

MDrive® Linear Actuator

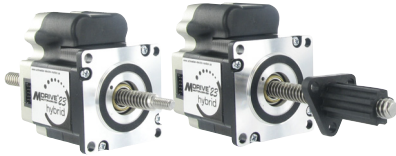
Compact, integrated all-in-one linear motion systems



MDrive 23 Hybrid Linear Actuator
Motion Control, fully programmable

IMS
INTELLIGENT MOTION
SYSTEMS, INC.

Schneider
Electric



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

Presentation

The MDrive® Hybrid Motion Control Linear Actuator is a very compact linear motion system that solves many servo applications with a low cost solution. The system includes a 1.8° 2-phase stepper motor linear actuator with on-board fully programmable motion controller, high performance microstepping drive, internal encoder integral to system operation, and Hybrid Motion Technology™ (HMT). HMT combines the best of servo and stepper motor technologies, while delivering unique capabilities and enhancements over both. These stand-alone motion control solutions that can be used without any external controller.

With MDrive Hybrid integrated motion control systems, point-to-point positioning, torque mode and velocity control are all user programmed with pre-installed MCode software, a simple language that uses 1 to 2 character instructions, and an easy-to-use terminal emulator program that is provided. Communication is via RS-422/485 or Ethernet.

MDrive Hybrid systems with Ethernet are 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.

A USB to RS-422/485 Communications Converter is available for ease of connecting to a user's PC. Connectivity options range from all-inclusive QuickStart Kits to individual interfacing cables and mating connector kits to build your own cables.

Application areas

The MDrive Hybrid Linear Actuator is ideal for machine builders who want a low cost linear motion alternative to servo motors and brushed DC motors. The highly compact all-in-one system converts signals directly from rotary to linear motion, eliminating the need for belts and pulleys, rack and pinion, hydraulics, pneumatics or other mechanical system.

Integrated electronics of the MDrive Hybrid Linear Actuator reduce the potential for problems due to electrical noise by eliminating the cable between motor and drive. This stepper-based linear actuator system requires no tuning, and provides real-time closed loop control through an internal encoder.

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 motor applications — both servo and stepper.

Features

- Highly integrated microstepping drive 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
- Fully programmable motion controller
- Hybrid Motion Technology™ control for exceptional performance
- Internal encoder
- RS-422/485 or Ethernet communication protocols
- Single supply: from +12 to +60
- Cost effective
- Extremely compact
- 20 microstep resolutions up to 51,200 steps per rev including: Degrees, Metric, Arc Minutes
- Available options:
 - QuickStart Kit
 - Drive Protection Module
- Graphical user interface provided for quick and easy configuration and programming



General specifications				
			MDrive 23	
Input power	Voltage	VDC	12 to 60	
	Current maximum (1)	amp	3.5	
Maximum thrust (2)	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 (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	
	Baud rate		4.8 to 115.2 kbps (5)	
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 (5)	
Encoder functions			Find index	
General purpose I/O	Number		8 (or 4 with Ethernet products)	
	Type		Sourcing or sinking outputs/inputs	
	Logic range		Sourcing outputs +12 to +24 VDC	
	Output sink/source current		Inputs and sinking outputs tolerant to +24 VDC, inputs TTL level compatible	
	Protection		Up to 600 mA per channel	
Motion	Closed loop configuration with encoder	Encoder type	Internal, magnetic	
		Steps per rev	51200	
		Resolution	1000 lines/4000 edges per rev	
	Counters	Type		Position, encoder/32 bit
		Edge rate max		5 MHz
	Velocity	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
	High speed I/O Position capture	Input filter range		50 nS to 12.9 µS (10 MHz to 38.8 kHz)
		Resolution		32 bit
	Trip output – speed/resolution/threshold		150 nS/32 bit/TTL	

(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) 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.

Programming

RS-422/485 MDrive Hybrid systems are fully programmable. Users can quickly communicate and program via a PC using IMS Terminal, an integrated ASCII terminal emulator and program editor available for download at www.imshome.com.

Ethernet MDrive Hybrid systems support two protocols in a single package. (1) MCode/TCP fully programmable systems utilize Schneider Electric Motion USA's proprietary MCode programming language, developed for MDrive Motion Control products and adapted to utilize TCP/IP message formatting. (2) MODBUS/TCP is a standard open industrial protocol supported by a variety of machine components such as programmable controllers, drives and controls, I/O modules and switches.

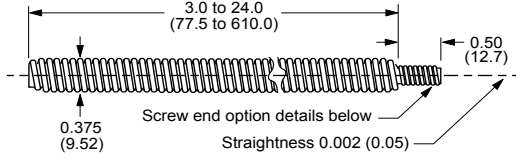


See User Manual for complete details: www.imshome.com/manuals.html

MDrive[®] 23 Hybrid Linear Actuator

Motion Control
fully programmable

Dimensions in inches (mm)



MDrive23 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

		MDrive 23	
		minimum	maximum
Length (1)	inches	3.0	24.0
	mm	77.5	610.0

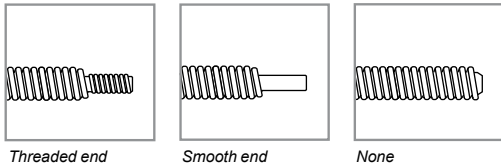
(1) Screw lengths are available in 0.1" (2.5mm) increments.

Lead/pitch options

		MDrive 23	
		per revolution	per full step
Screw G	travel		
	inches	0.3750	0.001875
	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

		MDrive 23
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

		MDrive 23
Non-captive shaft (2)	lbs	200
	kg	91
External shaft	General	lbs 60
	purpose nut	kg 27
	Anti-backlash	lbs 25
	nut	kg 11

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

Calculating length

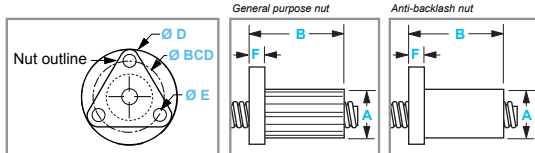
■ Non-captive shaft products
Screw length = [mounting surface plate thickness] + [desired stroke length] + [1.8" (45.7mm)]

■ 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.

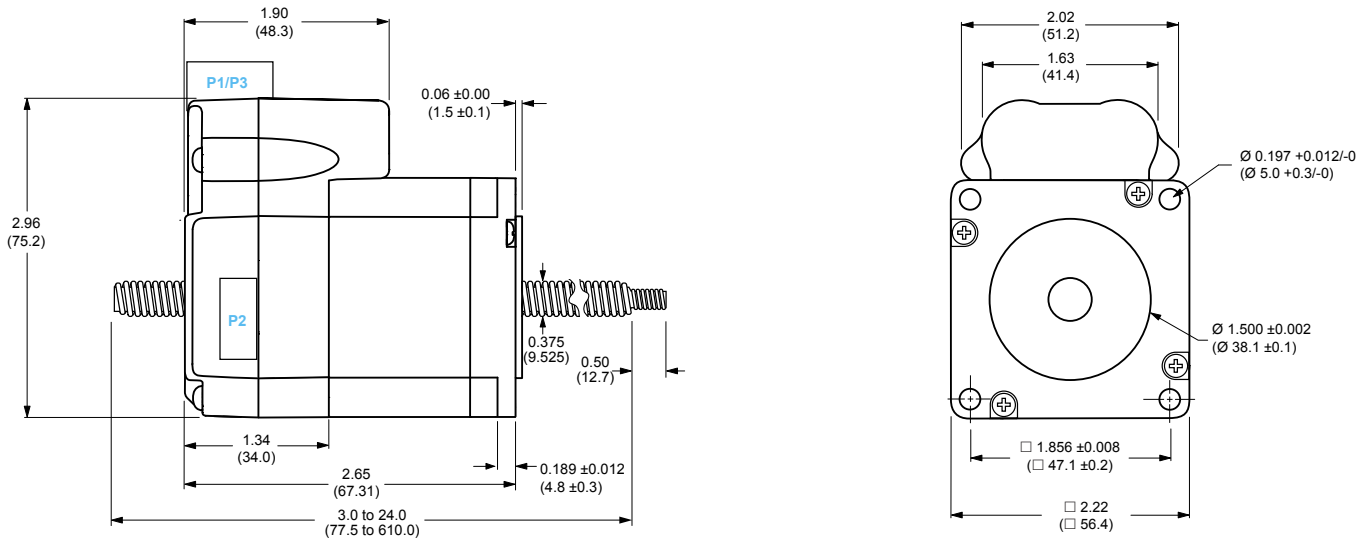
MDrive 23 nuts



Dimensions and performance

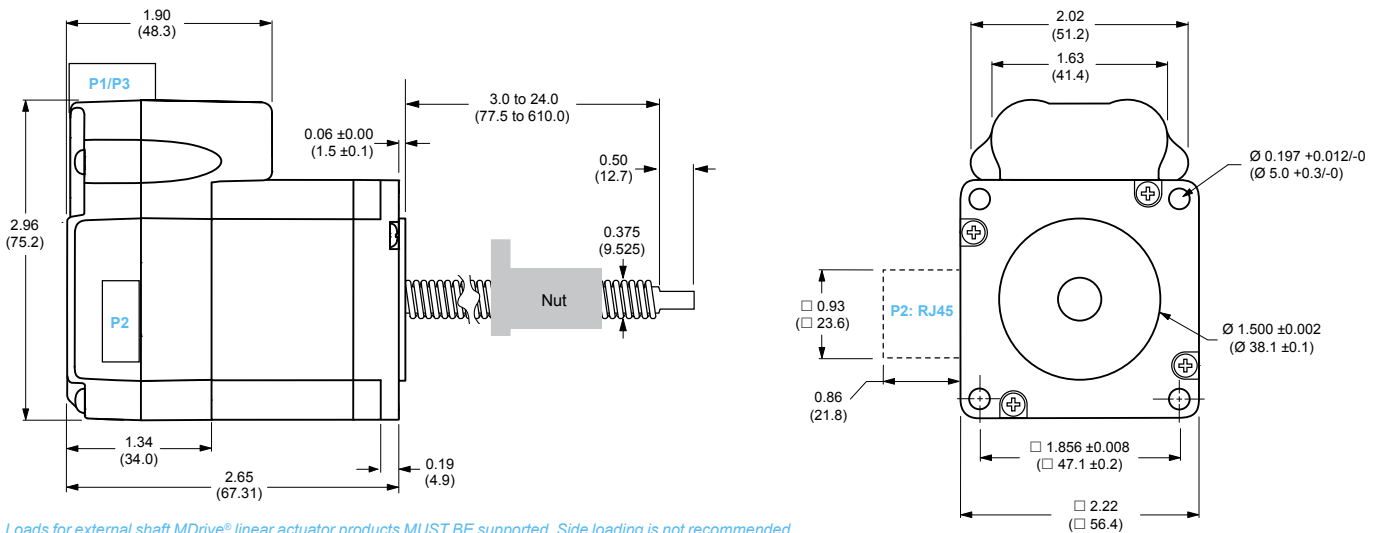
		MDrive23	
		general purpose	anti-backlash
A	nut type		
	inches	0.71	0.82
B	mm	18.0	20.8
	inches	1.50	1.875 max
D	mm	38.1	47.63 max
	inches	1.5	1.5
E	mm	38.1	38.1
	inches	0.20	0.20
F	mm	5.08	5.08
	inches	0.20	0.20
BCD	mm	5.08	5.08
	inches	1.125	1.125
Load limit	mm	28.6	28.6
	lbs	60	25
Drag torque	kg	27	11
		free wheeling	1 to 3

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



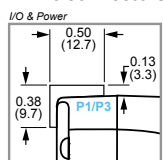
Unsupported loads and side loading are not recommended for non-captive shaft MDrive® linear actuator products.

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



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

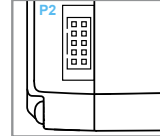
P1/P3 connectors



14- & 2-pin locking wire crimp connectors

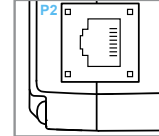
P2 connectors

RS-422/485 Communication



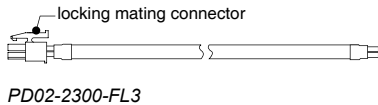
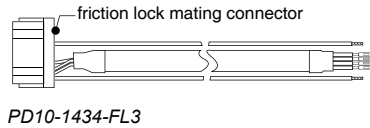
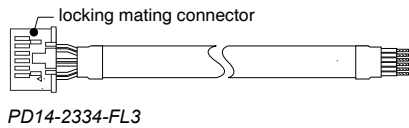
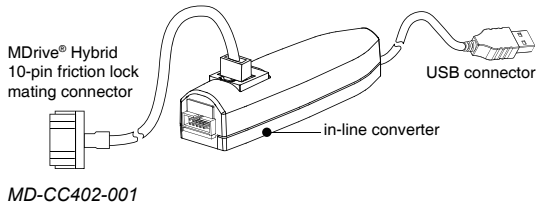
10-pin friction lock wire crimp connector

Ethernet Communication



RJ45 connector for Ethernet only (1)

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



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 Hybrid Linear Actuator initial functional setup and system testing.

- For MDrive 23 Hybrid Motion Control systems — 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 Hybrid Linear Actuator via a PC's USB port.

- 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 14-pin locking wire crimp connector for I/O — 10.0 (3.0) **PD14-2334-FL3**
- Mates to 10-pin friction lock wire crimp connector for communication — 10.0 (3.0) **PD10-1434-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**
- 10-pin friction lock wire crimp connector for communication — **CK-02**
- 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.

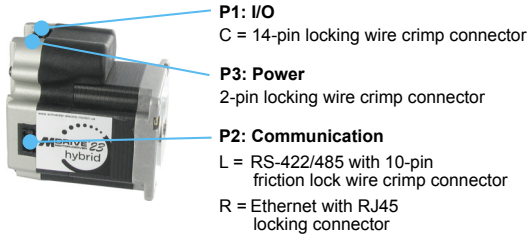
- For all MDrive Linear Actuator systems — **DPM75**

(1) See page 8.

MDrive® 23 Hybrid Linear Actuator

Motion Control
fully programmable

MDrive® 23 Hybrid



Part numbers														
Example:	K	M	A	I	3	C	R	L	2	3	A	6	-EJM	-●
QuickStart Kit K = kit option, or leave blank if not wanted	K	M	A	I	3	C	R	L	2	3	A	6	-EJM	-●
MDrive Hybrid Linear Actuator version MAI = Motion Control	K	M	A	I	3	C	R	L	2	3	A	6	-EJM	-●
Type 3 = Hybrid Motion Technology	K	M	A	I	3	C	R	L	2	3	A	6	-EJM	-●
P1 connector C = wire crimp	K	M	A	I	3	C	R	L	2	3	A	6	-EJM	-●
Communication R = RS-422/485 E = Ethernet	K	M	A	I	3	C	R	L	2	3	A	6	-EJM	-●
P2 connector L = wire crimp R = RJ45 (1)	K	M	A	I	3	C	R	L	2	3	A	6	-EJM	-●
Motor size 23 = NEMA 23 (2.3" / 57 mm)	K	M	A	I	3	C	R	L	2	3	A	6	-EJM	-●
Motor length A = single stack	K	M	A	I	3	C	R	L	2	3	A	6	-EJM	-●
Drive voltage 6 = +12 to +60 VDC	K	M	A	I	3	C	R	L	2	3	A	6	-EJM	-●
Encoder -EJM = 1000-line internal encoder	K	M	A	I	3	C	R	L	2	3	A	6	-EJM	-●
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	-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 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 G = general purpose, only with External shaft products (2) A = anti-backlash, only with External shaft products (3)	-L	G	1	M	0	6	0	Z	T	
Coating T = Teflon Z = None	-L	G	1	M	0	6	0	Z	T	

(1) Only available with products with Ethernet protocol.
 (2) Dynamic load limit to 60 lbs / 22 kg.
 (3) Dynamic load limit to 25 lbs / 11 kg.



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

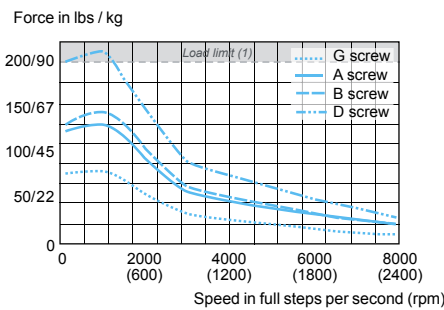
Motor specifications			
Stack length			Single
Holding torque		oz-in	90.0
		N-cm	64.0
Rotor inertia		oz-in-sec ²	0.0025
		kg-cm ²	0.18
Maximum screw misalignment		°	± 1
Weight without screw		oz	22.0
		g	625.0
Maximum thrust (1)	Non-captive shaft	lbs	200
		kg	91
	External shaft with general purpose nut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

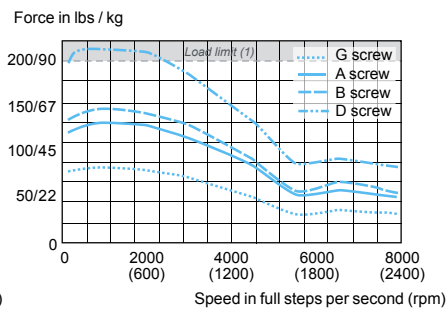
(2) Only applicable for External shaft linear actuator with anti-backlash nut.

Speed force characteristics

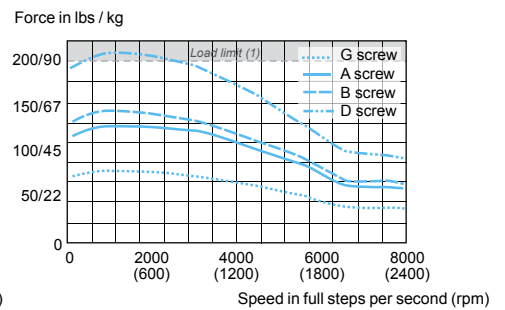
24 VDC



48 VDC



60 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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