

M DRIVE[®] 17 Linear ACTUATORS

MOTOR+DRIVER Plus

MDrive[®] Linear Actuators combine leading all-in-one integrated step motor+driver technology with linear motion to deliver long life, high accuracy and unsurpassed repeatability, all in a package that is extremely compact and affordable.



MDrive[®] 17 Linear Actuators feature high torque NEMA 17 (1.7"/43mm sq.) 1.8° brushless linear actuator step motors integrated with electronics. A broad input voltage range from +12 up to +48 VDC and an extended operating range of -40° to +85°C provide long life, trouble free service in demanding environments.

These linear motion systems deliver high accuracy and unsurpassed repeatability with a load limit of up to 50lbs. Precision rolled lead screws are corrosion resistant stainless steel with an optional coating.

Linear actuator styles

Two (2) MDrive[®] linear actuator styles are available:

- **Non-captive shaft**
a threaded shaft extends through the MDrive product and moves axially as the motor rotates
- **External shaft**
a rotating screw, integral to the MDrive rotor, moves the nut axially along the threaded shaft

MDrive 17 Plus versions

Two (2) MDrive17 Plus integrated motor + driver versions provide a choice of features and capabilities:

- **Microstepping, motor+driver**
for step and direction input
- **Motion Control, motor+driver+controller**
fully programmable, RS-485 or CANopen interface stand alone solution can be used without a PLC

Unsurpassed smoothness and performance delivered by MDrive Linear Actuator products are achieved through IMS's advanced 2nd generation current control. By applying innovative techniques to control current flow through the motor, resonance is significantly dampened over the entire speed range and audible noise is reduced. Over-sized input capacitors are used to minimize power line surges, reducing problems that can occur with long cable runs and multiple drive systems.

Non-captive shaft

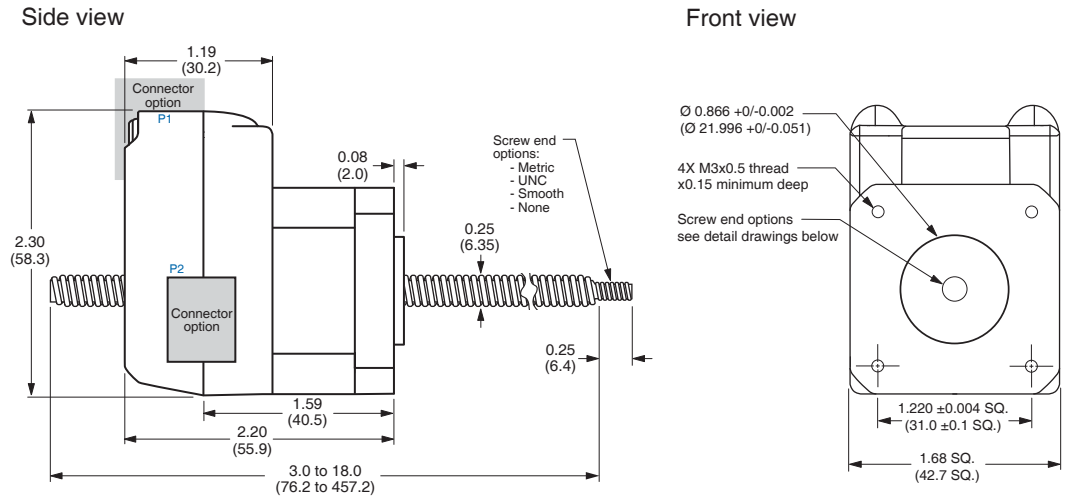


A threaded shaft extends through the MDrive® product and moves axially as the motor rotates



Mechanical specifications

Dimensions in inches (mm)



Load limit

Nominal load limit: 50 lbs (22 kg)*

*Screw D: 10 lbs (4.5 kg). Heavier loads will degrade screw life. Consult factory for alternatives.

Screw specifications

Screw material

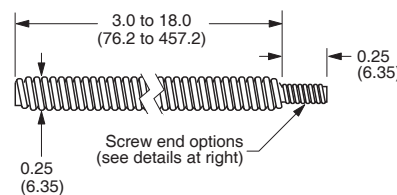
MDrive Linear Actuator precision rolled lead screws are designed specifically for motion control applications to deliver maximum life and quiet operation. Corrosion resistant and non-magnetic, screws are manufactured from premium grade stainless steel.

Screw coating

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

Standard screw

Dimensions in inches (mm)



Lead options

inches (mm)	travel per revolution	travel per full step
Screw A	0.250 (6.350)	0.00125 (0.0317)
Screw B	0.125 (3.175)	0.00063 (0.0158)
Screw C	0.063 (1.588)	0.00031 (0.0079)
Screw D	0.031 (0.794)	0.00016 (0.0040)

Screw end options

	Metric end: M4 x 0.7mm thread to within 0.03" (0.76mm) of shoulder	UNC end: #8-32 UNC-2A thread to within 0.03" (0.76mm) of shoulder
	$\text{Ø } 0.1967" \pm 0.001$ $(\text{Ø } 5\text{mm} \pm 0.003)$	
	—	

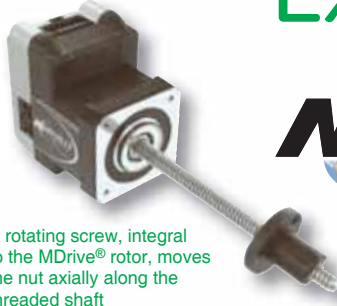
Cantilevered loads

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

Calculating screw length

Screw length = [mounting surface plate thickness] + [1.40" (35.56mm)] + [desired stroke length]

External shaft



A rotating screw, integral to the MDrive® rotor, moves the nut axially along the threaded shaft

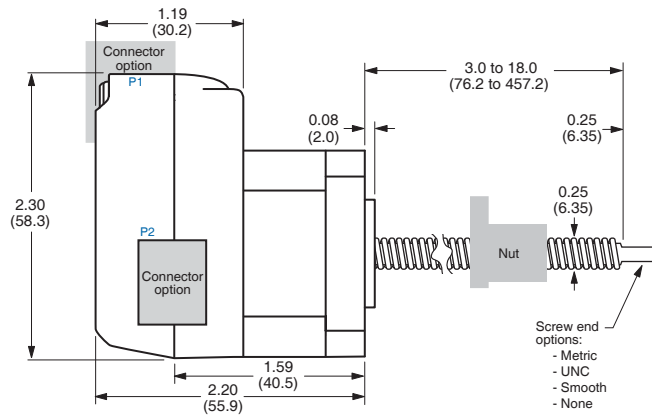
MDrive® 17 Linear ACTUATORS

MOTOR+DRIVER Plus

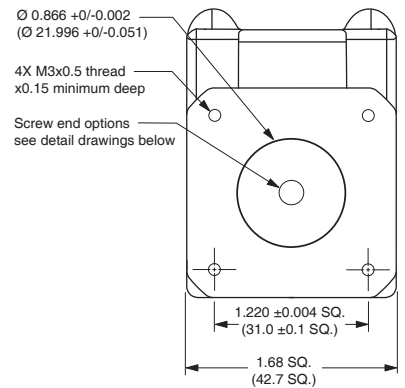
Mechanical specifications

Dimensions in inches (mm)

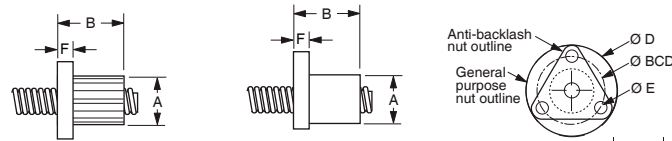
Side view



Front view



Nut detail



General purpose nut
Flange shape: round
Load limit: 25 lbs (11 kg)
Purpose: for applications not requiring anti-backlash and wear compensation.

Anti-backlash nut
Flange shape: triangle
Load limit: 5 lbs (2 kg)
Purpose: backlash free operation for high accuracy and low drag torque.

inches (mm)	A	B	D	E	F	BCD	load limit	drag torque
General purpose	0.50 (12.7)	0.75 (19.1)	1.0 (25.4)	0.14 (3.6)	0.15 (3.81)	0.75 (19.1)	25lbs/ 11 kg	free wheeling
Anti-backlash	0.50 (12.7)	0.9max (22.86)	1.0 (25.4)	0.143 (3.63)	0.18 (4.57)	0.75 (19.1)	5lbs/ 2 kg	< 1.0 oz-in < 0.7 N-cm

Screw specifications

Screw material

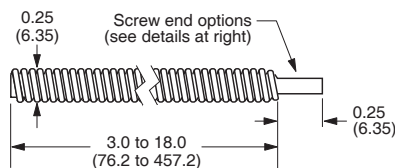
MDrive Linear Actuator precision rolled lead screws are corrosion resistant and non-magnetic, manufactured from premium grade stainless steel.

Screw coating

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

Standard screw

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Lead options

inches (mm)	travel per revolution	travel per full step
Screw A	0.250 (6.350)	0.00125 (0.0317)
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Screw C	0.063 (1.588)	0.00031 (0.0079)
Screw D	0.031 (0.794)	0.00016 (0.0040)

Screw end options

Threaded end	Metric end: M4 x 0.7mm thread to within 0.03" (0.76mm) of shoulder	UNC end: #8-32 UNC-2A thread to within 0.03" (0.76mm) of shoulder
Smooth end	Ø 0.1967" ±0.001 (Ø 5mm ±0.003)	
None	—	

Cantilevered loads

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

Calculating stroke length

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



MDrive[®] Plus

Leading all-in-one integrated step motor+driver technology combined with linear motion to deliver long life, high accuracy and unsurpassed repeatability all in a package that is extremely compact and affordable.

Integrated linear motion

MDrivePlus Linear Actuators are compact, powerful, easy to use and low cost, and can reduce machine cost, size and time-to-market.

Extremely compact design

Motor, mechanicals and electronics form a single, compact unit that dramatically reduces the space requirements in linear motion applications.

Great versatility

For a wide range of linear motion applications, two (2) MDrivePlus versions provide a rich choice of features at low cost. Unique to the market, a rugged internal encoder integrated with the screw is available.

Easy installation and setup

Minimized wiring and production time along with user-friendly software contribute to easy integration of MDrive products. Available QuickStart Kits provide everything needed for initial setup and testing.

Features

Features		MDrivePlus versions	
		Microstepping	Motion Control
Highly integrated microstepping driver and NEMA 17 1.8° single length brushless step linear actuator motor		√	√
Integrated fully programmable motion controller			√
Advanced 2nd generation current control for exceptional performance and smoothness		√	√
Single supply: +12 to +48 VDC		√	√
Low cost		√	√
Extremely compact		√	√
20 programmable microstep resolutions to 51,200 steps/rev including: Degrees, Metric, Arc Minutes		√	√
Premium stainless steel lead screws		√	√
Linear actuator styles	Non-captive shaft	√	√
	External shaft	√	√
Options	Internal magnetic encoder	√	√
	Anti-backlash (external linear actuators only)	√	√
	Coated screw	√	√
Interface connectors	Pluggable locking wire crimp connector	√ ⁴	√
	Pluggable terminal strip connector	√	√
	Flying leads — 12.0"/30.5cm long wires	√	√
Communications type		SPI	RS-422 / 485 or CANopen
Electronically configurable		√ ¹	√
Programmable motor run and hold currents		√	√
Interface software included		√	√
Parameters switchable on-the-fly		√	√
Current reduction		Automatic	Programmable
Noise reduction		Optically isolated input	Programmable filtering
Optically isolated logic input options ²		√	
Up to eight +5 to +24 VDC I/O lines ³			√
Selectable 10-bit analog input for motion/speed control			√
High speed position capture input or trip output			√ ⁴
Auxiliary logic power supply input			√
0 to 5MHz step clock rate selectable in 0.59Hz increments			√
62 software addresses for multi-drop communications			√

¹ Includes: motor direction vs. direction input; clock type - step and direction, quadrature, step up and down; programmable digital filtering for clock and direction inputs

² Select either universal +5 to +24 VDC signals (sourcing or sinking) or differential +5 VDC signals

³ MDrivePlus version offers four +5 to +24 VDC I/O line accepting sourcing or sinking outputs; MDrivePlus2 version with expanded features offer +24 VDC tolerant I/O lines sourcing or sinking, inputs & outputs with either 8 I/O lines with electronic gearing or 4 I/O lines with external/remote encoder for closed loop control

⁴ Only with MDrivePlus2 expanded features



Compact intelligence

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More success with innovative linear motion

General specifications: all versions

	Holding torque	Rotor inertia	Maximum screw misalignment	Weight without screw
Linear actuator motor	29 oz-in (20 N-cm)	0.0005 oz-in-sec ² (0.035 kg-cm ²)	± 1°	9.6 oz (272.2 g)
	Maximum thrust		Maximum repeatability	
	general purpose	with anti-backlash nut	general purpose	with anti-backlash nut
Non-captive shaft	50 lbs (22 kg)	—	0.005" (0.127mm)	—
External shaft	25 lbs (11 kg)	5 lbs (2 kg)	0.005" (0.127mm)	0.0005" (0.0127mm)

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

Input voltage (+V)	Range	+12 to +48 VDC	Power supply current requirements = 2A (max) per MDrive17Plus. Actual power supply current will depend on voltage and load.
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)
Thermal	Operating temperature	Heat sink	-40° to +85°C (non-condensing)
		Motor	-40° to +100°C (non-condensing)

Microstepping version with step and direction input

Standard specifications

Isolated input	Universal	Voltage range: +5 to +24 VDC sourcing or sinking — Step Clock, Direction and Enable
	Differential	Voltage range: +5 VDC — Step Clock and Direction
Motion	Digital filter range	50 nS to 12.9 μS (10 MHz to 38.8 kHz)
	Clock types	Step/Direction, Quadrature, Step Up/Step Down
	Step frequency	2 MHz default / 5 MHz maximum

Setup parameters

	Function	Range	Units	Default
MHC	Motor hold current	0 to 100	percent	5
MRC	Motor run current	1 to 100	percent	25
MSEL	Microstep resolution	1, 2, 4, 5, 8, 10, 16, 25, 32, 50, 64, 100, 108, 125, 127, 128, 180, 200, 250, 256	μsteps per full step	256
DIR	Motor direction override	0/1	—	CW
HCDT	Hold current delay time	0 or 2-65535	mSec	500
CLK TYPE	Clock type	Step/Dir, Quadrature, Up/Down	—	Step/Dir
CLK IOF	Clock and direction filter	50 nS to 12.9 μS (10 MHz to 38.8 kHz)	nS (MHz)	200 nS (2.5 MHz)
USER ID	User ID	Customizable	1-3 characters	IMS
EN ACT	Enable active	High/Low	—	High

All parameters are set using the supplied IMS SPI Motor Interface GUI and may be changed on-the-fly. An optional Communication Converter is recommended with first orders.

Interface wire/pin assignments

P1 I/O and power connector					P2 Communication connector (SPI)**	
Pluggable terminal strip	Flying leads: wire colors	12-pin locking wire crimp**	Function		10-pin IDC	Function
			Universal input	Differential input <i>Clockwise/Counterclockwise</i>		
Pin 1	White	Pin 3	Optocoupler reference	CW +	Pin 1	No connect
Pin 2	—	—	No connect	No connect	Pin 2	No connect
Pin 3	Orange	Pin 4	Step clock input	CW -	Pin 3	No connect
Pin 4	Blue	Pin 6	CW/CCW direction input	CCW -	Pin 4	SPI chip select
Pin 5	Brown	Pin 5	Enable input	CCW +	Pin 5	Communications ground
Pin 6	Black	Pin 1	Power ground	Power ground	Pin 6	+5 VDC output
Pin 7	Red	Pin 2	+V (+12 to +48 VDC)	+V (+12 to +48 VDC)	Pin 7	SPI master out - slave in
		Pin 7	+5 VDC output	+5 VDC output	Pin 8	SPI clock
		Pin 8	SPI clock	SPI clock	Pin 9	No connect
		Pin 9	Communications ground	Communications ground	Pin 10	SPI master in - slave out
		Pin 10	SPI master out - slave in	SPI master out - slave in		
		Pin 11	SPI chip select	SPI chip select		
		Pin 12	SPI master in - slave out	SPI master in - slave out		

**The 12-pin pluggable locking wire crimp connector at P1 eliminates the P2 connector.

Motion Control version with programmable controller or CANopen

Standard (Plus) specifications

Auxiliary logic input voltage	Range	+12 to +24 VDC Maintains power to control and feedback circuits (only) when input voltage is removed.		
	Resolution	10 Bit		
Analog input	Voltage range	0 to +5 VDC, 0 to +10 VDC, 0-20 mA, 4-20 mA		
	Number/type	4 sinking outputs/4 sourcing or sinking inputs		
General purpose I/O	Logic range	Inputs and outputs tolerant to +24VDC, inputs TTL level compatible		
	Output sink current	Up to 600 mA per channel		
	Protection	Over temp, short circuit, transient over voltage, over voltage, inductive clamp		
	Standard	Type	RS-422/485	
Communication	Standard	Baud rate	4.8 to 115.2kbps	
		Type	CANopen DSP-402 (V2.0), DS-301 (V3.0), 2.0B active	
	Optional	ID	11 and/or 29 bit	
		Isolation	Galvanic	
		Features	Node guarding, heartbeat, SDOs, PDOs (variable mapping)	
		Number of settings	20	
Motion	Open loop configuration	Steps per revolution	200, 400, 800, 1000, 1600, 2000, 3200, 5000, 6400, 10000, 12800, 20000, 25000, 25600, 40000, 50000, 51200, 36000 (0.01 deg/ μ step), 21600 (1 arc minute/ μ step), 25400 (0.001mm/ μ step)	
		Type	Internal, magnetic	
	Closed loop configuration (optional)	Internal encoder	Steps per revolution	51200
			Resolution	512 lines/2048 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	
Software	Program storage	Type/size	Flash/6384 bytes	
	User registers	(4) 32 Bit		
	User program labels and variables	192		
	Math functions	+, -, x, \div , >, <, =, <=, >=, 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, analog in, general purpose	
		Outputs	Moving, fault, stall, velocity change, general purpose	
	Trip functions	Trip on input, trip on position, trip on time, trip capture		
	Party mode addresses	62		
	Encoder functions	Stall detection, position maintenance, find index		

Expanded (Plus²) specifications

General purpose I/O	Number/type	8 sourcing or sinking outputs/inputs (or 4 when remote encoder option is selected)			
	Logic range	Sourcing outputs +12 to +24 VDC, inputs and sinking outputs tolerant to +24 VDC, inputs TTL level compatible			
	Output sink/source current	Up to 600 mA per channel			
Motion	Electronic gearing	Range [‡] /resolution/threshold (external clock in)	0.001 to 2.000/32 bit/TTL		
		Input filter range	50 nS to 12.9 μ S (10 MHz to 38.8 kHz)		
		Range [‡] (secondary clock out)	1 to 1		
	High speed I/O	Position capture	Input filter range	50 nS to 12.9 μ S (10 MHz to 38.8 kHz)	
			Resolution	32 bit	
		Trip output – speed/resolution/threshold	150 nS/32 bit/TTL		
Closed loop configuration (optional)	Remote encoder	Type	User-supplied differential encoder		
		Steps per revolution	See above: "Standard specs open loop steps/rev"		
		Resolution	User-defined Note: μ step/rev 2X the encoder count/rev minimum		

[‡] Adjusting the microstep resolution can increase the range.

Interface wire/pin assignments

Plus P1 I/O and power connector			Plus ² P1 I/O and power connector			Plus & Plus ² P2 Communication connector				
Pluggable terminal strip	Flying leads: wire colors	Function	Function			RS-422/485			CANopen	
			16-pin wire crimp	Expanded I/O	Remote encoder closed loop control	10-pin IDC	Wire crimp	Function	DB9	Function
Pin 1	White/yellow	I/O 1	Pin 1	I/O power	I/O power	Pin 1	Pin 9	TX +	Pin 1	No connect
Pin 2	White/orange	I/O 2	Pin 2	I/O ground	I/O ground	Pin 2	Pin 10	TX –	Pin 2	CAN low
Pin 3	White/violet	I/O 3	Pin 3	I/O 1	I/O 1	Pin 3	Pin 7	RX +	Pin 3	CAN –V
Pin 4	White/blue	I/O 4	Pin 4	I/O 2	I/O 2	Pin 4	Pin 8	RX –	Pin 4	No connect
Pin 5	Green	Analog input	Pin 5	I/O 3	I/O 3	Pin 5	Pin 5	Aux-logic (+12 to +24 VDC)	Pin 5	Shield
Pin 6	Black	Power/aux ground	Pin 6	I/O 4	I/O 4	Pin 6	Pin 6	RX +	Pin 6	CAN –V
Pin 7	Red	+V (+12 to +48 VDC)	Pin 7	I/O 9	Channel A +	Pin 7	Pin 3	RX –	Pin 7	CAN high
			Pin 8	I/O 10	Channel A –	Pin 8	Pin 4	TX –	Pin 8	No connect
			Pin 9	I/O 11	Channel B +	Pin 9	Pin 1	TX +	Pin 9	CAN +V
			Pin 10	I/O 12	Channel B –	Pin 10	Pin 2	Comm ground		
			Pin 11	Capture/trip I/O	Capture/trip I/O					
			Pin 12	Analog in	Analog in					
			Pin 13	Step/clock I/O	Index +					
			Pin 14	Direction/clock I/O	Index –					
			Pin 15	+V (+12 to +48 VDC)	+V (+12 to +48 VDC)					
			Pin 16	Power/aux ground	Power/aux ground					

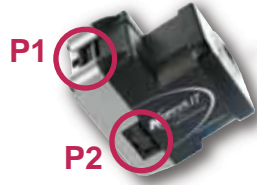


Part numbering

QuickStart Kits

Order by placing a "K" at front of part number.

All-inclusive QuickStart Kits are for rapid design verification. They include communication converter, prototype development cable(s), instructions and CD for MDrive product initial functional setup and system testing.



P1

I/O & power connectors:

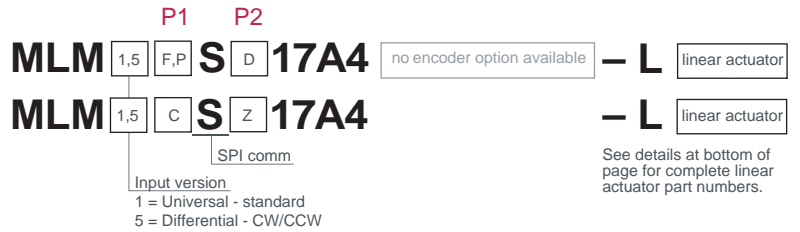
- F = flying leads
- P = pluggable terminal
- C = locking wire crimp (includes Comm on Microstepping version)

P2

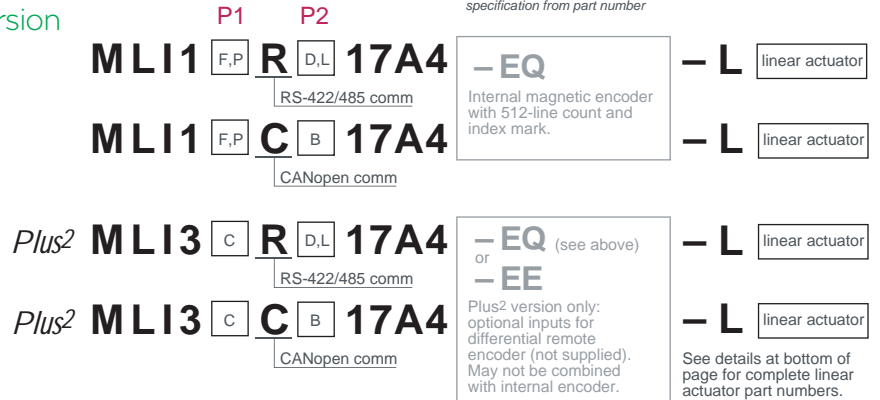
Communication connectors:

- D = 10-pin IDC
- L = 10-pin friction lock wire crimp
- B = DB9, only with CANopen Comm
- Z = None (when C used at P1 on Microstepping version)

Microstepping version



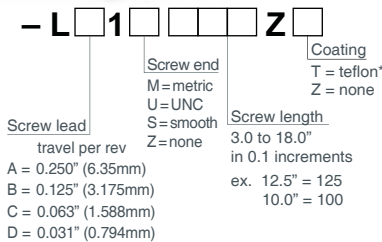
Motion Control version



Linear actuator styles



Non-captive shaft

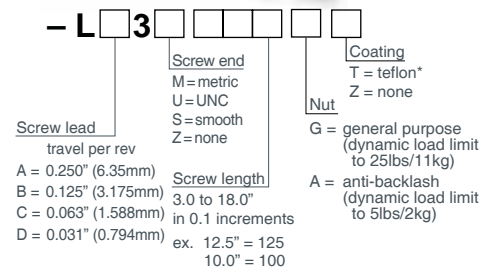


Screw length calculation = desired stroke length + 1.40" (35.56mm) + mounting surface plate thickness

*Contact factory for availability.



External shaft

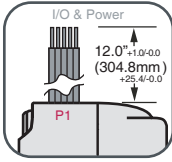


Screw length calculation = desired stroke length + nut length + mounting surface plate thickness

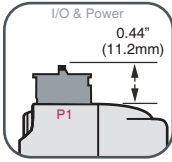
Connectivity

Interfacing options

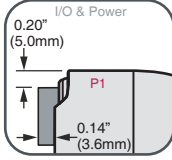
P1 Connector



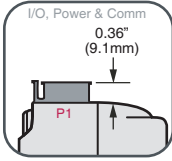
F = flying leads



P = pluggable terminal 7-pin strip

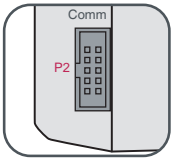


C = locking wire crimp 16-pin (Plus² only)

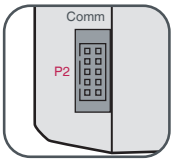


C = locking wire crimp 12-pin (Microstepping only)

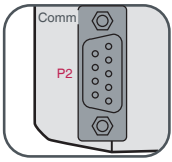
P2 Connector



D = 10-pin IDC



L = 10-pin friction lock wire crimp



B = DB9 (CANopen only)

Microstepping version

Communication Converters

Electrically isolated, in-line converters pre-wired with mating connectors to conveniently set/program communication parameters for a single MDrive product via a PC's USB port. Length 12.0' (3.6m).

Mates to connector:

- P1 12-pin wire crimpMD-CC303-001
- P2 10-pin IDCMD-CC300-001

Prototype Development Cables

Speed test/development with pre-wired mating connectors that have flying leads other end.

Mates to wire crimp connector:

- P1 12-pin (length: 10.0'/3.0m).....PD12-1434-FL3

Mating Connector Kits

Use to build your own cables. Kit contains 5 mating shells with pins. Cable not supplied. Manufacturer's crimp tool recommended.

Mates to connector:

- P1 12-pin wire crimpCK-03

Kit contains 5 mating connectors that press fit onto ribbon cable. Cable not supplied.

- P2 10-pin IDCCK-01

Motion Control version

Communication Converters

Electrically isolated, in-line converters pre-wired with mating connectors to conveniently set/program communication parameters for a single MDrive product via a PC's USB port. Length 12.0' (3.6m).

Mates to connector:

- P2 10-pin IDCMD-CC400-001
- P2 10-pin wire crimp.....MD-CC402-001
- P2 DB9 (dangle requires adapter & power supply)MD-CC500-000

Prototype Development Cables

Speed test/development with pre-wired mating connectors that have flying leads other end. Length 10.0' (3.0m).

Mates to connector:

- P1 16-pin wire crimp.....PD16-1417-FL3
- P2 10-pin wire crimp.....PD10-1434-FL3

Mating Connector Kits

Use to build your own cables. Kit contains 5 mating shells with pins. Cable not supplied. Manufacturer's crimp tool recommended.

Mates to connector:

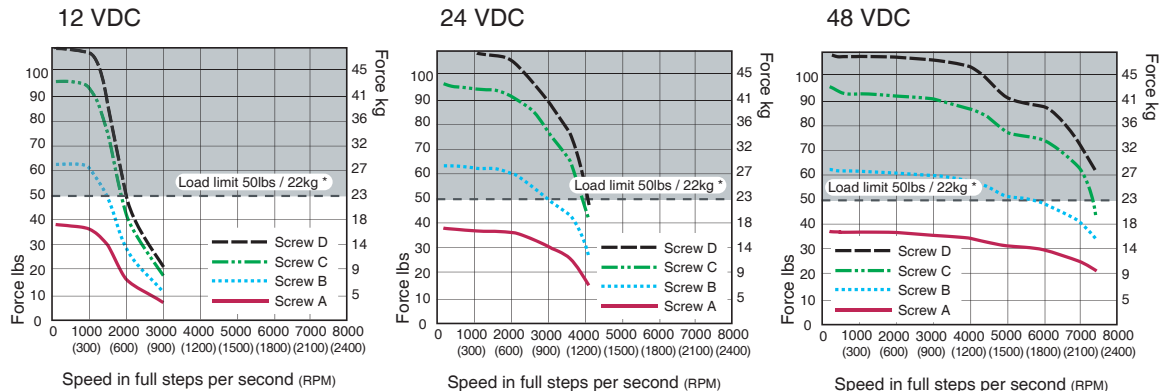
- P1 16-pin wire crimp.....CK-10
- P2 10-pin wire crimp.....CK-02

Kit contains 5 mating connectors that press fit onto ribbon cable. Cable not supplied.

- P2 10-pin IDC.....CK-01

Connectivity details: www.imshome.com/cables_cordsets.html

Speed-force performance curves



NOTE: Performance data for maximum force/load is based on a static load and will vary with a dynamic load.

*For non-captive shaft linear actuators. Load limit for external shaft linear actuators is determined by selected nut.


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