

# MDrive® Linear Actuator

## MLI•14 programmable Motion Control

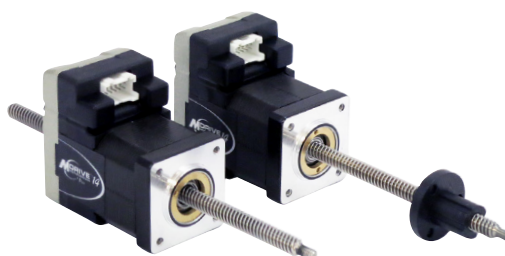
### Product overview

MDrive® Linear Actuators are compact linear motion systems. External or non-captive shaft linear mechanicals are integrated with stepper motor and electronics for reliable, repeatable motion. Customization is available for volume opportunities.

Programmable Motion Control products integrate 1.8° 2-phase stepper motor linear actuator, fully programmable motion controller and drive electronics. An optional encoder can deliver stall detection, position maintenance and find index mark. Products include up to 8 I/O lines.

MDrive product's precision rolled lead screws are manufactured from premium grade stainless steel with optional Teflon® coating. Designed specifically for motion control applications, our high quality screws deliver long life and quiet operation.

Simplify machine design and reduce assembly time by replacing multiple components with a single compact integrated motor. Fewer individual system components eliminates multiple potential failure points, and lowers risk of electrical noise by eliminating cabling between motor and drive.



**MDrive Linear Actuator MLI•14 Motion Control products: integrated NEMA14 motor, controls and mechanicals, non-captive and external shaft styles, IP20-rated**

### Specifications

Communication	Protocol type		RS-422/485
Input power	Voltage	VDC	+12...+48
	Current maximum (1)	Amp	1.0
Motor	Frame size	NEMA	14
		inches	1.4
		mm	35
	Length	stack size	single
Maximum thrust (2)	Non-captive shaft	lbs	50
		kg	22
	External shaft with general purpose nut	lbs	25
		kg	11
		External shaft with anti-backlash nut	lbs
	kg	2	
Maximum repeat-ability	General purpose	inch	0.005
		mm	0.127
	Anti-backlash (3)	inch	0.0005
		mm	0.0127
Thermal	Operating temp non-condensing	Heat sink maximum	85°C
		Motor maximum	100°C
Protection	Type	IP rating	IP20
Motion	Microstep resolution	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)

(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.

# MDrive Linear Actuator

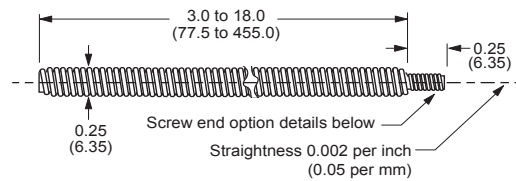
## MLI•14 programmable Motion Control

### Screws (1)

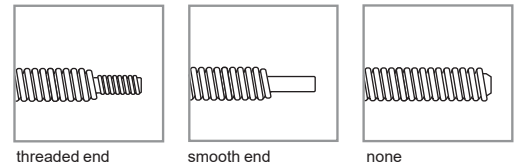
Screw lengths (2)	minimum	inches	3.0	
		mm	77.5	
	maximum	inches	18.0	
		mm	455.0	
Load limits (3)	non-captive shaft	lbs	50	
		kg	22	
	external shaft w/ general purpose nut	lbs	25	
		kg	11	
	external shaft w/ anti-backlash nut	lbs	5	
		kg	2	
End options	threaded	metric	M4 x 0.7 mm thread to within 0.03"/0.76 mm of shoulder	
		UNC	#8-32 UNC-2A thread to within 0.03"/0.76 mm of shoulder	
	smooth	inches	Ø 0.1967 ±0.001	
		mm	Ø 5 ±0.003	
	none	-	-	
	Lead / pitch	screw A	travel	per rev
inches			0.250	0.00125
mm			6.350	0.0317
screw B		inches	0.125	0.00063
		mm	3.175	0.0158
screw C		inches	0.063	0.00031
		mm	1.588	0.0079

- (1) Stainless steel rolled screws are corrosion resistant and non-magnetic, with Teflon coating available.  
 (2) Standard 0.1" / 2.5mm screw length increments are available.  
 (3) Performance data for maximum force/load is based on a static load and will vary with a dynamic load.

#### screw dimensions



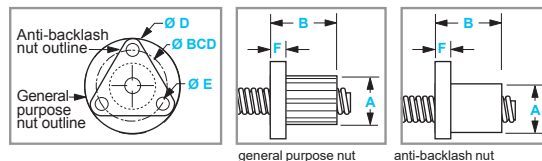
#### end options



### Nuts (4)

		general purpose nuts		anti-backlash nuts
Dimensions	A	inches	0.50	0.50
		mm	12.7	12.7
	B	inches max	0.75	0.9
		mm max	19.1	22.86
	D	inches	1.0	1.0
		mm	25.4	25.4
	E	inches	0.14	0.14
		mm	3.6	3.6
	F	inches	0.15	0.18
		mm	3.81	4.57
BCD	inches	0.75	0.75	
	mm	19.1	19.1	
Load limit	lbs	25	5	
	kg	11	2	
Drag torque		free wheeling	< 1.0 oz-in < 0.7 N-cm	

- (4) External shaft MDrive Linear Actuators 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.



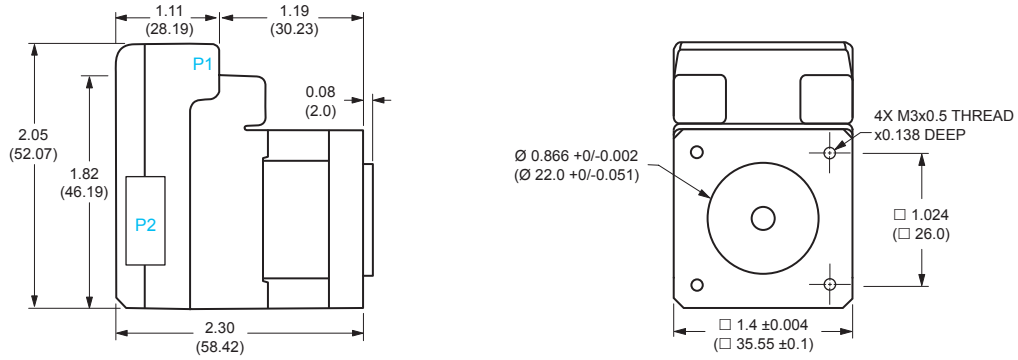
# MDrive Linear Actuator

## MLI•14 programmable Motion Control

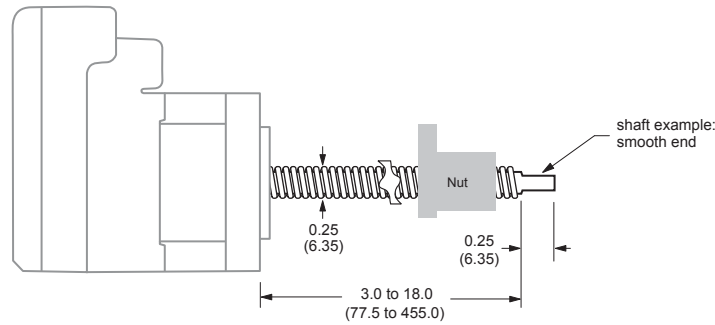
### Dimensions

inches (mm)

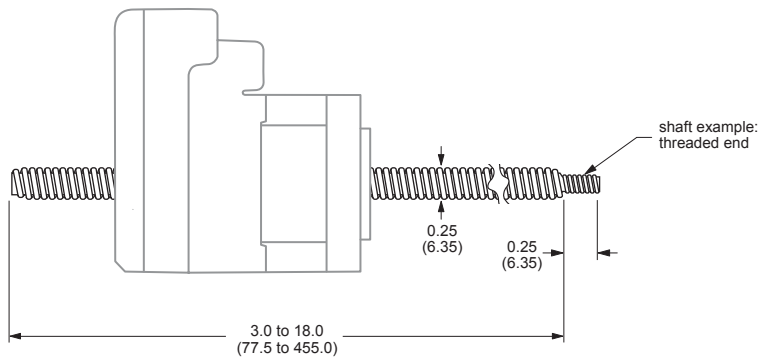
MDrive body



external shaft

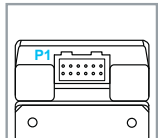


non-captive shaft



### P1 connector (1)

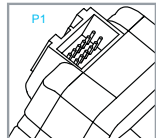
I/O, Power & Communication



12-pin locking wire crimp connector

### P1 connector (2)

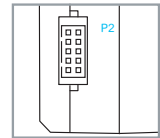
I/O, Power, Remote encoder



16-pin locking wire crimp connector

### P2 connector (2)

Communication

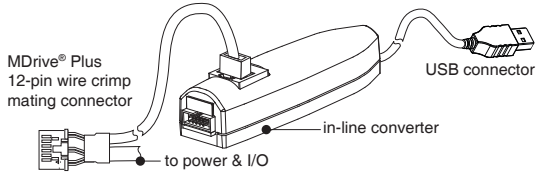


10-pin friction lock wire crimp connector

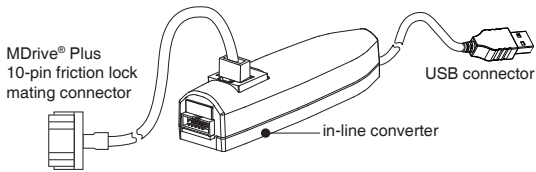
- (1) Plus products with standard features have a single connector at P1.
- (2) Plus<sup>2</sup> products with expanded features have 2 connectors, at P1 & P2.

# MDrive Plus

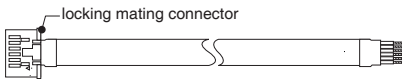
## MLI•14 programmable Motion Control



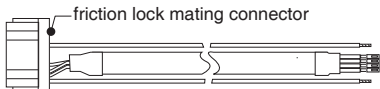
MD-CC403-001



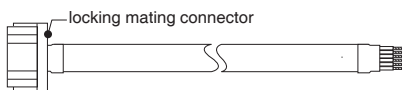
MD-CC402-001



PD12B-1434-FL3



PD10-1434-FL3



PD16-1417-FL3

### Accessories

description	length feet (m)	part number
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#### QuickStart Kit

For rapid design verification, all-inclusive QuickStart Kits includes prototype development cables and a communication converter for MDrive Plus initial functional setup and system testing.

For all MLI•14 programmable Motion Control products	—	add "K" to 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 via a PC's USB port.

Mates to 12-pin locking wire crimp connector	12.0 (3.6)	MD-CC403-001
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 12-pin locking wire crimp connector for I/O, power and communication	10.0 (3.0)	PD12B-1434-FL3
Mates to 10-pin friction lock wire crimp connector for comm	10.0 (3.0)	PD10-1434-FL3
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 kits

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

12-pin locking wire crimp connector for I/O, power and communication	—	CK-08
10-pin friction lock wire crimp connector for communication	—	CK-02
16-pin locking wire crimp connector for I/O, power and remote encoder option	—	CK-10

#### Drive protection module

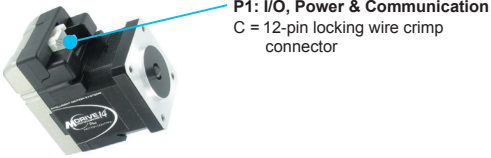
Limits surge current and voltage to a safe level when DC input power is switched on-and-off to an MDrive Plus.

For all MDrive Plus linear actuator products	—	DPM75
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# MDrive Plus

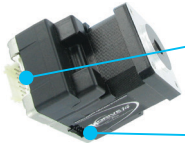
## MLI•14 programmable Motion Control

MDrive® 14 Plus IP20



**P1: I/O, Power & Communication**  
C = 12-pin locking wire crimp connector

MDrive® 14 Plus<sup>2</sup> IP20



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

**P2: Communication**  
L = RS-422/485 with 10-pin friction lock wire crimp connector



Non-captive shaft style



External shaft style

### Part numbers

#### IP20-rated products

example part number	K	M	L	I	1	C	R	Z	1	4	A	4	-EQ	--
QuickStart Kit	K	M	L	I	1	C	R	Z	1	4	A	4	-EQ	--
K = kit option, omit from part number if unwanted														
MDrive Linear Actuator version	K	M	L	I	1	C	R	Z	1	4	A	4	-EQ	--
MLI = Intelligent — programmable Motion Control														
Input	K	M	L	I	1	C	R	Z	1	4	A	4	-EQ	--
1 = Plus version with standard features 3 = Plus <sup>2</sup> version with expanded features														
P1 connector	K	M	L	I	1	C	R	Z	1	4	A	4	-EQ	--
C = wire crimp														
Communication type	K	M	L	I	1	C	R	Z	1	4	A	4	-EQ	--
R = RS-422/485														
P2 connector	K	M	L	I	1	C	R	Z	1	4	A	4	-EQ	--
Z = none (only for Plus products) L = wire crimp (only for Plus <sup>2</sup> products)														
Motor size	K	M	L	I	1	C	R	Z	1	4	A	4	-EQ	--
14 = NEMA 14 1.4" / 35mm														
Motor length	K	M	L	I	1	C	R	Z	1	4	A	4	-EQ	--
A = single stack														
Drive voltage	K	M	L	I	1	C	R	Z	1	4	A	4	-EQ	--
4 = +12 to +48 VDC														
Options — omit from part number if unwanted													-EQ	--
-EQ = internal 512-line magnetic encoder w/ index mark														
-EE (1) = remote differential encoder interface; encoder not supplied														
Linear actuator specifications														
Complete the part number from the table below														

(1) Only with Plus<sup>2</sup> products.

#### - • continued

example part number — linear actuator specifications	-L	A	1	M	0	6	0	Z	T
Linear actuator	-L <td>A <td>1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td></td></td>	A <td>1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td></td>	1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td>	M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td>	0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td>	6 <td>0 <td>Z <td>T</td> </td></td>	0 <td>Z <td>T</td> </td>	Z <td>T</td>	T
-L = linear actuator									
Screw lead / pitch by travel per rev	-L <td>A <td>1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td></td></td>	A <td>1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td></td>	1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td>	M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td>	0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td>	6 <td>0 <td>Z <td>T</td> </td></td>	0 <td>Z <td>T</td> </td>	Z <td>T</td>	T
A = 0.250" / 6.35mm B = 0.125" / 3.175mm C = 0.063" / 1.588mm									
Shaft style	-L <td>A <td>1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td></td></td>	A <td>1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td></td>	1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td>	M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td>	0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td>	6 <td>0 <td>Z <td>T</td> </td></td>	0 <td>Z <td>T</td> </td>	Z <td>T</td>	T
1 = non-captive (2) 3 = external (3)									
Screw end finish	-L <td>A <td>1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td></td></td>	A <td>1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td></td>	1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td>	M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td>	0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td>	6 <td>0 <td>Z <td>T</td> </td></td>	0 <td>Z <td>T</td> </td>	Z <td>T</td>	T
M = metric threaded U = UNC threaded S = smooth Z = none									
Screw length (4)	-L <td>A <td>1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td></td></td>	A <td>1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td></td>	1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td>	M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td>	0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td>	6 <td>0 <td>Z <td>T</td> </td></td>	0 <td>Z <td>T</td> </td>	Z <td>T</td>	T
030 = minimum 3.0" / 77.5mm 180 = maximum 18.0" / 455.0mm									
Nut	-L <td>A <td>1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td></td></td>	A <td>1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td></td>	1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td>	M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td>	0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td>	6 <td>0 <td>Z <td>T</td> </td></td>	0 <td>Z <td>T</td> </td>	Z <td>T</td>	T
Z = none — for non-captive shaft products G = general purpose — for external shaft products A = anti-backlash — for external shaft products									
Coating	-L <td>A <td>1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td></td></td>	A <td>1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td></td>	1 <td>M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td></td>	M <td>0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td></td>	0 <td>6 <td>0 <td>Z <td>T</td> </td></td></td>	6 <td>0 <td>Z <td>T</td> </td></td>	0 <td>Z <td>T</td> </td>	Z <td>T</td>	T
T = Teflon® Z = none									

(2) Unsupported loads and side loading are not recommended.  
(3) Loads must be supported. Side loading is not recommended.  
(4) Screw lengths specified in 0.1" / 2.5mm increments.

# MDrive Plus

## MLI•14 programmable Motion Control

### Motor performance

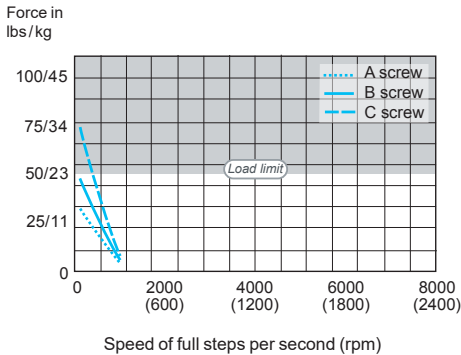
ML•14 NEMA 14 motor specifications		Motor	Stack length	Single
Holding torque			oz-in	18
			N-cm	13
Rotor inertia			oz-in-sec <sup>2</sup>	0.0003
			kg-cm <sup>2</sup>	0.021
Weight without screw			oz	8.0
Maximum screw misalignment			°	±1
Maximum thrust (1)	Non-captive shaft		lbs	50
			kg	22
	External 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.

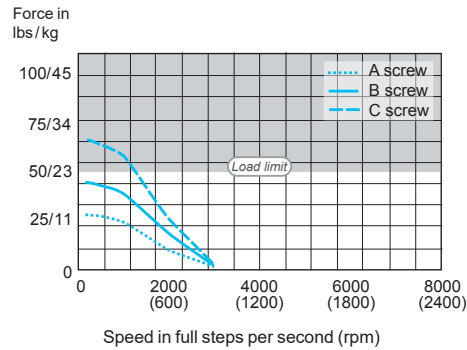
(2) Only applicable for External shaft linear actuator with anti-backlash nut.

### ML•14 NEMA 14 speed force

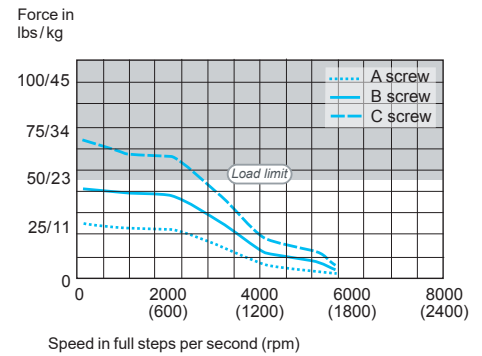
#### 12 VDC



#### 24 VDC



#### 48 VDC



Test conditions: maximum force/load is based on a static load. This will vary with a dynamic load.

Load limits – non-captive shaft: 50lbs/22kg  
 – external shaft: determined by selected nut

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