ice® and Kerkote® TFE Coated Lead Screws*

TFE Coated Lead Screws for applications that require a *greaseless* screw and nut interface.

A *dry* (non-lubricated) TFE coated lead screw provides improved performance in both life and thrust as compared to a conventional stainless steel lead-screw. TFE can be applied to a wide variety of lead-screw pitches and is available for our brand captive, non-captive and external linear actuators. Not available for 0.00006-in (.0015 mm) and 0.000098-in (.0025 mm) resolutions.

*Certain conditions apply.

Integrated Anti-Backlash Nut for Hybrids*

Most sizes (except Size 34) of our captive and non-captive hybrid stepper motors can be equipped with an integral anti-backlash feature. There is a normal backlash between the lead screw and integral rotor nut.

Our actuators are designed for millions of cycles. However over time, additional backlash could increase and eventually double. Haydon Kerk Integrated Anti-Backlash Nut can eliminate all backlash. Designed specifically for our captive and non-captive hybrid motors, nuts use an opposing spring force to eliminate backlash between the screw and the nut interface. The nuts will self-compensate and accommodate any wear. Haydon Kerk Motion Solutions application engineers can help you select the appropriate preload for your application

*Except Size 34.

21000 Series
Size 8 Double Stack
Hybrid Linear Actuators

Size 8 Double Stack Hybrid Stepper Motor Linear Actuators provide enhanced performance over a single stack.

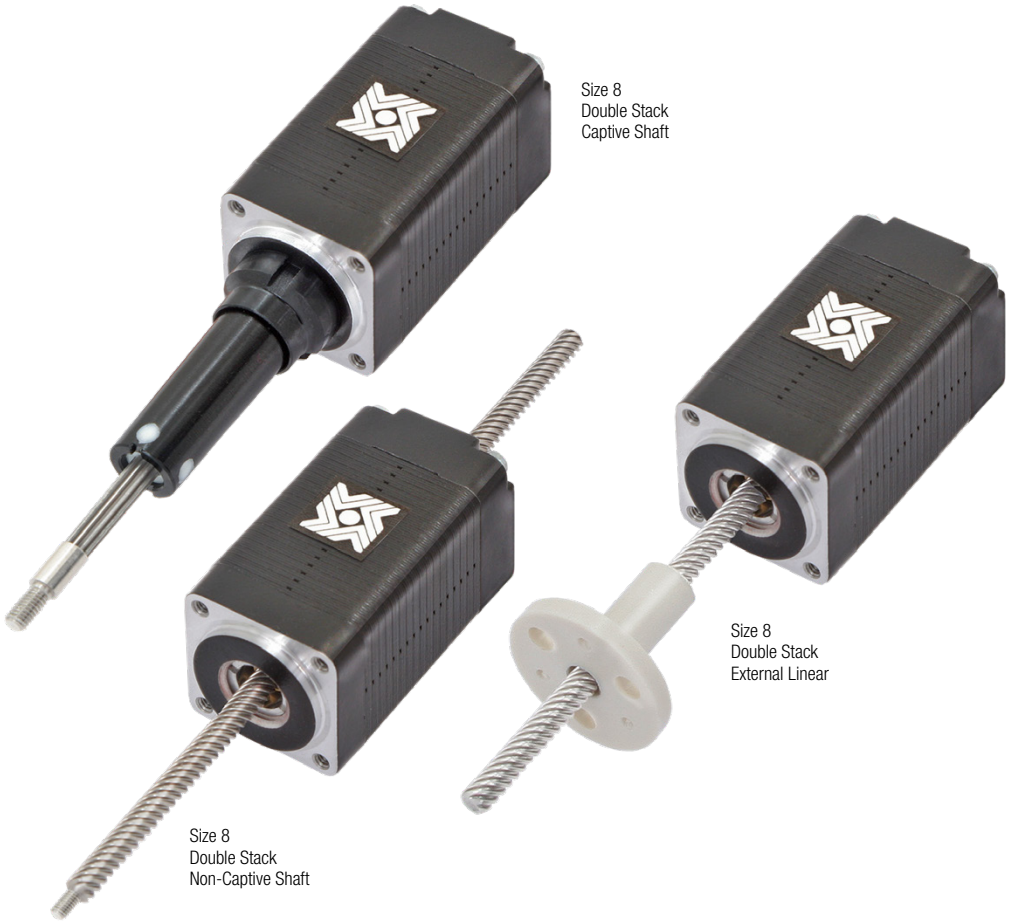
Improved Performance & New Linear Motion Design Opportunities in a 20 mm Frame Size

3 Available Designs

– Captive
– Non-Captive
– External Linear

The 21000 Series is available in a wide variety of resolutions - from 0.000098 in (.0025 mm) per step to 0.00157 in (0.04 mm) per step. The Size 8 actuator delivers thrust of up to 17 lbs. (75 N).

Assembly options include:
Incremental encoders, proximity sensors (captive types only), anti-backlash and custom nuts, and TFE coated lead-screws.



Size 8
Double Stack
Captive Shaft

Size 8
Double Stack
External Linear

Size 8
Double Stack
Non-Captive Shaft

Specifications

Size 8 Double Stack: 21 mm (0.8-in) Hybrid Linear Actuator (1.8° Step Angle)			
Part No.	**Captive**	21M4 ☐ – ☐☐ – ☐☐☐ †	
	Non-Captive	21L4 ☐ – ☐☐ – ☐☐☐ †	
	External Linear	E21M4 ☐ – ☐☐ – ☐☐☐ †	
Wiring	Bipolar		
Winding Voltage	2.5 VDC	5 VDC	7.5 VDC
Current (RMS)/phase	1.32 A	.65 A	.43 A
Resistance/phase	1.9 Ω	7.7 Ω	17.3 Ω
Inductance/phase	0.8 mH	3.2 mH	6.1 mH
Power Consumption	6.5 W Total		
Rotor Inertia	2.6 gcm^2		
Insulation Class	Class B (Class F available)		
Weight	2.4 oz (43 g)		
Insulation Resistance	20 MΩ		

†Part numbering information on page 4

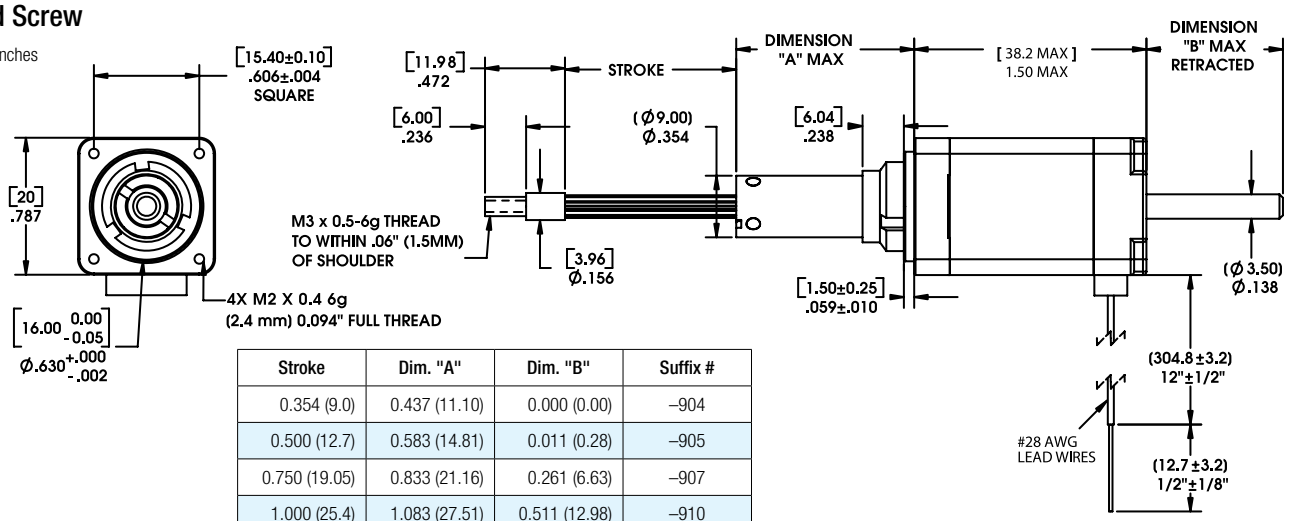
Linear Travel / Step Screw Ø.14-in (3.56mm)		Order Code I.D.
inches	mm	
.000098*	.0025	AA
.00012	.0030*	N
.00019*	.005	AB
.00024	.006*	K
.00039*	0.01	AC
.00048	.0121*	J
.00078*	.02	AD
.00157*	.04	AE
.00157	.04	AE

*Values truncated
Standard motors are Class B rated for maximum temperature of 130°C.

Special drive considerations may be necessary when leaving shaft fully extended or fully retracted.

Captive Lead Screw

Dimensions = (mm) inches

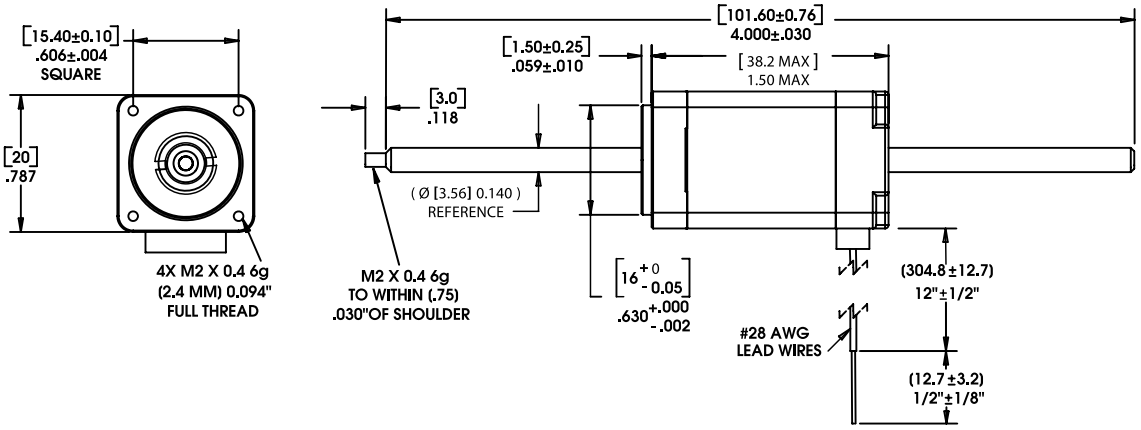


Stroke	Dim. "A"	Dim. "B"	Suffix #
0.354 (9.0)	0.437 (11.10)	0.000 (0.00)	–904
0.500 (12.7)	0.583 (14.81)	0.011 (0.28)	–905
0.750 (19.05)	0.833 (21.16)	0.261 (6.63)	–907
1.000 (25.4)	1.083 (27.51)	0.511 (12.98)	–910
1.250 (31.8)	1.333 (33.86)	0.761 (19.33)	–912
1.500 (38.1)	1.583 (40.21)	1.011 (25.68	–915

Non-Captive Lead Screw

Dimensions = (mm) inches

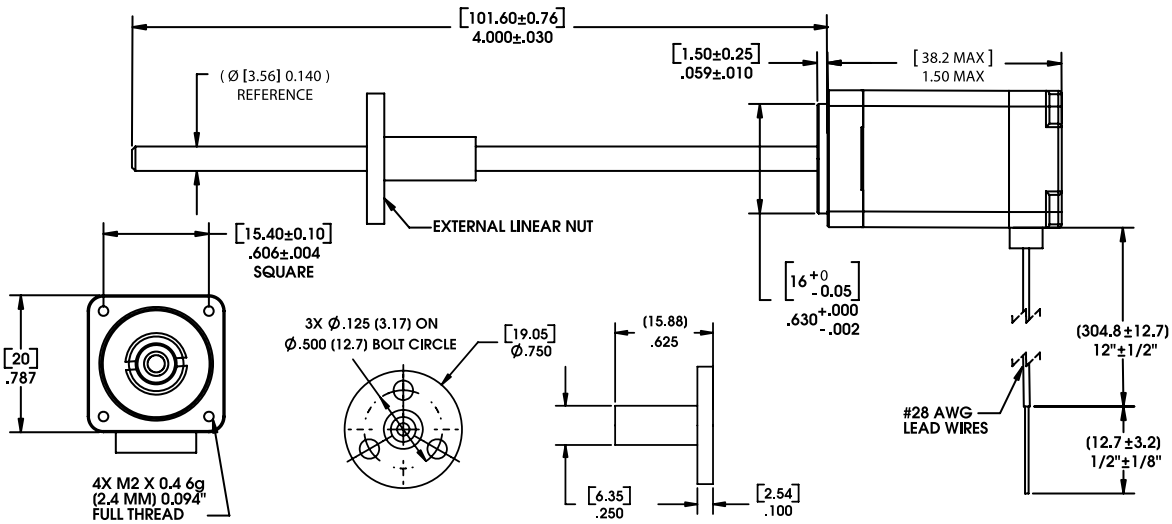
Up to 6 in (152 mm)
standard screw lengths.
Longer screw lengths are available.



External Linear

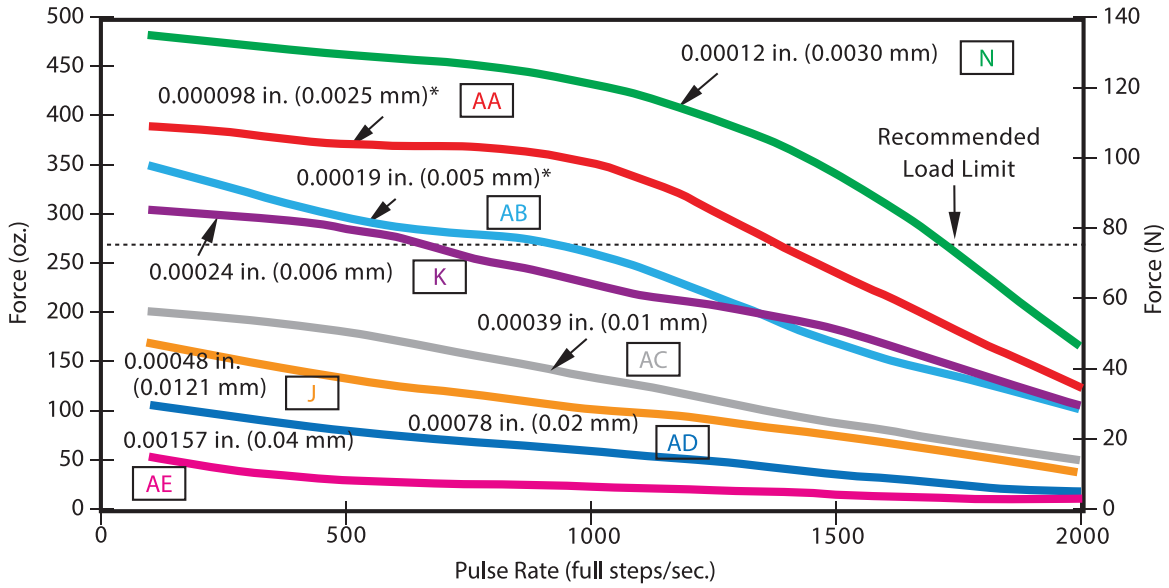
Dimensions = (mm) inches

Up to 6 in (152 mm)
standard screw lengths.
Longer screw lengths are available.



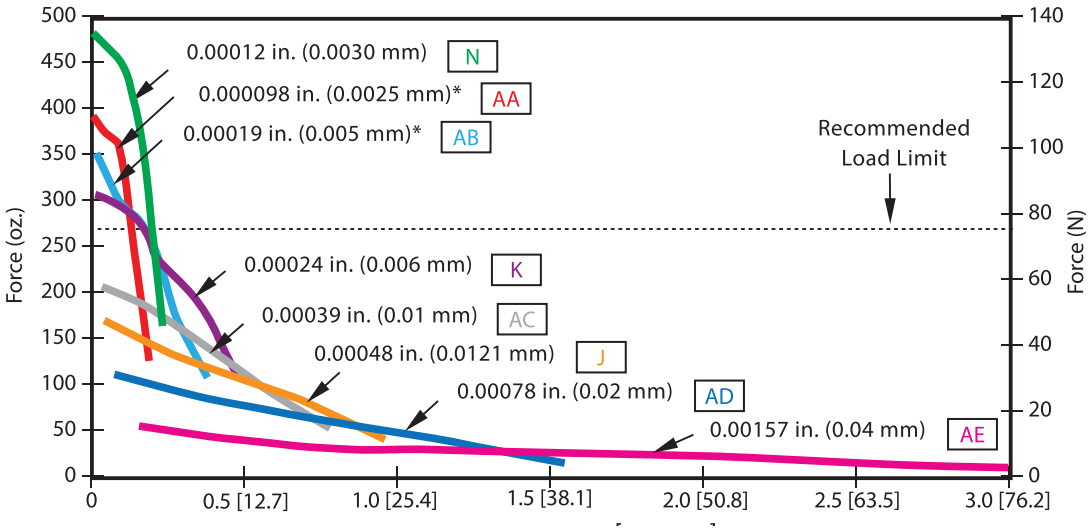
FORCE vs. PULSE RATE

– Chopper
– Bipolar
– 100% Duty Cycle
– Ø .14 (3.56) Lead Screw
– 8:1 Motor Coil to Drive Supply Voltage



FORCE vs. LINEAR VELOCITY

– Chopper
– Bipolar
– 100% Duty Cycle
– Ø .14 (3.56) Lead Screw
– 8:1 Motor Coil to Drive Supply Voltage



*Care should be taken when utilizing these screw pitches to ensure that the physical load limits of the motor are not exceeded. Please consult the factory for advice in selecting the proper pitch for your application.

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Ramping can increase the performance of a motor either by increasing the top speed or getting a heavier load accelerated up to speed faster. Also, deceleration can be used to stop the motor without overshoot.

With L/R drives peak force and speeds are reduced, using a unipolar drive will yield a further 30% force reduction.

Identifying the Hybrid Part Number Codes when Ordering

E	21	M	4	N	—	2.5	—	910
Prefix (include only when using the following) **A** = A Coil (See AC Synchronous Data Sheet) **E** = External **K** = External with 40° thread form **P** = Proximity Sensor	**Series Number Designation** **21 = 21000** (Series numbers represent approximate width of motor body)	**Style** **L** = 1.8° Non-captive **M** = 1.8°Captive or External (use "E" or "K" Prefix for External version)	**Coils** **4** = Bipolar (4 wire)	**Code ID Resolution Travel/Step** **AA***= .000098-in (.0025) **N** = .00012-in (.0030) **AB** = .00019-in (.005) **K** = .00024-in (.006) **AC** = .00039-in (.01) **J** = .00048-in (.0121) **AD** = .00078-in (.02) **AE** = .00157-in (.04) *TFE not available		**Voltage** **2.5** = 2.5 VDC **05** = 5 VDC **7.5** = 7.5 VDC Custom V available		**Suffix** **Stroke** Example: –910 = 1-in (Refer to Stroke chart on Captive motor series product page.) **Suffix also represents**: –800 = Metric –900 = External Linear with grease and flanged nut –XXX = Proprietary suffix assigned to a specific customer application. The identifier can apply to either a standard or custom part.

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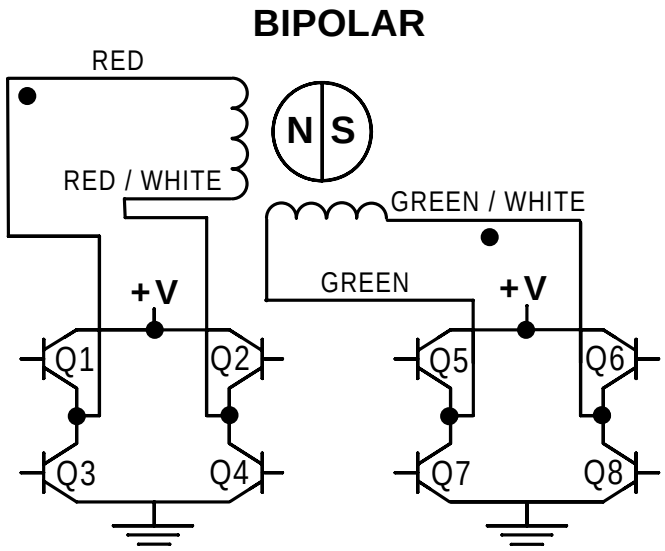
Hybrids: **Wiring**



Hybrids: **Stepping Sequence**

Bipolar	Q2-Q3	Q1-Q4	Q6-Q7	Q5-Q8
Step				
1	ON	OFF	ON	OFF
2	OFF	ON	ON	OFF
3	OFF	ON	OFF	ON
4	ON	OFF	OFF	ON
1	ON	OFF	ON	OFF

EXTEND CW ↓ ↑ RETRACT CCW

Note: Half stepping is accomplished by inserting an off state between transitioning phases.

Encoders Designed for All Sizes of Hybrid Linear Actuators

All Haydon Hybrid Linear Actuators are available with specifically designed encoders for applications that require feedback. The compact optical incremental encoder design is available with two channel quadrature TTL squarewave outputs. An optional index is also available as a 3rd channel. The Size 8 Encoder provides resolutions for applications that require 250 and 300 counts per revolution. Encoders are available for all motor configurations – captive, non-captive and external linear.

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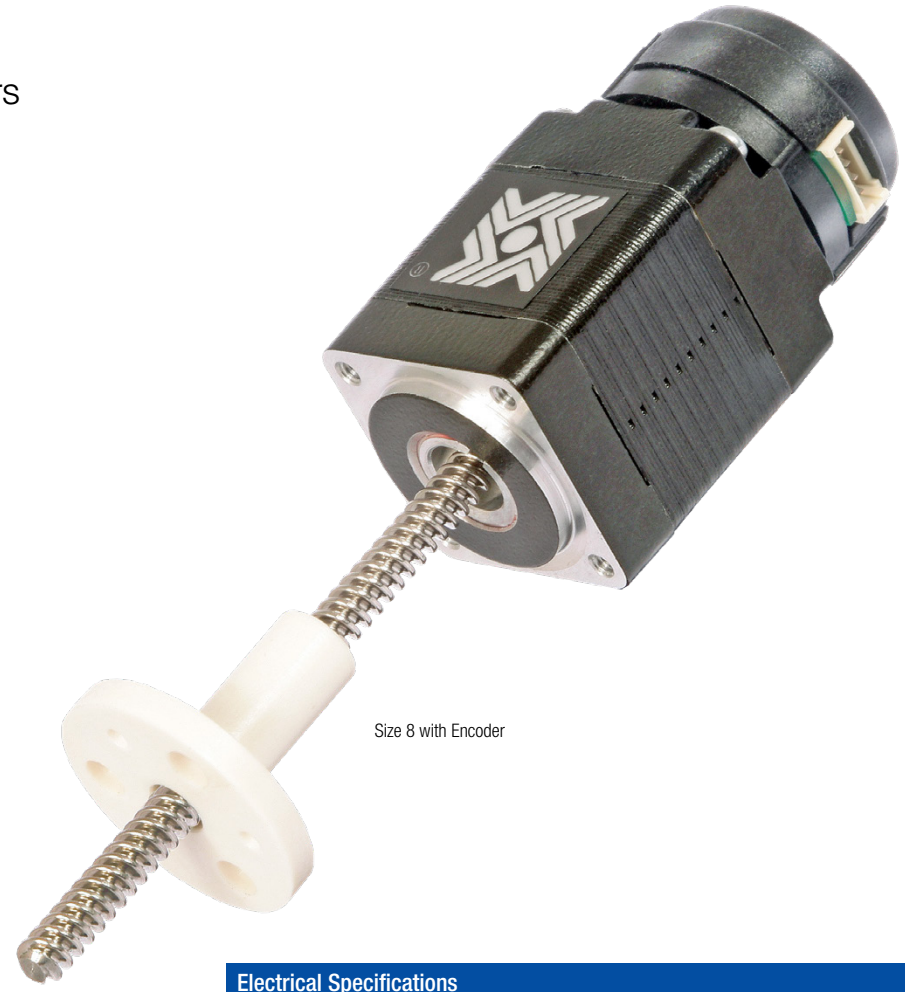
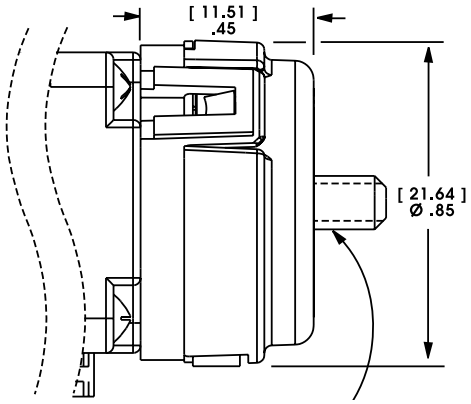


Size 8 with Encoder

21mm 21000 Series Size 8



NOTE: Lead Screw extends beyond encoder on specific captive and non-captive motors. External linear shaft extension is available upon request.

Single Ended Encoder - Pinout - Size 8	
Connector Pin #	**Description**
1	+5 VDC Power
2	Channel A
3	Ground
4	Channel B

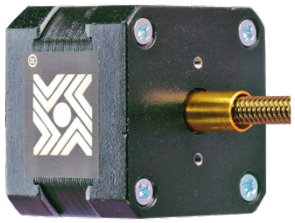
Electrical Specifications				
	Minimum	**Typical**	**Maximum**	**Units**
Input Voltage	4.5	5.0	5.5	VDC
Output Signals	4.5	5.0	5.5	VDC

2 channel quadrature TTL squarewave outputs.
Channel B leads A for a clockwise rotation of the rotor viewed from the encoder cover.
Tracks at speeds of 0 to 100,000 cycles/sec.
Optional index available as a 3rd channel (one pulse per revolution).

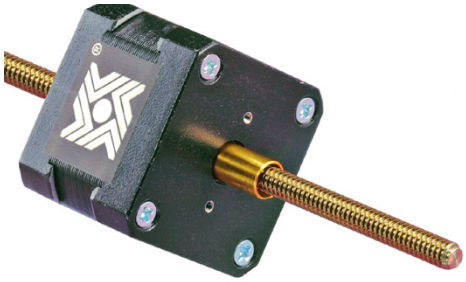
Operating Temperature		
Size 8	**Minimum**	**Maximum**
	- 10°C (14°F)	85°C (185°F)

Mechanical Specifications	
	Maximum
Acceleration	250,000 rad/sec2
Vibration (5 Hz to 2 kHz)	20 g

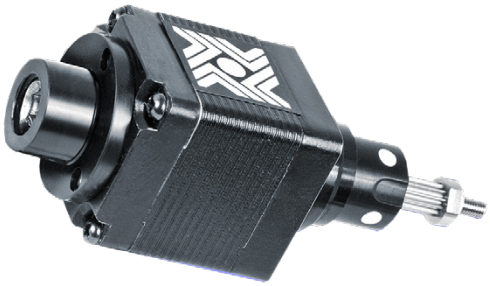
Resolution			
4 Standard Cycles Per Revolution (CPR) or Pulses Per Revolution (PPR)			
Size 8	**CPR**	250	300
	PPR	1000	1200



Encoder Ready Option Shown 34000 Series Size 17

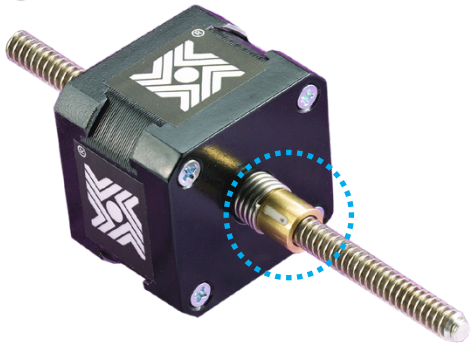


Extended Rotor Journal Shown 34000 Series Size 17



End of Stroke Proximity Sensor

TFE Coated Lead Screw



Integrated Anti-Backlash Nut

Encoder Ready Option for all Hybrid Sizes

Our Hybrid Linear Actuators can now be manufactured as an Encoder Ready Actuator. Encoder Ready Actuators can be used to install several popular hollow shaft encoders. Available with an extended rotor journal and a threaded rear housing. The motor uses a proprietary manufacturing process which incorporates engineering thermoplastics in the rotor drive nut and a stainless steel Acme Lead Screw that allows the motor to be much more efficient and durable than today's more commonly used V-thread bronze nut configurations.

Extended Rotor Journal for all Hybrid Sizes

Available with an extended rotor journal. The extended rotor journal can be used for encoder installation, manual adjustment, or flag installation for a positioning sensor.

Home Position Switch for Hybrids

A miniature electronic Home Position Switch capable of monitoring the home positions of linear actuators. The switch mounts on the rear sleeve of captive linear motors and allows the user to identify start, stop or home positions.

When ordering motors with the home position switch the part number should be preceded by an "S" prefix.

End of Stroke Proximity Sensor for all Hybrid Sized

The Sensor incorporates a hall effect device, which is activated by a rare earth magnet embedded in the end of the internal screw. The compact profile of the sensor allows for installation in limited space applications. The sensor has a virtually unlimited cycle life. Special cabling and connectors can also be provided.

When ordering motors with the proximity sensor, the part number should be preceded by a "P" prefix.

Black Ice® and Kerkote® TFE Coated Lead Screws*

TFE Coated Lead Screws for applications that require a *greaseless* screw and nut interface.

A *dry* (non-lubricated) TFE coated lead screw provides improved performance in both life and thrust as compared to a conventional stainless steel lead-screw. TFE can be applied to a wide variety of lead-screw pitches and is available for our brand captive, non-captive and external linear actuators. Not available for 0.00006-in (.0015 mm) and 0.000098-in (.0025 mm) resolutions.

*Certain conditions apply.

Integrated Anti-Backlash Nut for Hybrids*

Most sizes (except Size 34) of our captive and non-captive hybrid stepper motors can be equipped with an integral anti-backlash feature. There is a normal backlash between the lead screw and integral rotor nut.

Our actuators are designed for millions of cycles. However over time, additional backlash could increase and eventually double. Haydon Kerk Integrated Anti-Backlash Nut can eliminate all backlash. Designed specifically for our captive and non-captive hybrid motors, nuts use an opposing spring force to eliminate backlash between the screw and the nut interface. The nuts will self-compensate and accommodate any wear. Haydon Kerk Motion Solutions application engineers can help you select the appropriate preload for your application

*Except Size 34.

28000 Series
Size 11 Hybrid Linear Actuators

Compact, production-proven precision in motion.

The various patented designs deliver high performance, opening avenues for equipment designers who require performance and endurance in a very small package.

3 Available Designs

– Captive
– Non-Captive
– External Linear

The 28000 Series is available in a wide variety of resolutions - from 0.000125-in (.003175 mm) per step to 0.002-in (.0508 mm) per step.

The Size 11 actuator delivers thrust of -up to 20 lbs. (90 N).

Size 11
Captive Shaft

Size 11
Non-Captive Shaft

Size 11
External Linear

Size 11: 28 mm (1.1-in) Hybrid Linear Actuator (1.8° Step Angle)						
Part No.	Captive	28H4 □ – □ □ – □ □ □ †			28H6 □ – □ □ – □ □ □ †	
	Non-Captive	28F4 □ – □ □ – □ □ □ †			28F4 □ – □ □ – □ □ □ †	
	External Linear	E28H4 □ – □ □ – □ □ □ †			E28H6 □ – □ □ – □ □ □ †	
Wiring		Bipolar			Unipolar**	
Winding Voltage		2.1 VDC	5 VDC	12 VDC	5 VDC	12 VDC
Current (RMS)/phase		1.0 A	0.42 A	0.18 A	0.42 A	0.18 A
Resistance/phase		2.1	11.9 Ω	68.6 Ω	11.9 Ω	68.6 Ω
Inductance/phase		1.5 mH	6.7 mH	39.0 mH	3.3 mH	19.5 mH
Power Consumption		4.2 W				
Rotor Inertia		9.0 gcm^2				
Insulation Class		Class B (Class F available)				
Weight		4.2 oz (119 g)				
Insulation Resistance		20 MΩ				

†Part numbering information on page 4. ** Unipolar drive gives approximately 30% less thrust than bipolar drive.

Linear Travel / Step Screw Ø.1875"(4.76mm)		Order Code I.D.
inches	mm	
.000125	.0031*	7
.00025	.0063*	9
.0005	.0127	3
.001	.0254	1
.002	.0508	2

*Values truncated.

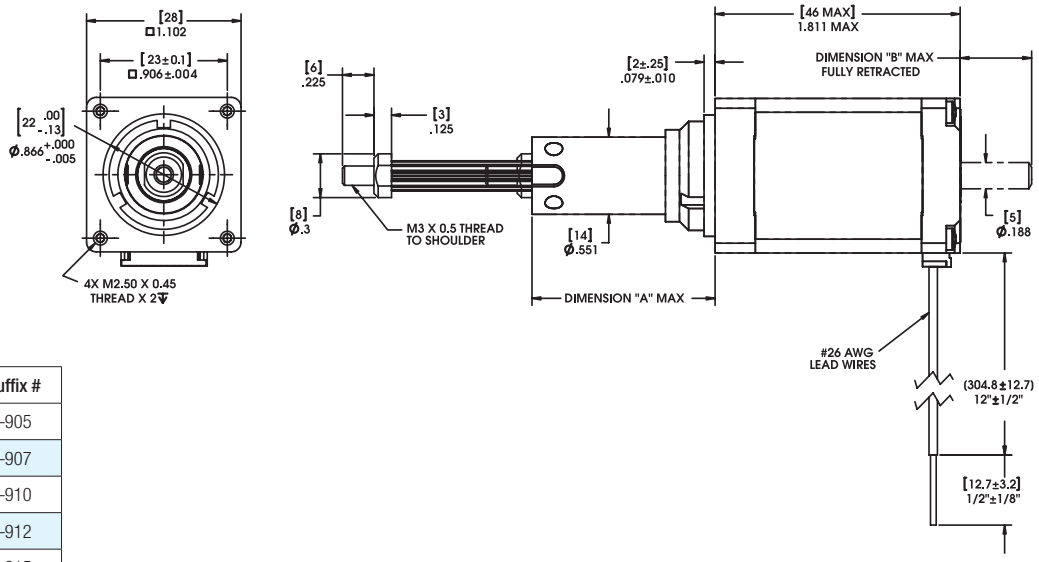
Standard motors are Class B rated for maximum temperature of 130°C.

Special drive considerations may be necessary when leaving shaft fully extended or fully retracted.

Captive Lead Screw

Dimensions = (mm) inches

Integrated connector option available



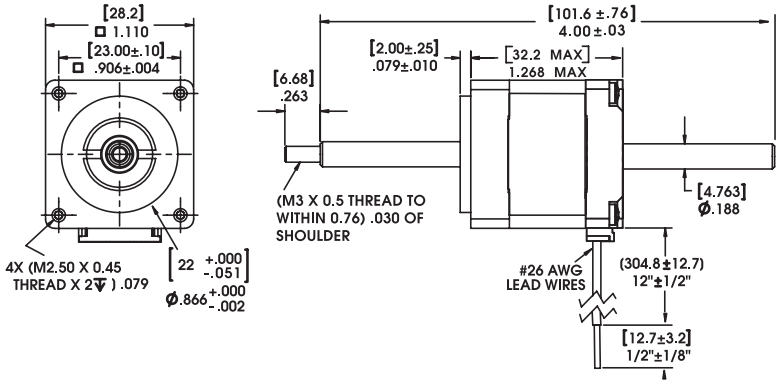
Stroke	Dim. "A"	Dim. "B"	Suffix #
0.500 (12.7)	0.806 (20.47)	0.208 (5.28)	–905
0.750 (19.05)	1.056 (26.82)	0.458 (11.63)	–907
1.000 (25.4)	1.306 (33.17)	0.708 (17.98)	–910
1.250 (31.8)	1.556 (39.52)	0.958 (24.33)	–912
1.500 (38.1)	1.806 (45.87)	1.208 (30.68)	–915
2.00 (50.8)	2.306 (58.57)	1.208 (30.68)	–920
2.500 (38.1)	2.806 (71.27)	1.208 (30.68)	–925

Non-Captive Lead Screw

Dimensions = (mm) inches

Integrated connector option available

4-in [101.6 mm]
standard screw lengths.
Longer screw lengths are available.

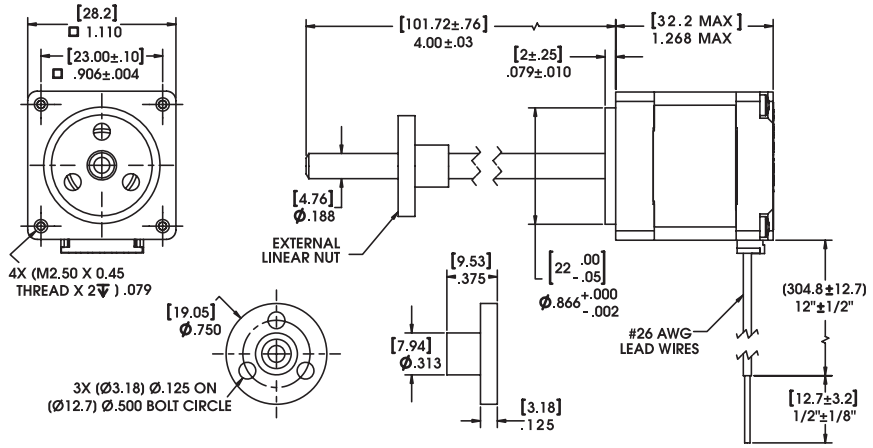


External Linear

Dimensions = (mm) inches

Integrated connector option available

4-in [101.6 mm]
standard screw lengths.
Longer screw lengths are available.



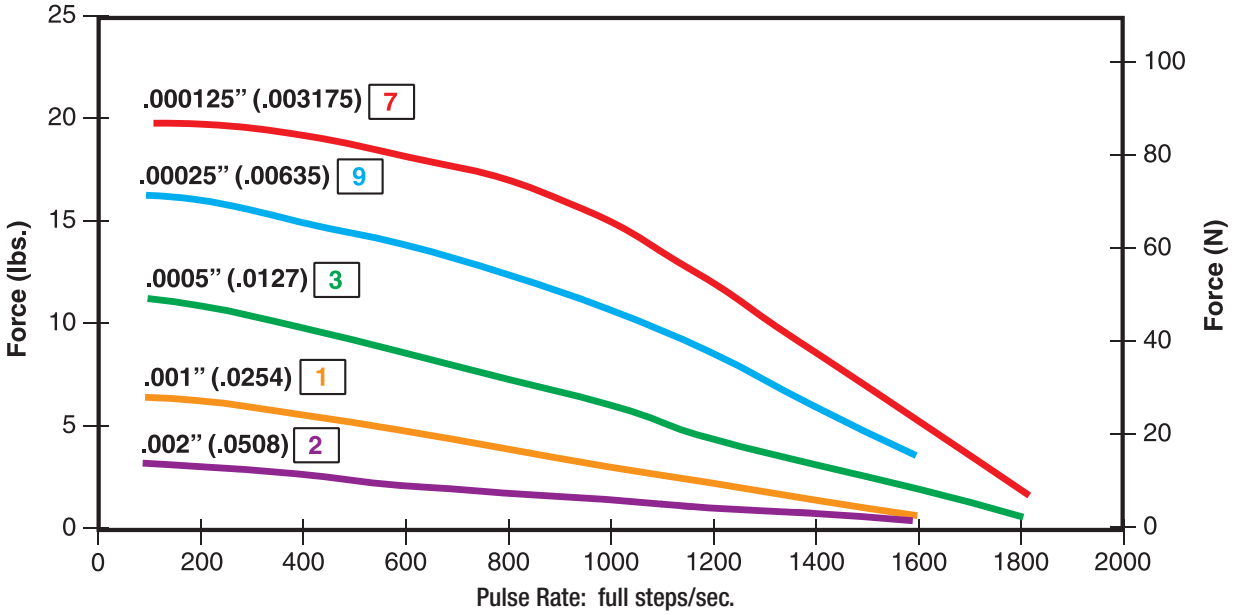
FORCE vs. PULSE RATE

– Chopper

– Bipolar

– 100% Duty Cycle

– Ø .1875 (4.75) Lead Screw



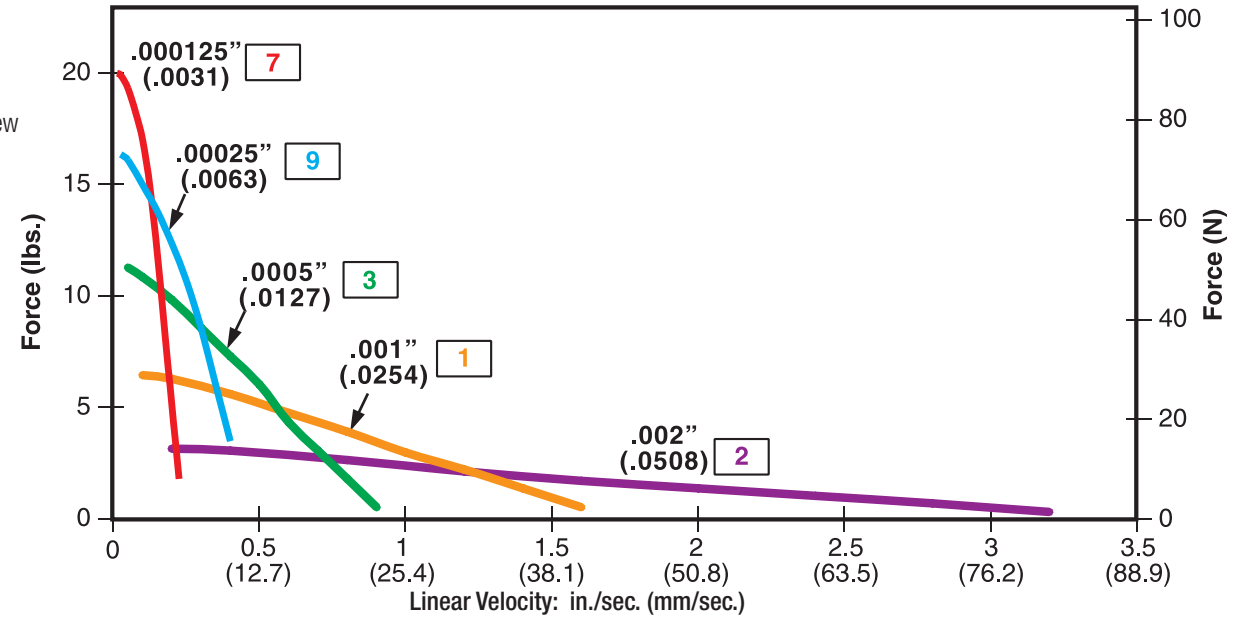
FORCE vs. LINEAR VELOCITY

– Chopper

– Bipolar

– 100% Duty Cycle

– Ø .1875 (4.75) Lead Screw



NOTE: All chopper drive curves were created with a 5 volt motor and a 40 volt power supply.

Ramping can increase the performance of a motor either by increasing the top speed or getting a heavier load accelerated up to speed faster. Also, deceleration can be used to stop the motor without overshoot.

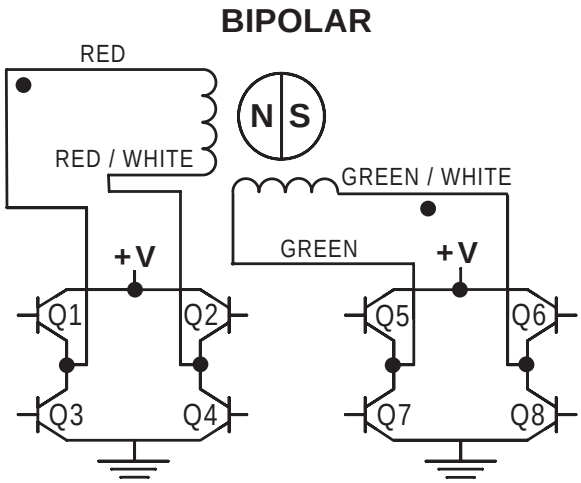
With L/R drives peak force and speeds are reduced, using a unipolar drive will yield a further 30% force reduction.

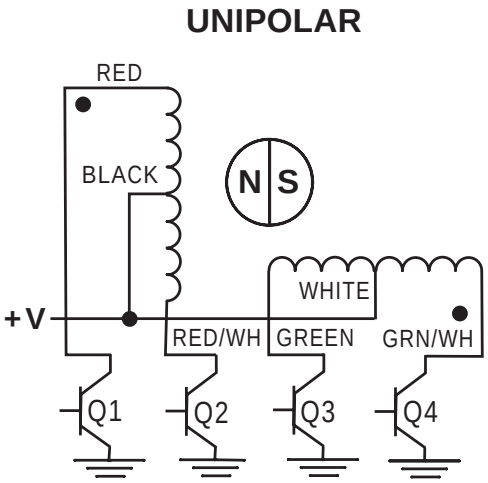
Identifying the Hybrid Part Number Codes when Ordering

E	28	H	4	7	—	05	—	910
Prefix (include only when using the following) **A =** A Coil (See AC Synchronous Data Sheet) **E** = External **K** = External with 40° thread form **P** = Proximity Sensor **S** = Home Position Switch	**Series Number Designation** **28 = 28000** (Series numbers represent approximate width of motor body)	**Style** **F** = 1.8° Non-captive **H** = 1.8°Captive or External (use "E" or "K" Prefix for External version)	**Coils** **4** = Bipolar (4 wire) **6** = Unipolar (6 wire)	**Code ID Resolution Travel/Step** **1** = .001-in (.0254) **2**= .002-in (.0508) **3** = .0005-in (.0127) **7** = .000125-in (.0031) **9** = .00025-in (.0063)		**Voltage** **2.1** = 2.1 VDC (Bipolar only) **05** = 5 VDC **12** = 12 VDC Custom V available		**Suffix** **Stroke** Example: –910 = 1-in (Refer to Stroke chart on Captive motor series product page.) **Suffix also represents**: –800 = Metric –900 = External Linear with grease and flanged nut –XXX = Proprietary suffix assigned to a specific customer application. The identifier can apply to either a standard or custom part.

NOTE: Dashes must be included in Part Number (–) as shown above. For assistance call our Engineering Team at 203 756 7441.

Hybrids: **Wiring**





Hybrids: **Stepping Sequence**

Bipolar	Q2-Q3	Q1-Q4	Q6-Q7	Q5-Q8
Step				
1	ON	OFF	ON	OFF
2	OFF	ON	ON	OFF
3	OFF	ON	OFF	ON
4	ON	OFF	OFF	ON
1	ON	OFF	ON	OFF

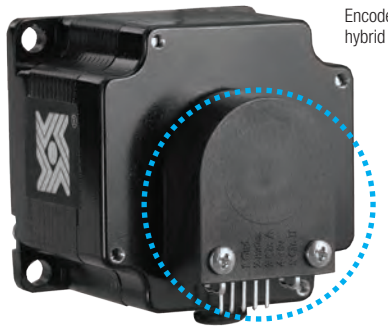
EXTEND CW ↓ — RETRACT CCW ↑

Note: Half stepping is accomplished by inserting an off state between transitioning phases.

Encoders Designed for All Sizes of Hybrid Linear Actuators

All Haydon Hybrid Linear Actuators are available with specifically designed encoders for applications that require feedback. The compact optical incremental encoder design is available with two channel quadrature TTL squarewave outputs. An optional index is also available as a 3rd channel. The Size 11 Encoder provides resolutions for applications that require 200, 400 and 1,000 counts per revolution. Encoders are available for all motor configurations.

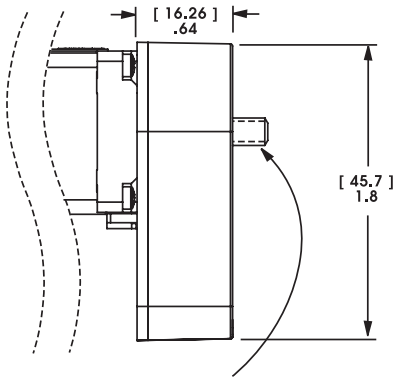
Simplicity and low cost make the encoders ideal for both high and low volume motion control applications. The internal monolithic electronic module converts the real-time shaft angle, speed, and direction into TTL compatible outputs. The encoder module incorporates a lensed LED light source and monolithic photodetector array with signal shaping electronics to produce the two channel bounceless TTL outputs.



Encoder on Size 23 hybrid motor

30 mm 28000 Series Size 11

NOTE: Lead Screw extends beyond encoder on specific captive and non-captive motors. External linear shaft extension is available upon request.



Electrical Specifications				
	Minimum	Typical	Maximum	Units
Input Voltage	4.5	5.0	5.5	VDC
Output Signals	4.5	5.0	5.5	VDC

2 channel quadrature TTL squarewave outputs.
Channel B leads A for a clockwise rotation of the rotor viewed from the encoder cover.
Tracks at speeds of 0 to 100,000 cycles/sec.
Optional index available as a 3rd channel (one pulse per revolution).

Operating Temperature		
	Minimum	Maximum
Size 11	- 40°C (- 40°F)	100°C (212°F)

Differential Ended Encoder - Pinout - Size 11	
Connector Pin #	Description
1	Ground
2	Ground
3	– Index
4	+ Index
5	Channel A –
6	Channel A +
7	+5 VDC Power
8	+5 VDC Power
9	Channel B –
10	Channel B +

Mechanical Specifications	
	Maximum
Acceleration	250,000 rad/sec2
Vibration (5 Hz to 2 kHz)	20 g

Resolution				
4 Standard Cycles Per Revolution (CPR) or Pulses Per Revolution (PPR)				
Size 11	CPR	200	400	1000*
	PPR	800	1600	4000*

*Index Pulse Channel not available.

Single Ended Encoder - Pinout - Size 11			
Connector Pin #	Description	Connector Pin #	Description
1	Ground	4	+5 VDC Power
2	Index (optional)	5	Channel B
3	Channel A		

Integrated Connector for Hybrid Size 11

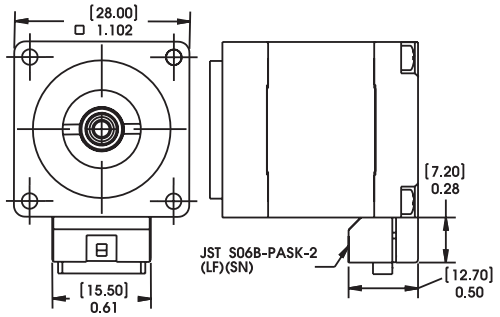
Offered alone or with a harness assembly, this connector is RoHS compliant and features a positive latch in order for high connection integrity. The connector is rated up to 3 amps and the mating connector will handle a range of wire gauges from 22 to 28. Ideal for those that want to plug in directly to pre-existing harnesses.

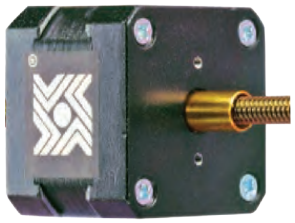
Motor Connector:
JST part # S06B-PASK-2

Mating Connector:
JST part # PAP-06V-S
Haydon Kerk Part #56-1210-5 (12 in. Leads)

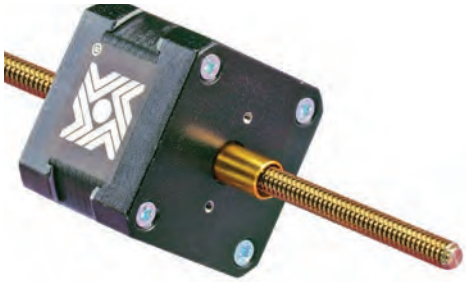
Wire to Board Connector:
JST part number SPHD-001T-P0.5

Pin #	Bipolar	Unipolar	Color
1	Phase 2 Start	Phase 2 Start	G/W
2	Open	Phase 2 Common	–
3	Phase 2 Finish	Phase 2 Finish	Green
4	Phase 1 Finish	Phase 1 Finish	R/W
5	Open	Phase 1 Common	–
6	Phase 1 Start	Phase 1 Start	Red





Encoder Ready Option Shown 34000 Series Size 17



Extended Rotor Journal Shown 34000 Series Size 17

End of Stroke Proximity Sensor

TFE Coated Lead Screw

Integrated Anti-Backlash Nut

Encoder Ready Option for all Hybrid Sizes

Our Hybrid Linear Actuators can now be manufactured as an Encoder Ready Actuator. Encoder Ready Actuators can be used to install several popular hollow shaft encoders. Available with an extended rotor journal and a threaded rear housing. The motor uses a proprietary manufacturing process which incorporates engineering thermoplastics in the rotor drive nut and a stainless steel Acme Lead Screw that allows the motor to be much more efficient and durable than today's more commonly used V-thread bronze nut configurations.

Extended Rotor Journal for all Hybrid Sizes

Available with an extended rotor journal. The extended rotor journal can be used for encoder installation, manual adjustment, or flag installation for a positioning sensor.

Home Position Switch for Hybrids

A miniature electronic Home Position Switch capable of monitoring the home positions of linear actuators. The switch mounts on the rear sleeve of captive linear motors and allows the user to identify start, stop or home positions.

When ordering motors with the home position switch the part number should be preceded by an "S" prefix.

End of Stroke Proximity Sensor for all Hybrid Sized

The Sensor incorporates a hall effect device, which is activated by a rare earth magnet embedded in the end of the internal screw. The compact profile of the sensor allows for installation in limited space applications. The sensor has a virtually unlimited cycle life. Special cabling and connectors can also be provided.

When ordering motors with the proximity sensor, the part number should be preceded by a "P" prefix.

Black Ice® and Kerkote® TFE Coated Lead Screws*

TFE Coated Lead Screws for applications that require a *greaseless* screw and nut interface.

A *dry* (non-lubricated) TFE coated lead screw provides improved performance in both life and thrust as compared to a conventional stainless steel lead-screw. TFE can be applied to a wide variety of lead-screw pitches and is available for our brand captive, non-captive and external linear actuators. Not available for 0.00006-in (.0015 mm) and 0.000098-in (.0025 mm) resolutions.

*Certain conditions apply.

Integrated Anti-Backlash Nut for Hybrids*

Most sizes (except Size 34) of our captive and non-captive hybrid stepper motors can be equipped with an integral anti-backlash feature. There is a normal backlash between the lead screw and integral rotor nut.

Our actuators are designed for millions of cycles. However over time, additional backlash could increase and eventually double. Haydon Kerk Integrated Anti-Backlash Nut can eliminate all backlash. Designed specifically for our captive and non-captive hybrid motors, nuts use an opposing spring force to eliminate backlash between the screw and the nut interface. The nuts will self-compensate and accommodate any wear. Haydon Kerk Motion Solutions application engineers can help you select the appropriate preload for your application

*Except Size 34.

28000 Series
Size 11 Double Stack
Hybrid Linear Actuators

Enhanced performance in motion control

The 28000 Series is available in a wide variety of resolutions - from 0.000125" (.003175 mm) per step to 0.002" (.0508 mm) per step.

3 Available Designs

– Captive
– Non-Captive
– External Linear

The Size 11 actuator delivers thrust of up to 30 lbs. (133 N).

Size 11 Double Stack: 28 mm (1.1-in) Hybrid Linear Actuator (1.8° Step Angle)				
Part No.	Captive	28M4 □ – □ □ – □ □ □ †		
	Non-Captive	28L4 □ – □ □ – □ □ □ †		
	External Linear	E28M4 □ – □ □ – □ □ □ †		
Wiring		Bipolar		
Winding Voltage		2.1 VDC	5 VDC	12 VDC
Current (RMS)/phase		1.9 A	750 mA	313 mA
Resistance/phase		1.1 Ω	6.7 Ω	34.8 Ω
Inductance/phase		1.1 mH	5.8 mH	35.6 mH
Power Consumption		7.5 W Total		
Rotor Inertia		13.5 gcm^2		
Insulation Class		Class B (Class F available)		
Weight		5.8 oz (180 g)		
Insulation Resistance		20 MΩ		

†Part numbering information on page 4.

Linear Travel / Step Screw Ø.1875"(4.76mm)		Order Code I.D.
inches	mm	
.000125	.0031*	7
.00025	.0063*	9
.0005	.0127	3
.001	.0254	1
.002	.0508	2

*Values truncated.

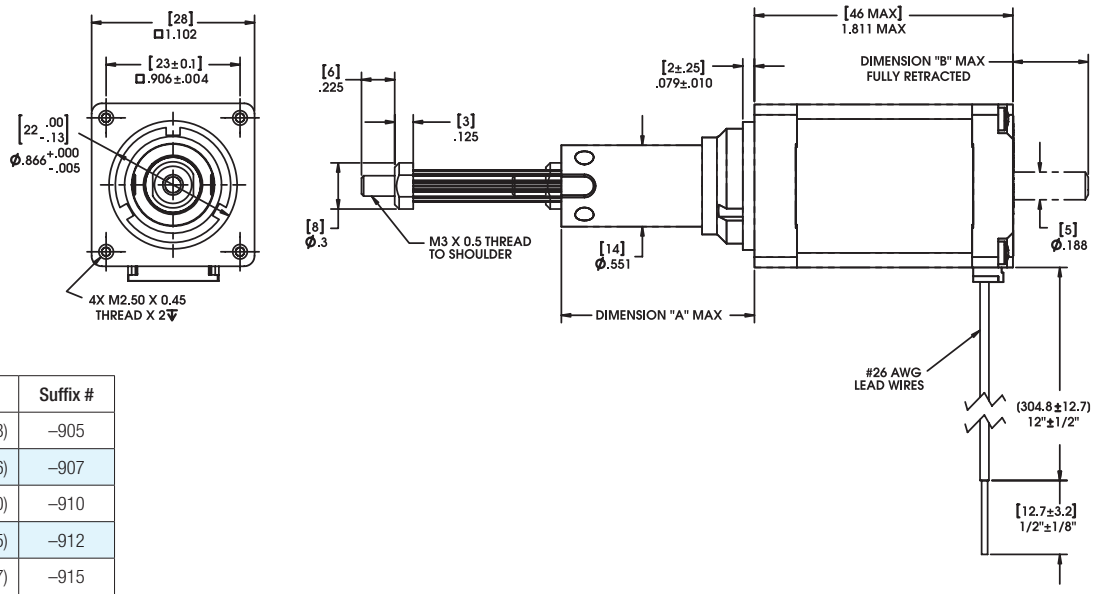
Standard motors are Class B rated for maximum temperature of 130°C.

Special drive considerations may be necessary when leaving shaft fully extended or fully retracted.

Captive Lead Screw

Dimensions = (mm) inches

Integrated connector option available



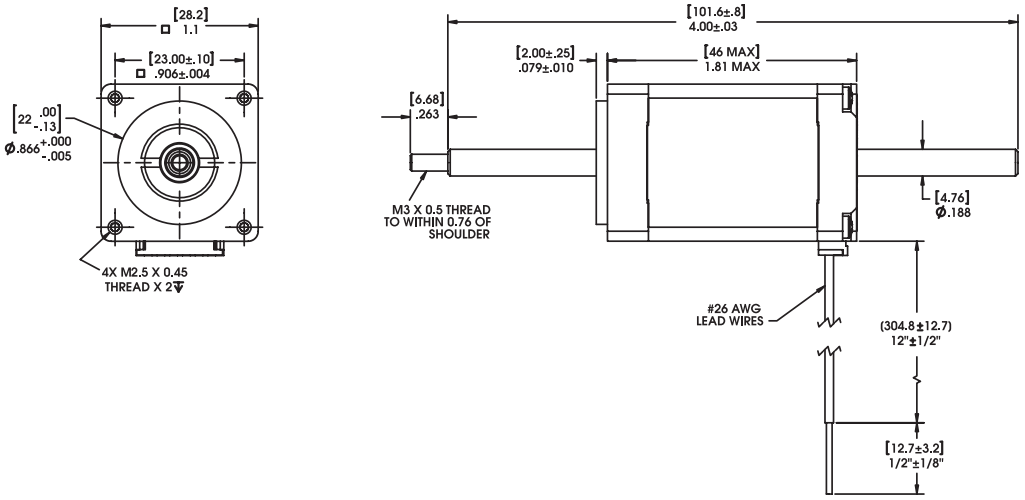
Stroke	Dim. "A"	Dim. "B"	Suffix #
0.500 (12.7)	0.80 (20.5)	0.09 (2.3)	–905
0.750 (19.05)	1.05 (26.8)	0.34 (8.6)	–907
1.000 (25.4)	1.30 (33.17)	0.59 (15.0)	–910
1.250 (31.8)	1.55 (39.5)	0.84 (21.35)	–912
1.500 (38.1)	2.86 (72.7)	1.09 (27.7)	–915
2.00 (50.8)	3.36 (85.4)	1.59 (40.4)	–920
2.500 (38.1)	3.86 (98.1)	2.09 (53.1)	–925

Non-Captive Lead Screw

Dimensions = (mm) inches

Integrated connector option available

4-in [101.6 mm]
standard screw lengths.
Longer screw lengths are available.

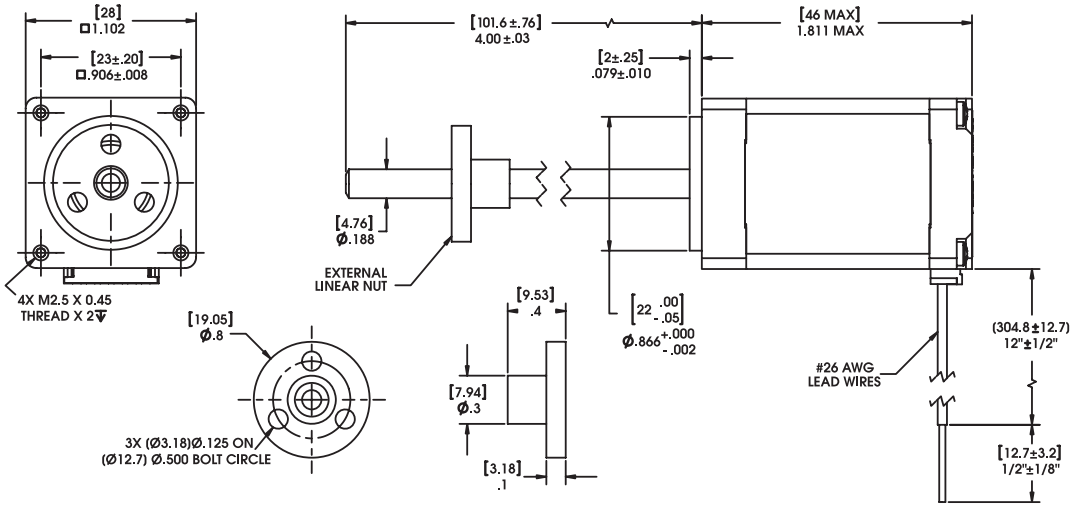


External Linear

Dimensions = (mm) inches

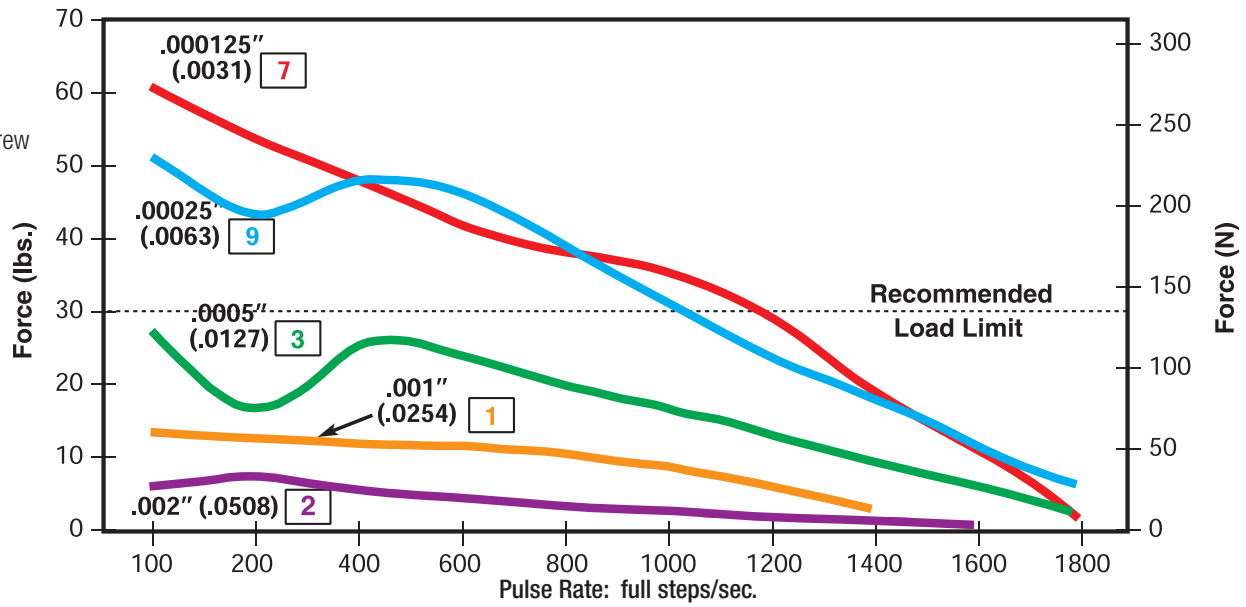
Integrated connector option available

4-in [101.6 mm]
standard screw lengths.
Longer screw lengths are available.



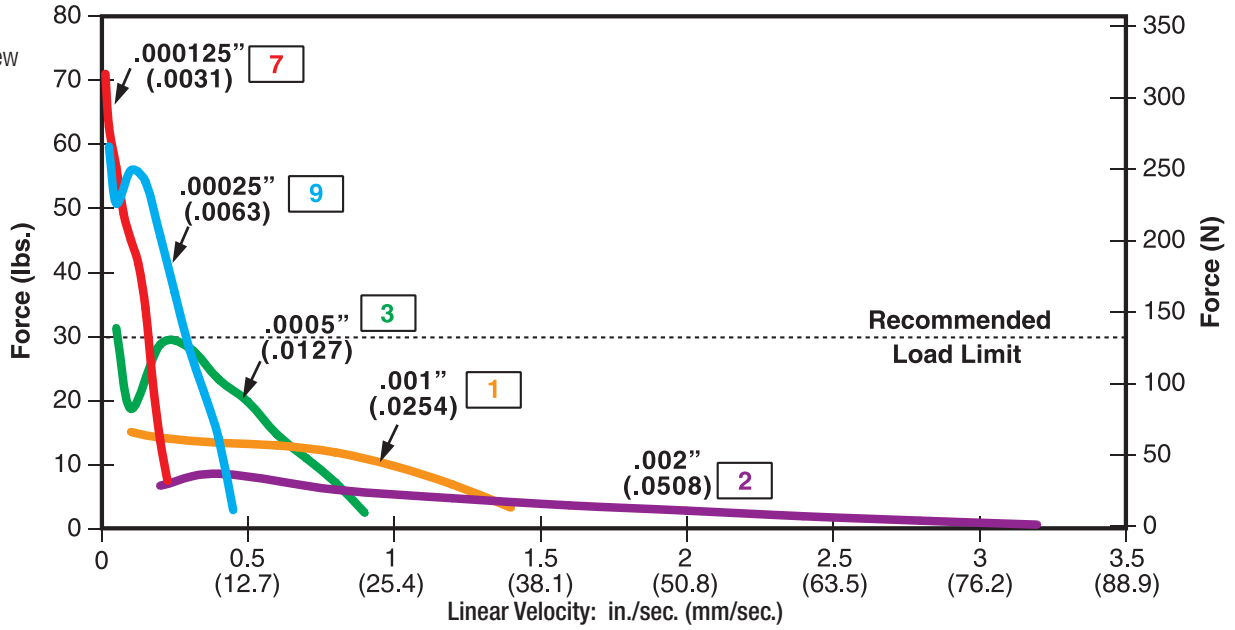
FORCE vs. PULSE RATE

– Chopper
– Bipolar
– 100% Duty Cycle
– Ø .1875 (4.75) Lead Screw



FORCE vs. LINEAR VELOCITY

– Chopper
– Bipolar
– 100% Duty Cycle
– Ø .1875 (4.75) Lead Screw



NOTE: All chopper drive curves were created with a 5 volt motor and a 40 volt power supply.

Ramping can increase the performance of a motor either by increasing the top speed or getting a heavier load accelerated up to speed faster. Also, deceleration can be used to stop the motor without overshoot.

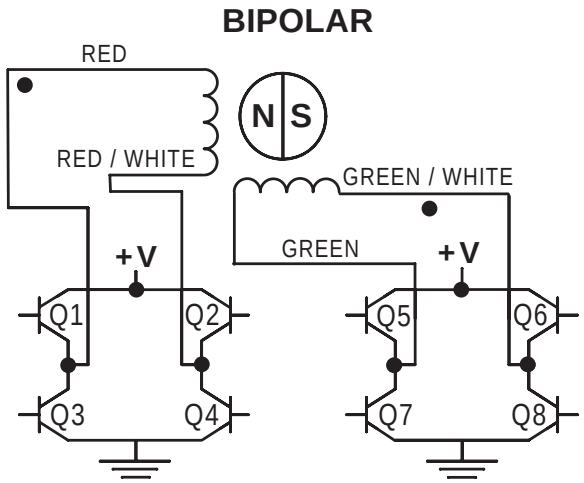
With L/R drives peak force and speeds are reduced, using a unipolar drive will yield a further 30% force reduction.

Identifying the Hybrid Part Number Codes when Ordering

E	28	M	4	7	—	05	—	910
Prefix (include only when using the following) **A =** A Coil (See AC Synchronous Data Sheet) **E** = External **K** = External with 40° thread form **P** = Proximity Sensor **S** = Home Position Switch	**Series Number Designation** **28 = 28000** (Series numbers represent approximate width of motor body)	**Style** **L** = 1.8° Non-captive **M** = 1.8°Captive or External (use "E" or "K" Prefix for External version)	**Coils** **4** = Bipolar (4 wire)	**Code ID Resolution Travel/Step** **1** = .001-in (.0254) **2**= .002-in (.0508) **3** = .0005-in (.0127) **7** = .000125-in (.0031) **9** = .00025-in (.0063)		**Voltage** **2.1** = 2.1 VDC (Bipolar only) **05** = 5 VDC **12** = 12 VDC Custom V available		**Suffix** **Stroke** Example: –910 = 1-in (Refer to Stroke chart on Captive motor series product page.) **Suffix also represents**: –800 = Metric –900 = External Linear with grease and flanged nut –XXX = Proprietary suffix assigned to a specific customer application. The identifier can apply to either a standard or custom part.

NOTE: Dashes must be included in Part Number (–) as shown above. For assistance call our Engineering Team at 203 756 7441.

Hybrids: **Wiring**



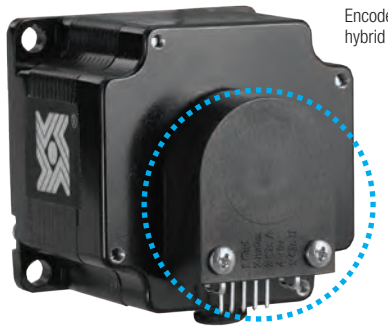
Hybrids: **Stepping Sequence**

Bipolar	Q2-Q3	Q1-Q4	Q6-Q7	Q5-Q8
Step				
1	ON	OFF	ON	OFF
2	OFF	ON	ON	OFF
3	OFF	ON	OFF	ON
4	ON	OFF	OFF	ON
1	ON	OFF	ON	OFF

EXTEND CW ↓ / ↑ RETRACT CCW

Note: Half stepping is accomplished by inserting an off state between transitioning phases.

Encoders Designed for All Sizes of Hybrid Linear Actuators

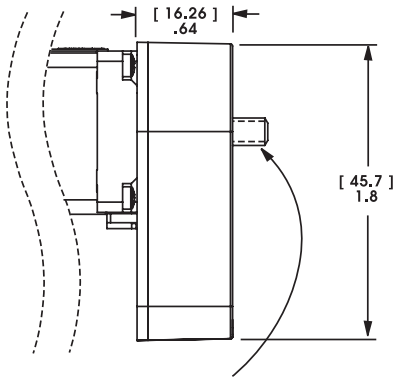


Encoder on Size 23 hybrid motor

All Haydon Hybrid Linear Actuators are available with specifically designed encoders for applications that require feedback. The compact optical incremental encoder design is available with two channel quadrature TTL squarewave outputs. An optional index is also available as a 3rd channel. The Size 11 Encoder provides resolutions for applications that require 200, 400 and 1,000 counts per revolution. Encoders are available for all motor configurations.

Simplicity and low cost make the encoders ideal for both high and low volume motion control applications. The internal monolithic electronic module converts the real-time shaft angle, speed, and direction into TTL compatible outputs. The encoder module incorporates a lensed LED light source and monolithic photodetector array with signal shaping electronics to produce the two channel bounceless TTL outputs.

30 mm 28000 Series Size 11



NOTE: Lead Screw extends beyond encoder on specific captive and non-captive motors. External linear shaft extension is available upon request.

Electrical Specifications				
	Minimum	Typical	Maximum	Units
Input Voltage	4.5	5.0	5.5	VDC
Output Signals	4.5	5.0	5.5	VDC

2 channel quadrature TTL squarewave outputs.
Channel B leads A for a clockwise rotation of the rotor viewed from the encoder cover.
Tracks at speeds of 0 to 100,000 cycles/sec.
Optional index available as a 3rd channel (one pulse per revolution).

Operating Temperature		
	Minimum	Maximum
Size 11	- 40°C (- 40°F)	100°C (212°F)

Differential Ended Encoder - Pinout - Size 11	
Connector Pin #	Description
1	Ground
2	Ground
3	– Index
4	+ Index
5	Channel A –
6	Channel A +
7	+5 VDC Power
8	+5 VDC Power
9	Channel B –
10	Channel B +

Mechanical Specifications	
	Maximum
Acceleration	250,000 rad/sec2
Vibration (5 Hz to 2 kHz)	20 g

Resolution				
4 Standard Cycles Per Revolution (CPR) or Pulses Per Revolution (PPR)				
Size 11	CPR	200	400	1000*
	PPR	800	1600	4000*

*Index Pulse Channel not available.

Single Ended Encoder - Pinout - Size 11			
Connector Pin #	Description	Connector Pin #	Description
1	Ground	4	+5 VDC Power
2	Index (optional)	5	Channel B
3	Channel A		

Integrated Connector for Hybrid Size 11

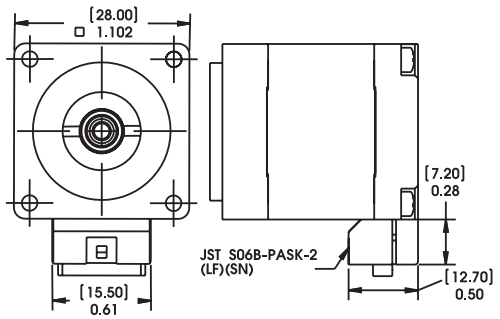
Offered alone or with a harness assembly, this connector is RoHS compliant and features a positive latch in order for high connection integrity. The connector is rated up to 3 amps and the mating connector will handle a range of wire gauges from 22 to 28. Ideal for those that want to plug in directly to pre-existing harnesses.

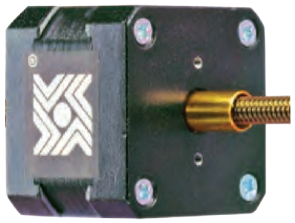
Motor Connector:
JST part # S06B-PASK-2

Mating Connector:
JST part # PAP-06V-S
Haydon Kerk Part #56-1210-5 (12 in. Leads)

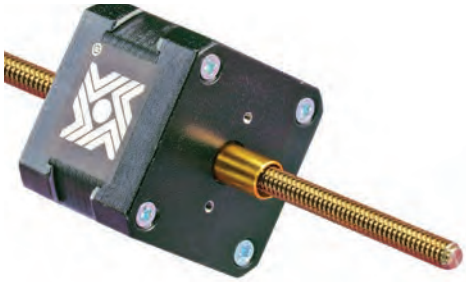
Wire to Board Connector:
JST part number SPHD-001T-P0.5

Pin #	Bipolar	Unipolar	Color
1	Phase 2 Start	Phase 2 Start	G/W
2	Open	Phase 2 Common	–
3	Phase 2 Finish	Phase 2 Finish	Green
4	Phase 1 Finish	Phase 1 Finish	R/W
5	Open	Phase 1 Common	–
6	Phase 1 Start	Phase 1 Start	Red





Encoder Ready Option Shown 34000 Series Size 17



Extended Rotor Journal Shown 34000 Series Size 17

End of Stroke Proximity Sensor

TFE Coated Lead Screw

Integrated Anti-Backlash Nut

Encoder Ready Option for all Hybrid Sizes

Our Hybrid Linear Actuators can now be manufactured as an Encoder Ready Actuator. Encoder Ready Actuators can be used to install several popular hollow shaft encoders. Available with an extended rotor journal and a threaded rear housing. The motor uses a proprietary manufacturing process which incorporates engineering thermoplastics in the rotor drive nut and a stainless steel Acme Lead Screw that allows the motor to be much more efficient and durable than today's more commonly used V-thread bronze nut configurations.

Extended Rotor Journal for all Hybrid Sizes

Available with an extended rotor journal. The extended rotor journal can be used for encoder installation, manual adjustment, or flag installation for a positioning sensor.

Home Position Switch for Hybrids

A miniature electronic Home Position Switch capable of monitoring the home positions of linear actuators. The switch mounts on the rear sleeve of captive linear motors and allows the user to identify start, stop or home positions.

When ordering motors with the home position switch the part number should be preceded by an "S" prefix.

End of Stroke Proximity Sensor for all Hybrid Sized

The Sensor incorporates a hall effect device, which is activated by a rare earth magnet embedded in the end of the internal screw. The compact profile of the sensor allows for installation in limited space applications. The sensor has a virtually unlimited cycle life. Special cabling and connectors can also be provided.

When ordering motors with the proximity sensor, the part number should be preceded by a "P" prefix.

Black Ice® and Kerkote® TFE Coated Lead Screws*

TFE Coated Lead Screws for applications that require a *greaseless* screw and nut interface.

A *dry* (non-lubricated) TFE coated lead screw provides improved performance in both life and thrust as compared to a conventional stainless steel lead-screw. TFE can be applied to a wide variety of lead-screw pitches and is available for our brand captive, non-captive and external linear actuators. Not available for 0.00006-in (.0015 mm) and 0.000098-in (.0025 mm) resolutions.

*Certain conditions apply.

Integrated Anti-Backlash Nut for Hybrids*

Most sizes (except Size 34) of our captive and non-captive hybrid stepper motors can be equipped with an integral anti-backlash feature. There is a normal backlash between the lead screw and integral rotor nut.

Our actuators are designed for millions of cycles. However over time, additional backlash could increase and eventually double. Haydon Kerk Integrated Anti-Backlash Nut can eliminate all backlash. Designed specifically for our captive and non-captive hybrid motors, nuts use an opposing spring force to eliminate backlash between the screw and the nut interface. The nuts will self-compensate and accommodate any wear. Haydon Kerk Motion Solutions application engineers can help you select the appropriate preload for your application

*Except Size 34.

35000 Series
Size 14 Hybrid Linear Actuators

Higher force, longer life and improved performance

The various patented designs deliver exceptional performance and new linear motion design opportunities.

3 Available Designs

– Captive
– Non-Captive
– External Linear

The 35000 Series is available in a wide variety of resolutions - from 0.00012-in (.003048 mm) per step to 0.00192-in (.048768 mm) per step. The motors can also be microstepped for even finer resolutions.

The Size 14 actuator delivers thrust of -up to 50 lbs. (222 N).

Size 14
Captive Shaft

Size 14
External Linear

Size 14
Non-Captive Shaft

Size 14: 35 mm (1.1-in) Hybrid Linear Actuator (1.8° Step Angle)						
Part No.	Captive	35H4 – – – †			35H6 – – – †	
	Non-Captive	35F4 – – – †			35F4 – – – †	
	External Linear	E35H4 – – – †			E35H6 – – – †	
Wiring		Bipolar			Unipolar**	
Winding Voltage		2.33 VDC	5 VDC	12 VDC	5 VDC	12 VDC
Current (RMS)/phase		1.25 A	0.57 A	0.24 A	0.57 A	0.24 A
Resistance/phase		1.86 Ω	8.8 Ω	50.5 Ω	8.8 Ω	50.5 Ω
Inductance/phase		2.8 mH	13 mH	60 mH	6.5 mH	30 mH
Power Consumption		5.7 W				
Rotor Inertia		16.0 gcm^2				
Insulation Class		Class B (Class F available)				
Weight		5.7 oz (162 g)				
Insulation Resistance		20 MΩ				

†Part numbering information on page 5. ** Unipolar drive gives approximately 30% less thrust than bipolar drive.

Linear Travel / Step Screw Ø .218" (5.54 mm)		Order Code I.D.
inches	mm	
.00012	.0030*	N
.00024	.0060*	K
.00048	.0121*	J
.00096	.0243*	Q
.00192	.0487*	R

Linear Travel / Step Screw Ø .250" (6.35 mm)		Order Code I.D.
inches	mm	
.00015625	.0039*	P
.0003125	.0079*	A
.000625	.0158*	B
.00125	.0317*	C

*Values truncated.

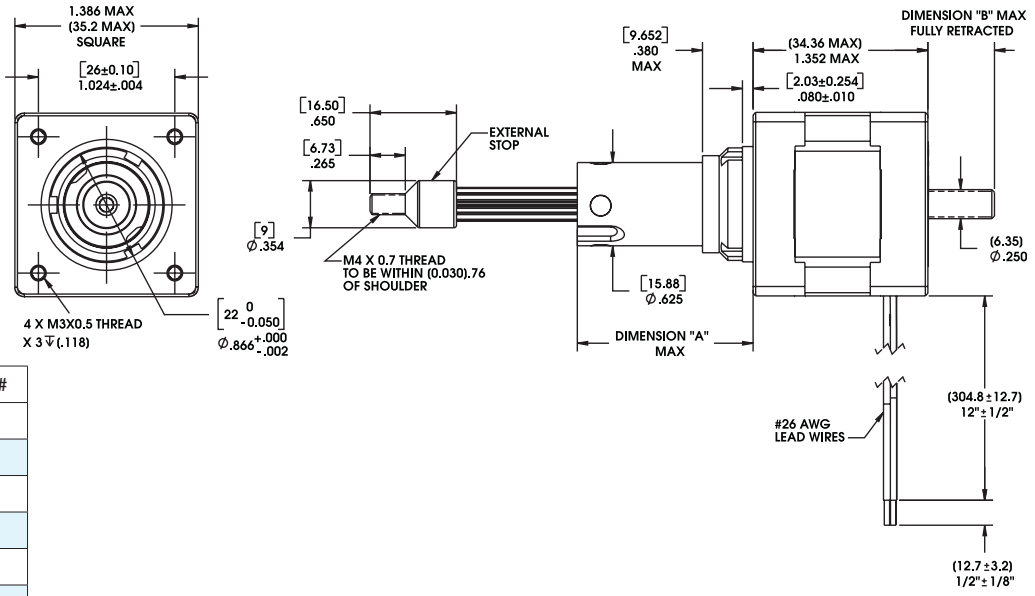
Standard motors are Class B rated for maximum temperature of 130°C.

Special drive considerations may be necessary when leaving shaft fully extended or fully retracted.

Captive Lead Screw

Dimensions = (mm) inches

Integrated connector option available



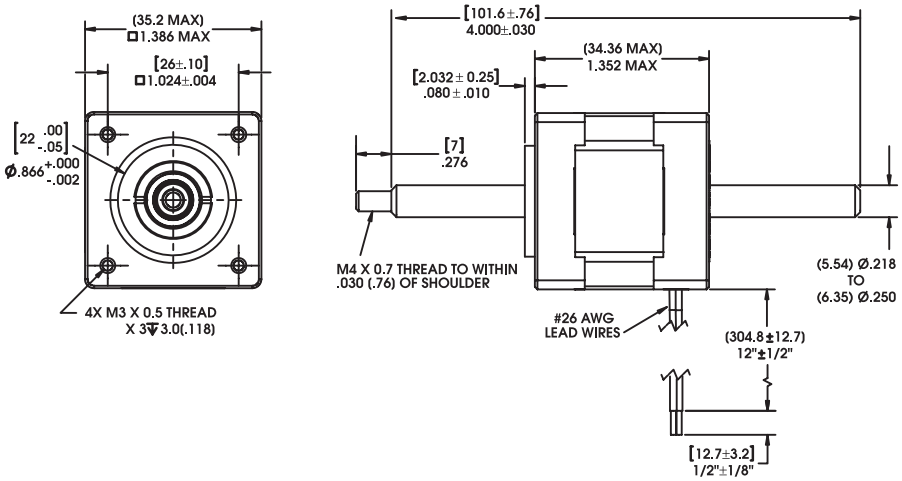
Stroke	Dim. "A"	Dim. "B"	Suffix #
0.500 (12.7)	0.82 (20.8)	0.04 (1.0)	–905
0.750 (19.05)	1.07 (27.2)	0.29 (7.4)	–907
1.000 (25.4)	1.32 (33.5)	0.54 (13.7)	–910
1.250 (31.8)	1.57 (39.9)	0.79 (20.1)	–912
1.500 (38.1)	1.82 (46.2)	1.04 (26.4)	–915
2.00 (50.8)	2.32 (58.9)	1.54 (39.1)	–920
2.500 (63.5)	2.82 (71.6)	2.04 (51.8)	–925

Non-Captive Lead Screw

Dimensions = (mm) inches

Integrated connector option available

4-in [101.6 mm]
standard screw lengths.
Longer screw lengths are available.

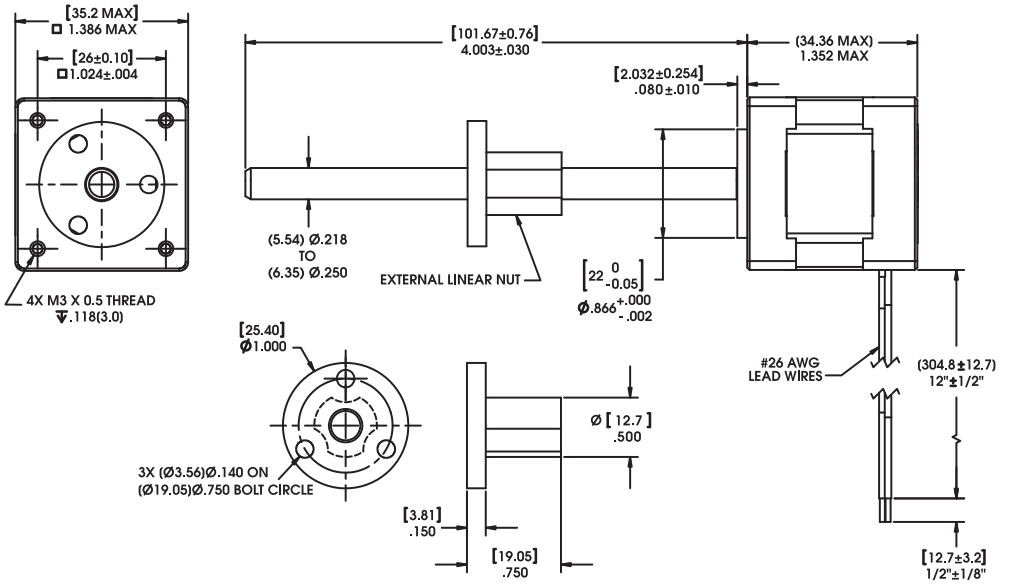


External Linear

Dimensions = (mm) inches

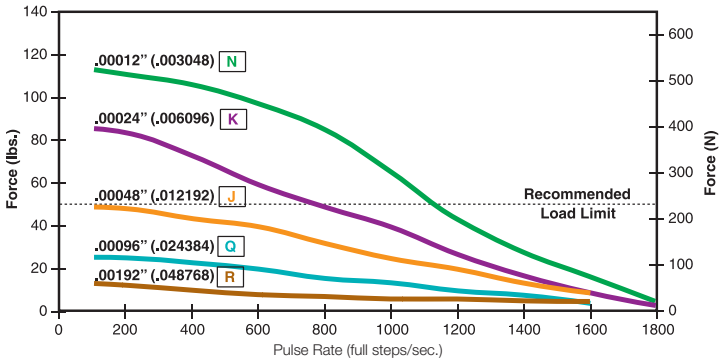
Integrated connector option available

4-in [101.6 mm]
standard screw lengths.
Longer screw lengths are available.

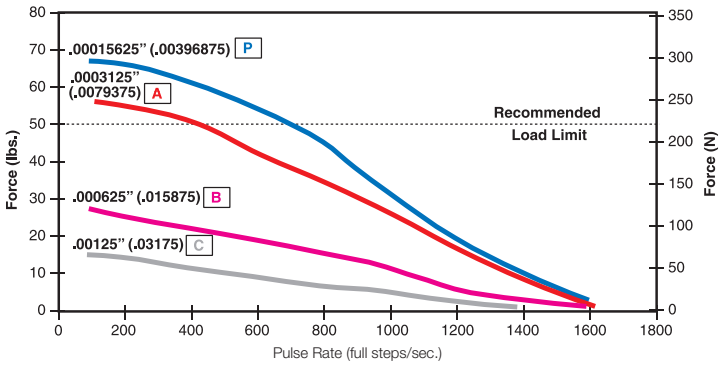


FORCE vs. PULSE RATE – Chopper – Bipolar – 100% Duty Cycle

– Ø .218 (5.54) Lead Screw

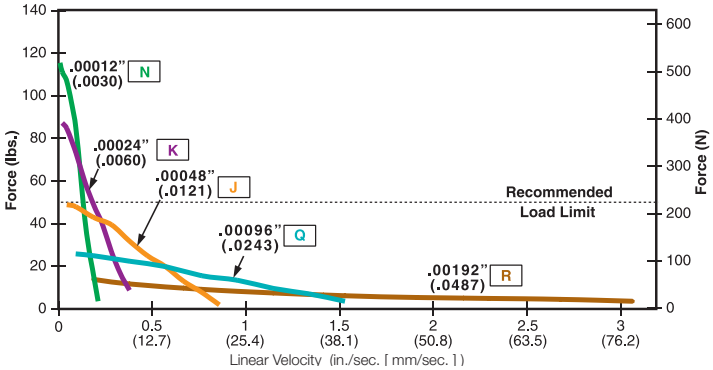


– Ø .250 (6.35) Lead Screw

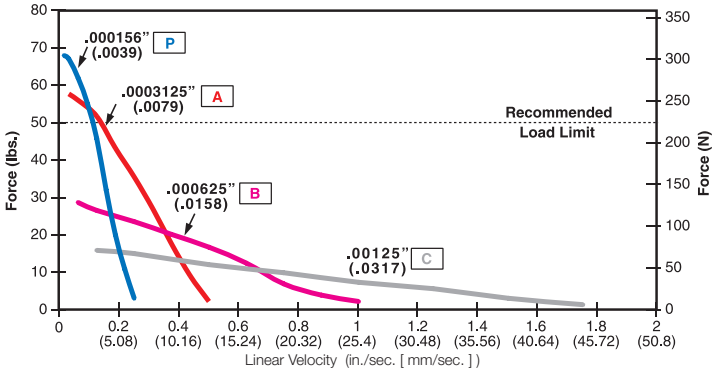


FORCE vs. LINEAR VELOCITY – Chopper – Bipolar – 100% Duty Cycle

– Ø .218 (5.54) Lead Screw



– Ø .250 (6.35) Lead Screw



NOTE: All chopper drive curves were created with a 5 volt motor and a 40 volt power supply.

Ramping can increase the performance of a motor either by increasing the top speed or getting a heavier load accelerated up to speed faster. Also, deceleration can be used to stop the motor without overshoot.

With L/R drives peak force and speeds are reduced, using a unipolar drive will yield a further 30% force reduction.

35000 Series
Size 14, 0.9° High Resolution Motor

Compared to the standard resolution (1.8°) this motor has been engineered to precisely deliver reliable high speed, force, up to 50 lbs (222 N), as well as a full step movement as low as 1.5 microns.

Size 14: 35 mm (1.1-in) Hybrid Linear Actuator (0.9° Step Angle)						
Part No.	Captive	35K4 □ – □ □ – □ □ □ †			35K6 □ – □ □ – □ □ □ †	
	Non-Captive	35J4 □ – □ □ – □ □ □ †			35J4 □ – □ □ – □ □ □ †	
	External Linear	E35K4 □ – □ □ – □ □ □ †			E35K6 □ – □ □ – □ □ □ †	
Wiring		Bipolar			Unipolar**	
Winding Voltage		2.33 VDC	5 VDC	12 VDC	5 VDC	12 VDC
Current (RMS)/phase		1.25 A	0.57 A	0.24 A	0.57 A	0.24 A
Resistance/phase		1.86 Ω	8.8 Ω	50.5 Ω	8.8 Ω	50.5 Ω
Inductance/phase		2.8 mH	13 mH	60 mH	6.5 mH	30 mH
Power Consumption		5.7 W				
Rotor Inertia		16.0 gcm^2				
Insulation Class		Class B (Class F available)				
Weight		5.7 oz (162 g)				
Insulation Resistance		20 MΩ				

** Unipolar drive gives approximately 30% less thrust than bipolar drive.

Linear Travel / Step Screw Ø .218" (5.54 mm)		Order Code I.D.
inches	mm	
.00006	.0015*	U
.00012	.0030*	N
.00024	.0060*	K
.00048	.0121*	J
.00096	.0243*	Q

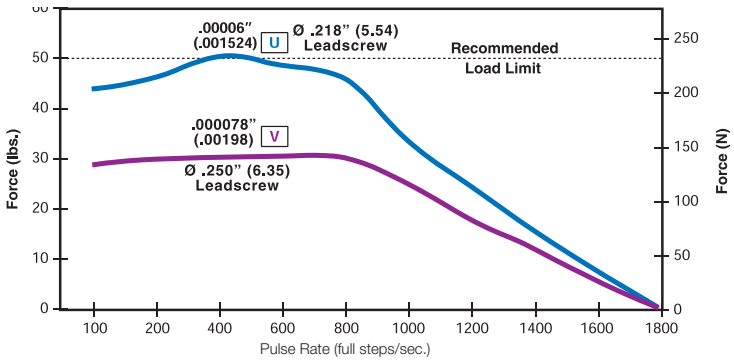
Linear Travel / Step Screw Ø .250" (6.35 mm)		Order Code I.D.
inches	mm	
.000078*	.00198*	V
.00015625	.0039*	P
.0003125	.0079*	A
.000625	.0158*	B

*Values truncated.

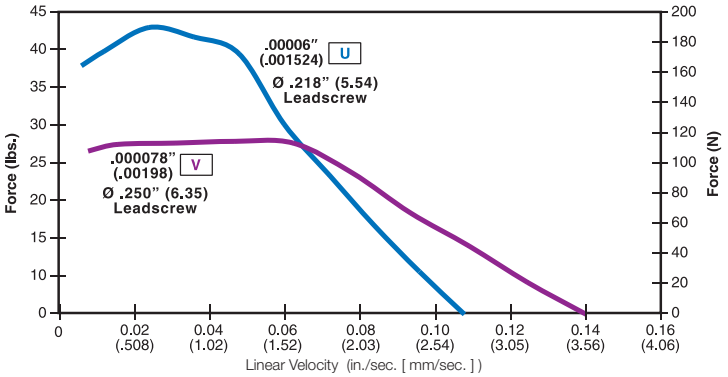
Standard motors are Class B rated for maximum temperature of 130°C.
NOTE: Refer to performance curves on page 3 for codes N, K, J, Q, P, A, B

Special drive considerations may be necessary when leaving shaft fully extended or fully retracted.

FORCE vs. PULSE RATE – Chopper – Bipolar – 100% Duty Cycle
with two available lead screw diameters



FORCE vs. LINEAR VELOCITY – Chopper – Bipolar – 100% Duty Cycle
with two available lead screw diameters



NOTE: All chopper drive curves were created with a 5 volt motor and a 40 volt power supply.

Ramping can increase the performance of a motor either by increasing the top speed or getting a heavier load accelerated up to speed faster. Also, deceleration can be used to stop the motor without overshoot.

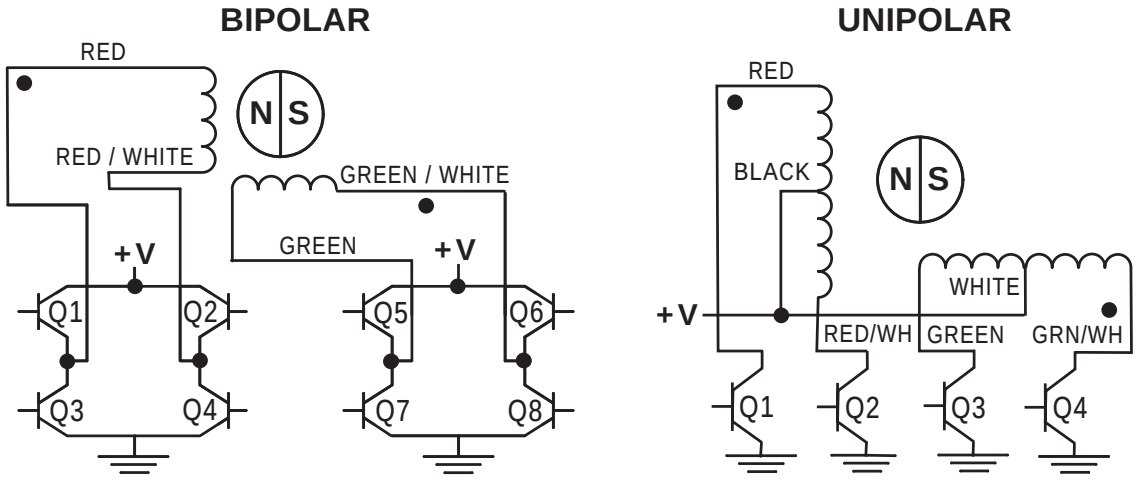
With L/R drives peak force and speeds are reduced, using a unipolar drive will yield a further 30% force reduction.

Identifying the Hybrid Part Number Codes when Ordering

E	35	H	4	7	—	2.33	—	910
Prefix (include only when using the following) **A =** A Coil (See AC Synchronous Data Sheet) **E** = External **K** = External with 40° thread form **P** = Proximity Sensor **S** = Home Position Switch	**Series Number Designation** **35 = 35000** (Series numbers represent approximate width of motor body)	**Style** **F** = 1.8° Non-captive **H** = 1.8° Captive or External (use "E" or "K" Prefix for External version) **J** = 0.9° Non-captive **K** = 0.9° Captive or External (use "E" or "K" Prefix for External version)	**Coils** **4** = Bipolar (4 wire) **6** = Unipolar (6 wire)	**Code ID Resolution Travel/Step** **N** = .00012-in (.0030) **K** = .00024-in (.0060) **J** = .00048-in (.0121) **Q** = .00096-in (.0243) **P** = .00015625-in (.0039) **A** = .0003125-in (.0079) **B** = .000625-in (.0158) **C** = .00125-in (.0317) **R** = .00192-in (.0478) **High Resolution** **U** = .00006-in (.0015) **V** = .000078-in (.00198)		**Voltage** **2.33** = 2.33 VDC **05** = 5 VDC **12** = 12 VDC Custom V available		**Suffix** **Stroke** Example: –910 = 1-in (Refer to Stroke chart on Captive motor series product page.) **Suffix also represents**: –800 = Metric –900 = External Linear with grease and flanged nut –XXX = Proprietary suffix assigned to a specific customer application. The identifier can apply to either a standard or custom part.

NOTE: Dashes must be included in Part Number (–) as shown above. For assistance call our Engineering Team at 203 756 7441.

Hybrids: **Wiring**



Hybrids: **Stepping Sequence**

Bipolar	Q2-Q3	Q1-Q4	Q6-Q7	Q5-Q8
Step				
1	ON	OFF	ON	OFF
2	OFF	ON	ON	OFF
3	OFF	ON	OFF	ON
4	ON	OFF	OFF	ON
1	ON	OFF	ON	OFF

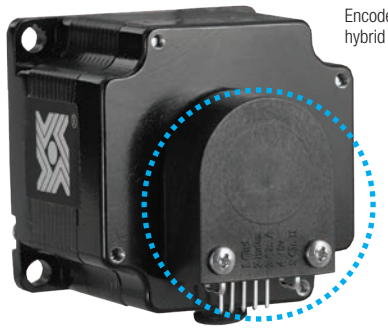
EXTEND CW ↓ ↑ RETRACT CCW

Note: Half stepping is accomplished by inserting an off state between transitioning phases.

Encoders Designed for All Sizes of Hybrid Linear Actuators

All Haydon Hybrid Linear Actuators are available with specifically designed encoders for applications that require feedback. The compact optical incremental encoder design is available with two channel quadrature TTL squarewave outputs. An optional index is also available as a 3rd channel. The Size 14 Encoder provides resolutions for applications that require 200, 400 and 1,000 counts per revolution. Encoders are available for all motor configurations.

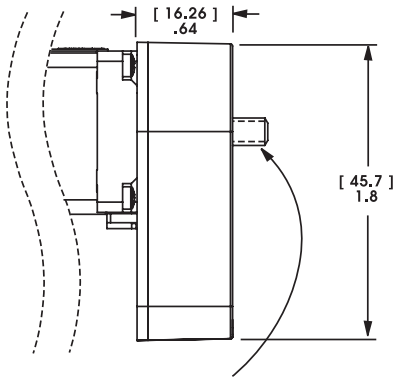
Simplicity and low cost make the encoders ideal for both high and low volume motion control applications. The internal monolithic electronic module converts the real-time shaft angle, speed, and direction into TTL compatible outputs. The encoder module incorporates a lensed LED light source and monolithic photodetector array with signal shaping electronics to produce the two channel bounceless TTL outputs.



Encoder on Size 23 hybrid motor

30 mm 35000 Series Size 14

NOTE: Lead Screw extends beyond encoder on specific captive and non-captive motors. External linear shaft extension is available upon request.



Electrical Specifications				
	Minimum	Typical	Maximum	Units
Input Voltage	4.5	5.0	5.5	VDC
Output Signals	4.5	5.0	5.5	VDC

2 channel quadrature TTL squarewave outputs.
Channel B leads A for a clockwise rotation of the rotor viewed from the encoder cover.
Tracks at speeds of 0 to 100,000 cycles/sec.
Optional index available as a 3rd channel (one pulse per revolution).

Operating Temperature		
	Minimum	Maximum
Size 14	- 40°C (- 40°F)	100°C (212°F)

Differential Ended Encoder - Pinout - Size 14	
Connector Pin #	Description
1	Ground
2	Ground
3	– Index
4	+ Index
5	Channel A –
6	Channel A +
7	+5 VDC Power
8	+5 VDC Power
9	Channel B –
10	Channel B +

Mechanical Specifications	
	Maximum
Acceleration	250,000 rad/sec2
Vibration (5 Hz to 2 kHz)	20 g

Resolution				
4 Standard Cycles Per Revolution (CPR) or Pulses Per Revolution (PPR)				
Size 14	CPR	200	400	1000*
	PPR	800	1600	4000*

*Index Pulse Channel not available.

Single Ended Encoder - Pinout - Size 14			
Connector Pin #	Description	Connector Pin #	Description
1	Ground	4	+5 VDC Power
2	Index (optional)	5	Channel B
3	Channel A		

Integrated Connector for Hybrid Size 14

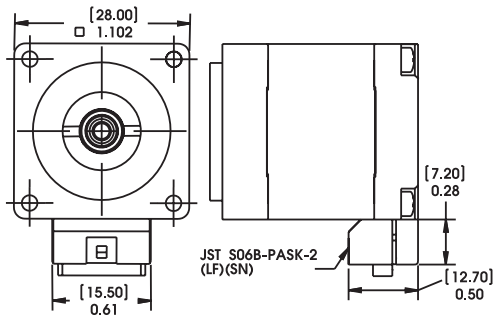
Offered alone or with a harness assembly, this connector is RoHS compliant and features a positive latch in order for high connection integrity. The connector is rated up to 3 amps and the mating connector will handle a range of wire gauges from 22 to 28. Ideal for those that want to plug in directly to pre-existing harnesses.

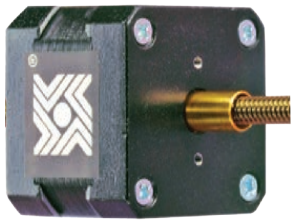
Motor Connector:
JST part # S06B-PASK-2

Mating Connector:
JST part # PAP-06V-S
Haydon Kerk Part #56-1210-5 (12 in. Leads)

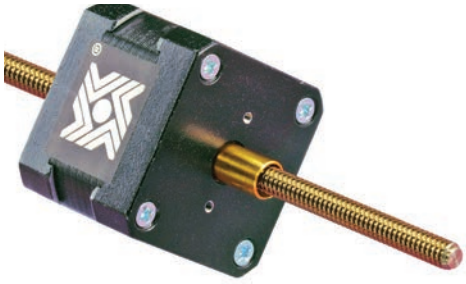
Wire to Board Connector:
JST part number SPHD-001T-P0.5

Pin #	Bipolar	Unipolar	Color
1	Phase 2 Start	Phase 2 Start	G/W
2	Open	Phase 2 Common	–
3	Phase 2 Finish	Phase 2 Finish	Green
4	Phase 1 Finish	Phase 1 Finish	R/W
5	Open	Phase 1 Common	–
6	Phase 1 Start	Phase 1 Start	Red

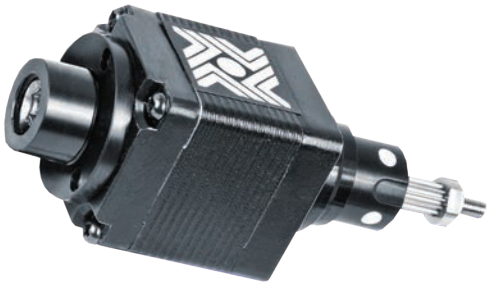




Encoder Ready Option Shown 34000 Series Size 17

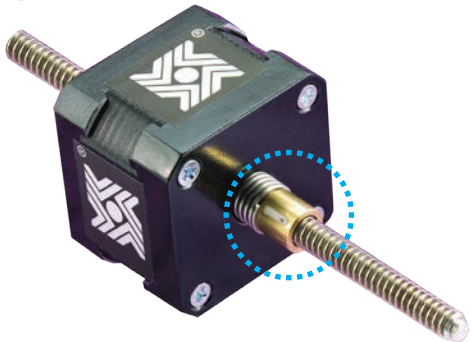


Extended Rotor Journal Shown 34000 Series Size 17



End of Stroke Proximity Sensor

TFE Coated Lead Screw



Integrated Anti-Backlash Nut

Encoder Ready Option for all Hybrid Sizes

Our Hybrid Linear Actuators can now be manufactured as an Encoder Ready Actuator. Encoder Ready Actuators can be used to install several popular hollow shaft encoders. Available with an extended rotor journal and a threaded rear housing. The motor uses a proprietary manufacturing process which incorporates engineering thermoplastics in the rotor drive nut and a stainless steel Acme Lead Screw that allows the motor to be much more efficient and durable than today's more commonly used V-thread bronze nut configurations.

Extended Rotor Journal for all Hybrid Sizes

Available with an extended rotor journal. The extended rotor journal can be used for encoder installation, manual adjustment, or flag installation for a positioning sensor.

Home Position Switch for Hybrids

A miniature electronic Home Position Switch capable of monitoring the home positions of linear actuators. The switch mounts on the rear sleeve of captive linear motors and allows the user to identify start, stop or home positions.

When ordering motors with the home position switch the part number should be preceded by an "S" prefix.

End of Stroke Proximity Sensor for all Hybrid Sized

The Sensor incorporates a hall effect device, which is activated by a rare earth magnet embedded in the end of the internal screw. The compact profile of the sensor allows for installation in limited space applications. The sensor has a virtually unlimited cycle life. Special cabling and connectors can also be provided.

When ordering motors with the proximity sensor, the part number should be preceded by a "P" prefix.

Black Ice® and Kerkote® TFE Coated Lead Screws*

TFE Coated Lead Screws for applications that require a *greaseless* screw and nut interface.

A *dry* (non-lubricated) TFE coated lead screw provides improved performance in both life and thrust as compared to a conventional stainless steel lead-screw. TFE can be applied to a wide variety of lead-screw pitches and is available for our brand captive, non-captive and external linear actuators. Not available for 0.00006-in (.0015 mm) and 0.000098-in (.0025 mm) resolutions.

*Certain conditions apply.

Integrated Anti-Backlash Nut for Hybrids*

Most sizes (except Size 34) of our captive and non-captive hybrid stepper motors can be equipped with an integral anti-backlash feature. There is a normal backlash between the lead screw and integral rotor nut.

Our actuators are designed for millions of cycles. However over time, additional backlash could increase and eventually double. Haydon Kerk Integrated Anti-Backlash Nut can eliminate all backlash. Designed specifically for our captive and non-captive hybrid motors, nuts use an opposing spring force to eliminate backlash between the screw and the nut interface. The nuts will self-compensate and accommodate any wear. Haydon Kerk Motion Solutions application engineers can help you select the appropriate preload for your application

*Except Size 34.

35000 Series
Size 14 Double Stack
Hybrid Linear Actuators

Improved force and performance

The 35000 Series is available in a wide variety of resolutions - from 0.000625-in (.0158 mm) per step to 0.005-in (.127 mm) per step. The motors can also be microstepped for even finer resolutions.

3 Available Designs

– Captive
– Non-Captive
– External Linear

The Size 14 actuator delivers thrust of up to 50 lbs. (222 N).

Size 14 Double Stack: 35 mm (1.4-in) Hybrid Linear Actuator (1.8° Step Angle)				
Part No.	Captive	35M4 □ – □ □ – □ □ □ †		
	Non-Captive	35L4 □ – □ □ – □ □ □ †		
	External Linear	E35M4 □ – □ □ – □ □ □ †		
Wiring		Bipolar		
Winding Voltage		2.33 VDC	5 VDC	12 VDC
Current (RMS)/phase		2 A	910 mA	380 mA
Resistance/phase		1.2 Ω	5.5 Ω	31.6 Ω
Inductance/phase		1.95 mH	7.63 mH	65.1 mH
Power Consumption		9.1 W Total		
Rotor Inertia		30 gcm^2		
Insulation Class		Class B (Class F available)		
Weight		8.5 oz (240 g)		
Insulation Resistance		20 MΩ		

†Part numbering information on page 4.

Linear Travel / Step Screw Ø.1875"(4.76mm)		Order Code I.D.
inches	mm	
.000625	.0158*	B
.00125	.0317*	C
.0025	.0635	Y
.00375	.0953	AG
.005	.127	Z

*Values truncated.

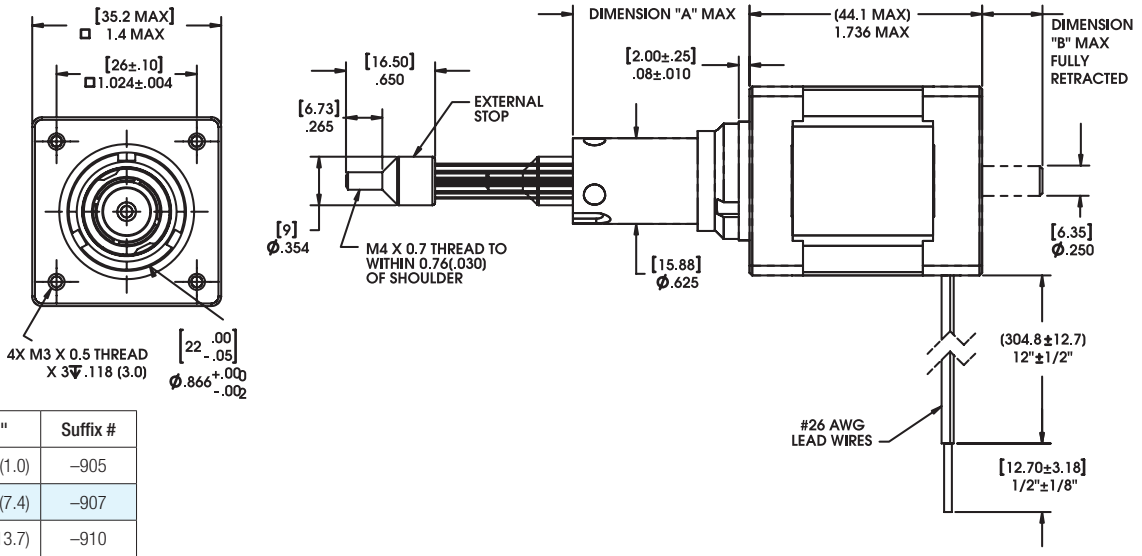
Standard motors are Class B rated for maximum temperature of 130°C.

Special drive considerations may be necessary when leaving shaft fully extended or fully retracted.

Captive Lead Screw

Dimensions = (mm) inches

Integrated connector option available



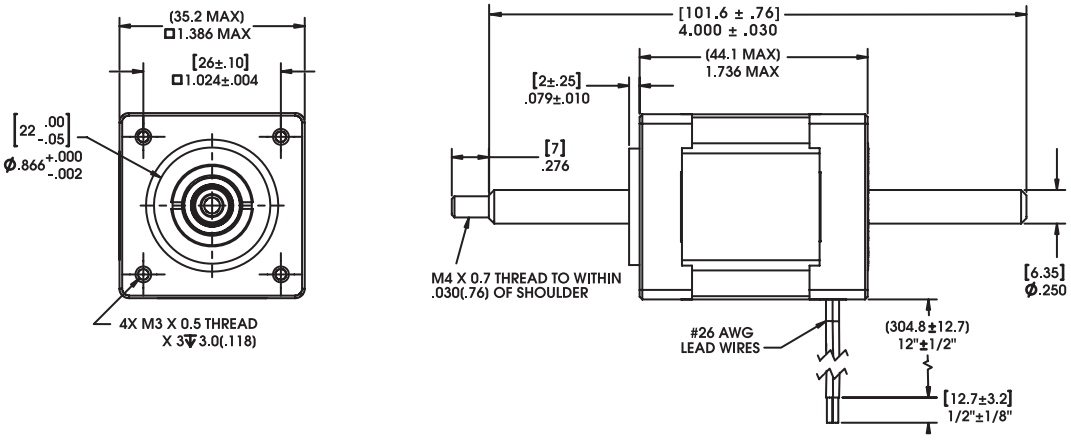
Stroke	Dim. "A"	Dim. "B"	Suffix #
0.500 (12.7)	0.82 (20.8)	0.04 (1.0)	–905
0.750 (19.05)	1.07 (27.2)	0.29 (7.4)	–907
1.000 (25.4)	1.32 (33.5)	0.54 (13.7)	–910
1.250 (31.8)	1.57 (39.9)	0.79 (20.1)	–912
1.500 (38.1)	1.82 (46.2)	1.04 (26.4)	–915
2.00 (50.8)	2.32 (58.9)	1.54 (39.1)	–920
2.500 (38.1)	2.82 (71.6)	2.04 (51.8)	–925

Non-Captive Lead Screw

Dimensions = (mm) inches

Integrated connector option available

4-in [101.6 mm]
standard screw lengths.
Longer screw lengths are available.

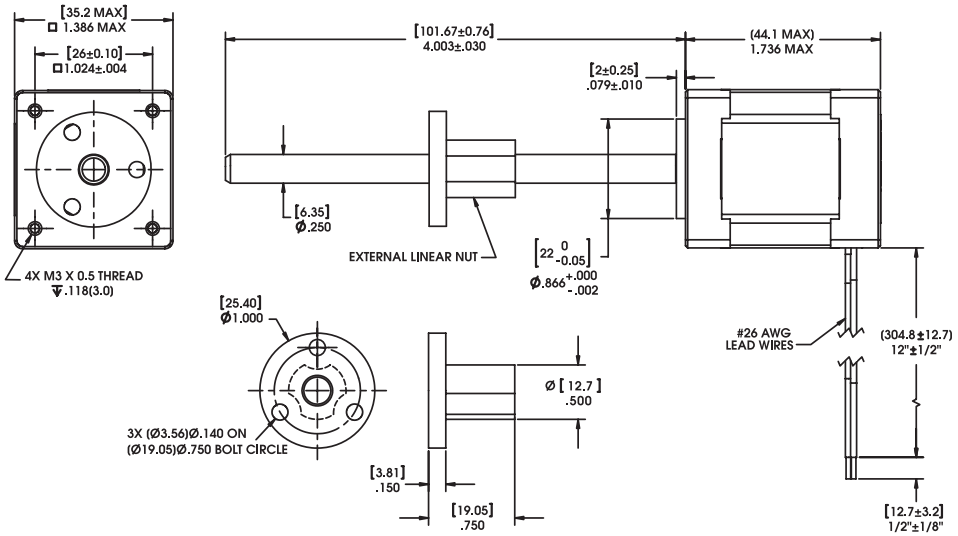


External Linear

Dimensions = (mm) inches

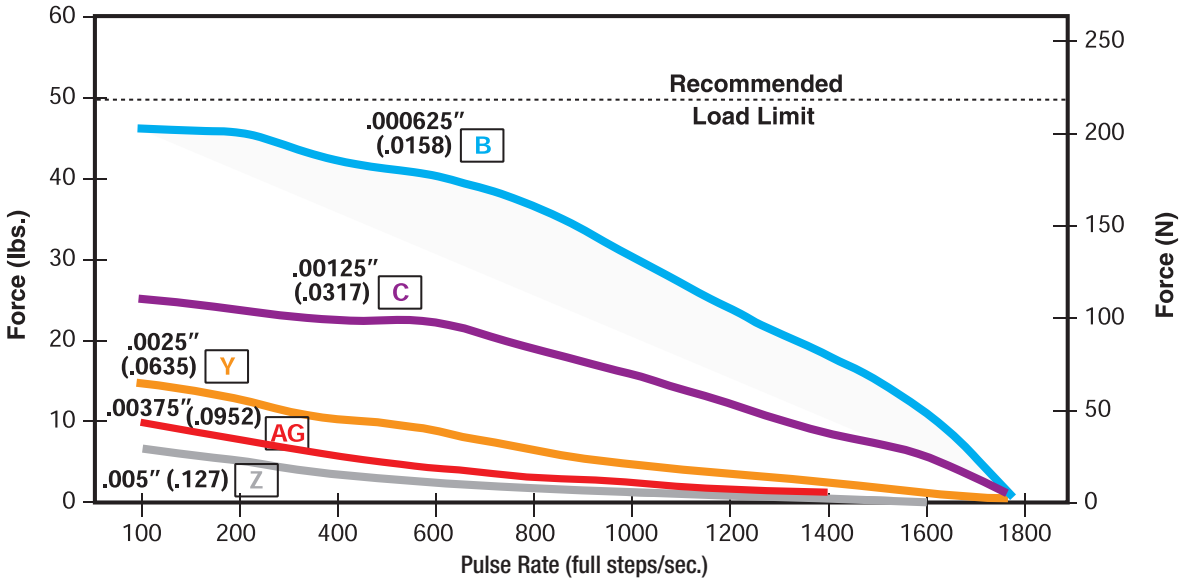
Integrated connector option available

4-in [101.6 mm]
standard screw lengths.
Longer screw lengths are available.



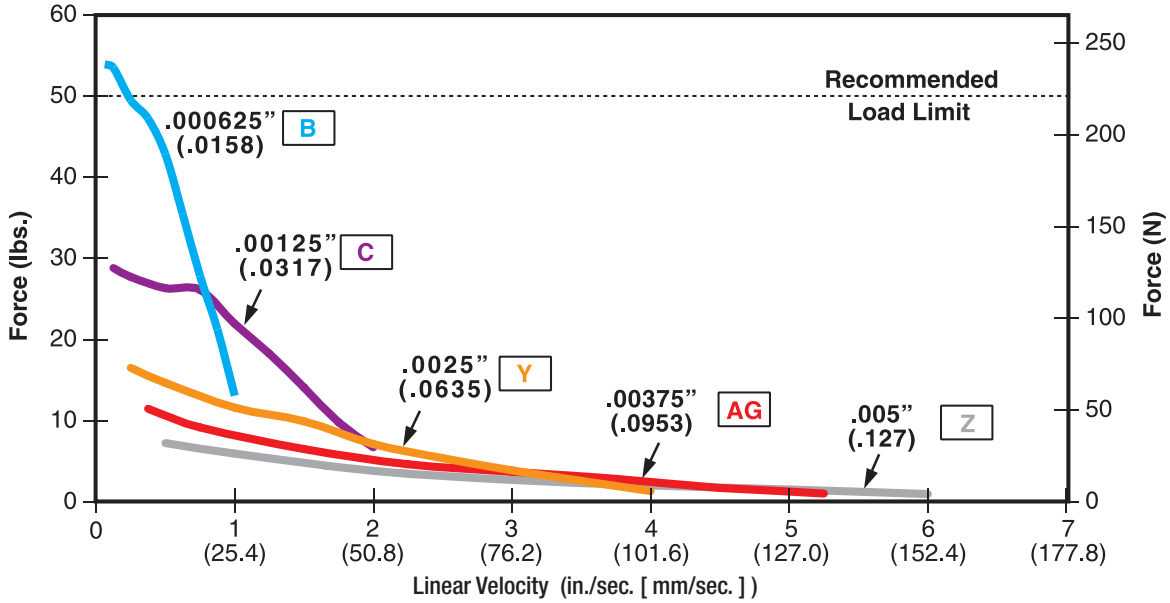
FORCE vs. PULSE RATE

– Chopper
– Bipolar
– 100% Duty Cycle
– Ø .250 (6.35)Lead Screw



FORCE vs. LINEAR VELOCITY

– Chopper
– Bipolar
– 100% Duty Cycle
– Ø .250 (6.35) Lead Screw



NOTE: All chopper drive curves were created with a 5 volt motor and a 40 volt power supply.

Ramping can increase the performance of a motor either by increasing the top speed or getting a heavier load accelerated up to speed faster. Also, deceleration can be used to stop the motor without overshoot.

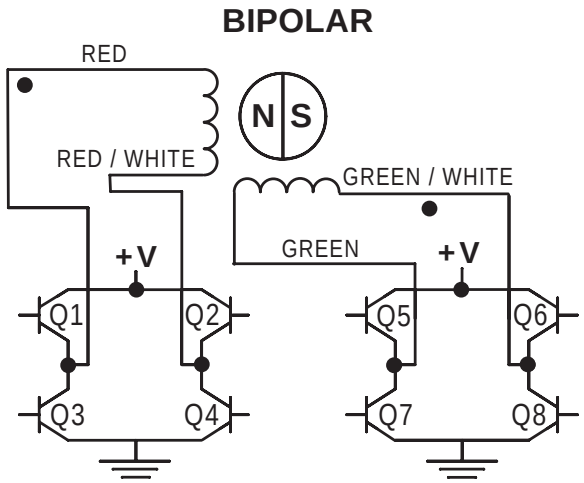
With L/R drives peak force and speeds are reduced, using a unipolar drive will yield a further 30% force reduction.

Identifying the Hybrid Part Number Codes when Ordering

E	35	L	4	B	—	12	—	910
Prefix (include only when using the following) **A =** A Coil (See AC Synchronous Data Sheet) **E** = External **K** = External with 40° thread form **P** = Proximity Sensor **S** = Home Position Switch	**Series Number Designation** **35 = 35000** (Series numbers represent approximate width of motor body)	**Style** **L** = 1.8° Non-captive **M** = 1.8°Captive or External (use "E" or "K" Prefix for External version)	**Coils** **4** = Bipolar (4 wire)	**Code ID Resolution Travel/Step** **B** = .000625-in (.0158) **C** = .00125-in (.0317) **Y** = .0025-in (.0635)) **AG** = .00375-in (.0953) **Z** = .005-in (.127)		**Voltage** **2.33** = 2.33 VDC **05** = 5 VDC **12** = 12 VDC Custom V available		**Suffix** **Stroke** Example: –910 = 1-in (Refer to Stroke chart on Captive motor series product page.) **Suffix also represents**: –800 = Metric –900 = External Linear with grease and flanged nut –XXX = Proprietary suffix assigned to a specific customer application. The identifier can apply to either a standard or custom part.

NOTE: Dashes must be included in Part Number (–) as shown above. For assistance call our Engineering Team at 203 756 7441.

Hybrids: **Wiring**



Hybrids: **Stepping Sequence**

EXTEND CW ⟵

Bipolar Step	Q2-Q3	Q1-Q4	Q6-Q7	Q5-Q8
1	ON	OFF	ON	OFF
2	OFF	ON	ON	OFF
3	OFF	ON	OFF	ON
4	ON	OFF	OFF	ON
1	ON	OFF	ON	OFF

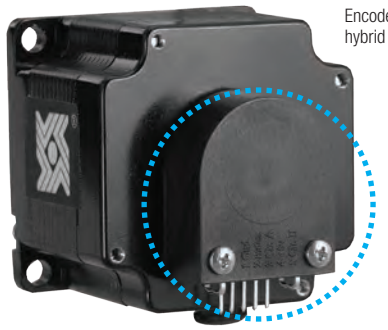
⟶ RETRACT CCW

Note: Half stepping is accomplished by inserting an off state between transitioning phases.

Encoders Designed for All Sizes of Hybrid Linear Actuators

All Haydon Hybrid Linear Actuators are available with specifically designed encoders for applications that require feedback. The compact optical incremental encoder design is available with two channel quadrature TTL squarewave outputs. An optional index is also available as a 3rd channel. The Size 14 Encoder provides resolutions for applications that require 200, 400 and 1,000 counts per revolution. Encoders are available for all motor configurations.

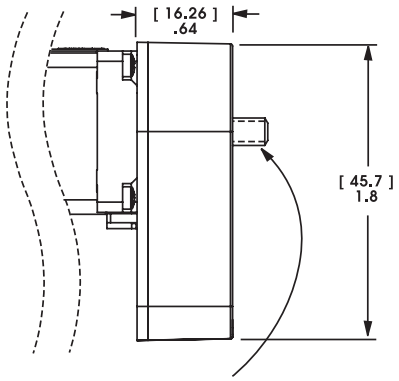
Simplicity and low cost make the encoders ideal for both high and low volume motion control applications. The internal monolithic electronic module converts the real-time shaft angle, speed, and direction into TTL compatible outputs. The encoder module incorporates a lensed LED light source and monolithic photodetector array with signal shaping electronics to produce the two channel bounceless TTL outputs.



Encoder on Size 23 hybrid motor

30 mm 35000 Series Size 14

NOTE: Lead Screw extends beyond encoder on specific captive and non-captive motors. External linear shaft extension is available upon request.



Electrical Specifications				
	Minimum	Typical	Maximum	Units
Input Voltage	4.5	5.0	5.5	VDC
Output Signals	4.5	5.0	5.5	VDC

2 channel quadrature TTL squarewave outputs.
Channel B leads A for a clockwise rotation of the rotor viewed from the encoder cover.
Tracks at speeds of 0 to 100,000 cycles/sec.
Optional index available as a 3rd channel (one pulse per revolution).

Operating Temperature		
	Minimum	Maximum
Size 14	- 40°C (- 40°F)	100°C (212°F)

Differential Ended Encoder - Pinout - Size 14	
Connector Pin #	Description
1	Ground
2	Ground
3	– Index
4	+ Index
5	Channel A –
6	Channel A +
7	+5 VDC Power
8	+5 VDC Power
9	Channel B –
10	Channel B +

Mechanical Specifications	
	Maximum
Acceleration	250,000 rad/sec2
Vibration (5 Hz to 2 kHz)	20 g

Resolution				
4 Standard Cycles Per Revolution (CPR) or Pulses Per Revolution (PPR)				
Size 14	CPR	200	400	1000*
	PPR	800	1600	4000*

*Index Pulse Channel not available.

Single Ended Encoder - Pinout - Size 14			
Connector Pin #	Description	Connector Pin #	Description
1	Ground	4	+5 VDC Power
2	Index (optional)	5	Channel B
3	Channel A		

Integrated Connector for Hybrid Size 14

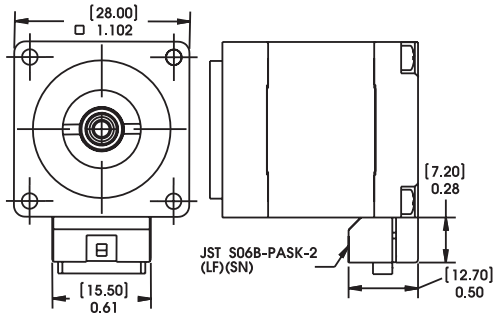
Offered alone or with a harness assembly, this connector is RoHS compliant and features a positive latch in order for high connection integrity. The connector is rated up to 3 amps and the mating connector will handle a range of wire gauges from 22 to 28. Ideal for those that want to plug in directly to pre-existing harnesses.

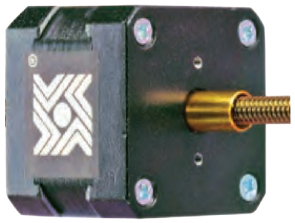
Motor Connector:
JST part # S06B-PASK-2

Mating Connector:
JST part # PAP-06V-S
Haydon Kerk Part #56-1210-5 (12 in. Leads)

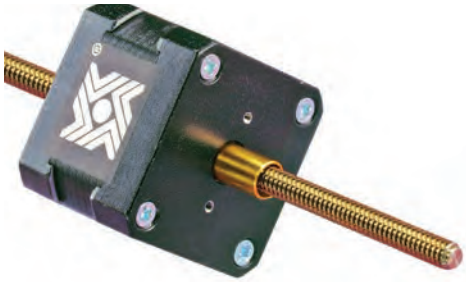
Wire to Board Connector:
JST part number SPHD-001T-P0.5

Pin #	Bipolar	Unipolar	Color
1	Phase 2 Start	Phase 2 Start	G/W
2	Open	Phase 2 Common	–
3	Phase 2 Finish	Phase 2 Finish	Green
4	Phase 1 Finish	Phase 1 Finish	R/W
5	Open	Phase 1 Common	–
6	Phase 1 Start	Phase 1 Start	Red





Encoder Ready Option Shown 34000 Series Size 17



Extended Rotor Journal Shown 34000 Series Size 17

End of Stroke Proximity Sensor

TFE Coated Lead Screw

Integrated Anti-Backlash Nut

Encoder Ready Option for all Hybrid Sizes

Our Hybrid Linear Actuators can now be manufactured as an Encoder Ready Actuator. Encoder Ready Actuators can be used to install several popular hollow shaft encoders. Available with an extended rotor journal and a threaded rear housing. The motor uses a proprietary manufacturing process which incorporates engineering thermoplastics in the rotor drive nut and a stainless steel Acme Lead Screw that allows the motor to be much more efficient and durable than today's more commonly used V-thread bronze nut configurations.

Extended Rotor Journal for all Hybrid Sizes

Available with an extended rotor journal. The extended rotor journal can be used for encoder installation, manual adjustment, or flag installation for a positioning sensor.

Home Position Switch for Hybrids

A miniature electronic Home Position Switch capable of monitoring the home positions of linear actuators. The switch mounts on the rear sleeve of captive linear motors and allows the user to identify start, stop or home positions.

When ordering motors with the home position switch the part number should be preceded by an "S" prefix.

End of Stroke Proximity Sensor for all Hybrid Sized

The Sensor incorporates a hall effect device, which is activated by a rare earth magnet embedded in the end of the internal screw. The compact profile of the sensor allows for installation in limited space applications. The sensor has a virtually unlimited cycle life. Special cabling and connectors can also be provided.

When ordering motors with the proximity sensor, the part number should be preceded by a "P" prefix.

Black Ice® and Kerkote® TFE Coated Lead Screws*

TFE Coated Lead Screws for applications that require a *greaseless* screw and nut interface.

A *dry* (non-lubricated) TFE coated lead screw provides improved performance in both life and thrust as compared to a conventional stainless steel lead-screw. TFE can be applied to a wide variety of lead-screw pitches and is available for our brand captive, non-captive and external linear actuators. Not available for 0.00006-in (.0015 mm) and 0.000098-in (.0025 mm) resolutions.

*Certain conditions apply.

Integrated Anti-Backlash Nut for Hybrids*

Most sizes (except Size 34) of our captive and non-captive hybrid stepper motors can be equipped with an integral anti-backlash feature. There is a normal backlash between the lead screw and integral rotor nut.

Our actuators are designed for millions of cycles. However over time, additional backlash could increase and eventually double. Haydon Kerk Integrated Anti-Backlash Nut can eliminate all backlash. Designed specifically for our captive and non-captive hybrid motors, nuts use an opposing spring force to eliminate backlash between the screw and the nut interface. The nuts will self-compensate and accommodate any wear. Our Engineers can help you select the appropriate preload for your application.

*Except Size 34.

43000 Series
Size 17 Hybrid Linear Actuators

Our best selling compact hybrid motors

Top selling designs deliver high performance, opening avenues for equipment designers who previously settled for products with inferior performance and endurance.

3 Available Designs

– Captive
– Non-Captive
– External Linear

The 43000 Series is available in a wide variety of resolutions - from 0.00006-in. (.001524 mm) per step to 0.00192-in. (.048768 mm) per step, and delivers thrust of up to 50 lbs. (222 N), or speeds exceeding 3 inches (7.62 cm) per second.

Size 17: 43 mm (1.7-in) Hybrid Linear Actuator (1.8° Step Angle)						
Part No.	Captive	43H4 – – – †			43H6 – – – †	
	Non-Captive	43F4 – – – †			43F4 – – – †	
	External Linear	E43H4 – – – †			E43H6 – – – †	
Wiring		Bipolar			Unipolar**	
Winding Voltage		2.33 VDC	5 VDC	12 VDC	5 VDC	12 VDC
Current (RMS)/phase		1.5 A	700 mA	290 mA	700 mA	290 mA
Resistance/phase		1.56 Ω	7.2 Ω	41.5 Ω	7.2 Ω	41.5 Ω
Inductance/phase		1.9 mH	8.7 mH	54.0 mH	4.4 mH	27.0 mH
Power Consumption		7 W				
Rotor Inertia		37 gcm^2				
Insulation Class		Class B (Class F available)				
Weight		8.5 oz (241 g)				
Insulation Resistance		20 MΩ				

†Part numbering information on page 7. ** Unipolar drive gives approximately 30% less thrust than bipolar drive.

Linear Travel / Step Screw Ø .218" (5.54 mm)		Order Code I.D.
inches	mm	
.00012	.0030*	N
.00024	.0060*	K
.00048	.0121*	J
.00096	.0243*	Q
.00192	.0487*	R

Linear Travel / Step Screw Ø .250" (6.35 mm)		Order Code I.D.
inches	mm	
.00015625	.0039*	P
.0003125	.0079*	A
.000625	.0158*	B
.00125	.0317*	C

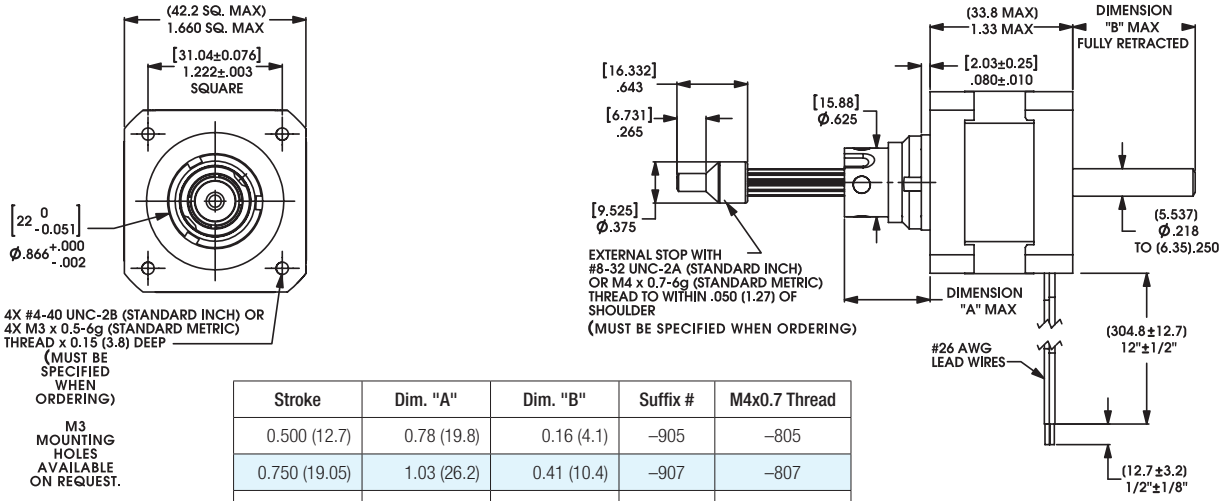
*Values truncated.
Standard motors are Class B rated for maximum temperature of 130°C. Also available, motors with high temperature capability windings up to 155°C.

Special drive considerations may be necessary when leaving shaft fully extended or fully retracted.

Captive Lead Screw

Dimensions = (mm) inches

Integrated connector option available



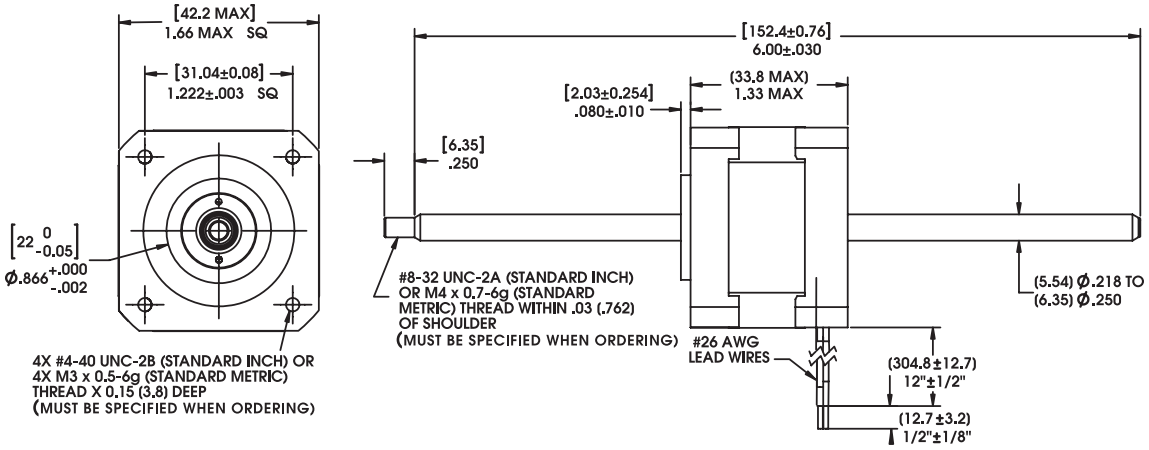
Stroke	Dim. "A"	Dim. "B"	Suffix #	M4x0.7 Thread
0.500 (12.7)	0.78 (19.8)	0.16 (4.1)	–905	–805
0.750 (19.05)	1.03 (26.2)	0.41 (10.4)	–907	–807
1.000 (25.4)	1.28 (32.5)	0.66 (16.8)	–910	–810
1.250 (31.8)	1.53 (38.9)	0.91 (23.1)	–912	–812
1.500 (38.1)	1.78 (45.2)	1.16 (29.5)	–915	–815
2.00 (50.8)	2.28 (57.9)	1.66 (42.2)	–920	–820
2.500 (63.5)	2.78 (70.6)	2.16 (54.9)	–925	–825

Non-Captive Lead Screw

Dimensions = (mm) inches

Integrated connector option available

4-in [101.6 mm]
standard screw lengths.
Longer screw lengths are available.

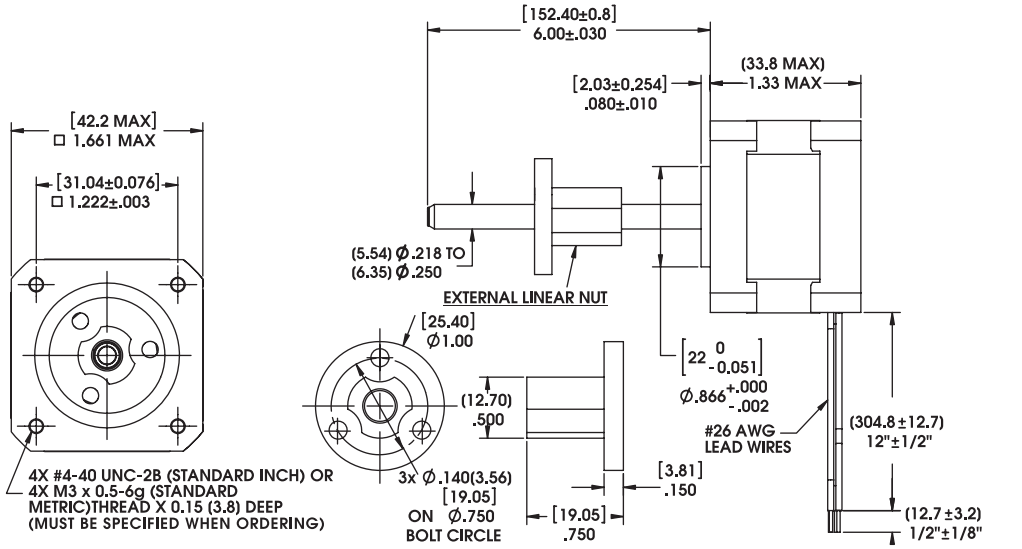


External Linear

Dimensions = (mm) inches

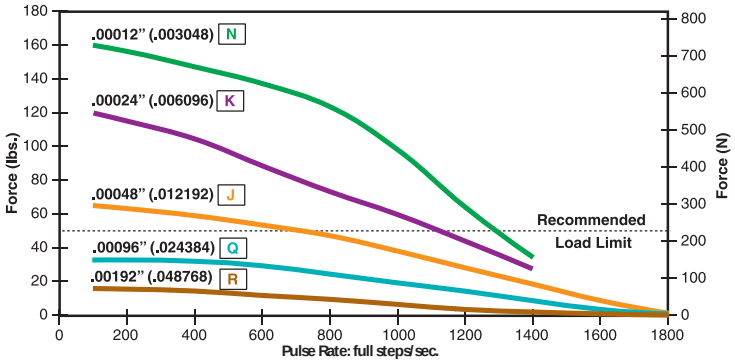
Integrated connector option available

4-in [101.6 mm]
standard screw lengths.
Longer screw lengths are available.

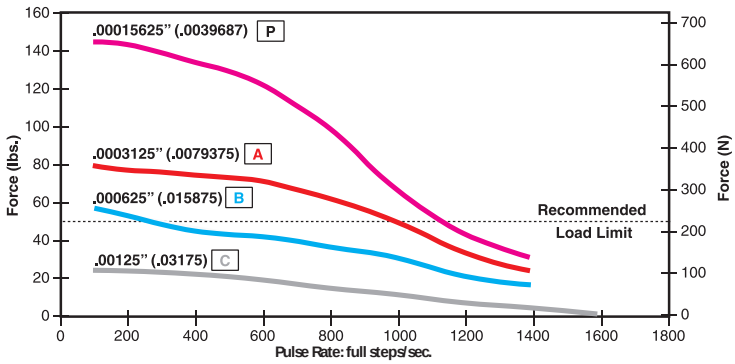


FORCE vs. PULSE RATE – Chopper – Bipolar – 100% Duty Cycle – 8:1 Motor Coil to Drive Supply Voltage

– Ø .218 (5.54) Lead Screw

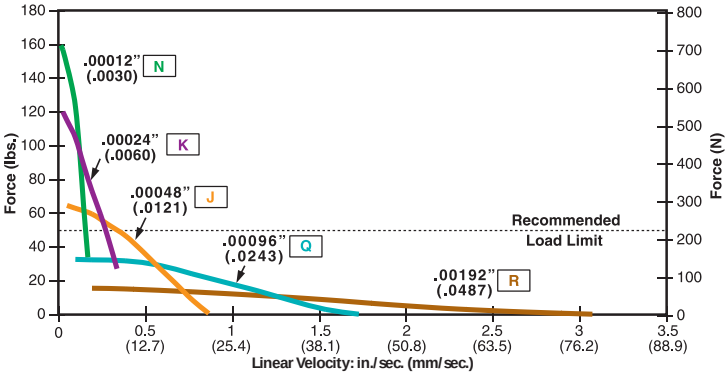


– Ø .250 (6.35) Lead Screw

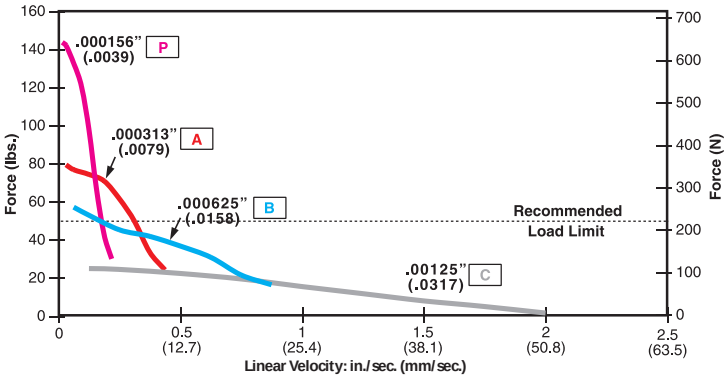


FORCE vs. LINEAR VELOCITY – Chopper – Bipolar – 100% Duty Cycle – 8:1 Motor Coil to Drive Supply Voltage

– Ø .218 (5.54) Lead Screw



– Ø .250 (6.35) Lead Screw



NOTE: All chopper drive curves were created with a 5 volt motor and a 40 volt power supply.

Ramping can increase the performance of a motor either by increasing the top speed or getting a heavier load accelerated up to speed faster. Also, deceleration can be used to stop the motor without overshoot.

With L/R drives peak force and speeds are reduced, using a unipolar drive will yield a further 30% force reduction.

43000 Series
Size 17, 0.9° High Resolution Motor

The Size 17 High Resolution Actuator features a production-proven, patented rotor drive nut that delivers trouble-free, long-term performance.

Size 17: 43 mm (1.7-in) Hybrid Linear Actuator (0.9° Step Angle)						
Part No.	Captive	43K4 – – – †			43K6 – – – †	
	Non-Captive	43J4 – – – †			43J4 – – – †	
	External Linear	E43K4 – – – †			E43K6 – – – †	
Wiring		Bipolar			Unipolar**	
Winding Voltage		2.33 VDC	5 VDC	12 VDC	5 VDC	12 VDC
Current (RMS)/phase		1.5 A	700 mA	290 mA	700 mA	290 mA
Resistance/phase		1.56 Ω	7.2 Ω	41.5 Ω	7.2 Ω	41.5 Ω
Inductance/phase		2.6 mH	12 mH	70 mH	6 mH	35 mH
Power Consumption		7 W				
Rotor Inertia		37 gcm²				
Insulation Class		Class B (Class F available)				
Weight		8.5 oz (241 g)				
Insulation Resistance		20 MΩ				

†Part numbering information on page 7. **Unipolar drive gives approximately 30% less thrust than bipolar drive.

Linear Travel / Step Screw Ø .218" (5.54 mm)		Order Code I.D.
inches	mm	
.00006	.0015*	U
.00012	.0030*	N
.00024	.0060*	K
.00048	.0121*	J
.00096	.0243*	Q

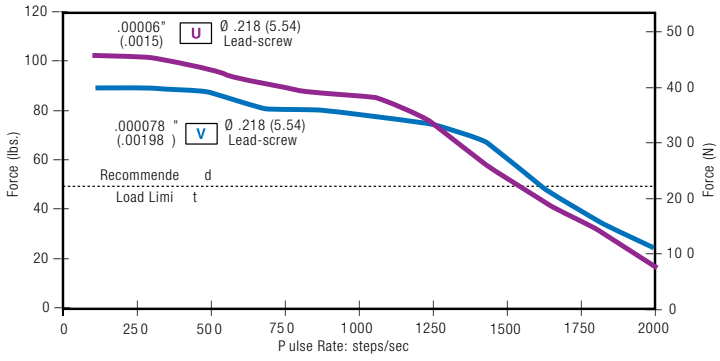
Linear Travel / Step Screw Ø .250" (6.35 mm)		Order Code I.D.
inches	mm	
.000078*	.00198*	V
.00015625	.0039*	P
.0003125	.0079*	A
.000625	.0158*	B

*Values truncated.

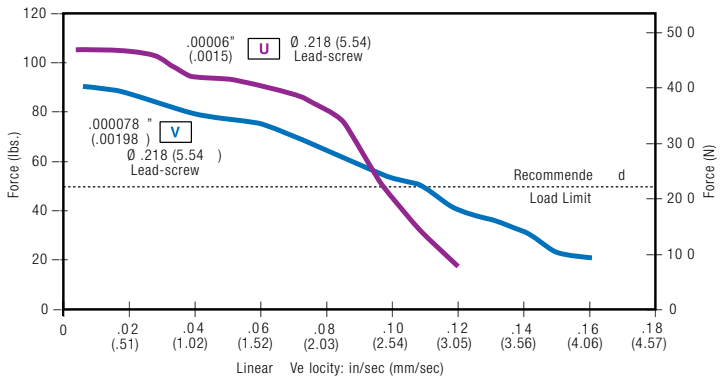
Standard motors are Class B rated for maximum temperature of 130°C.
NOTE: Refer to performance curves on page 3 for codes N, K, J, Q, P, A, B

Special drive considerations may be necessary when leaving shaft fully extended or fully retracted.

FORCE vs. PULSE RATE – Chopper – Bipolar – 100% Duty Cycle – 18:1 Motor Coil to Drive Supply Voltage with two available lead screw diameters



FORCE vs. LINEAR VELOCITY – Chopper – Bipolar – 100% Duty Cycle – 18:1 Motor Coil to Drive Supply Voltage with two available lead screw diameters



NOTE: All chopper drive curves were created with a 5 volt motor and a 40 volt power supply.

Ramping can increase the performance of a motor either by increasing the top speed or getting a heavier load accelerated up to speed faster. Also, deceleration can be used to stop the motor without overshoot.

With L/R drives peak force and speeds are reduced, using a unipolar drive will yield a further 30% force reduction.

43000 Series
Size 17 Hybrid Linear Actuators with integrated IDEA™ Drive

High performance in a compact package

The 43000 Series Single Stack actuator is available in a wide variety of resolutions – from 0.00006-in (.001524 mm) per step to 0.00192-in (.048768mm) per step. Delivers output force of up to 50 lbs (220N), or speeds exceeding 3 inches (7.62 cm) per second.

43000 Series with IDEA™ Drive features:

– Fully Programmable
– RoHS Compliant
– USB or RS-485 Communication
– Microstepping Capability: Full, 1/2, 1/4, 1/8, 1/16, 1/32, 1/64
– Graphic User Interface
– Auto-population of Drive Parameters
– Programmable Acceleration/Deceleration and Current Control

3 Available Designs

– Captive – Non-Captive – External Linear

NOTE: For more information see the Haydon Kerk IDEA™ Drive Data Sheet.

Size 17 Single Stack: 43 mm (1.7-in) Hybrid Linear Actuator (1.8° Step Angle)		
Part No.	Captive	43HG ☐ – ☐☐ – ☐☐☐ †
	Non-Captive	43FG ☐ – ☐☐ – ☐☐☐ †
	External Linear	E43HG ☐ – ☐☐ – ☐☐☐ †
Wiring		Bipolar
Winding Voltage		2.33 VDC**

†Part numbering information on page 7. **Contact Haydon Kerk if a higher voltage motor is desired. Special drive considerations may be necessary when leaving shaft fully extended or fully retracted.

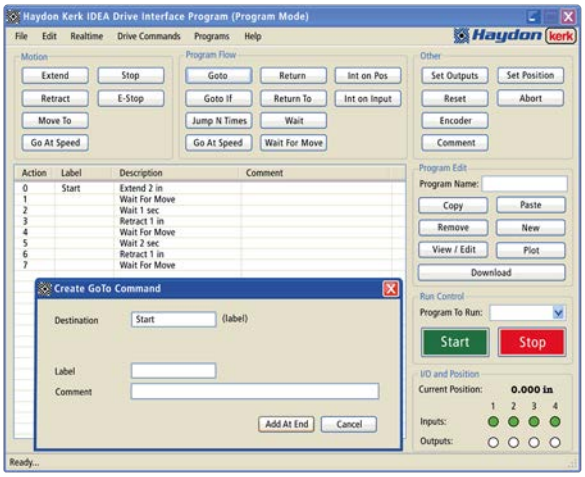
Linear Travel / Step Screw Ø .218" (5.54 mm)		Order Code I.D.
inches	mm	
.00012	.0030*	N
.00024	.0060*	K
.00048	.0121*	J
.00096	.0243*	Q
.00192	.0487*	R

Linear Travel / Step Screw Ø .250" (6.35 mm)		Order Code I.D.
inches	mm	
.00015625	.0039*	P
.0003125	.0079*	A
.000625	.0158*	B
.00125	.0317*	C

*Values truncated.

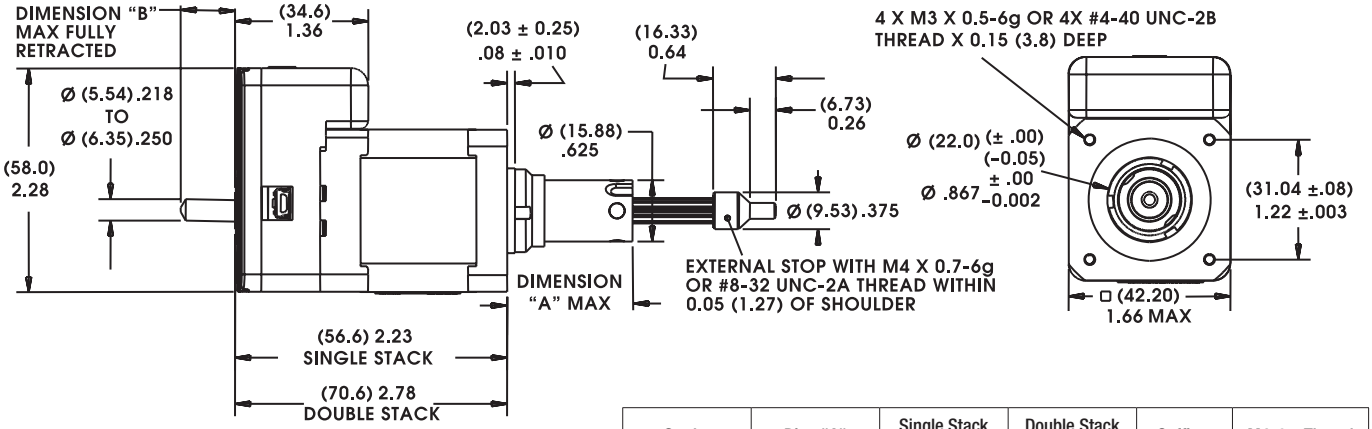
Simple to use IDEA™ Drive software with on-screen buttons and easy-to-understand programming guides

Software program generates motion profiles directly into the system and also contains a "debug" utility allowing line-by-line execution of a motion program for easy troubleshooting.



Captive Lead Screw

Dimensions = (mm) inches

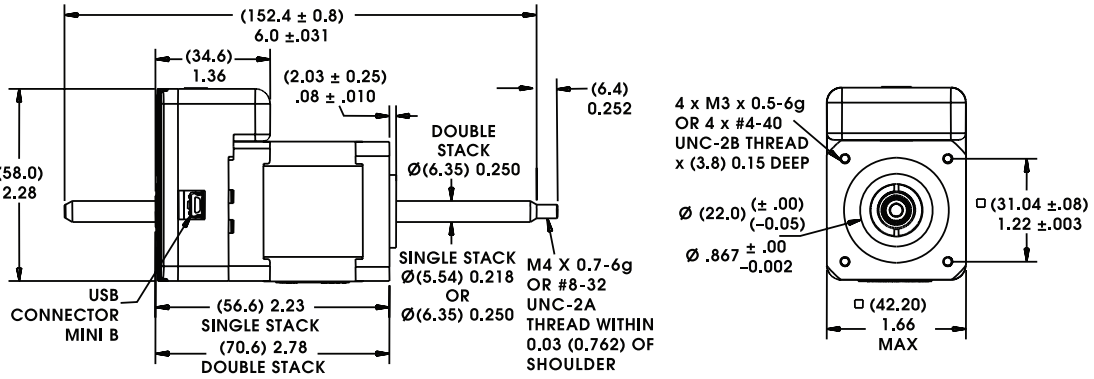


Stroke	Dim. "A"	Single Stack Dim. "B"	Double Stack Dim. "B"	Suffix #	M4x0.7 Thread
0.500 (12.7)	0.78 (19.8)	0	0	–905	–805
0.750 (19.05)	1.03 (26.2)	0	0	–907	–807
1.000 (25.4)	1.28 (32.5)	0	0	–910	–810
1.250 (31.8)	1.53 (38.9)	0	0	–912	–812
1.500 (38.1)	1.78 (45.2)	0.232 (5.9)	0.091 (2.5)	–915	–815
2.00 (50.8)	2.28 (57.9)	0.732 (18.6)	0.591 (15.0)	–920	–820
2.500 (63.5)	2.78 (70.6)	1.232 (31.3)	1.091 (27.7)	–925	–825

Non-Captive Lead Screw

Dimensions = (mm) inches

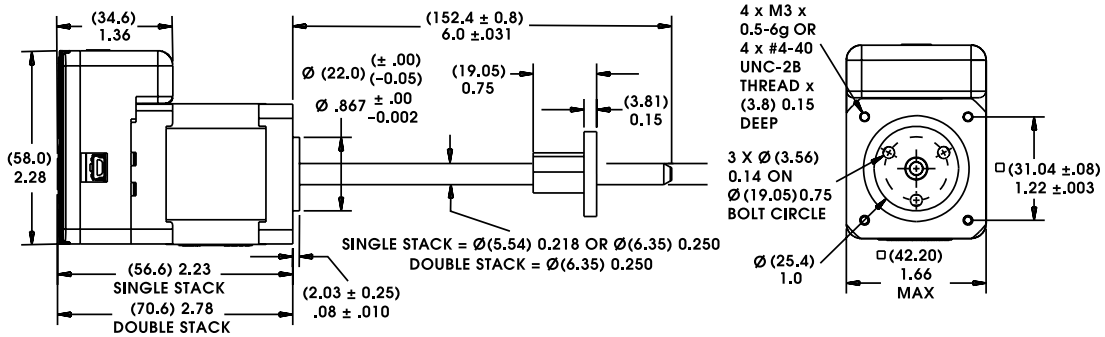
Up to 10-in (254 mm) standard screw lengths. Longer screw lengths are available.



External Linear

Dimensions = (mm) inches

Up to 10-in (254 mm) standard screw lengths. Longer screw lengths are available.

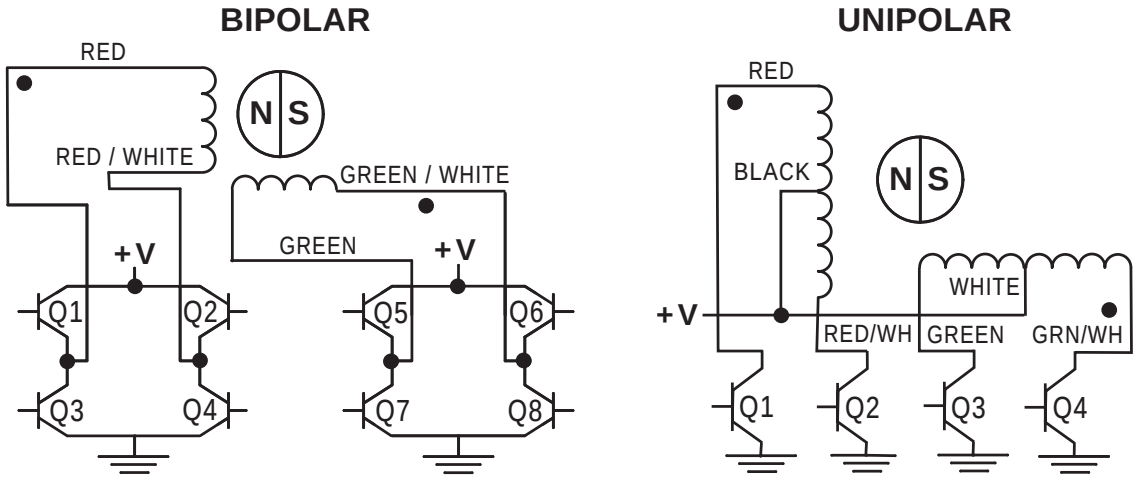


Identifying the Hybrid Part Number Codes when Ordering

E	43	H	6	N	—	2.33	—	910
Prefix (include only when using the following) **A =** A Coil (See AC Synchronous Data Sheet) **E** = External **K** = External with 40° thread form **P** = Proximity Sensor **S** = Home Position Switch	**Series Number Designation** **43 = 43000** (Series numbers represent approximate width of motor body)	**Style** **F** = 1.8° Non-captive **H** = 1.8° Captive or External (use "E" or "K" Prefix for External version) **J** = 0.9° Non-captive **K** = 0.9° Captive or External (use "E" or "K" Prefix for External version)	**Coils** **4** = Bipolar (4 wire) **6** = Unipolar (6 wire) **G** = IDEA Drive (Size 17, 43000 Series, Bipolar only)	**Code ID Resolution Travel/Step** **N** = .00012-in (.0030) **K** = .00024-in (.0060) **J** = .00048-in (.0121) **Q** = .00096-in (.0243) **P** = .00015625-in (.0039) **A** = .0003125-in (.0079) **B** = .000625-in (.0158) **C** = .00125-in (.0317) **R** = .00192-in (.0478) **High Resolution** **U** = .00006-in (.0015) **V** = .000078-in (.00198)		**Voltage** **2.33** = 2.33 VDC **05** = 5 VDC **12** = 12 VDC Custom V available		**Suffix** **Stroke** Example: –910 = 1-in (Refer to Stroke chart on Captive motor series product page.) **Suffix also represents**: –800 = Metric –900 = External Linear with grease and flanged nut –XXX = Proprietary suffix assigned to a specific customer application. The identifier can apply to either a standard or custom part.

NOTE: Dashes must be included in Part Number (–) as shown above. For assistance call our Engineering Team at 203 756 7441.

Hybrids: **Wiring**



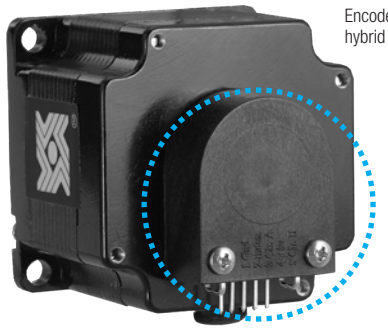
Hybrids: **Stepping Sequence**

Bipolar	Q2-Q3	Q1-Q4	Q6-Q7	Q5-Q8
Step				
1	ON	OFF	ON	OFF
2	OFF	ON	ON	OFF
3	OFF	ON	OFF	ON
4	ON	OFF	OFF	ON
1	ON	OFF	ON	OFF

EXTEND CW ↓ ↑ RETRACT CCW

Note: Half stepping is accomplished by inserting an off state between transitioning phases.

Encoders Designed for All Sizes of Hybrid Linear Actuators

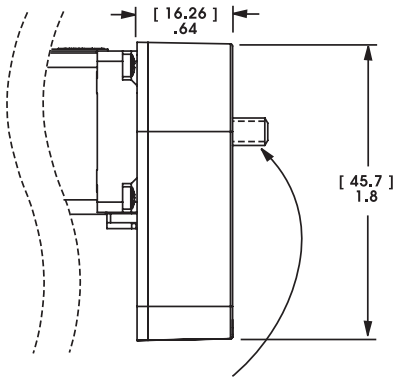


Encoder on Size 23 hybrid motor

All Haydon Hybrid Linear Actuators are available with specifically designed encoders for applications that require feedback. The compact optical incremental encoder design is available with two channel quadrature TTL squarewave outputs. An optional index is also available as a 3rd channel. The Size 17 Encoder provides resolutions for applications that require 200, 400 and 1,000 counts per revolution. Encoders are available for all motor configurations.

Simplicity and low cost make the encoders ideal for both high and low volume motion control applications. The internal monolithic electronic module converts the real-time shaft angle, speed, and direction into TTL compatible outputs. The encoder module incorporates a lensed LED light source and monolithic photodetector array with signal shaping electronics to produce the two channel bounceless TTL outputs.

30 mm 43000 Series Size 17



NOTE: Lead Screw extends beyond encoder on specific captive and non-captive motors. External linear shaft extension is available upon request.

Electrical Specifications				
	Minimum	Typical	Maximum	Units
Input Voltage	4.5	5.0	5.5	VDC
Output Signals	4.5	5.0	5.5	VDC

2 channel quadrature TTL squarewave outputs.
Channel B leads A for a clockwise rotation of the rotor viewed from the encoder cover.
Tracks at speeds of 0 to 100,000 cycles/sec.
Optional index available as a 3rd channel (one pulse per revolution).

Operating Temperature		
	Minimum	Maximum
Size 17	- 40°C (- 40°F)	100°C (212°F)

Differential Ended Encoder - Pinout - Size 17	
Connector Pin #	Description
1	Ground
2	Ground
3	– Index
4	+ Index
5	Channel A –
6	Channel A +
7	+5 VDC Power
8	+5 VDC Power
9	Channel B –
10	Channel B +

Mechanical Specifications	
	Maximum
Acceleration	250,000 rad/sec2
Vibration (5 Hz to 2 kHz)	20 g

Resolution				
4 Standard Cycles Per Revolution (CPR) or Pulses Per Revolution (PPR)				
Size 17	CPR	200	400	1000*
	PPR	800	1600	4000*

*Index Pulse Channel not available.

Single Ended Encoder - Pinout - Size 17			
Connector Pin #	Description	Connector Pin #	Description
1	Ground	4	+5 VDC Power
2	Index (optional)	5	Channel B
3	Channel A		

Integrated Connectors

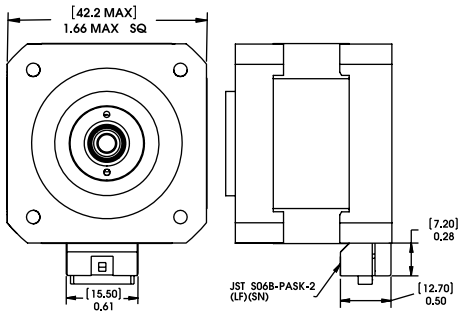
Hybrid Size 17 linear actuators are available with an integrated connector. Offered alone or with a harness assembly, this connector is RoHS compliant and features a positive latch in order for high connection integrity. The connector is rated up to 3 amps and the mating connector will handle a range of wire gauges from 22 to 28. This motor is ideal for those that want to plug in directly to pre-existing harnesses.

Motor Connector:
JST part # S06B-PASK-2

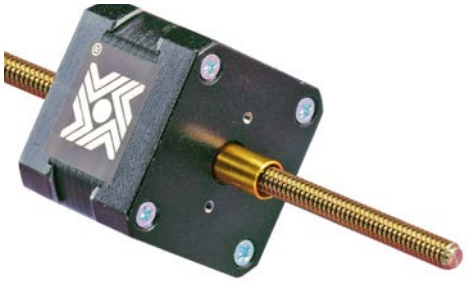
Mating Connector:
JST part # PAP-06V-S
Haydon Kerk Part #56-1210-5 (12 in. Leads)

Wire to Board Connector:
JST part number SPHD-001T-P0.5

Pin #	Bipolar	Unipolar	Color
1	Phase 2 Start	Phase 2 Start	G/W
2	Open	Phase 2 Common	–
3	Phase 2 Finish	Phase 2 Finish	Green
4	Phase 1 Finish	Phase 1 Finish	R/W
5	Open	Phase 1 Common	–
6	Phase 1 Start	Phase 1 Start	Red



Encoder Ready Option Shown 34000 Series Size 17



Extended Rotor Journal Shown 34000 Series Size 17

End of Stroke Proximity Sensor

TFE Coated Lead Screw

Integrated Anti-Backlash Nut

Encoder Ready Option for all Hybrid Sizes

Our Hybrid Linear Actuators can now be manufactured as an Encoder Ready Actuator. Encoder Ready Actuators can be used to install several popular hollow shaft encoders. Available with an extended rotor journal and a threaded rear housing. The motor uses a proprietary manufacturing process which incorporates engineering thermoplastics in the rotor drive nut and a stainless steel Acme Lead Screw that allows the motor to be much more efficient and durable than today's more commonly used V-thread bronze nut configurations.

Size 23 Mounting Face Plate for Size 17 Hybrids

Size 23 mounting pattern for our Hybrid Size 17 Linear Actuators.

Extended Rotor Journal for all Hybrid Sizes

Available with an extended rotor journal. The extended rotor journal can be used for encoder installation, manual adjustment, or flag installation for a positioning sensor.

Home Position Switch for Hybrids

A miniature electronic Home Position Switch capable of monitoring the home positions of linear actuators. The switch mounts on the rear sleeve of captive linear motors and allows the user to identify start, stop or home positions.

When ordering motors with the home position switch the part number should be preceded by an "S" prefix.

End of Stroke Proximity Sensor for all Hybrid Sized

The Sensor incorporates a hall effect device, which is activated by a rare earth magnet embedded in the end of the internal screw. The compact profile of the sensor allows for installation in limited space applications. The sensor has a virtually unlimited cycle life. Special cabling and connectors can also be provided.

When ordering motors with the proximity sensor, the part number should be preceded by a "P" prefix.

Black Ice® and Kerkote® TFE Coated Lead Screws*

TFE Coated Lead Screws for applications that require a *greaseless* screw and nut interface.

A *dry* (non-lubricated) TFE coated lead screw provides improved performance in both life and thrust as compared to a conventional stainless steel lead-screw. TFE can be applied to a wide variety of lead-screw pitches and is available for our brand captive, non-captive and external linear actuators. Not available for 0.00006-in (.0015 mm) and 0.000098-in (.0025 mm) resolutions.

*Certain conditions apply.

Integrated Anti-Backlash Nut for Hybrids*

Most sizes (except Size 34) of our captive and non-captive hybrid stepper motors can be equipped with an integral anti-backlash feature. There is a normal backlash between the lead screw and integral rotor nut.

Our actuators are designed for millions of cycles. However over time, additional backlash could increase and eventually double. Haydon Kerk Integrated Anti-Backlash Nut can eliminate all backlash. Designed specifically for our captive and non-captive hybrid motors, nuts use an opposing spring force to eliminate backlash between the screw and the nut interface. The nuts will self-compensate and accommodate any wear. Haydon Kerk Motion Solutions application engineers can help you select the appropriate preload for your application.

*Except Size 34.

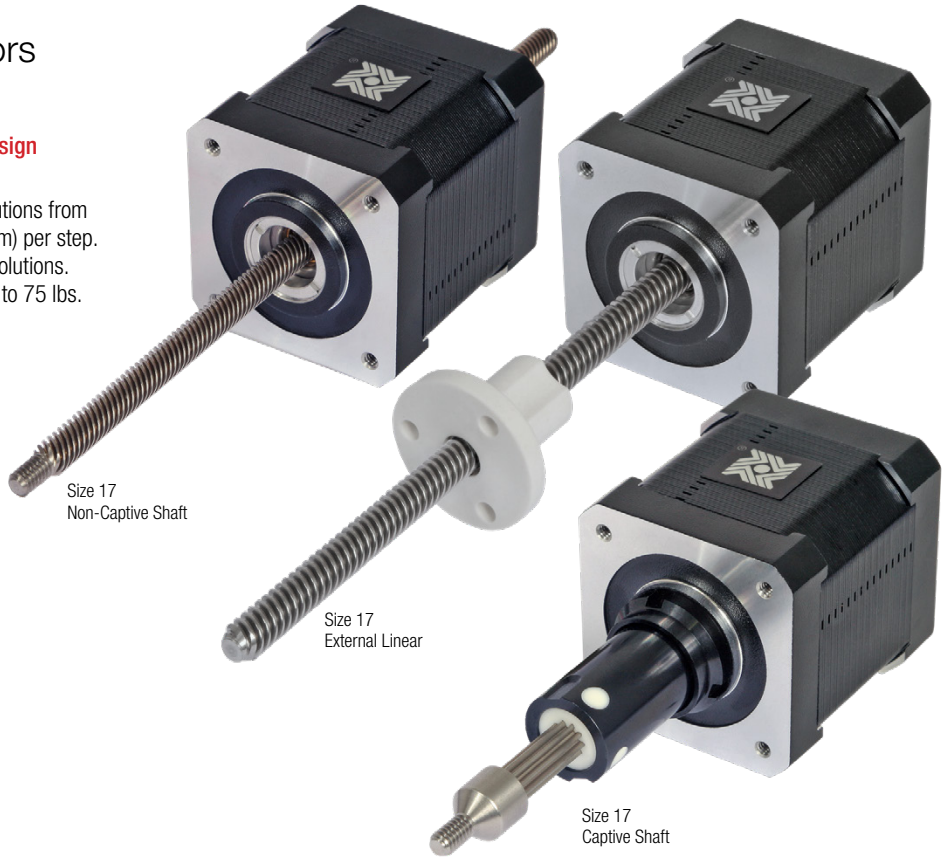
43000 Series Double Stack Size 17 Hybrid Linear Actuators

Exceptional performance and new linear motion design opportunities

The 43000 Series is available in a wide variety of resolutions from 0.000625-in (.0158 mm) per step to 0.005-in (.127 mm) per step. The motors can also be microstepped for even finer resolutions. The Size 17 Double Stack actuator delivers thrust of up to 75 lbs. (337 N).

3 Available Designs

– Captive
– Non-Captive
– External Linear



Size 17 Double Stack: 43 mm (1.7-in) Hybrid Linear Actuator (1.8° Step Angle)				
Part No.	Captive	43M4 ☐ – ☐☐ – ☐☐☐ †		
	Non-Captive	43L4 ☐ – ☐☐ – ☐☐☐ †		
	External Linear	E43M4 ☐ – ☐☐ – ☐☐☐ †		
Wiring		Bipolar		
Winding Voltage		2.33 VDC	5 VDC	12 VDC
Current (RMS)/phase		2.6 A	1.3 A	550 mA
Resistance/phase		0.9 Ω	3.8 Ω	21.9 Ω
Inductance/phase		1.33 mH	8.21 mH	45.1 mH
Power Consumption		13.2 W		
Rotor Inertia		78 gcm^2		
Insulation Class		Class B (Class F available)		
Weight		12.5 oz (352 g)		
Insulation Resistance		20 MΩ		

†Part numbering information on page 6.

Linear Travel / Step Screw Ø.1875"(4.76mm)		Order Code I.D.
inches	mm	
.000625	.0158*	B
.00125	.0317*	C
.0025	.0635	Y
.00375	.0953	AG
.005	.127	Z

*Values truncated.

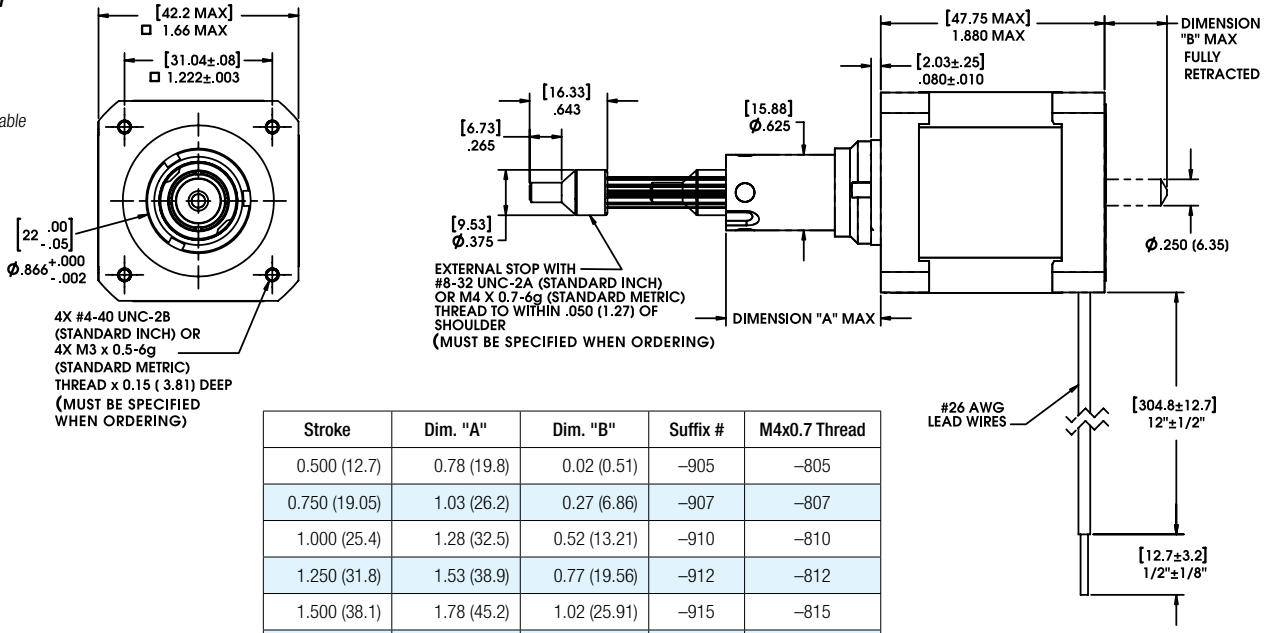
Standard motors are Class B rated for maximum temperature of 130°C.

Special drive considerations may be necessary when leaving shaft fully extended or fully retracted.

Captive Lead Screw

Dimensions = (mm) inches

Integrated connector option available



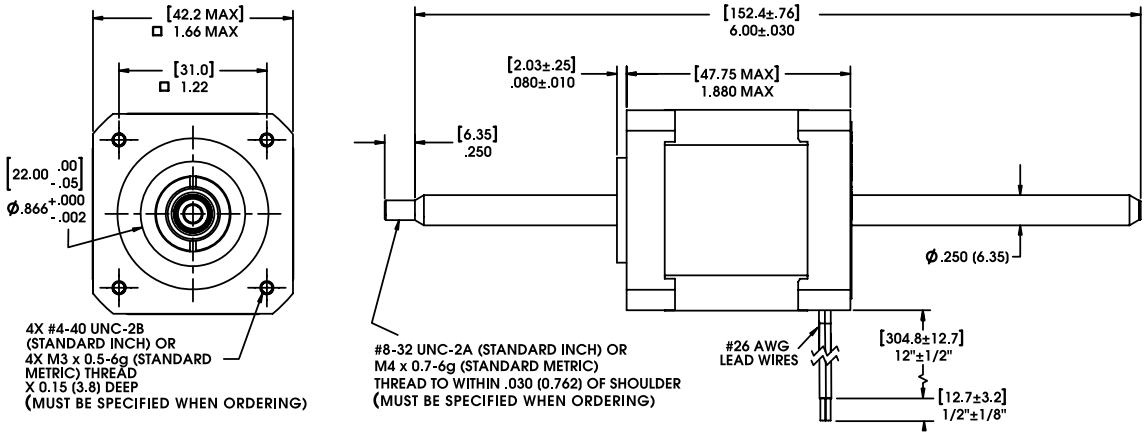
Stroke	Dim. "A"	Dim. "B"	Suffix #	M4x0.7 Thread
0.500 (12.7)	0.78 (19.8)	0.02 (0.51)	–905	–805
0.750 (19.05)	1.03 (26.2)	0.27 (6.86)	–907	–807
1.000 (25.4)	1.28 (32.5)	0.52 (13.21)	–910	–810
1.250 (31.8)	1.53 (38.9)	0.77 (19.56)	–912	–812
1.500 (38.1)	1.78 (45.2)	1.02 (25.91)	–915	–815
2.00 (50.8)	2.28 (57.9)	1.52 (38.61)	–920	–820
2.500 (63.5)	2.78 (70.6)	2.02 (51.31)	–925	–825

Non-Captive Lead Screw

Dimensions = (mm) inches

Integrated connector option available

4-in [101.6 mm]
standard screw lengths.
Longer screw lengths are available.

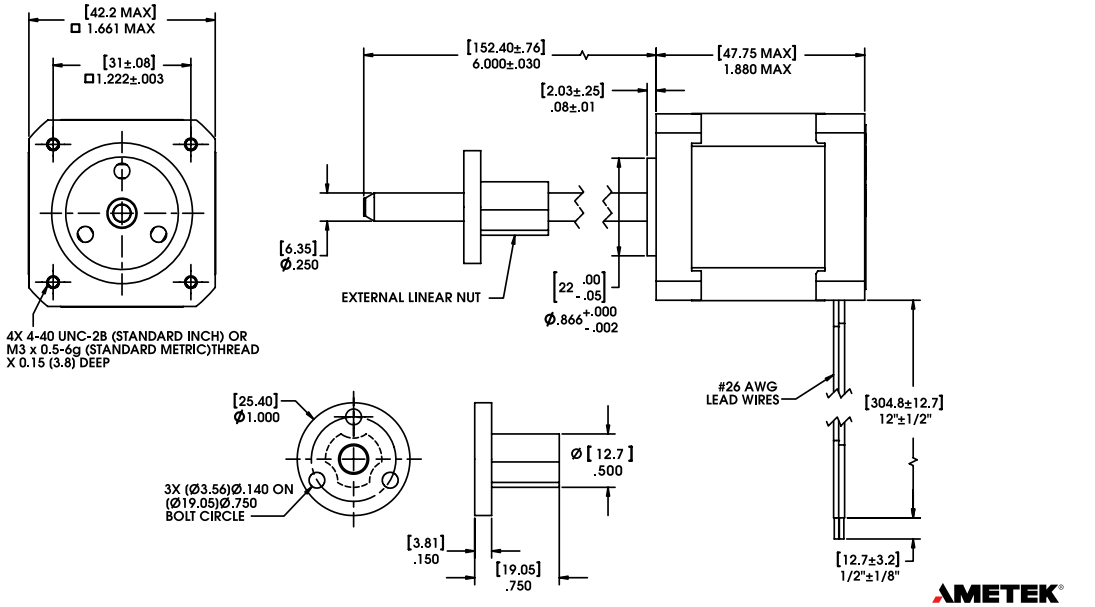


External Linear

Dimensions = (mm) inches

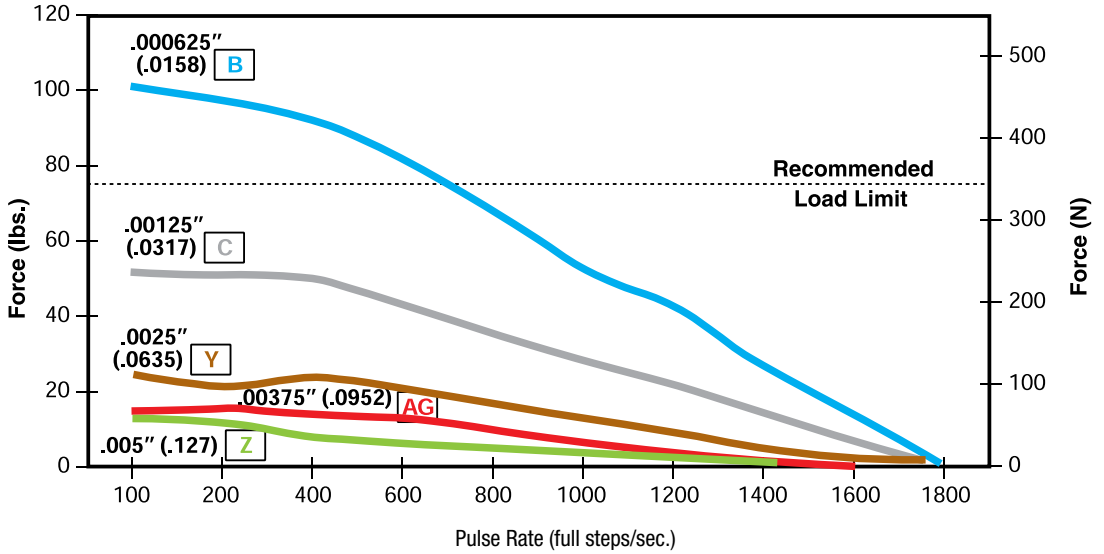
Integrated connector option available

4-in [101.6 mm]
standard screw lengths.
Longer screw lengths are available.



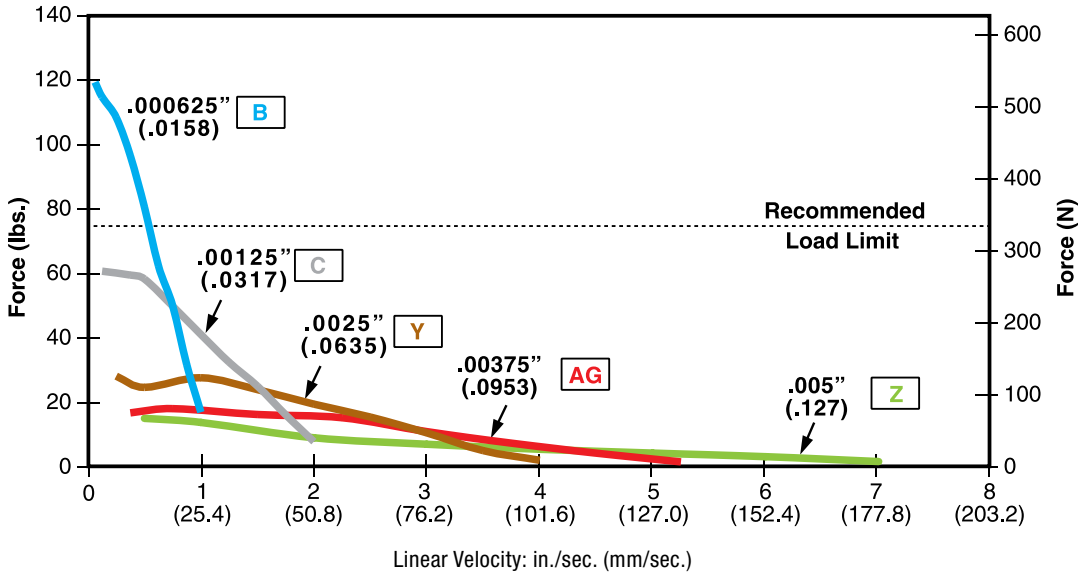
FORCE vs. PULSE RATE – Chopper – Bipolar – 100% Duty Cycle – 8:1 Motor Coil to Drive Supply Voltage

– Ø .250 (6.35) Lead Screw



FORCE vs. LINEAR VELOCITY – Chopper – Bipolar – 100% Duty Cycle – 8:1 Motor Coil to Drive Supply Voltage

– Ø .250 (6.35) Lead Screw



NOTE: All chopper drive curves were created with a 5 volt motor and a 40 volt power supply.

Ramping can increase the performance of a motor either by increasing the top speed or getting a heavier load accelerated up to speed faster. Also, deceleration can be used to stop the motor without overshoot.

With L/R drives peak force and speeds are reduced, using a unipolar drive will yield a further 30% force reduction.

43000 Series Size 17 Double Stack Hybrid Linear Actuators with integrated IDEA™ Drive

High performance in a compact package

The 43000 Series Double Stack actuator is available in a wide variety of resolutions – from 0.000625-in (.0158 mm) per step to 0.005-in (.127 mm) per step. Delivers output force of up to 75 lbs (337N).

43000 Series with IDEA™ Drive features:

– Fully Programmable
– RoHS Compliant
– USB or RS-485 Communication
– Microstepping Capability: Full, 1/2, 1/4, 1/8, 1/16, 1/32, 1/64
– Graphic User Interface
– Auto-population of Drive Parameters
– Programmable Acceleration/Deceleration and Current Control

3 Available Designs

– Captive – Non-Captive – External Linear

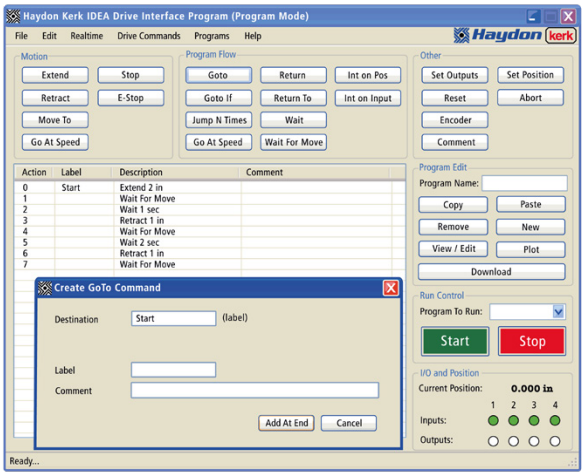
Size 17 Double Stack: 43 mm (1.7-in) Hybrid Linear Actuator (1.8° Step Angle)		
Part No.	Captive	43MG ☐ – ☐☐ – ☐☐☐ †
	Non-Captive	43LG ☐ – ☐☐ – ☐☐☐ †
	External Linear	E43MG ☐ – ☐☐ – ☐☐☐ †
Wiring		Bipolar
Winding Voltage		2.33 VDC**

†Part numbering information on page 7. **Contact Haydon Kerk if a higher voltage motor is desired. Special drive considerations may be necessary when leaving shaft fully extended or fully retracted.

Linear Travel / Step Screw Ø .250" (6.35 mm)		Order Code I.D.
inches	mm	
.000625	.0158*	B
.00125	.0317*	C
.0025	.0635*	Y
.00375	.0953*	AG
.005	.127*	Z

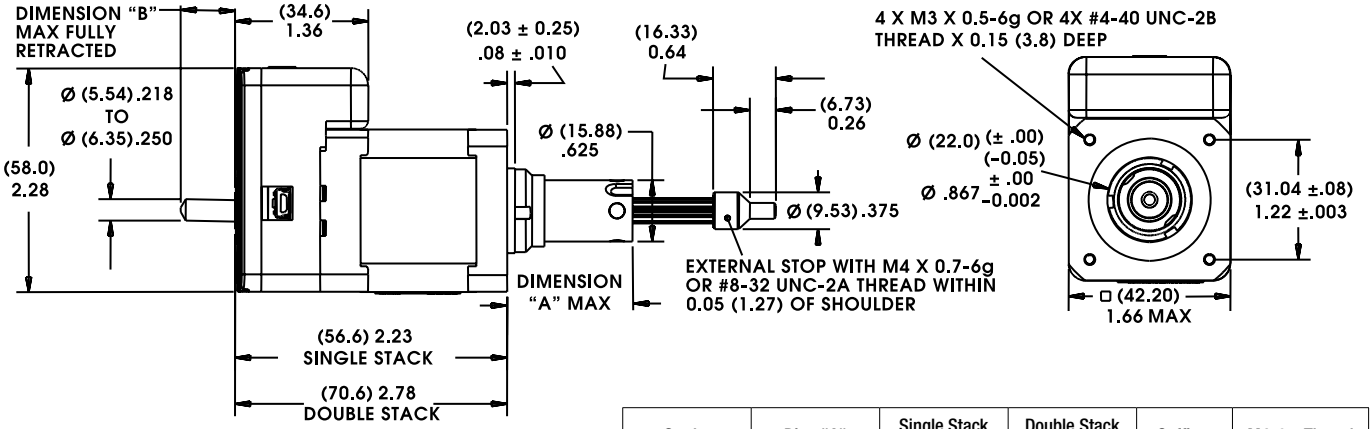
Simple to use IDEA™ Drive software with on-screen buttons and easy-to-understand programming guides

Software program generates motion profiles directly into the system and also contains a "debug" utility allowing line-by-line execution of a motion program for easy troubleshooting.



Captive Lead Screw

Dimensions = (mm) inches

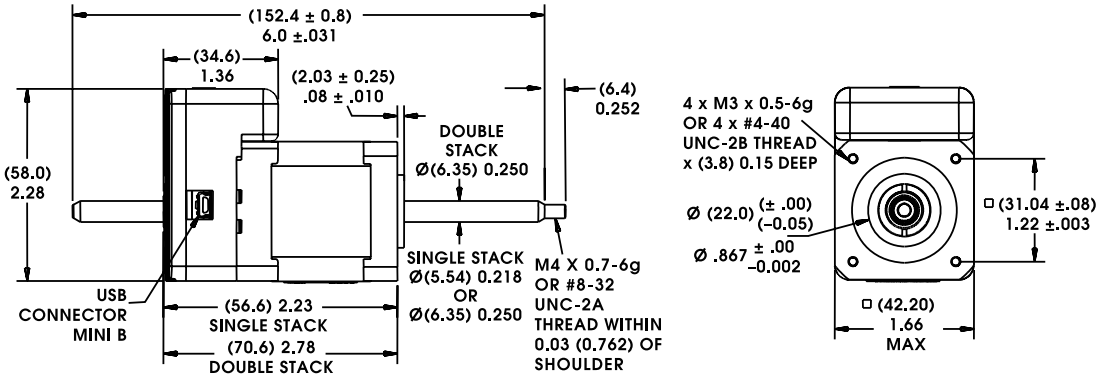


Stroke	Dim. "A"	Single Stack Dim. "B"	Double Stack Dim. "B"	Suffix #	M4x0.7 Thread
0.500 (12.7)	0.78 (19.8)	0	0	–905	–805
0.750 (19.05)	1.03 (26.2)	0	0	–907	–807
1.000 (25.4)	1.28 (32.5)	0	0	–910	–810
1.250 (31.8)	1.53 (38.9)	0	0	–912	–812
1.500 (38.1)	1.78 (45.2)	0.232 (5.9)	0.091 (2.5)	–915	–815
2.00 (50.8)	2.28 (57.9)	0.732 (18.6)	0.591 (15.0)	–920	–820
2.500 (63.5)	2.78 (70.6)	1.232 (31.3)	1.091 (27.7)	–925	–825

Non-Captive Lead Screw

Dimensions = (mm) inches

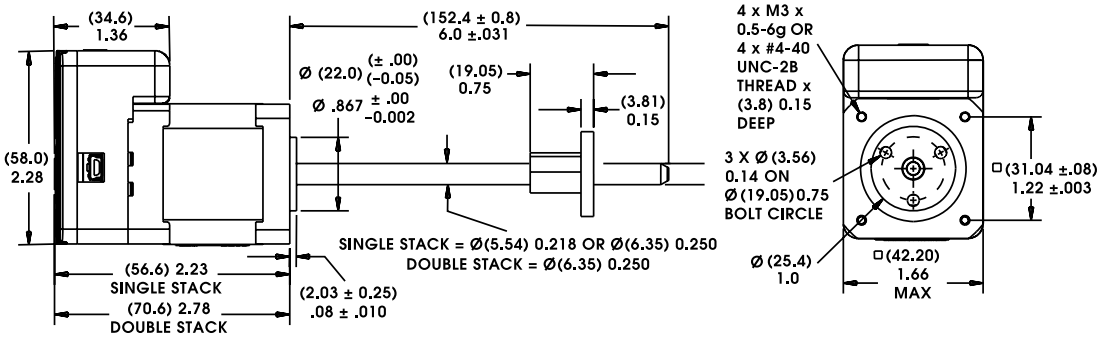
Up to 10-in (254 mm) standard screw lengths. Longer screw lengths are available.



External Linear

Dimensions = (mm) inches

Up to 10-in (254 mm) standard screw lengths. Longer screw lengths are available.

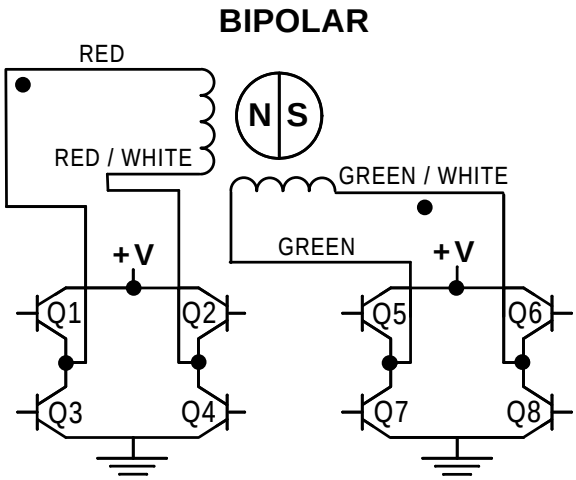


Identifying the Hybrid Part Number Codes when Ordering

E	43	M	G	C	—	2.33	—	910
Prefix (include only when using the following) **A =** A Coil (See AC Synchronous Data Sheet) **E** = External **K** = External with 40° thread form **P** = Proximity Sensor **S** = Home Position Switch	**Series Number Designation** **43 = 43000** (Series numbers represent approximate width of motor body)	**Style** **L** = 1.8° Non-captive **M** = 1.8° Captive or External (use "E" or "K" Prefix for External version)	**Coils** **4** = Bipolar (4 wire) **G** = IDEA Drive (Size 17, 43000 Series, Bipolar only)	**Code ID Resolution Travel/Step** **B** = .000625-in (.0158) **C** = .00125-in (.0317) **Y** = .0025-in (.0635) **AG** = .00375-in (.0953) **Z** = .005-in (.127)		**Voltage** **2.33** = 2.33 VDC **05** = 5 VDC **12** = 12 VDC Custom V available		**Suffix** **Stroke** Example: –910 = 1-in (Refer to Stroke chart on Captive motor series product page.) **Suffix also represents**: –800 = Metric –900 = External Linear with grease and flanged nut –XXX = Proprietary suffix assigned to a specific customer application. The identifier can apply to either a standard or custom part.

NOTE: Dashes must be included in Part Number (–) as shown above. For assistance call our Engineering Team at 203 756 7441.

Hybrids: **Wiring**



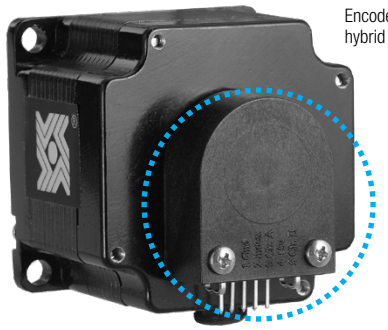
Hybrids: **Stepping Sequence**

Bipolar Step	Q2-Q3	Q1-Q4	Q6-Q7	Q5-Q8
1	ON	OFF	ON	OFF
2	OFF	ON	ON	OFF
3	OFF	ON	OFF	ON
4	ON	OFF	OFF	ON
1	ON	OFF	ON	OFF

EXTEND CW ↓ ↑ RETRACT CCW

Note: Half stepping is accomplished by inserting an off state between transitioning phases.

Encoders Designed for All Sizes of Hybrid Linear Actuators

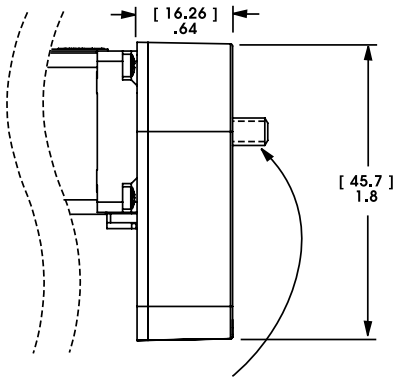


Encoder on Size 23 hybrid motor

All Haydon Hybrid Linear Actuators are available with specifically designed encoders for applications that require feedback. The compact optical incremental encoder design is available with two channel quadrature TTL squarewave outputs. An optional index is also available as a 3rd channel. The Size 17 Encoder provides resolutions for applications that require 200, 400 and 1,000 counts per revolution. Encoders are available for all motor configurations.

Simplicity and low cost make the encoders ideal for both high and low volume motion control applications. The internal monolithic electronic module converts the real-time shaft angle, speed, and direction into TTL compatible outputs. The encoder module incorporates a lensed LED light source and monolithic photodetector array with signal shaping electronics to produce the two channel bounceless TTL outputs.

30 mm 43000 Series Size 17



NOTE: Lead Screw extends beyond encoder on specific captive and non-captive motors. External linear shaft extension is available upon request.

Electrical Specifications				
	Minimum	**Typical**	**Maximum**	**Units**
Input Voltage	4.5	5.0	5.5	VDC
Output Signals	4.5	5.0	5.5	VDC

2 channel quadrature TTL squarewave outputs.
Channel B leads A for a clockwise rotation of the rotor viewed from the encoder cover.
Tracks at speeds of 0 to 100,000 cycles/sec.
Optional index available as a 3rd channel (one pulse per revolution).

Operating Temperature		
Size 17	**Minimum**	**Maximum**
	- 40°C (- 40°F)	100°C (212°F)

Mechanical Specifications	
	Maximum
Acceleration	250,000 rad/sec2
Vibration (5 Hz to 2 kHz)	20 g

Resolution				
4 Standard Cycles Per Revolution (CPR) or Pulses Per Revolution (PPR)				
Size 17	**CPR**	200	400	1000*
	PPR	800	1600	4000*

*Index Pulse Channel not available.

Differential Ended Encoder - Pinout - Size 17	
Connector Pin #	**Description**
1	Ground
2	Ground
3	– Index
4	+ Index
5	Channel A –
6	Channel A +
7	+5 VDC Power
8	+5 VDC Power
9	Channel B –
10	Channel B +

Single Ended Encoder - Pinout - Size 17			
Connector Pin #	**Description**	**Connector Pin #**	**Description**
1	Ground	**4**	+5 VDC Power
2	Index (optional)	**5**	Channel B
3	Channel A		

Integrated Connectors

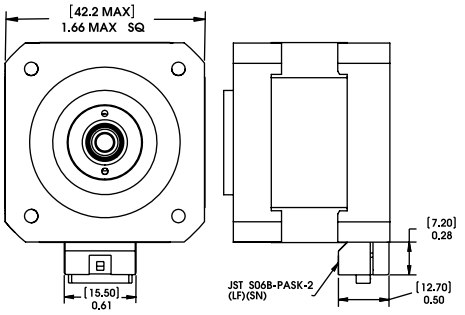
Hybrid Size 17 linear actuators are available with an integrated connector. Offered alone or with a harness assembly, this connector is RoHS compliant and features a positive latch in order for high connection integrity. The connector is rated up to 3 amps and the mating connector will handle a range of wire gauges from 22 to 28. This motor is ideal for those that want to plug in directly to pre-existing harnesses.

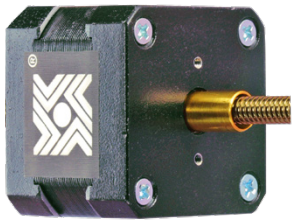
Motor Connector:
JST part # S06B-PASK-2

Mating Connector:
JST part # PAP-06V-S
Haydon Kerk Part #56-1210-5 (12 in. Leads)

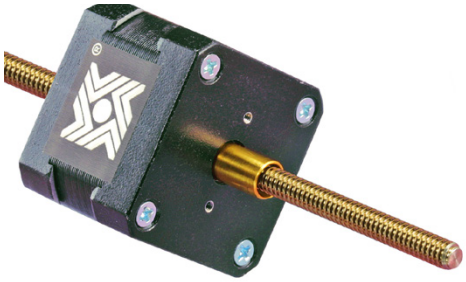
Wire to Board Connector:
JST part number SPHD-001T-P0.5

Pin #	Bipolar	Unipolar	Color
1	Phase 2 Start	Phase 2 Start	G/W
2	Open	Phase 2 Common	–
3	Phase 2 Finish	Phase 2 Finish	Green
4	Phase 1 Finish	Phase 1 Finish	R/W
5	Open	Phase 1 Common	–
6	Phase 1 Start	Phase 1 Start	Red

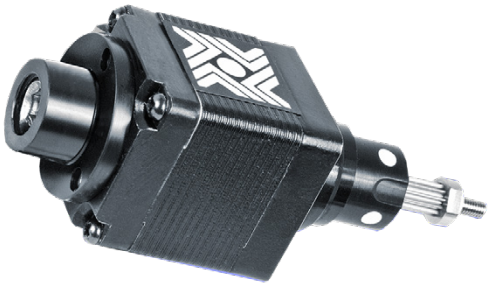




Encoder Ready Option Shown 34000 Series Size 17

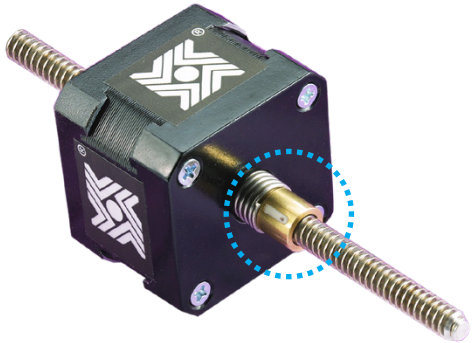


Extended Rotor Journal Shown 34000 Series Size 17



End of Stroke Proximity Sensor

TFE Coated Lead Screw



Integrated Anti-Backlash Nut

Encoder Ready Option for all Hybrid Sizes

Our Hybrid Linear Actuators can now be manufactured as an Encoder Ready Actuator. Encoder Ready Actuators can be used to install several popular hollow shaft encoders. Available with an extended rotor journal and a threaded rear housing. The motor uses a proprietary manufacturing process which incorporates engineering thermoplastics in the rotor drive nut and a stainless steel Acme Lead Screw that allows the motor to be much more efficient and durable than today's more commonly used V-thread bronze nut configurations.

Size 23 Mounting Face Plate for Size 17 Hybrids

Size 23 mounting pattern for our Hybrid Size 17 Linear Actuators.

Extended Rotor Journal for all Hybrid Sizes

Available with an extended rotor journal. The extended rotor journal can be used for encoder installation, manual adjustment, or flag installation for a positioning sensor.

Home Position Switch for Hybrids

A miniature electronic Home Position Switch capable of monitoring the home positions of linear actuators. The switch mounts on the rear sleeve of captive linear motors and allows the user to identify start, stop or home positions.

When ordering motors with the home position switch the part number should be preceded by an "S" prefix.

End of Stroke Proximity Sensor for all Hybrid Sized

The Sensor incorporates a hall effect device, which is activated by a rare earth magnet embedded in the end of the internal screw. The compact profile of the sensor allows for installation in limited space applications. The sensor has a virtually unlimited cycle life. Special cabling and connectors can also be provided.

When ordering motors with the proximity sensor, the part number should be preceded by a "P" prefix.

Black Ice® and Kerkote® TFE Coated Lead Screws*

TFE Coated Lead Screws for applications that require a *greaseless* screw and nut interface.

A *dry* (non-lubricated) TFE coated lead screw provides improved performance in both life and thrust as compared to a conventional stainless steel lead-screw. TFE can be applied to a wide variety of lead-screw pitches and is available for our brand captive, non-captive and external linear actuators. Not available for 0.00006-in (.0015 mm) and 0.000098-in (.0025 mm) resolutions.

*Certain conditions apply.

Integrated Anti-Backlash Nut for Hybrids*

Most sizes (except Size 34) of our captive and non-captive hybrid stepper motors can be equipped with an integral anti-backlash feature. There is a normal backlash between the lead screw and integral rotor nut.

Our actuators are designed for millions of cycles. However over time, additional backlash could increase and eventually double. Haydon Kerk Integrated Anti-Backlash Nut can eliminate all backlash. Designed specifically for our captive and non-captive hybrid motors, nuts use an opposing spring force to eliminate backlash between the screw and the nut interface. The nuts will self-compensate and accommodate any wear. Haydon Kerk Motion Solutions application engineers can help you select the appropriate preload for your application.

*Except Size 34.

57000 Series
Size 23 Hybrid Linear Actuators

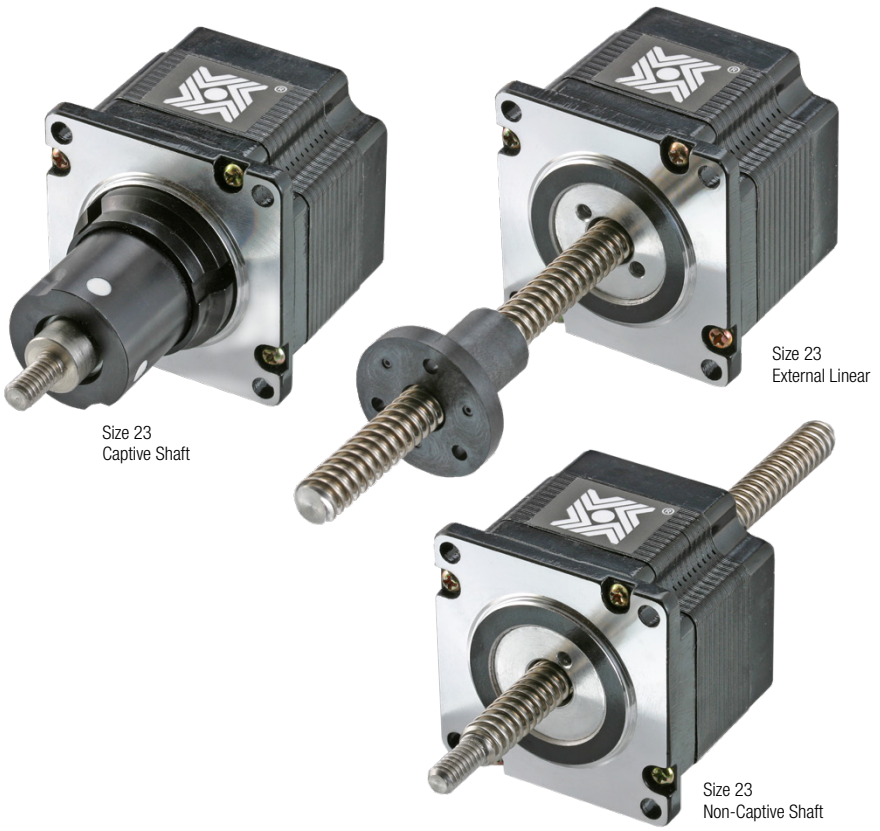
For applications that require forces up to 200 lbs. (890 N).

Size 23 incorporates the same high performance and durable design as the Size 17.

3 Available Designs

– Captive
– Non-Captive
– External Linear

The 57000 Series Hybrid Linear Actuator is available in a wide variety of resolutions, from 0.0003125-in. (.0079375 mm) per step to 0.002-in. (.0508 mm) per step. They deliver a thrust of up to 200 lbs. (890 N) or speeds exceeding 2.0-in. (5.08 cm) per second.



Size 23
Captive Shaft

Size 23
External Linear

Size 23
Non-Captive Shaft

Size 23: 57 mm (2.3-in) Hybrid Linear Actuator (1.8° Step Angle)						
Part No.	Captive	57H4 ☐ – ☐☐ – ☐☐☐ †			57H6 ☐ – ☐☐ – ☐☐☐ †	
	Non-Captive	57F4 ☐ – ☐☐ – ☐☐☐ †			57F4 ☐ – ☐☐ – ☐☐☐ †	
	External Linear	E57H4 ☐ – ☐☐ – ☐☐☐ †			E57H6 ☐ – ☐☐ – ☐☐☐ †	
Wiring		Bipolar			Unipolar**	
Winding Voltage		3.25 VDC	5 VDC	12 VDC	5 VDC	12 VDC
Current (RMS)/phase		2.0 A	1.3 A	.54 A	1.3 A	.54 A
Resistance/phase		1.63 Ω	3.85 Ω	22.2 Ω	3.85 Ω	22.2 Ω
Inductance/phase		3.5 mH	10.5 mH	58 mH	5.3 mH	23.6 mH
Power Consumption		13 W				
Rotor Inertia		166 gcm^2				
Insulation Class		Class B (Class F available)				
Weight		18 oz (511 g)				
Insulation Resistance		20 MΩ				

†Part numbering information on page 5. ** Unipolar drive gives approximately 30% less thrust than bipolar drive.

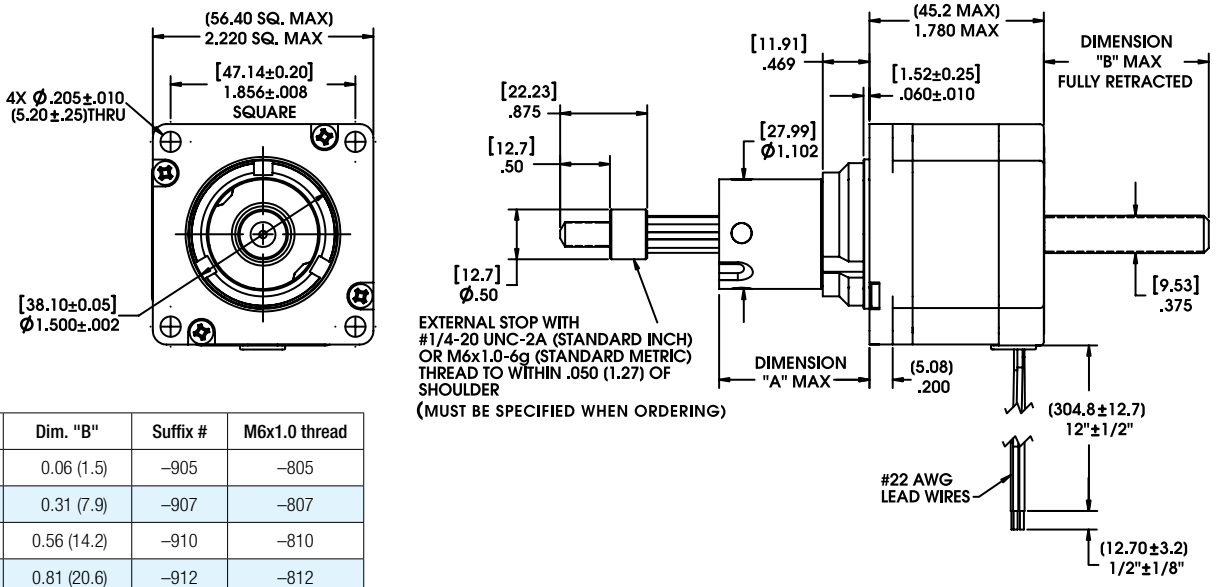
Linear Travel / Step Screw Ø .375" (9.53 mm)		Order Code I.D.
inches	mm	
.0003125	.0079*	A
.0004167	.0105*	S
.0005	.0127	3
.0008333	.0211*	T
.001	.0254	1
.002	.0508	2

*Values truncated.
Standard motors are Class B rated for maximum temperature of 130°C.

Special drive considerations may be necessary when leaving shaft fully extended or fully retracted.

Captive Lead Screw

Dimensions = (mm) inches

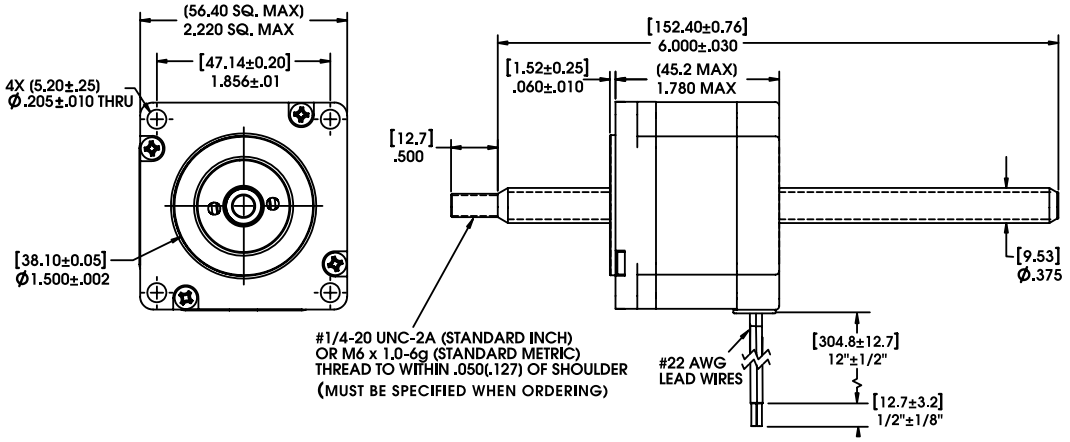


Stroke	Dim. "A"	Dim. "B"	Suffix #	M6x1.0 thread
0.500 (12.7)	1.01 (25.7)	0.06 (1.5)	–905	–805
0.750 (19.05)	1.26 (32.0)	0.31 (7.9)	–907	–807
1.000 (25.4)	1.51 (38.4)	0.56 (14.2)	–910	–810
1.250 (31.8)	1.76 (44.7)	0.81 (20.6)	–912	–812
1.500 (38.1)	2.01 (51.1)	1.06 (26.9)	–915	–815
2.00 (50.8)	2.51 (63.8)	1.56 (39.6)	–920	–820
2.500 (63.5)	3.01 (76.5)	2.06 (52.3)	–925	–825

Non-Captive Lead Screw

Dimensions = (mm) inches

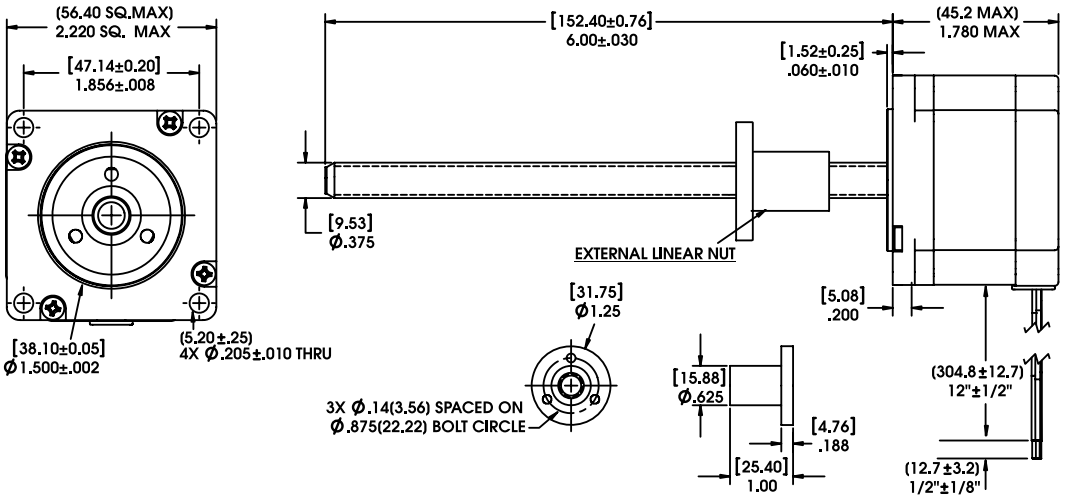
Up to 10-in (254 mm) standard screw lengths. Longer screw lengths are available.



External Linear

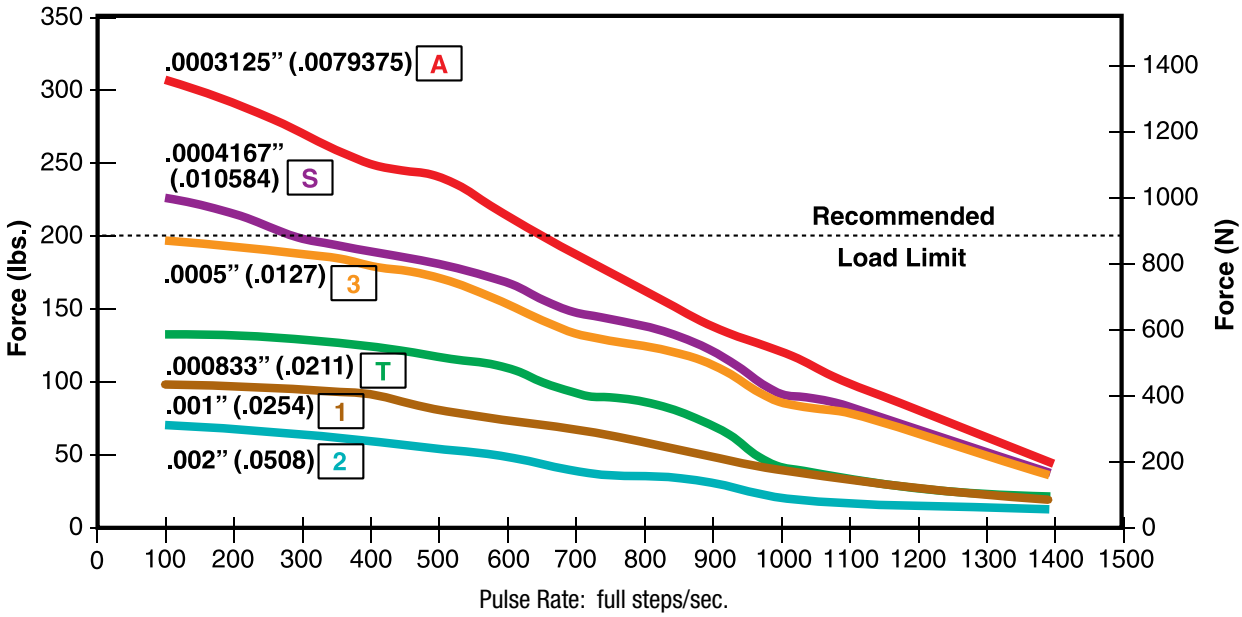
Dimensions = (mm) inches

Up to 12-in (305 mm) standard screw lengths. Longer screw lengths are available.



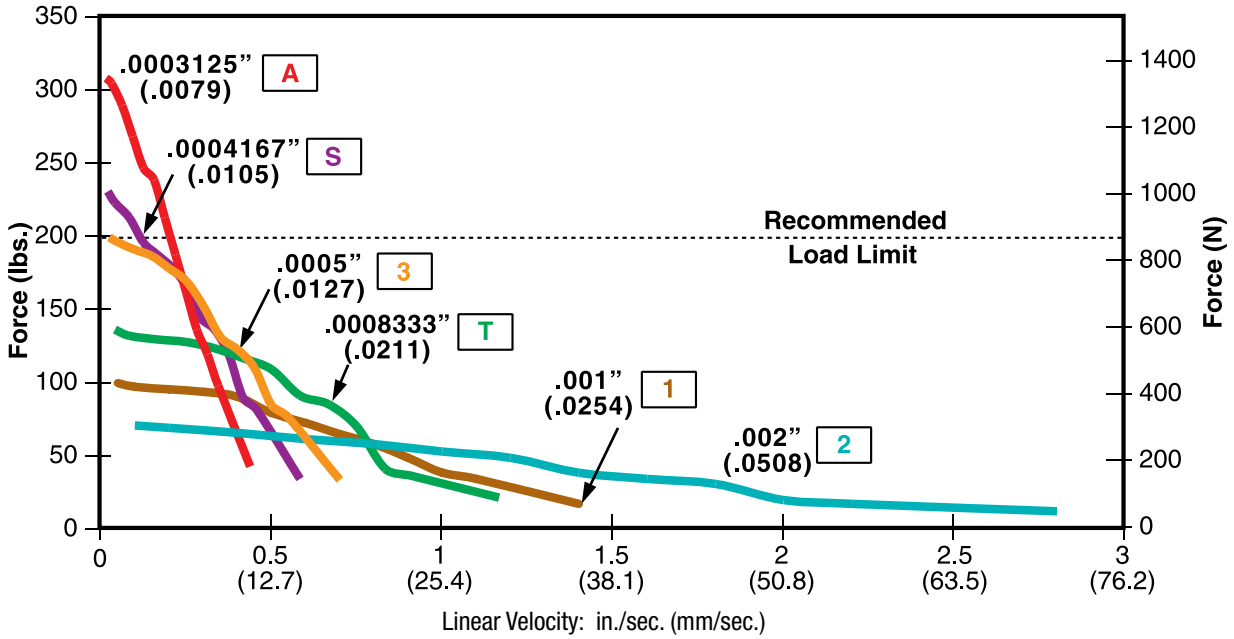
FORCE vs. PULSE RATE – Chopper – Bipolar – 100% Duty Cycle

– Ø .375 (9.53) Lead Screw



FORCE vs. LINEAR VELOCITY – Chopper – Bipolar – 100% Duty Cycle

– Ø .375 (9.53) Lead Screw



NOTE: All chopper drive curves were created with a 5 volt motor and a 75 volt power supply.

Ramping can increase the performance of a motor either by increasing the top speed or getting a heavier load accelerated up to speed faster. Also, deceleration can be used to stop the motor without overshoot.

With L/R drives peak force and speeds are reduced, using a unipolar drive will yield a further 30% force reduction.

57000 Series
Size 23, 0.9° High Resolution Motor

The Size 23, 0.9° high resolution hybrid offers precise, excellent motion control with a full linear step movement as low as 2 microns and a thrust capability up to 200 lbs (890 N).

Size 23: 57 mm (2.3-in) Hybrid Linear Actuator (0.9° Step Angle)						
Part No.	Captive	57K4 – – – †			57K6 – – – †	
	Non-Captive	57J4 – – – †			57J6 – – – †	
	External Linear	E57K4 – – – †			E57K6 – – – †	
Wiring		Bipolar			Unipolar**	
Winding Voltage		3.25 VDC	5 VDC	12 VDC	5 VDC	12 VDC
Current (RMS)/phase		2.0 A	1.3 A	0.54 A	1.3 A	0.54 A
Resistance/phase		1.63 Ω	3.85 Ω	22.2 Ω	3.85 Ω	22.2 Ω
Inductance/phase		4.2 mH	13 mH	68 mH	6 mH	27 mH
Power Consumption		13 W				
Rotor Inertia		166 gcm^2				
Insulation Class		Class B (Class F available)				
Weight		18 oz (511 g)				
Insulation Resistance		20 MΩ				

†Part numbering information on page 5. **Unipolar drive gives approximately 30% less thrust than bipolar drive.

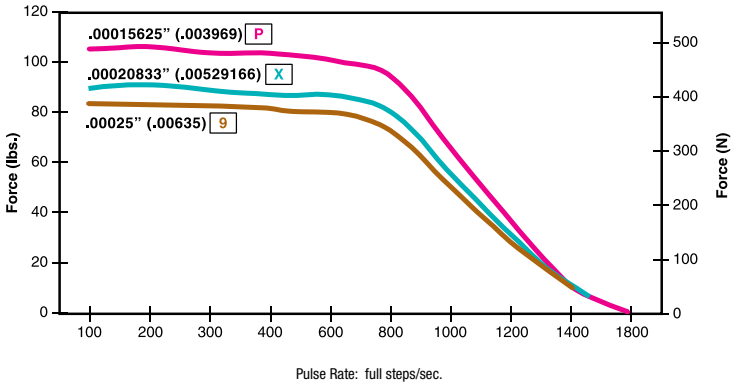
Linear Travel / Step Screw Ø .250" (6.35 mm)		Order Code I.D.
inches	mm	
.000125	.0031*	7
.00015625	.003969	P
.00020833	.00529166	X
.00025	.00635	9
.0004167	.01058418	S
.0005	.0127	3
.001	.0254	1

*Values truncated.

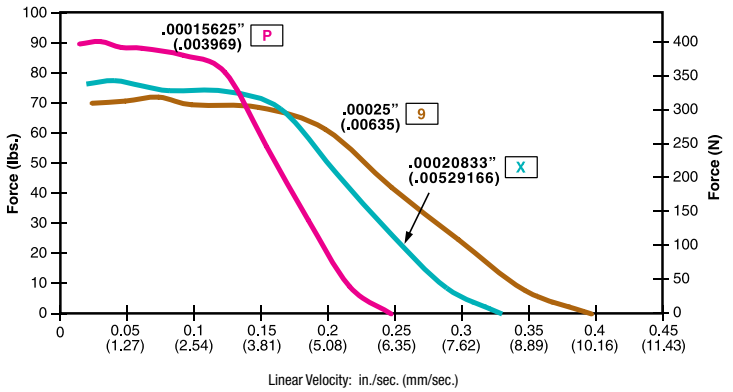
NOTE: Refer to performance curves on page 3 for codes S, 3, 1.

Special drive considerations may be necessary when leaving shaft fully extended or fully retracted.

FORCE vs. PULSE RATE – Chopper – Bipolar – 100% Duty Cycle
with two available lead screw diameters



FORCE vs. LINEAR VELOCITY – Chopper – Bipolar – 100% Duty Cycle
with two available lead screw diameters



NOTE: All chopper drive curves were created with a 5 volt motor and a 75 volt power supply.

Ramping can increase the performance of a motor either by increasing the top speed or getting a heavier load accelerated up to speed faster. Also, deceleration can be used to stop the motor without overshoot.

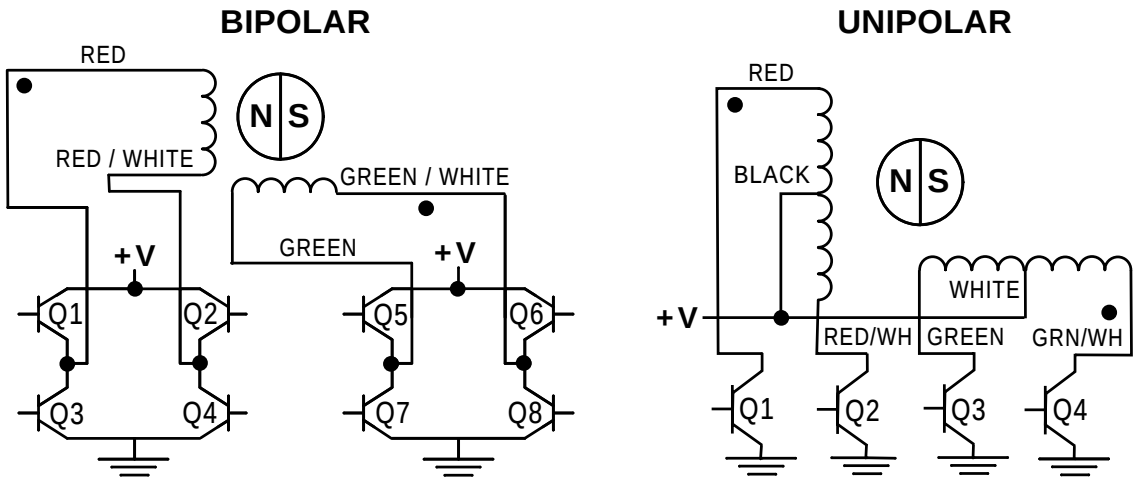
With L/R drives peak force and speeds are reduced, using a unipolar drive will yield a further 30% force reduction.

Identifying the Hybrid Part Number Codes when Ordering

E	57	H	6	7	—	3.25	—	910
Prefix (include only when using the following) **A =** A Coil (See AC Synchronous Data Sheet) **E** = External **K** = External with 40° thread form **P** = Proximity Sensor **S** = Home Position Switch	**Series Number Designation** **57 = 57000** (Series numbers represent approximate width of motor body)	**Style** **F** = 1.8° Non-captive **H** = 1.8° Captive or External (use "E" or "K" Prefix for External version) **J** = 0.9° Non-captive **K** = 0.9° Captive or External (use "E" or "K" Prefix for External version)	**Coils** **4** = Bipolar (4 wire) **6** = Unipolar (6 wire)	**Code ID Resolution Travel/Step** **7** = .000125-in (.0031) **S** = .0004167-in (.01058418) **3** = .0005-in (.0127) **1** = .001-in (.0254) **A** = .0003125-in (.0079) **T** = .0008333-in (.0211) **2** = .002-in (.0508) **High Resolution** **P** = .00015625-in (.003969) **X** = .00020833-in (.00529166) **9** = .00025-in (.0635)		**Voltage** **3.25** = 3.25 VDC **05** = 5 VDC **12** = 12 VDC Custom V available		**Suffix** **Stroke** Example: –910 = 1-in (Refer to Stroke chart on Captive motor series product page.) **Suffix also represents**: –800 = Metric –900 = External Linear with grease and flanged nut –XXX = Proprietary suffix assigned to a specific customer application. The identifier can apply to either a standard or custom part.

NOTE: Dashes must be included in Part Number (–) as shown above. For assistance call our Engineering Team at 203 756 7441.

Hybrids: **Wiring**



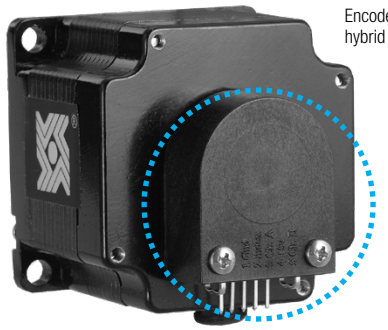
Hybrids: **Stepping Sequence**

Bipolar	Q2-Q3	Q1-Q4	Q6-Q7	Q5-Q8
Step				
1	ON	OFF	ON	OFF
2	OFF	ON	ON	OFF
3	OFF	ON	OFF	ON
4	ON	OFF	OFF	ON
1	ON	OFF	ON	OFF

EXTEND CW ↓ — RETRACT CCW ↑

Note: Half stepping is accomplished by inserting an off state between transitioning phases.

Encoders Designed for All Sizes of Hybrid Linear Actuators



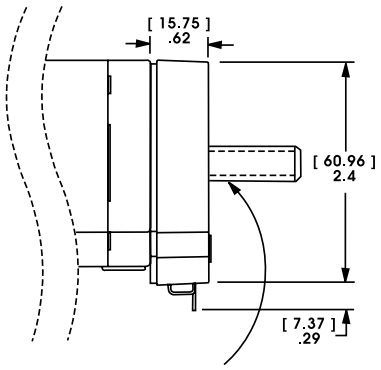
Encoder on Size 23 hybrid motor

All Haydon Hybrid Linear Actuators are available with specifically designed encoders for applications that require feedback. The compact optical incremental encoder design is available with two channel quadrature TTL squarewave outputs. An optional index is also available as a 3rd channel. The Size 23 encoder is offered in resolutions of 200, 400, 1,000 and 2,000 counts per revolution. Encoders are available for all motor configurations: captive, non-captive and external linear.

Simplicity and low cost make the encoders ideal for both high and low volume motion control applications. The internal monolithic electronic module converts the real-time shaft angle, speed, and direction into TTL compatible outputs. The encoder module incorporates a lensed LED light source and monolithic photodetector array with signal shaping electronics to produce the two channel bounceless TTL outputs.

57 mm 57000 Series Size 23

NOTE: Lead Screw extends beyond encoder on specific captive and non-captive motors. External linear shaft extension is available upon request.



Differential Ended Encoder - Pinout - Size 23	
Connector Pin #	**Description**
1	Ground
2	Ground
3	– Index
4	+ Index
5	Channel A –
6	Channel A +
7	+5 VDC Power
8	+5 VDC Power
9	Channel B –
10	Channel B +

Electrical Specifications				
	Minimum	**Typical**	**Maximum**	**Units**
Input Voltage	4.5	5.0	5.5	VDC
Output Signals	4.5	5.0	5.5	VDC

2 channel quadrature TTL squarewave outputs.
Channel B leads A for a clockwise rotation of the rotor viewed from the encoder cover.
Tracks at speeds of 0 to 100,000 cycles/sec.
Optional index available as a 3rd channel (one pulse per revolution).

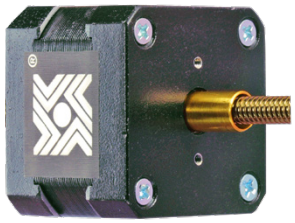
Operating Temperature		
Size 23	**Minimum**	**Maximum**
	- 40°C (- 40°F)	100°C (212°F)

Mechanical Specifications	
	Maximum
Acceleration	250,000 rad/sec2
Vibration (5 Hz to 2 kHz)	20 g

Resolution					
4 Standard Cycles Per Revolution (CPR) or Pulses Per Revolution (PPR)					
Size 23	**CPR**	200	400*	1000	2000
	PPR	800	1600*	4000	8000

*Index Pulse Channel not available.

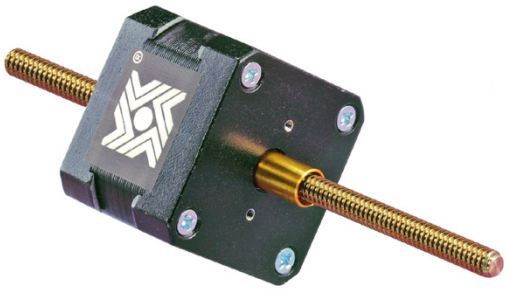
Single Ended Encoder - Pinout - Size 23			
Connector Pin #	**Description**	**Connector Pin #**	**Description**
1	Ground	**4**	+5 VDC Power
2	Index (optional)	**5**	Channel B
3	Channel A		



Encoder Ready Option Shown 34000 Series Size 17

Encoder Ready Option for all Hybrid Sizes

Our Hybrid Linear Actuators can now be manufactured as an Encoder Ready Actuator. Encoder Ready Actuators can be used to install several popular hollow shaft encoders. Available with an extended rotor journal and a threaded rear housing. The motor uses a proprietary manufacturing process which incorporates engineering thermoplastics in the rotor drive nut and a stainless steel Acme Lead Screw that allows the motor to be much more efficient and durable than today's more commonly used V-thread bronze nut configurations.



Extended Rotor Journal Shown 34000 Series Size 17

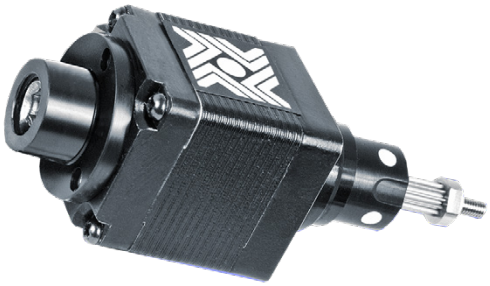
Extended Rotor Journal for all Hybrid Sizes

Available with an extended rotor journal. The extended rotor journal can be used for encoder installation, manual adjustment, or flag installation for a positioning sensor.

Home Position Switch for Hybrids

A miniature electronic Home Position Switch capable of monitoring the home positions of linear actuators. The switch mounts on the rear sleeve of captive linear motors and allows the user to identify start, stop or home positions.

When ordering motors with the home position switch the part number should be preceded by an "S" prefix.



End of Stroke Proximity Sensor

End of Stroke Proximity Sensor for all Hybrid Sized

The Sensor incorporates a hall effect device, which is activated by a rare earth magnet embedded in the end of the internal screw. The compact profile of the sensor allows for installation in limited space applications. The sensor has a virtually unlimited cycle life. Special cabling and connectors can also be provided.

When ordering motors with the proximity sensor, the part number should be preceded by a "P" prefix.

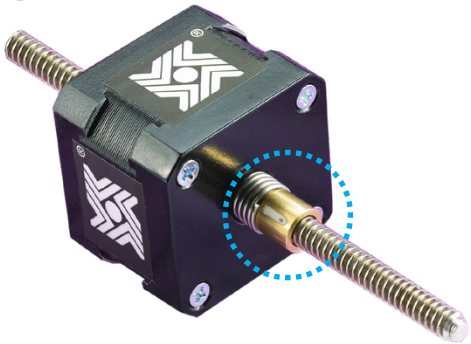
TFE Coated Lead Screw

Black Ice® and Kerkote® TFE Coated Lead Screws*

TFE Coated Lead Screws for applications that require a *greaseless* screw and nut interface.

A *dry* (non-lubricated) TFE coated lead screw provides improved performance in both life and thrust as compared to a conventional stainless steel lead-screw. TFE can be applied to a wide variety of lead-screw pitches and is available for our brand captive, non-captive and external linear actuators. Not available for 0.00006-in (.0015 mm) and 0.000098-in (.0025 mm) resolutions.

*Certain conditions apply.



Integrated Anti-Backlash Nut

Integrated Anti-Backlash Nut for Hybrids*

Most sizes (except Size 34) of our captive and non-captive hybrid stepper motors can be equipped with an integral anti-backlash feature. There is a normal backlash between the lead screw and integral rotor nut.

Our actuators are designed for millions of cycles. However over time, additional backlash could increase and eventually double. Haydon Kerk Integrated Anti-Backlash Nut can eliminate all backlash. Designed specifically for our captive and non-captive hybrid motors, nuts use an opposing spring force to eliminate backlash between the screw and the nut interface. The nuts will self-compensate and accommodate any wear. Haydon Kerk Motion Solutions application engineers can help you select the appropriate preload for your application.

*Except Size 34.

57000 Series
Size 23 Double Stack
Hybrid Linear Actuators

Greater performance in a compact size

The various patented designs deliver exceptional performance and new linear motion design opportunities. The 57000 Series is available in a wide variety of resolutions, from 0.0005-in (.0127 mm) per step to 0.005-in (.127 mm) per step. The motors can also be microstepped for even finer resolutions.

3 Available Designs

– Captive
– Non-Captive
– External Linear

The Size 23 actuator delivers thrust of up to 200 lbs. (890 N).

Size 23
Double Stack
Non-Captive Shaft

Size 23
Double Stack
External Linear

Size 23
Double Stack
Captive Shaft

Size 23 Double Stack: 57 mm (2.3-in) Hybrid Linear Actuator (1.8° Step Angle)				
Part No.	Captive	57M4 □ – □ □ – □ □ □ †		
	Non-Captive	57L4 □ – □ □ – □ □ □ †		
	External Linear	E57M4 □ – □ □ – □ □ □ †		
Wiring		Bipolar		
Winding Voltage		3.25 VDC	5 VDC	12 VDC
Current (RMS)/phase		3.85 A	2.5 A	1 A
Resistance/phase		0.98 Ω	2.0 Ω	12.0 Ω
Inductance/phase		2.3 mH	7.6 mH	35.0 mH
Power Consumption		25 W Total		
Rotor Inertia		321 gcm^2		
Insulation Class		Class B (Class F available)		
Weight		32 oz (958 g)		
Insulation Resistance		20 MΩ		

†Part numbering information on page 4.

Linear Travel / Step Screw Ø.375" (9.53 mm)		Order Code I.D.
inches	mm	
.0005	.0127*	3
.001	.0254*	1
.002	.0508	2
.0025	.0635	Y
.005	.127	Z

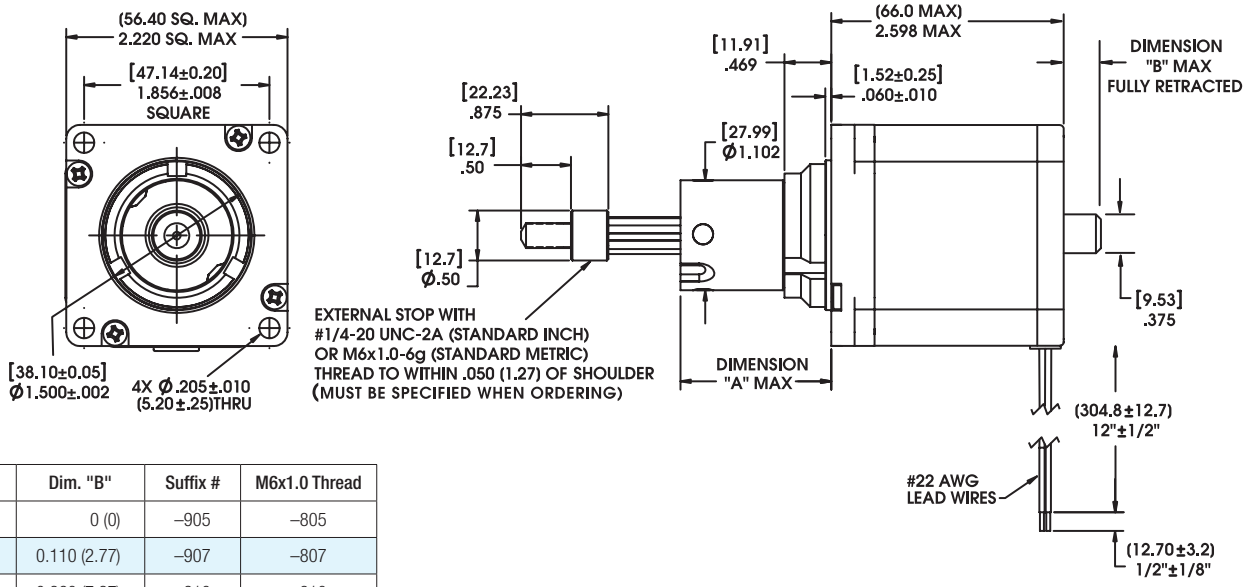
*Values truncated.

Standard motors are Class B rated for maximum temperature of 130°C.

Special drive considerations may be necessary when leaving shaft fully extended or fully retracted.

Captive Lead Screw

Dimensions = (mm) inches

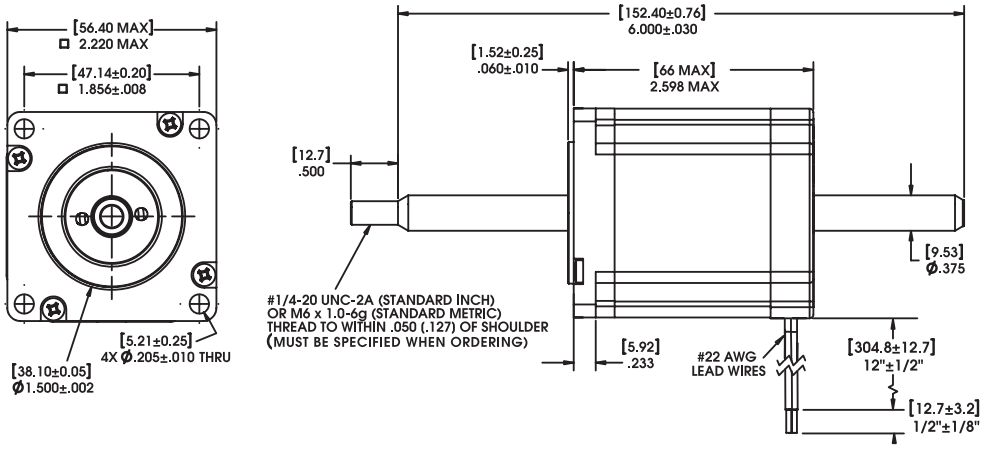


Stroke	Dim. "A"	Dim. "B"	Suffix #	M6x1.0 Thread
0.500 (12.7)	1.01 (25.7)	0 (0)	–905	–805
0.750 (19.05)	1.26 (32.0)	0.110 (2.77)	–907	–807
1.000 (25.4)	1.51 (38.4)	0.360 (7.37)	–910	–810
1.250 (31.8)	1.76 (44.7)	0.610 (15.47)	–912	–812
1.500 (38.1)	2.01 (51.1)	0.860 (21.83)	–915	–815
2.00 (50.8)	2.51 (63.8)	1.360 (34.52)	–920	–820
2.500 (63.5)	3.01 (76.5)	1.860 (47.22)	–925	–825

Non-Captive Lead Screw

Dimensions = (mm) inches

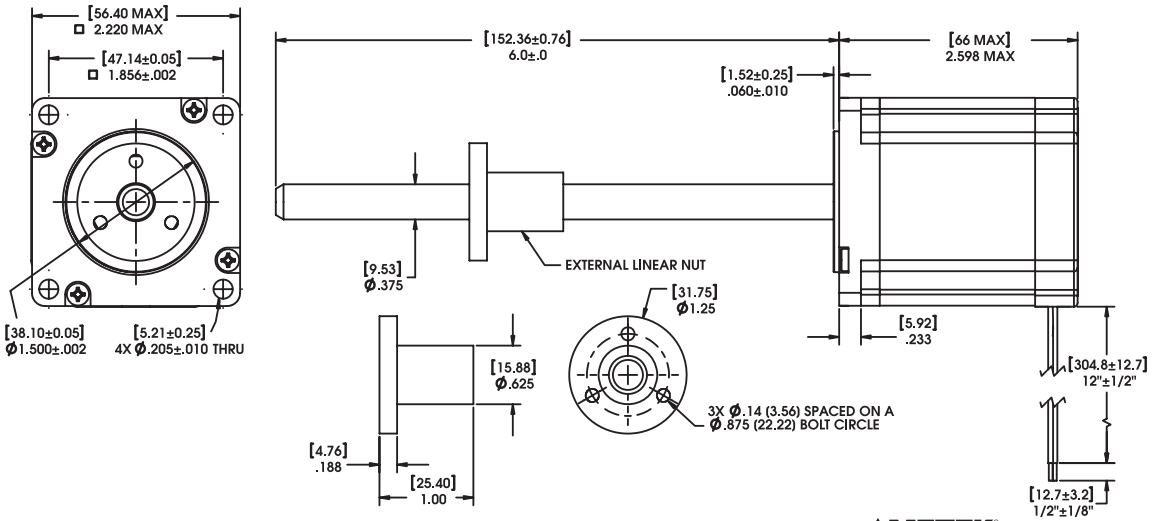
Up to 18-in (457 mm) standard screw lengths. Longer screw lengths are available.



External Linear

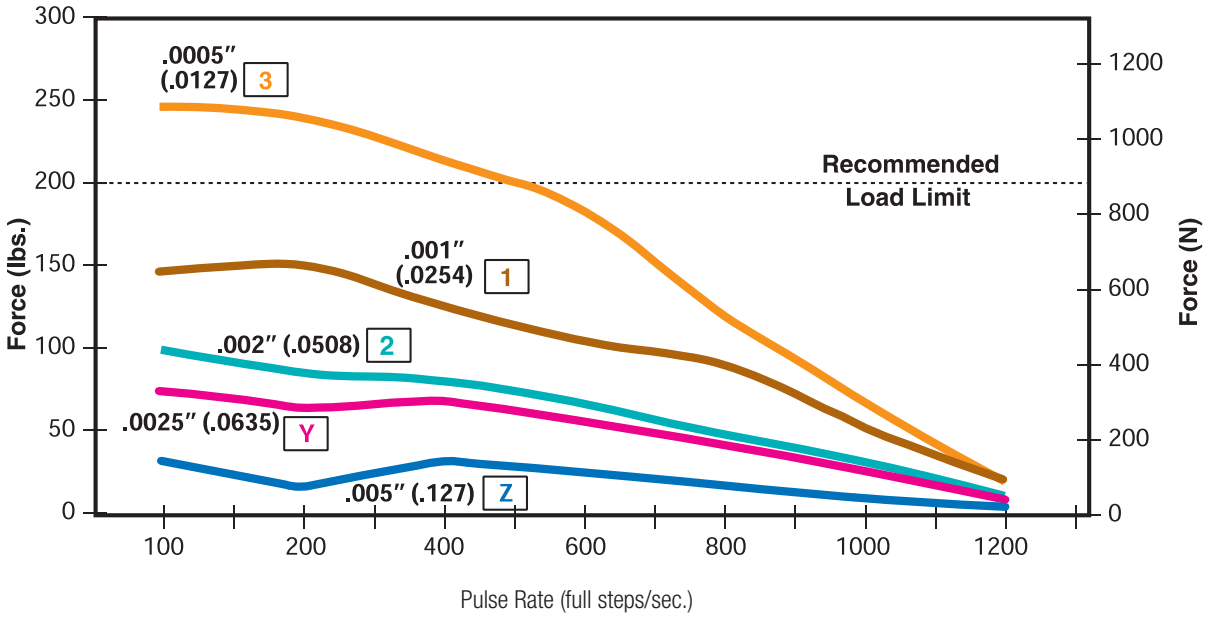
Dimensions = (mm) inches

Up to 12-in (305 mm) standard screw lengths. Longer screw lengths are available.



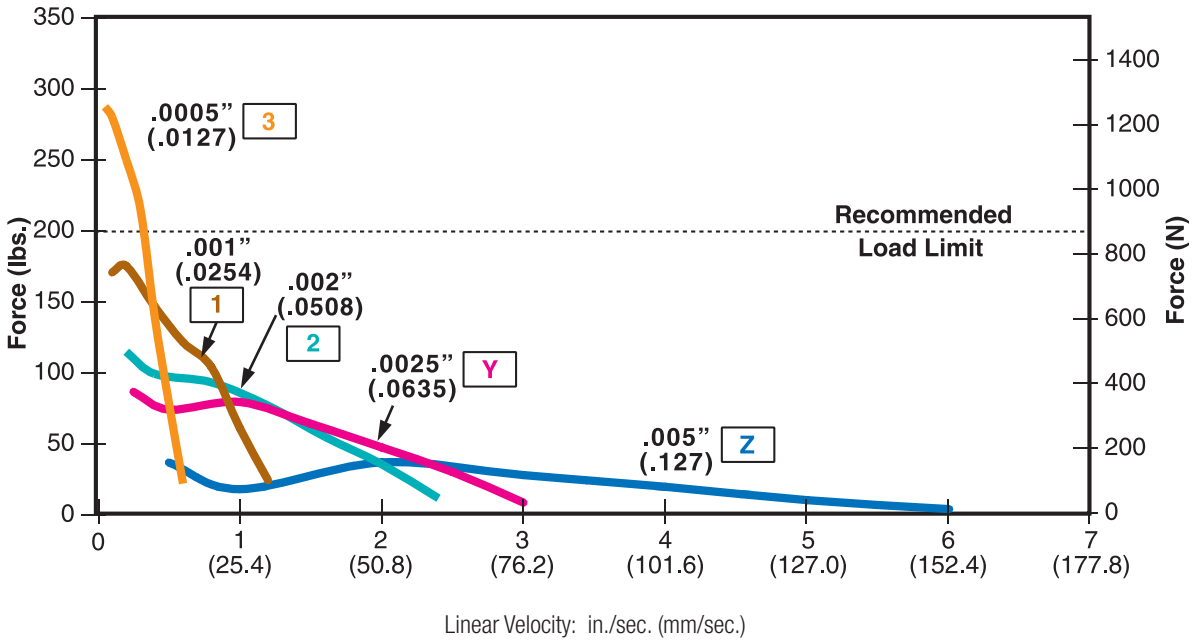
FORCE vs. PULSE RATE

– Chopper
– Bipolar
– 100% Duty Cycle
– Ø .375 (9.53) Lead Screw



FORCE vs. LINEAR VELOCITY

– Chopper
– Bipolar
– 100% Duty Cycle
– Ø .375 (9.53) Lead Screw



NOTE: All chopper drive curves were created with a 5 volt motor and a 75 volt power supply.

Ramping can increase the performance of a motor either by increasing the top speed or getting a heavier load accelerated up to speed faster. Also, deceleration can be used to stop the motor without overshoot.

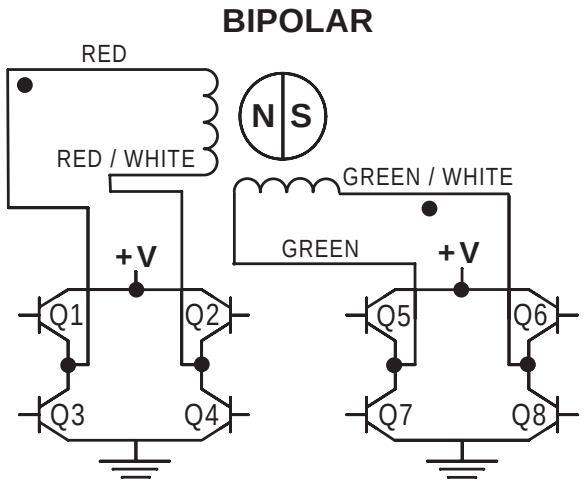
With L/R drives peak force and speeds are reduced, using a unipolar drive will yield a further 30% force reduction.

Identifying the Hybrid Part Number Codes when Ordering

E	57	M	4	3	—	3.25	—	910
Prefix (include only when using the following) **A =** A Coil (See AC Synchronous Data Sheet) **E** = External **K** = External with 40° thread form **P** = Proximity Sensor **S** = Home Position Switch	**Series Number Designation** **57 = 57000** (Series numbers represent approximate width of motor body)	**Style** **L** = 1.8° Non-captive **M** = 1.8°Captive or External (use "E" or "K" Prefix for External version)	**Coils** **4** = Bipolar (4 wire)	**Code ID Resolution Travel/Step** **3** = .0005-in (.0127) **1** = .001-in (.0254) **2** = .002-in (.0508) **Y** = .0025-in (.0635) **Z** = .005-in (.127)		**Voltage** **3.25** = 3.25 VDC **05** = 5 VDC **12** = 12 VDC Custom V available		**Suffix** **Stroke** Example: –910 = 1-in (Refer to Stroke chart on Captive motor series product page.) **Suffix also represents**: –800 = Metric –900 = External Linear with grease and flanged nut –XXX = Proprietary suffix assigned to a specific customer application. The identifier can apply to either a standard or custom part.

NOTE: Dashes must be included in Part Number (–) as shown above. For assistance call our Engineering Team at 203 756 7441.

Hybrids: **Wiring**



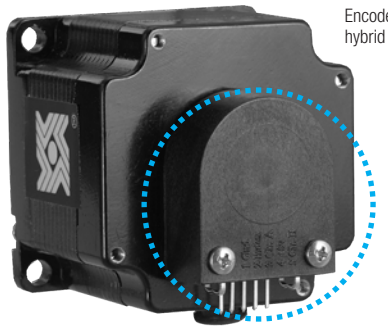
Hybrids: **Stepping Sequence**

Bipolar	Q2-Q3	Q1-Q4	Q6-Q7	Q5-Q8
Step				
1	ON	OFF	ON	OFF
2	OFF	ON	ON	OFF
3	OFF	ON	OFF	ON
4	ON	OFF	OFF	ON
1	ON	OFF	ON	OFF

EXTEND CW ↓ — RETRACT CCW ↑

Note: Half stepping is accomplished by inserting an off state between transitioning phases.

Encoders Designed for All Sizes of Hybrid Linear Actuators



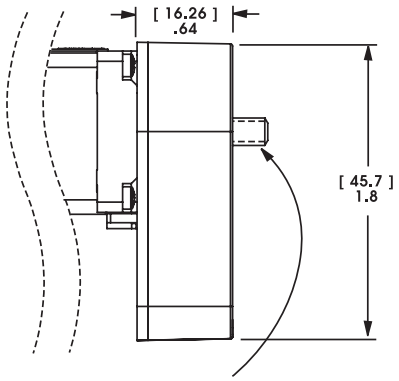
Encoder on Size 23 hybrid motor

All Haydon Hybrid Linear Actuators are available with specifically designed encoders for applications that require feedback. The compact optical incremental encoder design is available with two channel quadrature TTL squarewave outputs. An optional index is also available as a 3rd channel. The Size 23 encoder is offered in resolutions of 200, 400, 1,000 and 2,000 counts per revolution. Encoders are available for all motor configurations, captive, non-captive and external linear.

Simplicity and low cost make the encoders ideal for both high and low volume motion control applications. The internal monolithic electronic module converts the real-time shaft angle, speed, and direction into TTL compatible outputs. The encoder module incorporates a lensed LED light source and monolithic photodetector array with signal shaping electronics to produce the two channel bounceless TTL outputs.

57 mm 57000 Series Size 23

NOTE: Lead Screw extends beyond encoder on specific captive and non-captive motors. External linear shaft extension is available upon request.



Differential Ended Encoder - Pinout - Size 23	
Connector Pin #	**Description**
1	Ground
2	Ground
3	– Index
4	+ Index
5	Channel A –
6	Channel A +
7	+5 VDC Power
8	+5 VDC Power
9	Channel B –
10	Channel B +

Electrical Specifications				
	Minimum	**Typical**	**Maximum**	**Units**
Input Voltage	4.5	5.0	5.5	VDC
Output Signals	4.5	5.0	5.5	VDC

2 channel quadrature TTL squarewave outputs.
Channel B leads A for a clockwise rotation of the rotor viewed from the encoder cover.
Tracks at speeds of 0 to 100,000 cycles/sec.
Optional index available as a 3rd channel (one pulse per revolution).

Operating Temperature		
Size 23	**Minimum**	**Maximum**
	- 40°C (- 40°F)	100°C (212°F)

Mechanical Specifications	
	Maximum
Acceleration	250,000 rad/sec2
Vibration (5 Hz to 2 kHz)	20 g

Resolution					
4 Standard Cycles Per Revolution (CPR) or Pulses Per Revolution (PPR)					
Size 23	**CPR**	200	400*	1000	2000
	PPR	800	1600*	4000	8000

*Index Pulse Channel not available.

Single Ended Encoder - Pinout - Size 23			
Connector Pin #	**Description**	**Connector Pin #**	**Description**
1	Ground	**4**	+5 VDC Power
2	Index (optional)	**5**	Channel B
3	Channel A		

Encoder Ready Option Shown 34000 Series Size 17

Extended Rotor Journal Shown 34000 Series Size 17

End of Stroke Proximity Sensor

TFE Coated Lead Screw

Integrated Anti-Backlash Nut

Encoder Ready Option for all Hybrid Sizes

Our Hybrid Linear Actuators can now be manufactured as an Encoder Ready Actuator. Encoder Ready Actuators can be used to install several popular hollow shaft encoders. Available with an extended rotor journal and a threaded rear housing. The motor uses a proprietary manufacturing process which incorporates engineering thermoplastics in the rotor drive nut and a stainless steel Acme Lead Screw that allows the motor to be much more efficient and durable than today's more commonly used V-thread bronze nut configurations.

Extended Rotor Journal for all Hybrid Sizes

Available with an extended rotor journal. The extended rotor journal can be used for encoder installation, manual adjustment, or flag installation for a positioning sensor.

Home Position Switch for Hybrids

A miniature electronic Home Position Switch capable of monitoring the home positions of linear actuators. The switch mounts on the rear sleeve of captive linear motors and allows the user to identify start, stop or home positions.

When ordering motors with the home position switch the part number should be preceded by an "S" prefix.

End of Stroke Proximity Sensor for all Hybrid Sized

The Sensor incorporates a hall effect device, which is activated by a rare earth magnet embedded in the end of the internal screw. The compact profile of the sensor allows for installation in limited space applications. The sensor has a virtually unlimited cycle life. Special cabling and connectors can also be provided.

When ordering motors with the proximity sensor, the part number should be preceded by a "P" prefix.

Black Ice® and Kerkote® TFE Coated Lead Screws*

TFE Coated Lead Screws for applications that require a *greaseless* screw and nut interface.

A *dry* (non-lubricated) TFE coated lead screw provides improved performance in both life and thrust as compared to a conventional stainless steel lead-screw. TFE can be applied to a wide variety of lead-screw pitches and is available for our brand captive, non-captive and external linear actuators. Not available for 0.00006-in (.0015 mm) and 0.000098-in (.0025 mm) resolutions.

*Certain conditions apply.

Integrated Anti-Backlash Nut for Hybrids*

Most sizes (except Size 34) of our captive and non-captive hybrid stepper motors can be equipped with an integral anti-backlash feature. There is a normal backlash between the lead screw and integral rotor nut.

Our actuators are designed for millions of cycles. However over time, additional backlash could increase and eventually double. Haydon Kerk Integrated Anti-Backlash Nut can eliminate all backlash. Designed specifically for our captive and non-captive hybrid motors, nuts use an opposing spring force to eliminate backlash between the screw and the nut interface. The nuts will self-compensate and accommodate any wear. Our Engineers can help you select the appropriate preload for your application.

*Except Size 34.

87000 Series
Size 34 Hybrid Linear Actuators

Our largest, most powerful linear actuator

Size 34 incorporates the same precision, high performance and durable patented designs featured in our entire hybrid product line.

3 Available Designs

– Captive
– Non-Captive
– External Linear

The 87000 series delivers forces up to 500 lbs. (2224 N) in a compact, 3.4-in (87 mm) square package. Available in a wide variety of resolutions, from 0.0005-in (.0127 mm) per step to 0.005-in (.127 mm) per step. Speeds exceed 3.0-in (7.62 cm) per second.

In addition to our standard configurations, we can custom build this powerful motor to meet your specific motion requirements.

Size 34: 87 mm (3.4-in) Hybrid Linear Actuator (1.8° Step Angle)						
Part No.	Captive	87H4 – – – †			87H6 – – – †	
	Non-Captive	87F4 – – – †			87F4 – – – †	
	External Linear	E87H4 – – – †			E87H6 – – – †	
Wiring		Bipolar			Unipolar**	
Winding Voltage		2.85 VDC	5 VDC	12 VDC	5 VDC	12 VDC
Current (RMS)/phase		5.47 A	3.12 A	1.3 A	3.12 A	1.3 A
Resistance/phase		0.52 Ω	1.6 Ω	9.23 Ω	1.6 Ω	9.23 Ω
Inductance/phase		2.86 mH	8.8 mH	51 mH	4.4 mH	25.5 mH
Power Consumption		31.2 W				
Rotor Inertia		1760 gcm^2				
Insulation Class		Class B (Class F available)				
Weight		5.1 lbs. (2.3 Kg)				
Insulation Resistance		20 MΩ				

†Part numbering information on page 4. ** Unipolar drive gives approximately 30% less thrust than bipolar drive.

Linear Travel / Step Screw Ø .625"(15.88 mm)		Order Code I.D.
inches	mm	
.0005	.0127	3
.000625	.0158*	B
.00125	.0317*	C
.0025	.0635	Y
.005	.127	Z

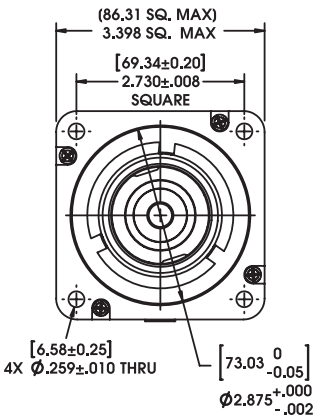
*Values truncated.

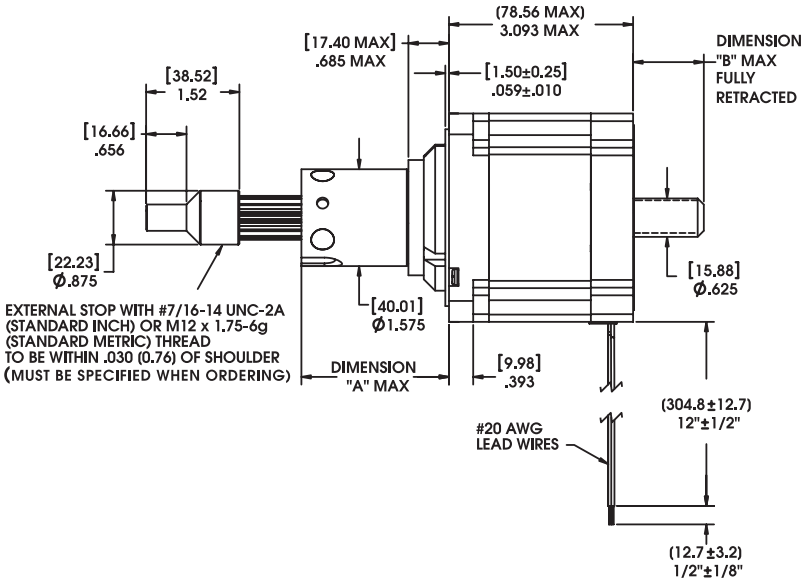
Standard motors are Class B rated for maximum temperature of 130°C.

Special drive considerations may be necessary when leaving shaft fully extended or fully retracted.

Captive Lead Screw

Dimensions = (mm) inches



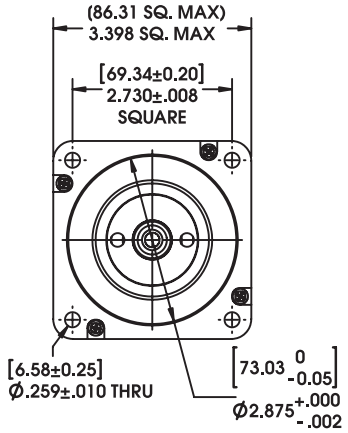


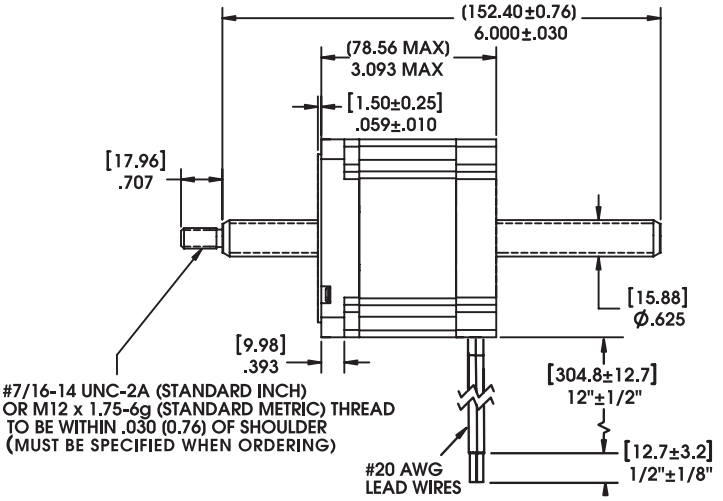
Stroke	Dim. "A"	Dim. "B"	Suffix #	M12x1.75 Thread
0.500 (12.7)	1.225 (31.12)	0 (0)	–905	–805
1.000 (25.4)	1.725 (43.82)	0.25 (6.35)	–910	–810
1.500 (38.1)	2.225 (56.52)	0.75 (19.05)	–915	–815
2.00 (50.8)	2.725 (69.22)	1.25 (31.75)	–920	–820
2.500 (63.5)	3.225 (81.92)	1.75 (44.45)	–925	–825

Non-Captive Lead Screw

Dimensions = (mm) inches

Up to 18-in (457 mm) standard screw lengths. Longer screw lengths are available.

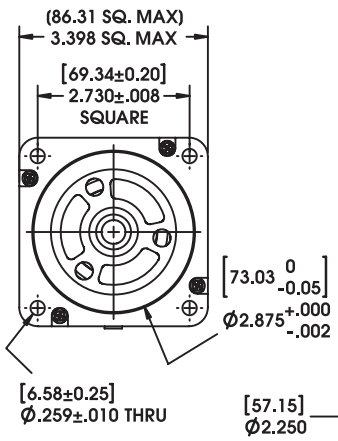


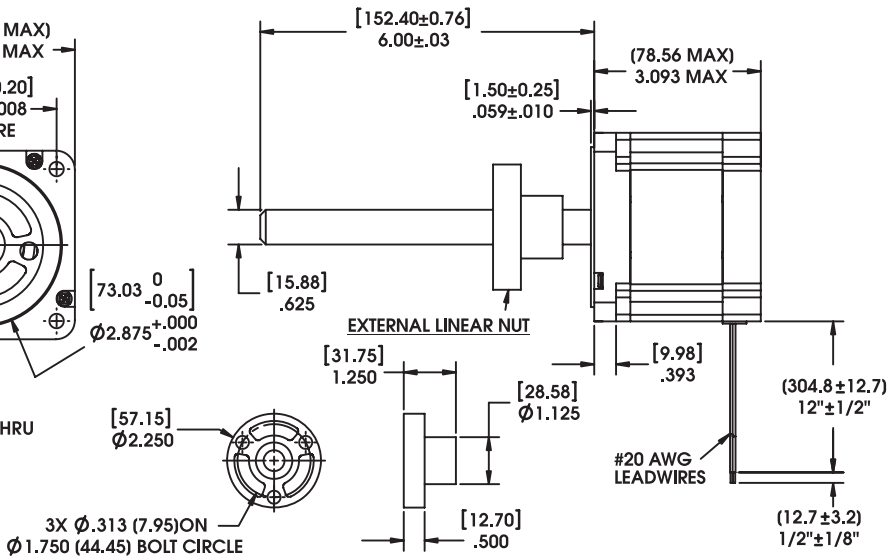


External Linear

Dimensions = (mm) inches

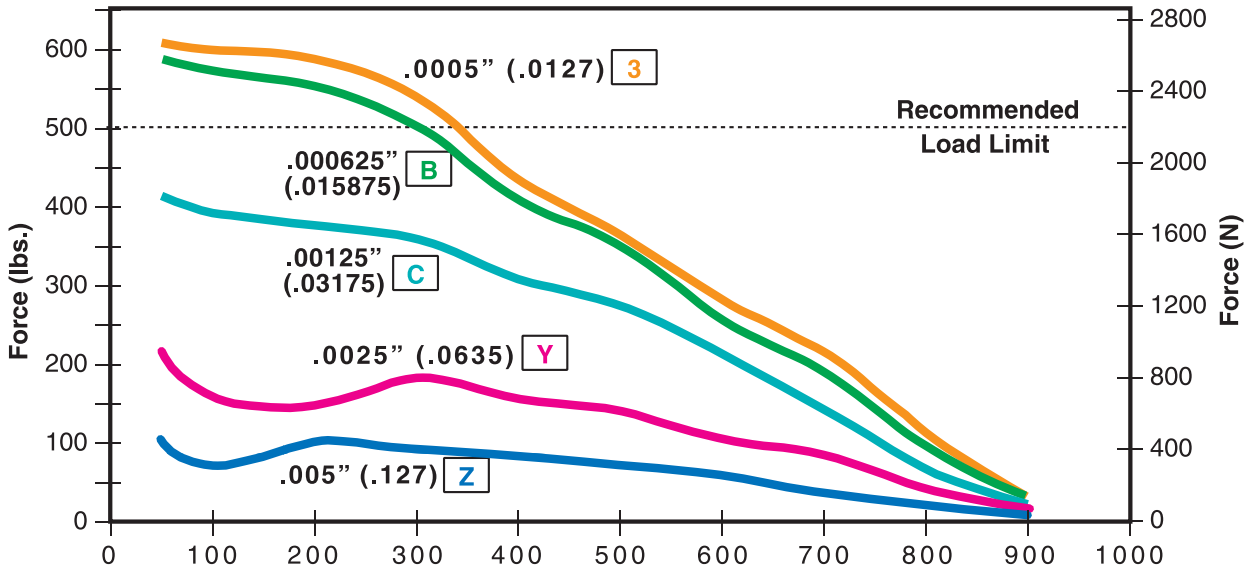
Up to 12-in (305 mm) standard screw lengths. Longer screw lengths are available.





FORCE vs. PULSE RATE – Chopper – Bipolar – 100% Duty Cycle

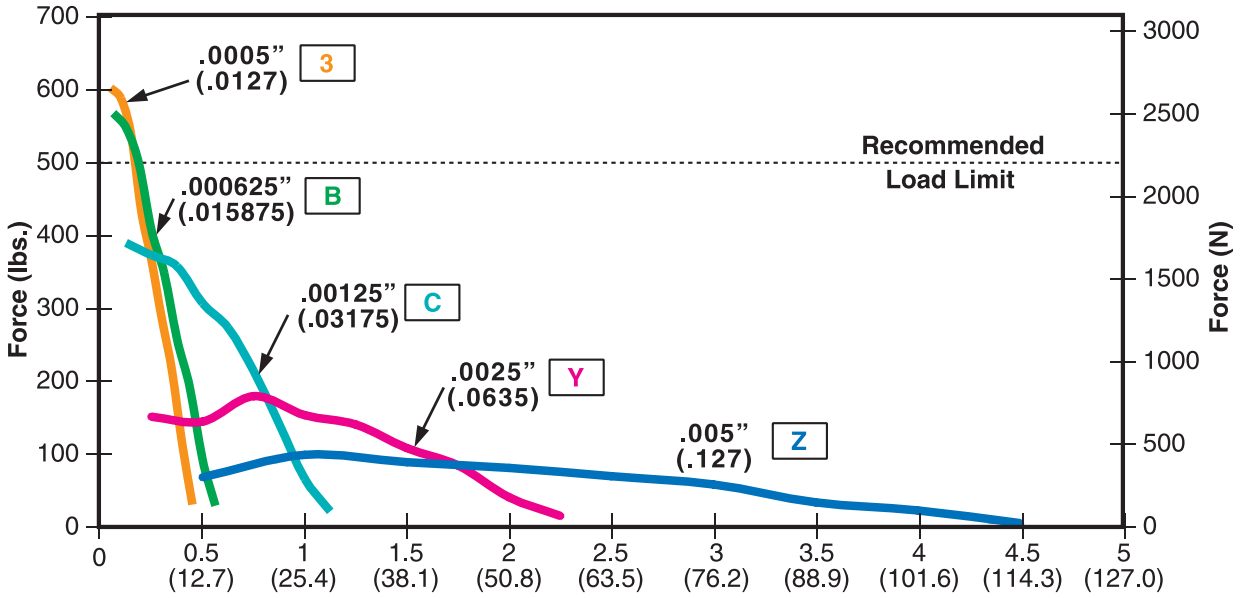
– Ø .625 (15.88) Lead Screw



Pulse Rate: full steps/sec.

FORCE vs. LINEAR VELOCITY – Chopper – Bipolar – 100% Duty Cycle

– Ø .625 (15.88) Lead Screw



Linear Velocity: in./sec. (mm/sec.)

NOTE: All chopper drive curves were created with a 5 volt motor and a 75 volt power supply.

Ramping can increase the performance of a motor either by increasing the top speed or getting a heavier load accelerated up to speed faster. Also, deceleration can be used to stop the motor without overshoot.

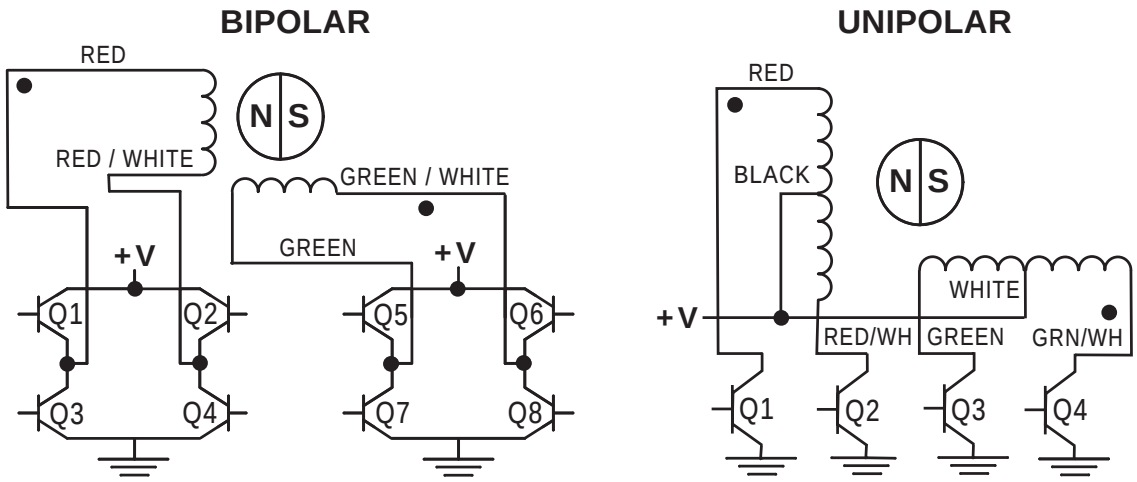
With L/R drives peak force and speeds are reduced, using a unipolar drive will yield a further 30% force reduction.

Identifying the Hybrid Part Number Codes when Ordering

E	87	H	4	C	—	2.85	—	910
Prefix (include only when using the following) **A =** A Coil (See AC Synchronous Data Sheet) **E** = External **K** = External with 40° thread form **P** = Proximity Sensor **S** = Home Position Switch	**Series Number Designation** **87 = 87000** (Series numbers represent approximate width of motor body)	**Style** **F** = 1.8° Non-captive **H** = 1.8° Captive or External (use "E" or "K" Prefix for External version)	**Coils** **4** = Bipolar (4 wire) **6** = Unipolar (6 wire)	**Code ID Resolution Travel/Step** **3** = .0005-in (.0127) **B** = .000625-in (.0158) **C** = .00125-in (.0317) **Y** = .0025-in (.0635) **Z** = .005-in (.127)		**Voltage** **2.85** = 2.85 VDC **05** = 5 VDC **12** = 12 VDC Custom V available		**Suffix** **Stroke** Example: –910 = 1-in (Refer to Stroke chart on Captive motor series product page.) **Suffix also represents**: –800 = Metric –900 = External Linear with grease and flanged nut –XXX = Proprietary suffix assigned to a specific customer application. The identifier can apply to either a standard or custom part.

NOTE: Dashes must be included in Part Number (–) as shown above. For assistance call our Engineering Team at 203 756 7441.

Hybrids: **Wiring**



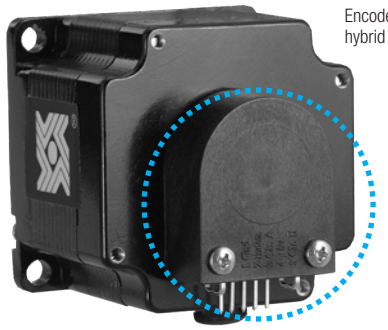
Hybrids: **Stepping Sequence**

Bipolar	Q2-Q3	Q1-Q4	Q6-Q7	Q5-Q8
Step				
1	ON	OFF	ON	OFF
2	OFF	ON	ON	OFF
3	OFF	ON	OFF	ON
4	ON	OFF	OFF	ON
1	ON	OFF	ON	OFF

EXTEND CW ↓ — RETRACT CCW ↑

Note: Half stepping is accomplished by inserting an off state between transitioning phases.

Encoders Designed for All Sizes of Hybrid Linear Actuators

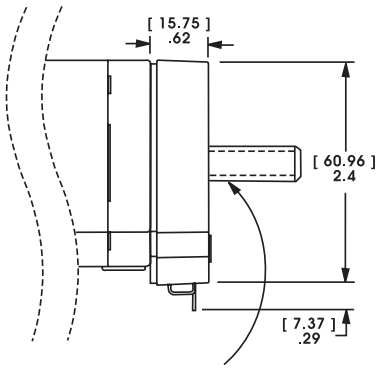


Encoder on Size 23 hybrid motor

All Haydon Hybrid Linear Actuators are available with specifically designed encoders for applications that require feedback. The compact optical incremental encoder design is available with two channel quadrature TTL squarewave outputs. An optional index is also available as a 3rd channel. The Size 34 encoder is offered in resolutions of 200, 400, 1,000 and 2,000 counts per revolution. Encoders are available for all motor configurations: captive, non-captive and external linear.

Simplicity and low cost make the encoders ideal for both high and low volume motion control applications. The internal monolithic electronic module converts the real-time shaft angle, speed, and direction into TTL compatible outputs. The encoder module incorporates a lensed LED light source and monolithic photodetector array with signal shaping electronics to produce the two channel bounceless TTL outputs.

57 mm 87000 Series Size 34



NOTE: Lead Screw extends beyond encoder on specific captive and non-captive motors. External linear shaft extension is available upon request.

Electrical Specifications				
	Minimum	Typical	Maximum	Units
Input Voltage	4.5	5.0	5.5	VDC
Output Signals	4.5	5.0	5.5	VDC

2 channel quadrature TTL squarewave outputs.
Channel B leads A for a clockwise rotation of the rotor viewed from the encoder cover.
Tracks at speeds of 0 to 100,000 cycles/sec.
Optional index available as a 3rd channel (one pulse per revolution).

Operating Temperature		
	Minimum	Maximum
Size 34	- 40°C (- 40°F)	100°C (212°F)

Mechanical Specifications	
	Maximum
Acceleration	250,000 rad/sec2
Vibration (5 Hz to 2 kHz)	20 g

Resolution					
4 Standard Cycles Per Revolution (CPR) or Pulses Per Revolution (PPR)					
Size 34	CPR	200	400*	1000	2000
	PPR	800	1600*	4000	8000

*Index Pulse Channel not available.

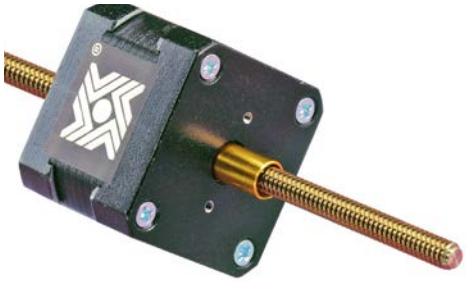
Differential Ended Encoder - Pinout - Size 34	
Connector Pin #	Description
1	Ground
2	Ground
3	– Index
4	+ Index
5	Channel A –
6	Channel A +
7	+5 VDC Power
8	+5 VDC Power
9	Channel B –
10	Channel B +

Single Ended Encoder - Pinout - Size 34			
Connector Pin #	Description	Connector Pin #	Description
1	Ground	4	+5 VDC Power
2	Index (optional)	5	Channel B
3	Channel A		

Encoder Ready Option Shown 34000 Series Size 17

Encoder Ready Option for all Hybrid Sizes

Our Hybrid Linear Actuators can now be manufactured as an Encoder Ready Actuator. Encoder Ready Actuators can be used to install several popular hollow shaft encoders. Available with an extended rotor journal and a threaded rear housing. The motor uses a proprietary manufacturing process which incorporates engineering thermoplastics in the rotor drive nut and a stainless steel Acme Lead Screw that allows the motor to be much more efficient and durable than today's more commonly used V-thread bronze nut configurations.



Extended Rotor Journal Shown 34000 Series Size 17

Extended Rotor Journal for all Hybrid Sizes

Available with an extended rotor journal. The extended rotor journal can be used for encoder installation, manual adjustment, or flag installation for a positioning sensor.

Home Position Switch for Hybrids

A miniature electronic Home Position Switch capable of monitoring the home positions of linear actuators. The switch mounts on the rear sleeve of captive linear motors and allows the user to identify start, stop or home positions.

When ordering motors with the home position switch the part number should be preceded by an "S" prefix.

End of Stroke Proximity Sensor

End of Stroke Proximity Sensor for all Hybrid Sized

The Sensor incorporates a hall effect device, which is activated by a rare earth magnet embedded in the end of the internal screw. The compact profile of the sensor allows for installation in limited space applications. The sensor has a virtually unlimited cycle life. Special cabling and connectors can also be provided.

When ordering motors with the proximity sensor, the part number should be preceded by a "P" prefix.

TFE Coated Lead Screw

Black Ice® and Kerkote® TFE Coated Lead Screws*

TFE Coated Lead Screws for applications that require a *greaseless* screw and nut interface.

A *dry* (non-lubricated) TFE coated lead screw provides improved performance in both life and thrust as compared to a conventional stainless steel lead-screw. TFE can be applied to a wide variety of lead-screw pitches and is available for our brand captive, non-captive and external linear actuators. Not available for 0.00006-in (.0015 mm) and 0.000098-in (.0025 mm) resolutions.

*Certain conditions apply.

Integrated Anti-Backlash Nut

Integrated Anti-Backlash Nut for Hybrids*

Most sizes (except Size 34) of our captive and non-captive hybrid stepper motors can be equipped with an integral anti-backlash feature. There is a normal backlash between the lead screw and integral rotor nut.

Our actuators are designed for millions of cycles. However over time, additional backlash could increase and eventually double. Haydon Kerk Integrated Anti-Backlash Nut can eliminate all backlash. Designed specifically for our captive and non-captive hybrid motors, nuts use an opposing spring force to eliminate backlash between the screw and the nut interface. The nuts will self-compensate and accommodate any wear. Haydon Kerk Motion Solutions application engineers can help you select the appropriate preload for your application.

*Except Size 34.