

MDrive® Linear Actuator

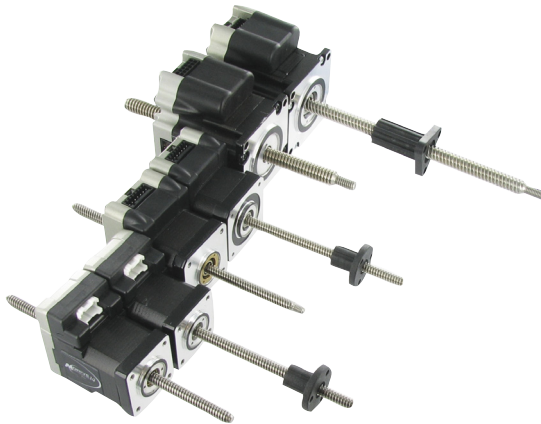
Compact, integrated all-in-one linear motion systems



MDrive 23 Plus Linear Actuator
Motion Control, fully programmable

IMS
INTELLIGENT MOTION
SYSTEMS, INC.

Schneider
Electric



*MDrive® Plus Motion Control Linear Actuator,
fully programmable, non-captive and external shaft styles*

Presentation

The MDrive® Plus Motion Control Linear Actuator is an integrated product that combines a stepper motor linear actuator with mechanicals and electronics to form a single, compact system. It features a 1.8° 2-phase stepper motor linear actuator with on-board fully programmable motion controller, drive electronics and optional encoder. This means MDrive Plus Motion Control Linear Actuators are stand-alone motion control solutions that can be used without any external controller. Signals are converted directly from rotary to linear motion, eliminating the need for belts and pulleys, rack and pinion, hydraulics, pneumatics or other mechanical system.

Programming of MDrive Plus Motion Control Linear Actuators with RS-422/485 interface is accomplished with MCode, simple 1 to 2 character instructions, using the IMS Terminal software tool. These MDrive products may also be equipped with encoders for stall detection, position maintenance and find index mark.

MDrive products with Ethernet can be programmed with the same MCode instruction set used for the RS-422/485 products. Ethernet products also support MODBUS/TCP application protocol, per specification Version 1.1b, with operation in immediate mode, not as programmable products.

Application areas

The MDrive Plus Motion Control Linear Actuator is ideal for machine builders who want an optimized stepper motor linear actuator with on-board electronics. The integrated electronics of the fully programmable MDrive product reduces the potential for problems due to electrical noise by eliminating the cable between motor and drive.

These compact, powerful and cost effective linear motion control solutions deliver unsurpassed smoothness and performance that will reduce system cost, design and assembly time for a large range of applications.

Features

Standard Plus

- Highly integrated microstepping drive, fully programmable motion controller, and high torque 1.8° 2-phase stepper motor linear actuator
 - Non-captive or external shaft style
 - Load limit up to 200 lbs
 - Precision rolled lead screws
- Advanced current control for exceptional performance and smoothness
- Single supply: from +12 up to +75 VDC
- Cost effective
- Extremely compact
- 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 sinking outputs, or sourcing or sinking inputs
- 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
- RS-422/485 or Ethernet communication protocols (1)
- 62 software addresses for multi-drop communications (2)
- Simple 1 to 2 character instructions
- Available options:
 - Encoder
 - Drive Protection Module
- GUI provided for quick and easy configuration and programming

Expanded Plus²

- +24 VDC tolerant I/O sourcing or sinking, inputs and outputs with up to 8 I/O lines and electronic gearing
- Closed loop control available with remote encoder option
- High speed position capture input or trip output

(1) Ethernet only available with MDrive23 External shaft products with expanded features (Plus²).

(2) Only with RS-422/485 products.



MDrive® Plus Linear Actuator

Motion Control

fully programmable

General specifications			MDrive 14	MDrive 17	MDrive 23	
Input power	Voltage	VDC	12 to 48	12 to 48	12 to 75	
	Current maximum (1)	amp	1	2	2	
Maximum thrust (2)	Non-captive shaft	lbs	50	50	200	
		kg	22	22	91	
	External shaft with general purpose nut	lbs	25	25	60	
		kg	11	11	27	
External shaft with anti-backlash nut	lbs	5	5	25		
	kg	2	2	11		
Maximum repeatability	General purpose	inch	0.005			
		mm	0.127			
	Anti-backlash (3)	inch	0.0005			
		mm	0.0127			
Thermal	Operating temp non-condensing	Heat sink	-40° to +85°C			
		Motor	-40° to +100°C			
Auxiliary 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			
Communication	Type		RS-422/485 or Ethernet (5)			
	Baud rate		4.8 to 115.2 kbps (6)			
Software	Program storage	Type/size	flash/6384 bytes			
	User registers		Four 32 bit			
	User program labels & variables		192			
	Math functions		+, -, ×, ÷, >, <, =, <=, >=, AND, OR, XOR, NOT			
	Branch functions		Branch and Call			
	General purpose I/O functions	Inputs		home, limit plus, limit minus, go, stop, pause, jog plus, jog minus, general purpose moving, fault, stall, velocity change, general purpose		
		Outputs				
	Trip functions		Trip on input, trip on position, trip on time, trip capture, trip on relative position			
	Party mode addresses		62 (6)			
Encoder functions		Stall detection, position maintenance, find index				
General purpose I/O	Number		Standard Plus products	Expanded Plus² products		
			4	8 (or 4 with Ethernet products or remote encoder option selected)		
	Type		Sourcing or sinking inputs, or sinking outputs			
	Logic range		Inputs and outputs tolerant to +24 VDC, inputs TTL level compatible		Sourcing outputs +12 to +24 VDC, inputs and sinking outputs tolerant to +24 VDC, inputs TTL level compatible	
	Output sink current		Up to 600 mA		Up to 600 mA	
Protection		Over temp, short circuit, transient, over voltage, inductive clamp				
Motion	Closed loop configuration	With internal encoder option	512 lines/2048 edges per rev resolution		512 lines/2048 edges per rev resolution	
		With user-supplied differential remote encoder	—		Encoder resolution defined by user	
	Electronic gearing	External clock in range (7)	—		0.001 to 2.000	
		Resolution/threshold	—		32 bit resolution/TTL threshold	
		Input filter range	—		50 nS to 12.9 μS (10 MHz to 38.8 kHz)	
	High speed I/O	Secondary clock out range (7)	—		1 to 1	
		Position capture	Input filter range	—		50 nS to 12.9 μS (10 MHz to 38.8 kHz)
		Resolution		—		32 bit
	Open loop configuration	Trip output – speed/resolution/threshold	—		150 nS/32 bit/TTL	
		Number of settings	20			
	Counters	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)			
		Type	position, encoder/32 bit			
	Velocity	Edge rate maximum	5 MHz			
Range		+/- 5,000,000 steps per second				
Accel/Decel	Resolution	0.5961 steps per second				
	Range	1.5 x 10 ⁹ steps per second ²				
	Resolution	90.9 steps per second ²				

(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) Ethernet only available with MDrive 23 External shaft products.

(6) Only with RS-422/485 systems. All parameters are set using the supplied system configuration GUI. An optional Communication Converter is recommended with first orders.

(7) Adjusting the microstep resolution can increase the range.



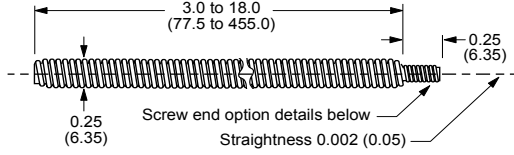
See User Manual for complete details: www.imshome.com/manuals.html

MDrive® Plus Linear Actuator

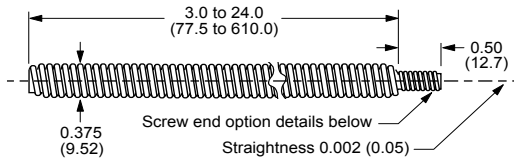
Motion Control

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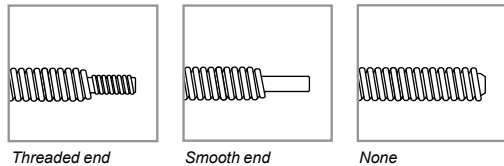
Dimensions in inches (mm)



MDrive 14 and MDrive 17 screw dimensions



MDrive 23 screw dimensions



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)	MDrive 14 and MDrive 17		MDrive 23	
	minimum	maximum	minimum	maximum
inches	3.0	18.0	3.0	24.0
mm	77.5	455.0	77.5	610.0

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

Lead/pitch options

Screw	travel	MDrive 14 and MDrive 17		MDrive 23	
		per revolution	per full step	per revolution	per full step
Screw G	inches	—	—	0.3750	0.001875
	mm	—	—	9.525	0.0476
Screw A	inches	0.250	0.00125	0.200	0.001
	mm	6.350	0.0317	5.08	0.0254
Screw B	inches	0.125	0.00063	0.1670	0.000835
	mm	3.175	0.0158	4.233	0.0212
Screw C	inches	0.063	0.00031	—	—
	mm	1.588	0.0079	—	—
Screw D	inches	0.031	0.00016	0.0833	0.0004165
	mm	0.794	0.0040	2.116	0.0106

End options

Threaded	metric end	MDrive 14 and MDrive 17	MDrive 23
		M4 x 0.7 mm thread to within 0.03"/0.76 mm of shoulder	M6 x 1.0 mm thread to within 0.03"/0.76 mm of shoulder
Smooth	inches	Ø 0.1967 ±0.001	Ø 0.2362 ±0.001
	mm	Ø 5 ±0.003	Ø 6 ±0.003
None		—	—

Load limit

Non-captive shaft (2)	lbs	MDrive 14 and MDrive 17	MDrive 23
		50 (3)	200
External shaft	kg	22 (3)	91
	General purpose nut	lbs	60
	kg	11	27
	Anti-backlash nut	lbs	25
	kg	2	11

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

(3) Screw D has a load limit of 10 lbs/4.5 kg. Heavier loads will degrade screw life. Consult factory for alternative.

Calculating length

■ Non-captive shaft products

Screw length = [mounting surface plate thickness] + [desired stroke length] + [•]

● MDrive 14 = 1.4" / 35.6 mm

● MDrive 17 = 1.4" / 35.6 mm

● MDrive 23 = 1.8" / 45.7 mm

■ External shaft products

Available stroke length = [screw length] – [nut length] – [mounting surface plate thickness]

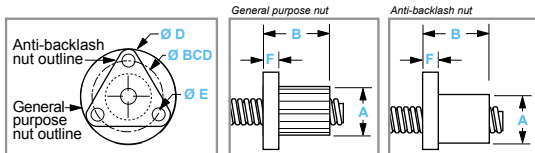
MDrive[®] Plus Linear Actuator

Motion Control
fully programmable

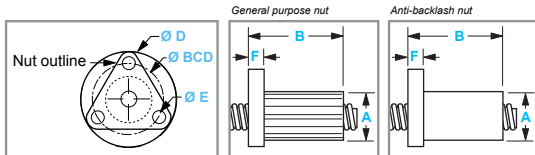
Nut specifications

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.

MDrive 14 and MDrive 17 nuts



MDrive 23 nuts



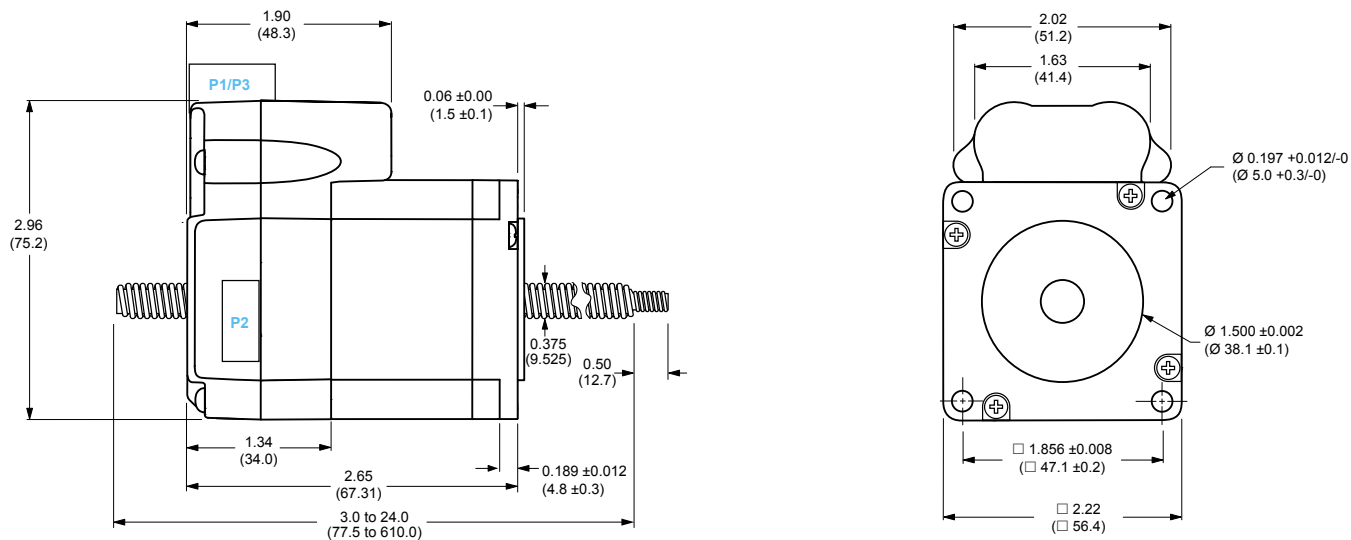
Dimensions and performance

		MDrive 14 and MDrive 17		MDrive 23	
	nut type	general purpose	anti-backlash	general purpose	anti-backlash
A	inches	0.50	0.50	0.71	0.82
	mm	12.7	12.7	18.0	20.8
B	inches	0.75	0.9 max	1.50	1.875 max
	mm	19.1	22.86 max	38.1	47.63 max
D	inches	1.0	1.0	1.5	1.5
	mm	25.4	25.4	38.1	38.1
E	inches	0.14	0.143	0.20	0.20
	mm	3.6	3.63	5.08	5.08
F	inches	0.15	0.18	0.20	0.20
	mm	3.81	4.57	5.08	5.08
BCD	inches	0.75	0.75	1.125	1.125
	mm	19.1	19.1	28.6	28.6
Load limit	lbs	25	5	60	25
	kg	11	2	27	11
Drag torque		free wheeling	< 1.0 oz-in	free wheeling	1 to 3
			< 0.7 N-cm		

MDrive® 23 Plus Linear Actuator

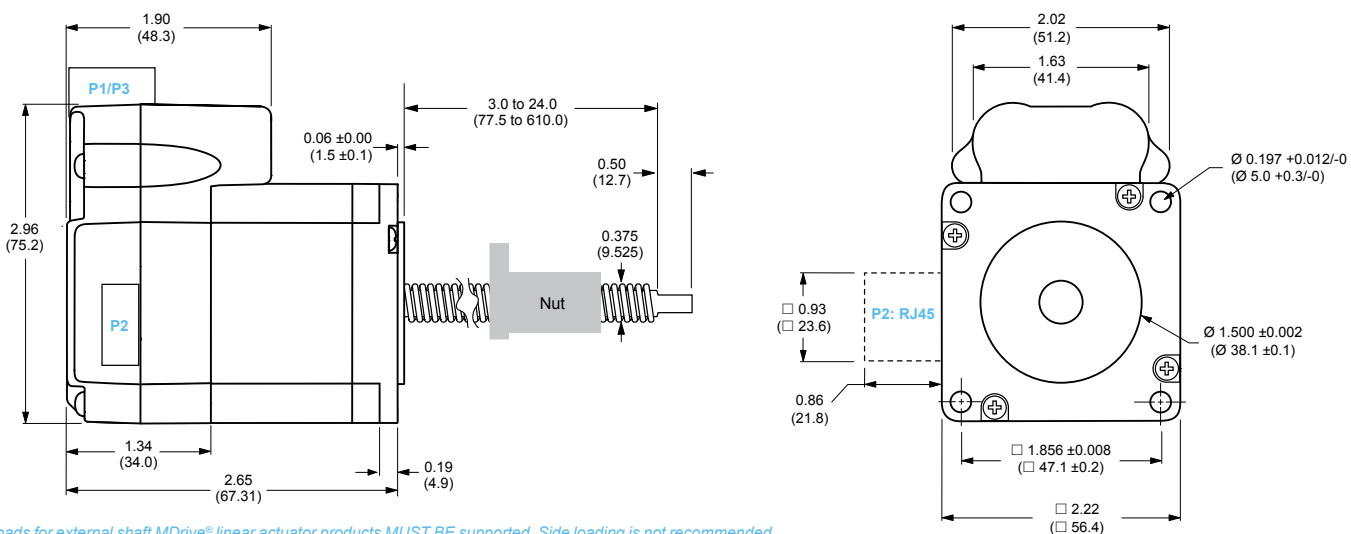
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– Non-captive shaft – mechanical specifications, dimensions in inches (mm)



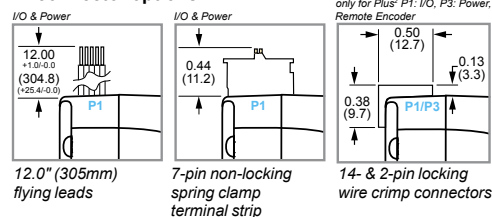
Unsupported loads and side loading are not recommended for non-captive shaft MDrive® linear actuator products.

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

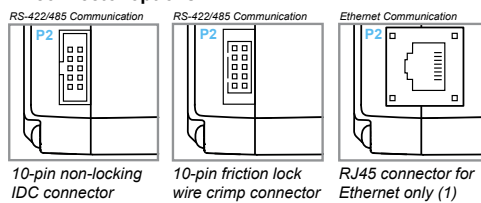


Loads for external shaft MDrive® linear actuator products MUST BE supported. Side loading is not recommended.

P1 connector options



P2 connector options

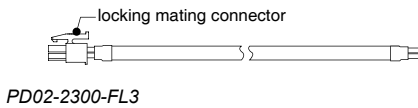
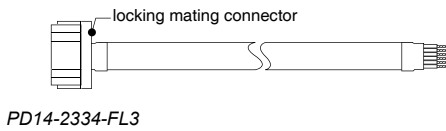
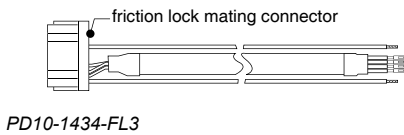
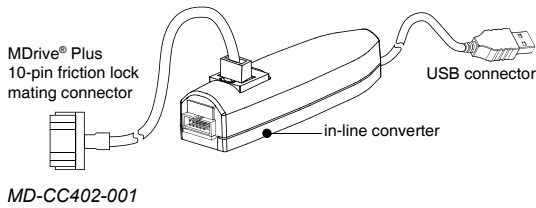
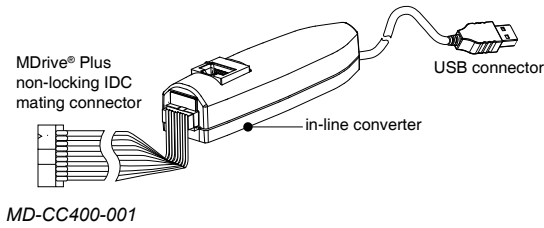


(1) Ethernet is only available with External shaft Plus² products.

MDrive® 23 Plus Linear Actuator

Motion Control

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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 Plus Linear Actuator initial functional setup and system testing.

- For MDrive 23 Plus Motion Control products — add "K" to part number (1)

Communication converter

Electrically isolated, in-line converter pre-wired with mating connector to conveniently set/program communication parameters for a single MDrive Plus Linear Actuator via a PC's USB port.

- | | | |
|--|------------|--------------|
| ■ Mates to 10-pin non-locking IDC connector | 12.0 (3.6) | MD-CC400-001 |
| ■ Mates to 10-pin friction lock wire crimp connector | 12.0 (3.6) | MD-CC402-001 |

Prototype development cable

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

- | | | |
|--|------------|---------------|
| ■ Mates to 10-pin friction lock wire crimp connector for communication | 10.0 (3.0) | PD10-1434-FL3 |
| ■ Mates to 14-pin locking wire crimp connector for I/O and remote encoder option | 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.

- | | | |
|---|---|-------|
| ■ 10-pin friction lock wire crimp connector for communication | — | CK-02 |
| ■ 10-pin non-locking IDC connector for communication | — | CK-01 |
| ■ 14-pin locking wire crimp connector for I/O and remote encoder option | — | 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.

- | | | |
|---|---|-------|
| ■ For all MDrive Linear Actuator products | — | DPM75 |
|---|---|-------|

(1) See page 8.



MDrive® 23 Plus Linear Actuator

Motion Control

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MDrive® 23 Plus



- P1: I/O & Power**
F = 12" flying leads
P = non-locking spring clamp terminal strip
- P2: Communication**
D = RS-422/485 with 10-pin IDC non-locking connector
L = RS-422/485 with 10-pin friction lock wire crimp connector

MDrive® 23 Plus²



- P1: I/O, and optional remote encoder**
C = 14-pin locking wire crimp connector
- P3: Power**
2-pin locking wire crimp connector
- P2: Communication**
D = RS-422/485 with 10-pin IDC non-locking connector
L = RS-422/485 with 10-pin friction lock wire crimp connector
R = Ethernet with RJ45 locking connector

Part numbers														
Example:	K	M	L	I	1	F	R	D	2	3	A	7	-EQ	-●
QuickStart Kit	K	M	L	I	1	F	R	D	2	3	A	7	-EQ	-●
K = kit option, or leave blank if not wanted														
MDrive Plus Linear Actuator version	K	M	L	I	1	F	R	D	2	3	A	7	-EQ	-●
MLI = Motion Control														
Type	K	M	L	I	1	F	R	D	2	3	A	7	-EQ	-●
1 = Plus, standard features 3 = Plus ² , expanded features														
P1 connector	K	M	L	I	1	F	R	D	2	3	A	7	-EQ	-●
F = flying leads (1) P = pluggable (1) C = wire crimp (2)														
Communication	K	M	L	I	1	F	R	D	2	3	A	7	-EQ	-●
R = RS-422/485 E = Ethernet (2)														
P2 connector	K	M	L	I	1	F	R	D	2	3	A	7	-EQ	-●
D = IDC L = wire crimp R = RJ45 (3)														
Motor size	K	M	L	I	1	F	R	D	2	3	A	7	-EQ	-●
23 = NEMA 23 (2.3" / 57 mm)														
Motor length	K	M	L	I	1	F	R	D	2	3	A	7	-EQ	-●
A = single stack														
Drive voltage	K	M	L	I	1	F	R	D	2	3	A	7	-EQ	-●
7 = +12 to +75 VDC														
Encoder													-EQ	-●
Leave blank if not wanted -EQ = internal encoder, 512-line internal magnetic encoder with index mark -EE = remote encoder interface, differential encoder to be provided by user (2) (4)														
Linear actuator specifications														-●
Complete the part number from the table below														

Continued – Part numbers														
Example - linear actuator specifications:	-L	G	1	M	0	6	0	Z	T					
Linear actuator	-L	G	1	M	0	6	0	Z	T					
Screw lead / pitch	-L	G	1	M	0	6	0	Z	T					
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														
Shaft style	-L	G	1	M	0	6	0	Z	T					
1 = Non-captive (4) 3 = External														
Screw end finish	-L	G	1	M	0	6	0	Z	T					
M = metric threaded U = UNC threaded S = smooth Z = none														
Screw length	-L	G	1	M	0	6	0	Z	T					
030 = 3.0" (77.5 mm) minimum up to 240 = 24.0" (610.0 mm) maximum, in 0.1" (2.5 mm) increments														
Nut	-L	G	1	M	0	6	0	Z	T					
Z = none, only with Non-captive shaft products G = general purpose, only with External shaft products (5) A = anti-backlash, only with External shaft products (6)														
Coating	-L	G	1	M	0	6	0	Z	T					
T = Teflon Z = None														

(1) Only available with Plus products.
 (2) Only available with Plus² products.
 (3) Only available with products with Ethernet protocol.
 (4) Unavailable with products with Ethernet protocol.
 (5) Dynamic load limit to 60 lbs / 22 kg.
 (6) Dynamic load limit to 25 lbs / 11 kg.



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

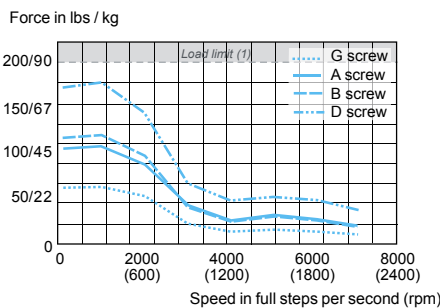
Motor specifications			
Stack length		Single	
Holding torque		oz-in	90.0
		N-cm	64.0
Rotor inertia		oz-in-sec ²	0.0025
		kg-cm ²	0.18
Maximum screw misalignment		°	± 1
Weight without screw		oz	22.0
		g	625.0
Maximum thrust (1)	Non-captive shaft	lbs	200
		kg	91
	External shaft with general purpose nut	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.

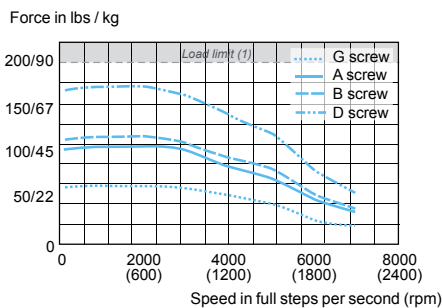
(2) Only applicable for External shaft linear actuator with anti-backlash nut.

Speed force characteristics

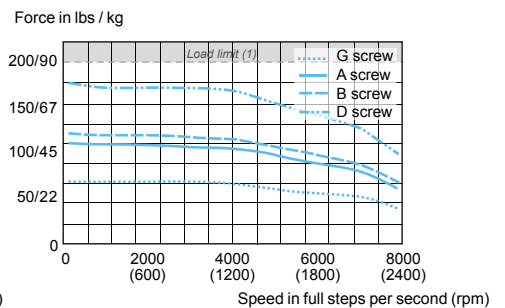
24 VDC



48 VDC



75 VDC



(1) Load limits are for non-captive shaft linear actuators: 200lbs/91kg.

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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