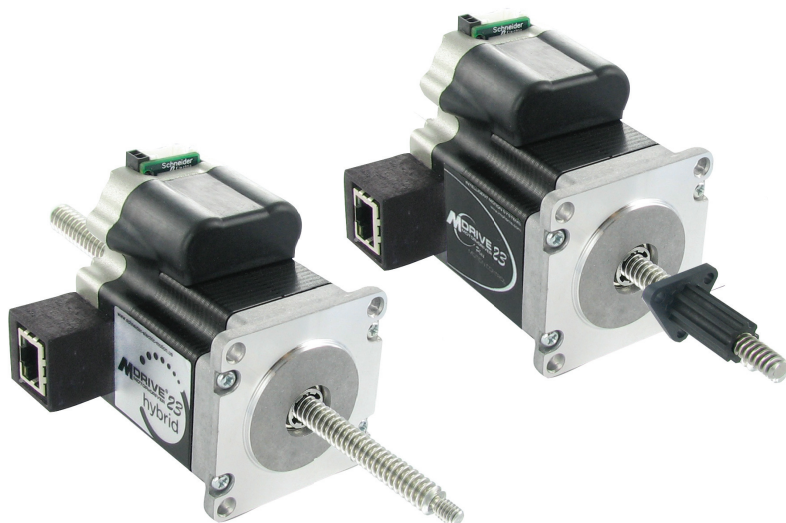


MDrive[®] EtherNet/IP[™]

Integrated all-in-one linear motion systems
for industrial automation



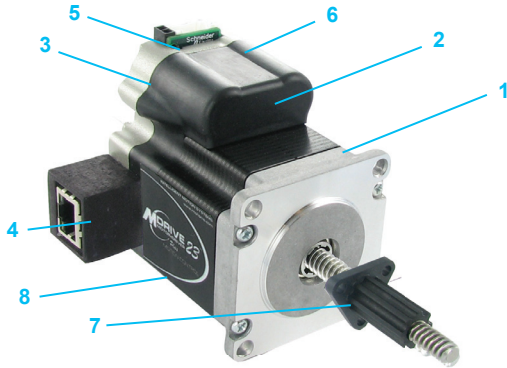
MDrive 23 EtherNet/IP Linear Actuator

Integrated linear actuator products

CE  **EtherNet/IP[™]**
conformance tested

Schneider
 Electric

MDrive 23 Plus / MDrive 23 Hybrid
Linear Actuator



pictured: external shaft style

- 1 stepper motor linear actuator with non-captive or external shaft style
- 2 microstepping drive
- 3 integrated controller version
- 4 EtherNet/IP protocol
- 5 internal encoder
- 6 4 I/O lines
- 7 screw options include length, pitch/lead, end finish, coating
- 8 control options: Plus or Hybrid Motion Technology

Product offer

MDrive® EtherNet/IP™ Linear Actuators are compact motion solutions, integrating a stepper motor linear actuator and electronics all in one package. MDrive EtherNet/IP products are ODVA™ compliant and interface with many manufacturer's systems, including Rockwell, Omron and Schneider Electric.

MDrivePlus Ethernet/IP products combine a 1.8° 2-phase stepper motor linear actuator with on-board I/O and motion controller, drive electronics and optional encoder.

MDriveHybrid systems add Hybrid Motion Technology™ (HMT) and an integral encoder to MDrivePlus product features. HMT combines the best of servo and stepper motor technologies, while delivering unique capabilities and enhancements over both, including:

- real time closed loop control
- no loss of synchronization
- full use of motor torque
- torque mode control
- reduced motor heat (1)
- lower energy consumption (1)

EtherNet/IP is an extension of the CIP™ (Common Industrial Protocol), the same upper layer protocol and object model used in DeviceNet™ and ControlNet™ utilizing the standard TCP/IP stack. As an adapter class device, MDrive EtherNet/IP products are capable of explicit or implicit messaging.

Configuration utility

MDrive EtherNet/IP products have a configuration port provided for setting the IP address. Windows-based TCP/IP Configuration Utility sets parameters and assembly object mapping.

Application areas

The MDrive EtherNet/IP product is ideal for machine builders who want an optimized linear actuator motor with on-board electronics and support for the widely used Ethernet industrial protocol. MDrive products are compact motion control solutions that can reduce system cost, design and assembly time for a wide range of linear motion applications.

Features

- Highly integrated microstepping drive and high torque NEMA 23 1.8° 2-phase stepper motor linear actuator
 - Non-captive or external shaft style (2)
 - Load limit up to 200 lbs
 - Precision rolled lead screws
- Hybrid Motion Technology version
- Advanced current control for exceptional performance and smoothness
- Single supply: from +12 up to +75 VDC
- Cost effective
- Extremely compact
- EtherNet/IP industrial protocol
- Standard TCP/IP stack with virtually unlimited nodes
- Dynamic mapping of assembly object
- Explicit and implicit messaging
- ODVA compliant
- 20 microstep resolutions to 51,200 steps/rev including: Degrees, Metric, Arc Minutes
- Auxiliary logic power supply input
- Open or optional closed loop control
- Programmable motor run and hold currents
- Four +5 to +24 VDC I/O lines accept sourcing or sinking inputs or outputs
- High speed position capture input or trip output
- One 10 bit analog input selectable: 0 to +10 VDC, 0 to +5 VDC, 0-20 mA, 4-20 mA
- 0 to 5 MHz step clock rate selectable in 0.59 Hz increments
- Graphical user interface provided for quick and easy configuration

(1) Achieved with Hybrid Motion Technology variable current control.

(2) Non-captive shaft only available with MDrive Hybrid products.

MDrive® EtherNet/IP™

MDrive 23 Plus / MDrive 23 Hybrid

Linear Actuator

Specifications				MDrive 23 Plus	MDrive 23 Hybrid	
Input power	Voltage			12 to 75 VDC	12 to 60 VDC	
	Current maximum (1)			2A	3.5A	
Max thrust (2)	Non-captive shaft	lbs (kg)		—	200 (91)	
	External shaft with general purpose nut	lbs (kg)		60 (27)	60 (27)	
	External shaft with anti-backlash nut	lbs (kg)		25 (11)	25 (11)	
Maximum repeatability	General purpose	inch (mm)		0.005 (0.127)	0.005 (0.127)	
	Anti-backlash (3)	inch (mm)		0.0005 (0.0127)	0.0005 (0.0127)	
Thermal	Operating temp non-condensing	Heat sink		-40° to +85°C		
		Motor		-40° to +100°C		
Aux. logic input	Voltage range (4)			+12 to +24 VDC		
Analog input	Resolution			10 bit		
	Voltage range			0 to +5 VDC, 0 to +10 VDC, 0-20 mA, 4-20 mA		
General purpose I/O	Number			4		
	Type			Sourcing or sinking outputs/inputs		
	Logic range			Sourcing outputs +12 to 24 VDC, inputs&sinking outputs tolerant to +24 VDC, inputs TTL level compatible		
	Output sink/source current			Up to 600 mA		
	Protection			Over temp, short circuit, transient, over voltage, inductive clamp		
Communication	Type			Ethernet TCP/IP		
	Protocols			EtherNet/IP (ODVA compliant) MCode/TCP on configuration port		
	Baud rate			100 Mbps		
	Configuration port			503		
Motion	Open loop configuration	Number of settings		20		
		Steps per revolution		200, 400, 800, 1000, 1600, 2000, 3200, 5000, 6400, 10000, 12800, 20000, 25000, 25600, 40000, 50000, 51200, 36000 (0.01 deg/μstep), 21600 (1 arc minute/μstep), 25400 (0.001mm/μstep)		
	Counters	Type		Position, encoder/32 bit		
		Edge rate maximum		5 MHz		
	Closed loop configuration	Steps per revolution		512 lines/2048 edges per rev	1000 lines/4000 edges per rev	
		Encoder		Differential magnetic (requires option)	Differential magnetic	
	Electronic gearing	External clock in (5)	Range	0.001 to 2.000		
			Resolution/Threshold	32 bit / TTL		
		Input filter	Range	50 nS to 12.9 μS (10 MHz to 38.8 kHz)	unavailable	
	High speed I/O	Secondary clock out (5)	Range	1 to 1		
			Position capture	Input filter range	50 nS to 12.9 μS (10 MHz to 38.8 kHz)	
		Trip output	Speed	150 nS		
	Velocity	Resolution/Threshold		32 bit / TTL		
Range		+/- 5,000,000 steps per second				
Resolution		0.5961 steps per second				
Accel/Decel	Range		1.5 x 10 ⁹ steps per second ²			
	Resolution		90.9 steps per second ²			
EtherNet/IP	Device class		Adapter			
	Message types		Explicit or implicit			
	Assembly object 0x04	Output (T→O)		Instance 100		
		Output (O→T)		Instance 112		
		Mapping to MCode		Dynamic		
	Device profile	Identity object		0x01		
		Assembly object		0x04		
		TCP object		0x05		
		Ethernet link object		0xF6		
		Manufacturer specific objects		0x64: Setup 0x65: Miscellaneous 0x66: Motion 0x67: Hardware inputs/outputs 0x68: Position 0x69: Encoder	0x64: Setup 0x65: Miscellaneous 0x66: Motion 0x67: Hardware inputs/outputs 0x68: Position 0x69: Encoder 0x6A: Hybrid Motion Technology	

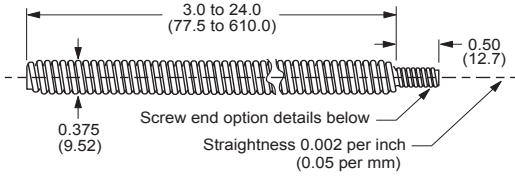
(1) Actual power supply current will depend on voltage and load.
 (2) Performance data for maximum force/load is based on a static load and will vary with a dynamic load.
 (3) Only applicable for External shaft linear actuator with anti-backlash nut.
 (4) When input voltage is removed, maintains power only to control and feedback circuits.
 (5) Adjusting the microstep resolution can increase the range.

MDrive® EtherNet/IP™

MDrive 23 Plus / MDrive 23 Hybrid

Linear Actuator

Screw dimensions in inches (mm)



Screw specifications

Material

MDrive Linear Actuator precision rolled lead screws are designed specifically for motion control applications to deliver maximum life and quiet operation. Corrosion resistant and non-magnetic, screws are manufactured from premium grade stainless steel.

Coating

An optional Teflon® screw coating is available for smooth operation and extended life.

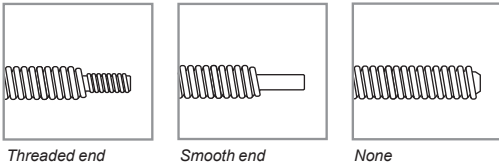
Length

Length (1)		minimum	maximum
		inches	3.0
	mm	77.5	610.0

(1) Screw lengths are available in 0.1" (2.5mm) increments.

Lead/pitch options

	travel	per revolution	per full step
	Screw G	inches	0.3750
mm		9.525	0.0476
Screw A	inches	0.200	0.001
	mm	5.08	0.0254
Screw B	inches	0.1670	0.000835
	mm	4.233	0.0212
Screw D	inches	0.0833	0.0004165
	mm	2.116	0.0106



End options

Threaded	metric end	M6 x 1.0 mm thread to within 0.03"/0.76 mm of shoulder
	UNC end	1/4-20 UNC-2A thread to within 0.05"/1.3 mm of shoulder
Smooth	inches	Ø 0.2362 ±0.001
	mm	Ø 6 ±0.003
None		—

Load limit

Non-captive shaft (2)		lbs	200
		kg	91
External shaft	General purpose nut	lbs	60
		kg	27
	Anti-backlash nut	lbs	25
		kg	11

(2) Performance data for maximum force/load is based on a static load and will vary with a dynamic load.

Calculating length

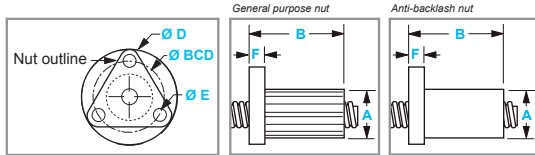
■ Non-captive shaft products
 Screw length = [mounting surface plate thickness] + [desired stroke length] + [1.8" (45.7mm)]

■ External shaft products
 Available stroke length = [screw length] – [nut length] – [mounting surface plate thickness]

Nut specifications

MDrive Linear Actuators with external shaft employ a nut which moves axially along the threaded shaft as the screw rotates. Two nut styles are available: general purpose and anti-backlash. While anti-backlash nuts provide higher accuracy and low drag torque, general purpose nuts are rated for higher load limits but lack wear compensation.

Nuts



Dimensions and performance

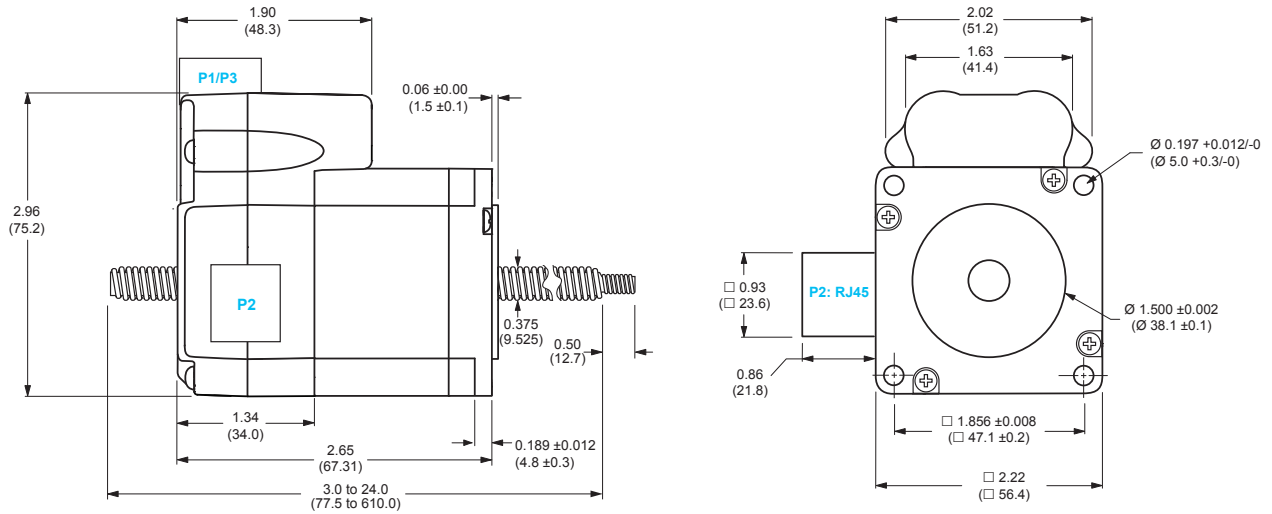
	nut type	general purpose	anti-backlash
A	inches	0.71	0.82
	mm	18.0	20.8
B	inches	1.5	1.875 max
	mm	38.1	47.63 max
D	inches	1.5	1.5
	mm	38.1	38.1
E	inches	0.20	0.20
	mm	5.08	5.08
F	inches	0.20	0.20
	mm	5.08	5.08
BCD	inches	1.125	1.125
	mm	28.6	28.6
Load limit	lbs	60	25
	kg	27	11
Drag torque		free wheeling	1 to 3

MDrive® EtherNet/IP™

MDrive 23 Plus / MDrive 23 Hybrid

Linear Actuator

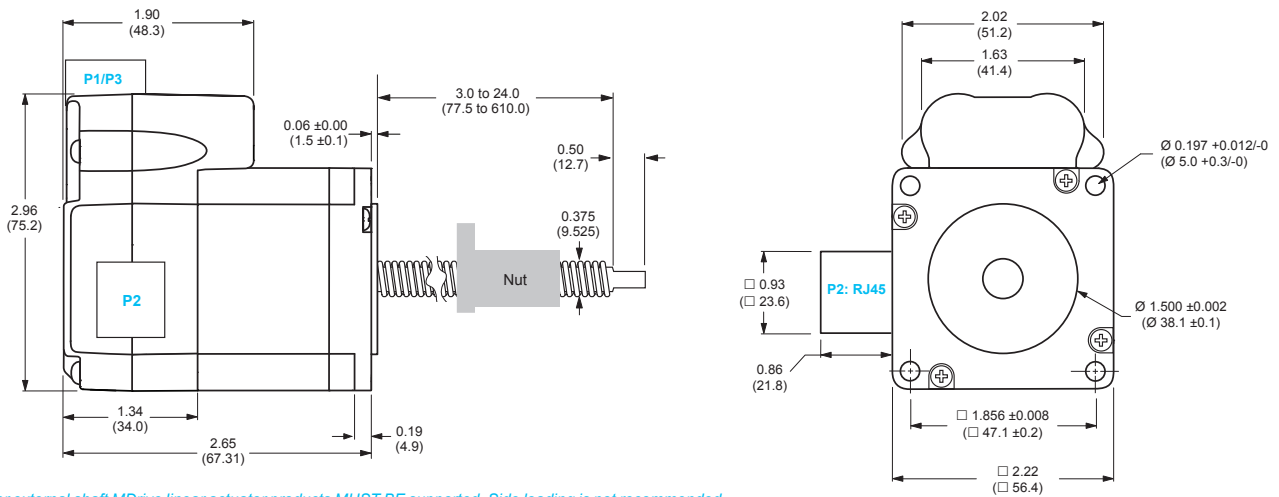
– Non-captive shaft – mechanical specifications, dimensions in inches (mm) (1)



Unsupported loads and side loading are not recommended for non-captive shaft MDrive linear actuator products.

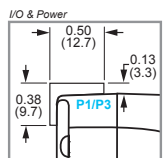
(1) Non-captive shaft only available on MDrive Hybrid products

– External shaft – mechanical specifications, dimensions in inches (mm)



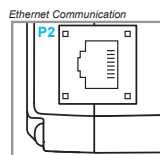
Loads for external shaft MDrive linear actuator products MUST BE supported. Side loading is not recommended.

P1/P3 connectors



14- & 2-pin locking wire crimp connectors

P2 connectors

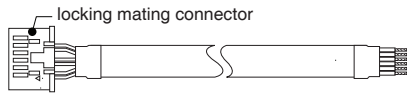


RJ45 connector

MDrive® EtherNet/IP™

MDrive 23 Plus / MDrive 23 Hybrid

Linear Actuator



PD14-2334-FL3



PD02-2300-FL3

Installation accessories

Description	Length feet (m)	Part number
-------------	-----------------	-------------

QuickStart Kit

For rapid design verification, all-inclusive QuickStart Kits include connectivity, instructions and CD for MDrive product initial functional setup and system testing. Kit includes a 6.0' (1.8m) CAT5 cable with RJ45 ends, not sold alone.

- For MDrive EtherNet/IP linear products — add "K" to part number (1)

Prototype development cable

Speed test/development with pre-wired mating connector with other cable end open.

- | | | |
|---|------------|---------------|
| ■ Mates to 14-pin locking wire crimp connector for I/O | 10.0 (3.0) | PD14-2334-FL3 |
| ■ Mates to 2-pin locking wire crimp connector for power | 10.0 (3.0) | PD02-2300-FL3 |

Mating connector kit

Connectors for assembly of cables, cable material not supplied. Sold in lots of 5. Manufacturer's crimp tool recommended for crimp connectors.

- | | | |
|--|---|-------|
| ■ 14-pin locking wire crimp connector for I/O | — | CK-09 |
| ■ 2-pin locking wire crimp connector for power | — | CK-04 |

Drive protection module

Limits surge current and voltage to a safe level when DC input power is switched on-and-off to an MDrive product.

- | | | |
|--|---|-------|
| ■ For all MDrive EtherNet/IP linear products | — | DPM75 |
|--|---|-------|

(1) See next page.

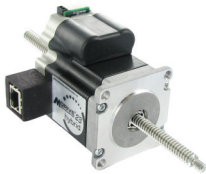
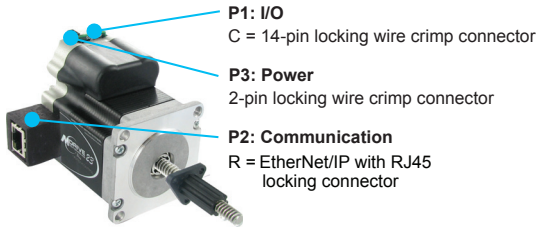


MDrive® EtherNet/IP™

MDrive 23 Plus / MDrive 23 Hybrid

Linear Actuator

MDrive® 23 EtherNet/IP Linear Actuator



Non-captive shaft style (2)



External shaft style

Part numbers														
Example:	K	M	L	I	3	C	I	R	2	3	A	7	-EQ	-●
QuickStart Kit K = kit option, or leave blank if unwanted	K	M	L	I	3	C	I	R	2	3	A	7	-EQ	-●
MDrive version MLI = MDrive Plus MAI = MDrive Hybrid	K	M	L	I	3	C	I	R	2	3	A	7	-EQ	-●
Type 3 = expanded features	K	M	L	I	3	C	I	R	2	3	A	7	-EQ	-●
P1 connector C = wire crimp	K	M	L	I	3	C	I	R	2	3	A	7	-EQ	-●
Communication I = EtherNet/IP	K	M	L	I	3	C	I	R	2	3	A	7	-EQ	-●
P2 connector R = RJ45	K	M	L	I	3	C	I	R	2	3	A	7	-EQ	-●
Motor size 23 = NEMA 23 (2.3" / 57 mm)	K	M	L	I	3	C	I	R	2	3	A	7	-EQ	-●
Motor length A = single stack	K	M	L	I	3	C	I	R	2	3	A	7	-EQ	-●
Drive voltage 7 = +12 to +75 VDC (1) 6 = +12 to +60 VDC (2)	K	M	L	I	3	C	I	R	2	3	A	7	-EQ	-●
Encoder Differential magnetic encoder with index mark, internal to the product, so footprint is unchanged -EQ = MDrive Plus products option, 512-line; omit from part number if unwanted (1) -EJM = Included in all MDrive Hybrid products, 1000-line (2)	K	M	L	I	3	C	I	R	2	3	A	7	-EQ	-●
Linear actuator specifications Complete the part number from the table below														

Continued – Part numbers													
	-L	G	1	M	0	6	0	Z	T				
Linear actuator -L	-L	G	1	M	0	6	0	Z	T				
Screw lead / pitch G = 0.375" / 9.525 mm travel per rev A = 0.200" / 5.08 mm travel per rev B = 0.167" / 4.233 mm travel per rev D = 0.083" / 2.116 mm travel per rev	-L	G	1	M	0	6	0	Z	T				
Shaft style 1 = Non-captive (2) 3 = External	-L	G	1	M	0	6	0	Z	T				
Screw end finish M = metric threaded U = UNC threaded S = smooth Z = none	-L	G	1	M	0	6	0	Z	T				
Screw length 030 = 3.0" (77.5 mm) minimum up to 240 = 24.0" (610.0 mm) maximum, in 0.1" (2.5 mm) increments	-L	G	1	M	0	6	0	Z	T				
Nut Z = none, only with Non-captive shaft products (2) G = general purpose, only with External shaft products (3) A = anti-backlash, only with External shaft products (4)	-L	G	1	M	0	6	0	Z	T				
Coating T = Teflon Z = None	-L	G	1	M	0	6	0	Z	T				

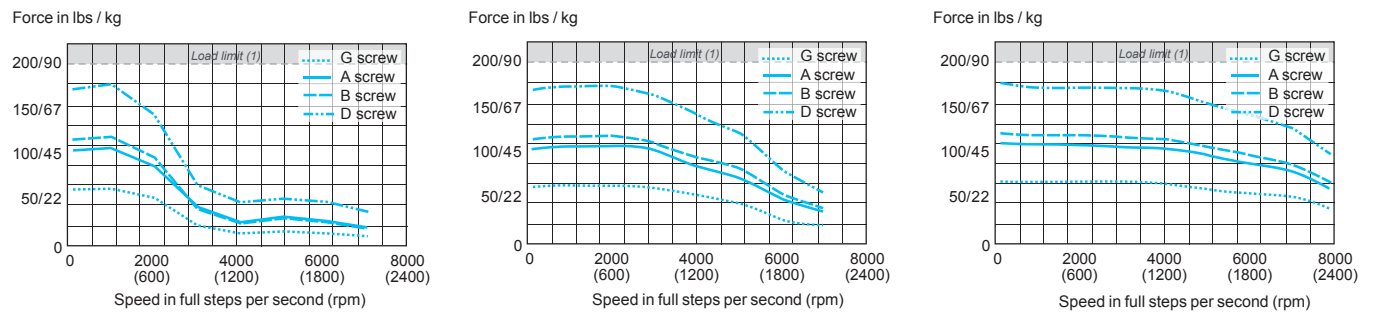
(1) MDrive Plus products only.
 (2) MDrive Hybrid products only.
 (3) Dynamic load limit to 60 lbs / 22 kg.
 (4) Dynamic load limit to 25 lbs / 11 kg.

Easy MDrive part numbers via an interactive tool at:
www.imshome.com/MDriveLinear.html

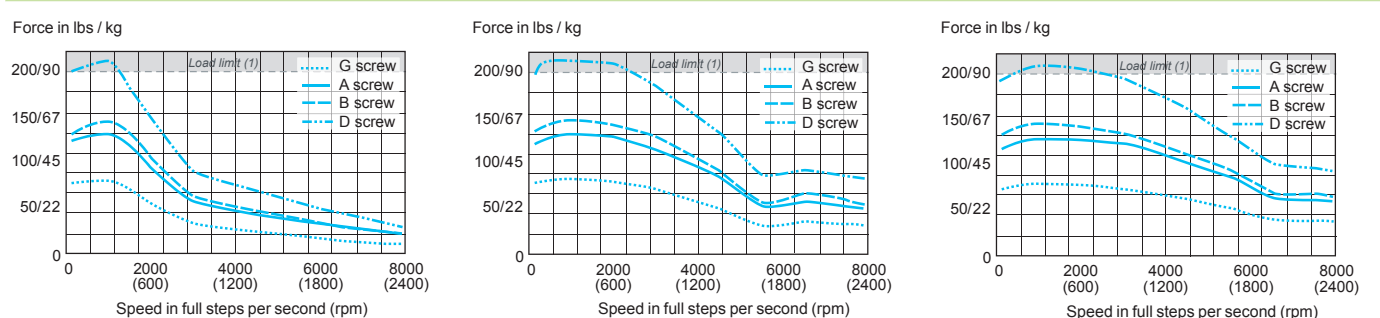
Motor specifications MDrive 23			
Motor stack length			single
Holding torque		oz-in	90.0
		N-cm	64.0
Rotor inertia		oz-in-sec ²	0.0025
		kg-cm ²	0.18
Maximum screw misalignment		°	±1
Weight without screw		oz	24.0
		g	680.0
Maximum thrust (1)	Non-captive shaft	lbs	200
		kg	91
	External shaft with general purpose nut	lbs	60
		kg	27
	External shaft with anti-backlash nut	lbs	25
		kg	11
Maximum repeatability	General purpose	inch	0.005
		mm	0.127
	Anti-backlash (2)	inch	0.0005
		mm	0.0127

(1) Performance data for maximum force/load is based on a static load and will vary with a dynamic load.
 (2) Only applicable for External shaft linear actuator with anti-backlash nut.

Speed force characteristics MDrive 23 Plus



Speed force characteristics MDrive 23 Hybrid



(1) Load limits are for non-captive shaft linear actuators: 200 lbs/91 kg.
 Load limits for external shaft linear actuators are determined by the nut selected.
 Note: Performance data for maximum force/load is based on a static load and will vary with a dynamic load.

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