

**AMETEK**°

**WAX SETTES** 30% performance increase compared to standard size 17

## M43000 Max Series Double Stack Size 17 Hybrid Linear Actuators

# Exceptional performance and new linear motion design opportunities, now with 30% performance increase

The M43000 Max 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

Siz	Size 17 Max Double Stack Max: 43 mm (1.7-in) Hybrid Linear Actuator (1.8° Step Angle)				
Captive		M43M4 – – <sup>†</sup>			
Part No.	Non-Captive	M	43L4 — — —	†	
	External Linear	EM	43M4 – –	t	
	Wiring		Bipolar		
Wind	ding Voltage	2.8 VDC	5.8 VDC	13.8 VDC	
Curren	t (RMS)/phase	2.6 A	1.3 A	550 mA	
Resis	stance/phase	1.1 Ω	4.5 Ω	25 Ω	
Inductance/phase		2.4 mH 10.5 mH 52 mH			
Power	Consumption	15 W			
Rc	otor Inertia	78.2 gcm <sup>2</sup>			
Temperature Rise		135° F Rise (70° C Rise)			
Insulation Class		Class B (Class F available)			
	Weight	14 oz (400 g)			
Insulation Resistance		20 MΩ			

Size 17 Non-Captive Shaft

> Size 17 External Linear

Linear Tra	Order			
Screw Ø.187	Screw Ø.1875"(4.76mm)			
inches	inches mm			
.000625	.0158*	В		
.00125	.0317*	С		
.0025	.0635	Y		
.00375	.0953	AG		
.005	.127	Z		

\*Values truncated.

Size 17 Captive Shaft

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.

<sup>†</sup>Part numbering information on page 6.

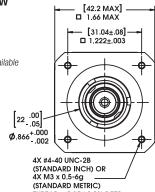
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## M43000 Max Series • Size 17 Double Stack Stepper Motor Linear Actuators • Dimensional Drawings

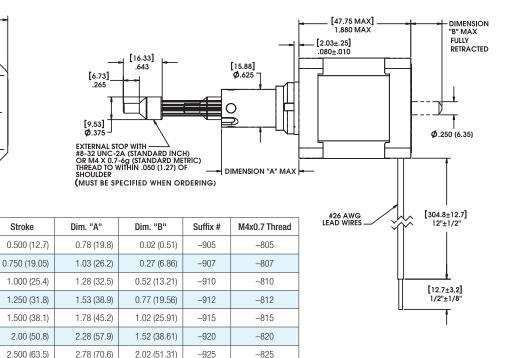
## **Captive Lead Screw**

Dimensions = (mm) inches

Integrated connector option available



THREAD x 0.15 ( 3.81) DEEP (MUST BE SPECIFIED WHEN ORDERING)

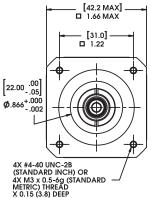


## **Non-Captive Lead Screw**

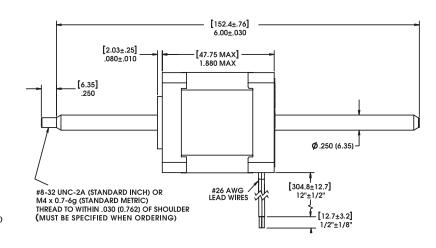
Dimensions = (mm) inches

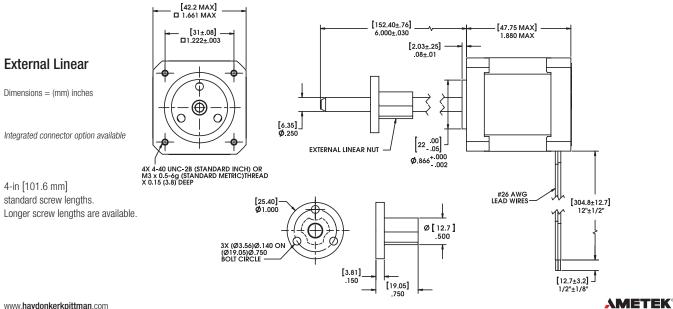
Integrated connector option available

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

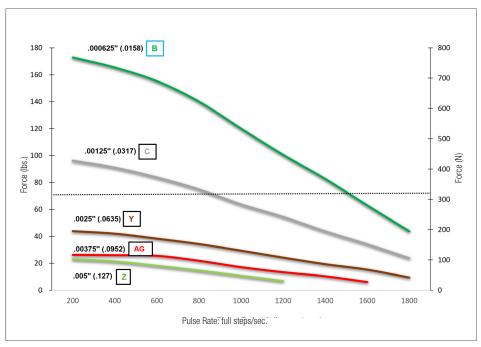


(MUST BE SPECIFIED WHEN ORDERING)



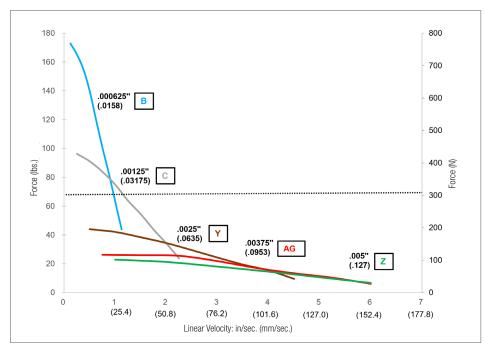


FORCE vs. PULSE RATE - Chopper - Bipolar - 100% Duty Cycle - 8:1 Motor Coil to Drive Supply Voltage



- Ø .250 (6.35) Lead Screw

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



NOTE: All chopper drive curves were created with a 5.8 volt, microstepping 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.

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**AMETEK** 

# 43000 Max Series Size 17 Double Stack Hybrid Linear Actuators with integrated IDEA<sup>™</sup> Drive

## High performance in a compact package

The M43000 Max 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<sup>™</sup> 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 Max Double Stack: 43 mm (1.7-in) Hybrid Linear Actuator (1.8° Step Angle)		
	Captive	M43MG — — — — <sup>†</sup>	
Part No.	Non-Captive	M43LG — — — <sup>†</sup>	
	External Linear	EM43MG — — — — — — <sup>†</sup>	
Wiring		Bipolar	
Winding Voltage		2.8 VDC**	

Linear Tra Screw Ø .250	Order	
inches mm		Code I.D.
.000625	.0158*	В
.00125	.0317*	С
.0025	.0635*	Y
.00375	.0953*	AG
.005	.127*	Z

Size 17

External Linear

<sup>1</sup>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.

# Simple to use IDEA<sup>™</sup> 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 lineby-line execution of a motion program for easy troubleshooting.

File    Edit    Readine    Drive Commands    Program Nov      Motion    Stop    Goto II    Return To    Int on Post      Move To    Goto III    Return To    Int on Input    Restard Comment      Move To    Goto III    Return To    Int on Post    Restard Comment      Action    Label    Description    Comment    Program Name:      3    Retract 1 in    Retract 1 in    Retract 1 in      4    Wait For Move    Copy    Paste      5    Wait 2 sec    Goto III    Retract 1 in      7    Wait For Move    Copy    Paste      8    Retract 1 in    Retract 1 in    Retract 1 in      7    Wait For Move    New    View / Edit    Plot      1    Usat 1 for Move    Copy    Paste    Retract 1 in    Retract 1	💥 Haydon Kerk IDEA Drive Interface P	rogram (Program Mode)	
Extend    Stop      Goto    Return      Move To    Goto 1/f      Move To    Goto 1/f      Goto 1/f    Return To      Int on Input    Reset      Abort    Goto At Speed      O    Start      Start To More    Program Rate:      Pogam Nate:    Pogam Rate:      Copy    Paste      Amore the formed    Copy      Amore the formed    Descination      Start    Clabel      Destination    Start      Label    Comment      Omethics    Organ Rate:      Pogam Nate:    Download      Pogam Nate:    Download      Paste:    Start      Start    Clabel      Ubed    Comment      Material    Add At End      Add At End    Cancel	File Edit Realtime Drive Commands	Programs Help	🚿 Haydon (kerk
Retract    E-Stop    Goto If    Return To    Int on Input      Move To    Go At Speed    Wait    Encoder      Go At Speed    Wait for Move    Comment      0    Start    Got Speed    Program Name;      1    Wait for Move    Program Name;    Paste      3    Retract 1 in    Program Name;    Paste      4    Wait for Move    New    Vew / Edit    Plot      5    Retract 1 in    Num for Move    Download    Part Comment      0    Start    Glabel    Download    Plot    New      6    Retract 1 in    Remove    New    Vew / Edit    Plot      0    Start    Glabel    Download    Plot    New      1    Used for Move    Comment    Out for Move    Vew / Edit    Plot      1    Label	Motion	ogram Flow	Other
Move To    Jump N Times    Wait      Go At Speed    Go At Speed    Wait for Move      Action    Label    Description      Comment    Program Name:    Program Name:      2    Wait Tor Move    Comy Paste      3    Refract 1 in    Refract 1 in      4    Wait Tor Move    Copy Paste      5    Wait 2 sec    Descination      7    Wait Tor Move    Descination      Start    Clabel    Descination      Label    Comment    Start      Label    Comment    Out Doubles      Model    Add At End    Cancel	Extend Stop	Goto Return Int on Pos	Set Outputs Set Position
Go At Speed  Go At Speed  Wait for Move    Action Label  Description  Comment    0  Start  Estend 2 in Wait for Move  Program Edit    2  Wait for Move  Copy    3  Retract 1 in 4  Wait for Move    5  Wait 2 cc    6  Retract 1 in 7    Wait For Move  Vew / Edit    6  Bestination    5  Start    0  Destination    Start  (tabel)    Label  Ut and Position    Comment  0.000 in 1 2 3 4    Input:  0	Retract E-Stop	Goto If Return To Int on Input	Reset Abort
Action    Label    Description      Comment    Program Edit      Program Name:    Copy      Paste    Program Name:      Copy    Paste      Retract 1 in    Retract 1 in      Wait 2 sc    Pool      Program Name:    Copy      Sc    Retract 1 in      Wait 2 sc    Retract 1 in      Pool    Plot      Destination    Start      Label    Comment      Label    Uto and Position      Comment    Add At End      Add At End    Cancel	Move To J	Jump N Times Wait	Encoder
Add At End  Callerent    0  Start    1  Wait for More    3  Retract 1 in    4  Wait for More    5  Wait 2 sc    6  Retract 1 in    7  Wait for More    Wait for More  Pogram Name:    Copy  Paste    8  Copy    8  Copy    9  Pogram Name:    0  Start    1  Copy    1  Pogram Name:    0  Start    1  Copy    1  Pogram Name:    1  Operation    1  Start    1  Comment	Go At Speed	Go At Speed Wait For Move	Comment
0  Start  Ested 2 in    1  Wait for More    2  Wait for More    3  Retract 1 in    4  Wait for More    5  Wait for More    7  Wait for More    9  Destination    1  Label    1  Uard Position:    1  Add At End    1  2    1  2	Action Label Description	Comment	Program Edit
2 With Sec 3 Retract 1 in A Walt for More 5 Walt 2 ac 6 Pownload 7 Walt 2 ac 7 Walt 2 ac 8 Create Golo Command Comment Label Comment Comment Add At End Cancel	0 Start Extend 2 in		Program Name:
4  Wait for Move    5  Wait 2 sc    6  Reract 1 in    7  Wait for Move    Wait for Move  Dewnload    Create GoTo Command  X    Label  Piot    Comment  U0 and Position    Current Position:  0.000 in    Add At End  Cancel	2 Wait 1 sec		Copy Paste
6  Retract 1 in Wuit for Moce    7  Wuit for Moce    Wuit for Moce  Run Control    Destination  Start    Label  Viou and Position    Comment  Out of Add At End	4 Wait For Move		Remove New
Create GoTo Command  Devination    Destination  Start    Label  Comment    Comment  Add At End			View / Edit Plot
Destination  Start  (label)    Label	7 Wait For Move		Download
Destination Start (Jabel)	Create GoTo Command		- Run Control
Label	Destination Start	(label)	Program To Run:
Label	Destination	(intel)	Churt Chur
Comment Current Position: 0.000 in 1 2 3 4 Inputs: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			Start Stop
Add At End Cancel	Label		I/O and Position
Add At End Cancel Inputs: • • • •	Comment		
		Add At End Cancel	
Ready	Ready		

Size 17

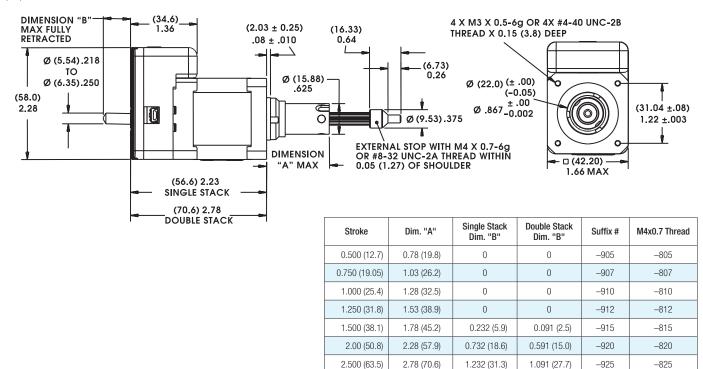
Captive Shaft

Size 17

Non-Captive Shaft

### **Captive Lead Screw**

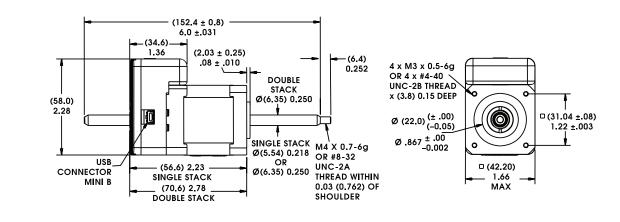
Dimensions = (mm) inches



## **Non-Captive Lead Screw**

Dimensions = (mm) inches

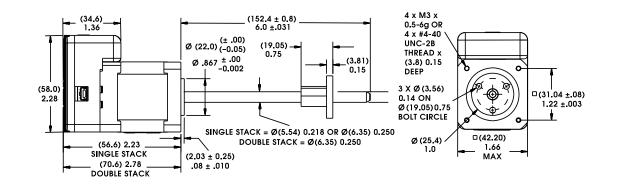
Up to 10-in (254 mm) standard screw lengths. Longer screw lengths are available.



## **External Linear**

Dimensions = (mm) inches

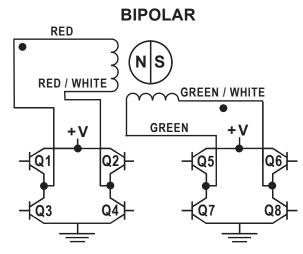
Up to 10-in (254 mm) standard screw lengths. Longer screw lengths are available.



		-	
E M43 M G	C	2.8	910
A = A Coil (See AC Synchronous Data Sheet)  Max Series (Series numbers represent  M = 1.8° Captive or External (use "E" or "K" Prefix for External  G = IDEA  O Drive (Size 17, 43000    E = External  approximate  for External  Series,	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 2.8 = 2.8 VDC 5.8 = 5.8 VDC 13.8 = 13.8 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	
EXTEND	Step					
B	1	ON	OFF	ON	OFF	
S	2	OFF	ON	ON	OFF	CCW
	3	OFF	ON	OFF	ON	RETRACT
¥	4	ON	OFF	OFF	ON	ETR
	1	ON	OFF	ON	OFF	Æ

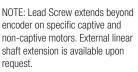
Note: Half stepping is accomplished by inserting an off state between transitioning phases.

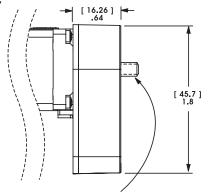
# Encoders Designed for All Sizes of Hybrid Linear Actuators

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 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 M43000 Series Size 17





INUTE. LEau Sciew Exterius Deyoriu
encoder on specific captive and
non-captive motors. External linear
shaft extension is available upon
request.

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	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 17	Minimum	Maximum	
5120 17	- 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.

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 Max 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

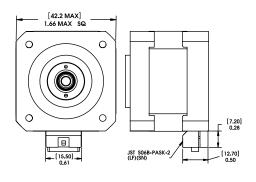
Mating	Connector:

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

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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



**AMETEK**<sup>®</sup>



Encoder Ready Option Shown 43000 Series Size 17



Extended Rotor Journal Shown 43000 Series Size 17





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.

