

MDrive® Linear Actuator

Compact, integrated all-in-one linear motion systems



MDrive 14 Plus Linear Actuator
CANopen



MDrive® Plus Linear Actuator with CANopen
non-captive and external shaft styles

Presentation

The MDrive® Plus Linear Actuator with CANopen interface 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 controller, drive electronics and optional encoder. 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.

CANopen firmware is provided for MDrive Plus Linear Actuator CANopen products, in addition to CANopen Tester GUI software for interface with the MD-CC500-000 CANopen dongle.

MDrive Plus Linear Actuator CANopen products support CiA DS301 and DSP402 Device Profile for Drives and Motion Control.

Application areas

The MDrive Plus Linear Actuator with CANopen interface is ideal for machine builders who want an optimized stepper motor linear actuator with on-board electronics. The integrated electronics of the 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 exceptional smoothness and performance, and may reduce system cost, design and assembly time for a large range of applications.

Features

Standard Plus

- Highly integrated microstepping drive, 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
- CANopen communication
- Available options:
 - Encoder
 - Drive Protection Module
- Graphical user interface (GUI) provided for quick and easy configuration and programming via optional MD-CC500-000 communication converter

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

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		CANopen CiA DS301 (V3.0), DSP402 (V2.0), 2.0B active		
	Baud rate		Configurable 5 KB to 1 Mb		
	ID		11 and/or 29 bit		
	Isolation		Galvanic		
	Features		Node guarding, heartbeat, SDOs, PDOs (variable mapping)		
Software	Setup parameters		Storable to nonvolatile memory		
	Transmit PDOs		3 dynamically mappable		
	Receive PDOs		3 dynamically mappable		
	Manufacturer specific objects		I/O configuration, run/hold current		
	Modes of operation		Profile position, homing mode, profile velocity		
	Input functions		General purpose, homing mode profiles		
	Output functions		General purpose		
General purpose I/O	Number		Standard Plus products		Expanded Plus ² products (5)
			4		8 (4 with remote encoder option selected)
	Type		Sourcing or sinking inputs, or sinking outputs		Sourcing or sinking outputs/inputs
	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	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		
	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		
	Electronic gearing	External clock in range (6)			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)
		Secondary clock out range (6)			1 to 1
	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	

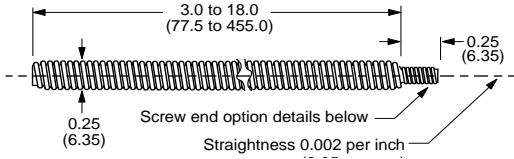
(1) Actual power supply current will depend on voltage and load.
 (2) Performance data for maximum force/load is based on a static load and will vary with a dynamic load.
 (3) Only applicable for External shaft linear actuator with anti-backlash nut.
 (4) When input voltage is removed, maintains power only to control and feedback circuits.
 (5) MDrive14 products available only as Plus² versions.
 (6) Adjusting the microstep resolution can increase the range.

 See User Manual for complete details: www.motion.schneider-electric.com/manuals.html

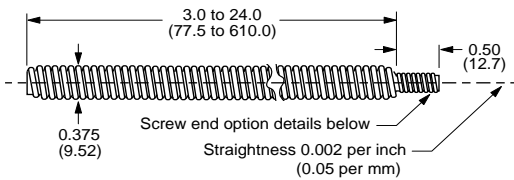
MDrive® Plus Linear Actuator

Step/direction input

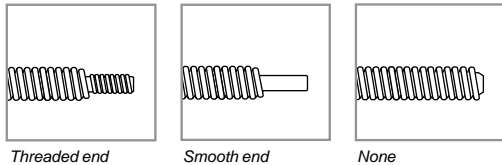
Dimensions in inches (mm)



MDrive14 and MDrive17 screw dimensions



MDrive23 screw dimensions



Screw 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 G	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	—	—	0.0833	0.0004165
	mm	—	—	2.116	0.0106

End options

Threaded		MDrive 14 and MDrive 17	MDrive 23
		metric end	M4 x 0.7 mm thread to within 0.03"/0.76 mm of shoulder
	UNC end	#8-32 UNC-2A thread to within 0.03"/0.76 mm of shoulder	1/4-20 UNC-2A thread to within 0.05"/1.3 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)		MDrive 14 and MDrive 17	MDrive 23
		lbs	50
	kg	22	91
External shaft	General purpose nut	lbs 25	60
		kg 11	27
	Anti-backlash nut	lbs 5	25
		kg 2	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

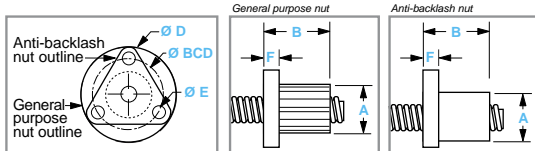
Screw length = [mounting surface plate thickness] + [desired stroke length] + [●]

- MDrive 14 = 1.4" / 35.6 mm
- MDrive 17 = 1.4" / 35.6 mm
- MDrive 23 = 1.8" / 45.7 mm

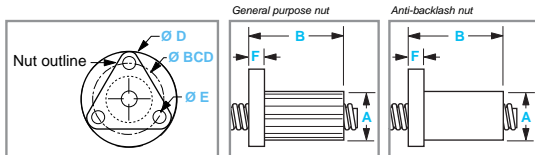
■ External shaft products

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

MDrive14 and MDrive17 nuts



MDrive23 nuts



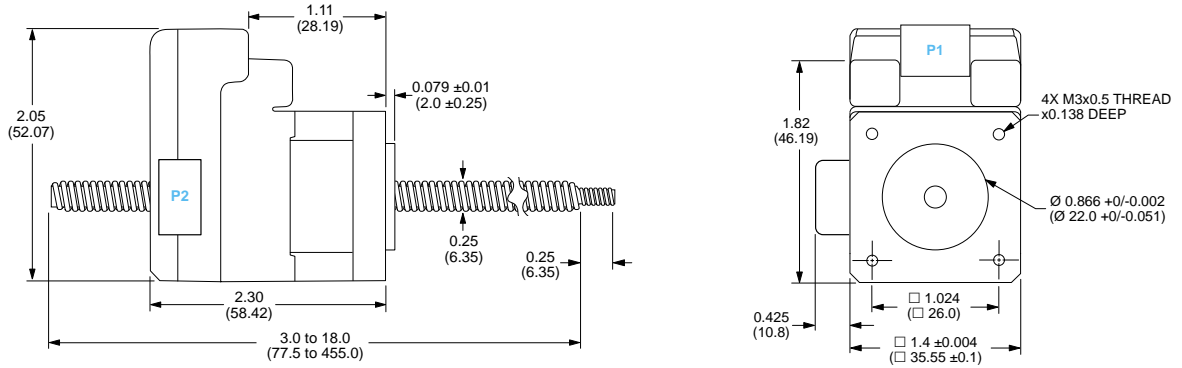
Nut styles

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 are lacking wear compensation.

Dimensions and performance

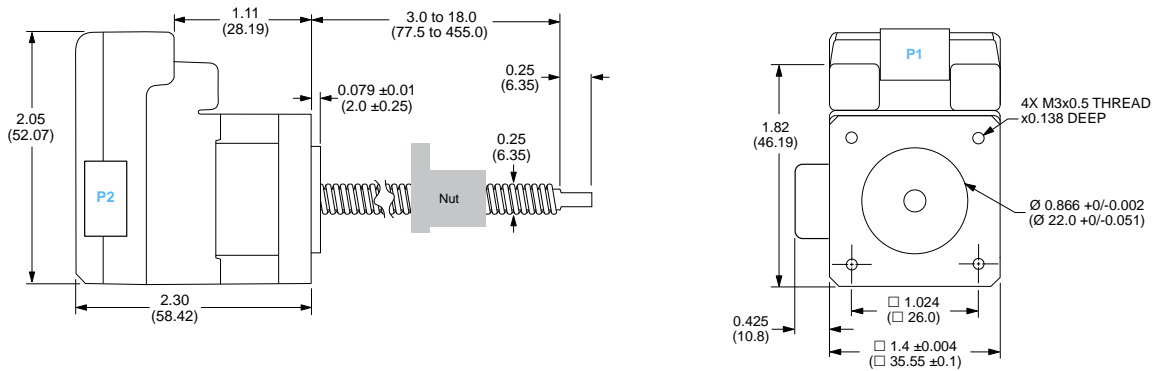
		MDrive 14 and MDrive 17		MDrive 23	
nut type		general purpose	anti-backlash	general purpose	anti-backlash
A	inches	0.50	0.50	0.71	0.82
	mm	12.7	12.7	18.0	20.8
B	inches	0.75	0.9 max	1.50	1.875 max
	mm	19.1	22.86 max	38.1	47.63 max
D	inches	1.0	1.0	1.5	1.5
	mm	25.4	25.4	38.1	38.1
E	inches	0.14	0.143	0.20	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 < 0.7 N-cm	free wheeling	1 to 3

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

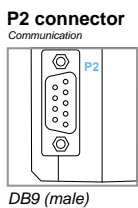
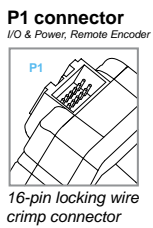


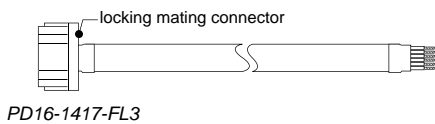
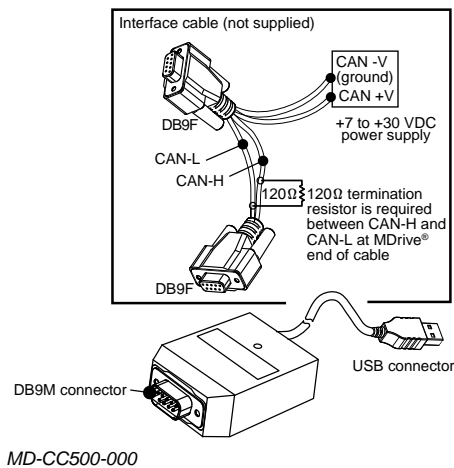
Unsupported loads and side loading are not recommended for non-captive shaft MDrive linear actuator products.

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



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





Installation accessories

Description	Length feet (m)	Part number
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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 DB9 connector (1) 12.0 (3.6) **MD-CC500-000**

Prototype development cable

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

- Mates to 16-pin locking wire crimp connector for I/O, power and remote encoder option 10.0 (3.0) **PD16-1417-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.

- 16-pin locking wire crimp connector for I/O, power and remote encoder option — **CK-10**

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) Requires mating connector adapter and power supply, not supplied.



MDrive® 14 Plus Linear Actuator CANopen

MDrive® 14 Plus²



P1: I/O & Power, and optional remote encoder
C = 16-pin locking wire crimp connector

P2: Communication
B = CANopen with DB9 male connector

Part numbers													
Example:	M	L	I	3	C	C	B	1	4	A	4	-EQ	-●
MDrive Plus Linear Actuator version	M	L	I	3	C	C	B	1	4	A	4	-EQ	-●
MLI = CANopen	M	L	I	3	C	C	B	1	4	A	4	-EQ	-●
Type 3 = Plus ² , expanded features	M	L	I	3	C	C	B	1	4	A	4	-EQ	-●
P1 connector C = wire crimp	M	L	I	3	C	C	B	1	4	A	4	-EQ	-●
Communication C = CANopen	M	L	I	3	C	C	B	1	4	A	4	-EQ	-●
P2 connector B = DB9	M	L	I	3	C	C	B	1	4	A	4	-EQ	-●
Motor size 14 = NEMA 14 (1.4" / 36 mm)	M	L	I	3	C	C	B	1	4	A	4	-EQ	-●
Motor length A = single stack	M	L	I	3	C	C	B	1	4	A	4	-EQ	-●
Drive voltage 4 = +12 to +48 VDC	M	L	I	3	C	C	B	1	4	A	4	-EQ	-●
Encoder Leave blank if not wanted -EQ = internal encoder, 512-line internal magnetic encoder with index mark	M	L	I	3	C	C	B	1	4	A	4	-EQ	-●
Linear actuator specifications Complete the part number from the table below	M	L	I	3	C	C	B	1	4	A	4	-EQ	-●

Continued – Part numbers													
Example - linear actuator specifications:	-L	A	1	M	0	6	0	Z	T				
Linear actuator	-L	A	1	M	0	6	0	Z	T				
-L	-L	A	1	M	0	6	0	Z	T				
Screw lead/pitch A = 0.250" / 6.35 mm travel per rev B = 0.125" / 3.175 mm travel per rev C = 0.063" / 1.588 mm travel per rev	-L	A	1	M	0	6	0	Z	T				
Shaft style 1 = Non-captive 3 = External	-L	A	1	M	0	6	0	Z	T				
Screw end finish M = metric threaded U = UNC threaded S = smooth Z = none	-L	A	1	M	0	6	0	Z	T				
Screw length 030 = 3.0" (77.5 mm) minimum up to 180 = 18.0" (455.0 mm) maximum, in 0.1" (2.5 mm) increments	-L	A	1	M	0	6	0	Z	T				
Nut Z = none, only with Non-captive shaft products G = general purpose, only with External shaft products (1) A = anti-backlash, only with External shaft products (2)	-L	A	1	M	0	6	0	Z	T				
Coating T = Teflon Z = None	-L	A	1	M	0	6	0	Z	T				



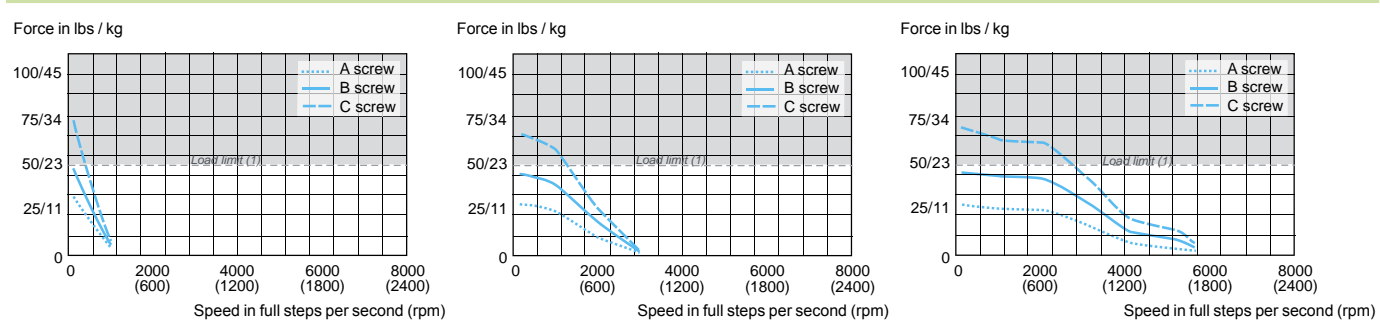
(1) Dynamic load limit to 25 lbs / 11 kg.
(2) Dynamic load limit to 5 lbs / 2 kg.

Easy MDrive part numbers via an interactive tool at:
www.motion.schneider-electric.com/MDriveLinear.html

Motor specifications			
Motor frame size	NEMA		14
	mm		35
Motor length	stacks		1
Holding torque	oz-in		18.0
	N-cm		13.0
Rotor inertia	oz-in-sec ²		0.0003
	kg-cm ²		0.021
Maximum screw misalignment	°		± 1
Weight without screw	oz		8.0
	g		230.0
Maximum thrust (1)	Non-captive shaft	lbs	50
		kg	22
	External shaft with general purpose nut	lbs	25
		kg	11
	External shaft with anti-backlash nut	lbs	5
		kg	2
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



(1) Load limits are for non-captive shaft linear actuators: 50lbs/22 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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