

MDrive[®] Plus

Stepper motors with integrated electronics



MDrive 17 Plus Motion Control
fully programmable



MDrive® Plus Motion Control, fully programmable

Presentation

The MDrive® Plus Motion Control is a 1.8° 2-phase stepper motor with on-board fully programmable motion controller, drive electronics and optional encoder. This means MDrive Plus Motion Control products are stand-alone motion control solutions that can be used without any external controller.

MDrive products come standard with RS-422/485 serial interface. Programming is with MCode, simple 1 to 2 character instructions, using the IMS Terminal software tool.

Size 23 MDrive products are also available for Modbus/TCP protocol. Programming is with the same MCode instruction set used for the RS-422/485 products. Modbus/TCP products support the application protocol per specification Version 1.1b, with operation in immediate mode, not as programmable products.

MDrive Plus Motion Control products may be equipped with encoders for stall detection, position maintenance and find index mark.

Application areas

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

These compact, powerful and cost effective motion control solutions deliver unsurpassed smoothness and performance that will reduce system cost, design and assembly time for a large range of 2-phase stepper motor applications.

Features

Standard Plus

- Highly integrated microstepping drive and high torque 1.8° 2-phase stepper motor
- Advanced current control for exceptional performance and smoothness
- Single supply: from +12 up to +75 VDC or 120 and 240 VAC
- 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 and 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 Modbus/TCP communication protocols (1)
- 62 software addresses for multi-drop communications (2)
- Simple 1 to 2 character instructions
- Available options:
 - Long life linear actuators (3)
 - Hybrid Motion Technology™ (3)
 - Encoders
 - Control knob for manual positioning
 - Industrial connectors with IP54 rating (4)
- Several motor stack lengths available
- Graphical user interface 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 external / remote encoder option
- High speed position capture input or trip output

(1) Modbus/TCP only available for MDrive23 products.

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

(3) See separate documentation.

(4) Industrial connectors are unavailable for MDrive14 or MDrive34 products.

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Standard Plus specifications

		MDrive 14	MDrive 17	MDrive 23 (1)	MDrive 23 (1)	MDrive 34	MDrive 34ac (2)		
Input power	Voltage	VDC	12 to 48	12 to 48	12 to 75	12 to 60	12 to 75	—	
		VAC	—	—	—	—	—	120	240
	Current maximum (3)		1A	2A	2A	3.5A	4A	95 to 132 VAC @ 50/60 Hz	95 to 264 VAC @ 50/60 Hz
Thermal	Operating temp non-condensing	Heat sink	-40° to +85°C				-40° to +75°C		
		Motor	-40° to +100°C				-40° to +90°C		
Protection	Type	not applicable						- Thermal - Over voltage / current	

Aux. logic input voltage	Range	+12 to +24 VDC <i>When input voltage is removed, maintains power only to control and feedback circuits. (4)</i>								
Analog input	Resolution	10 bit								
	Voltage range	0 to +5 VDC, 0 to +10 VDC, 0-20 mA, 4-20 mA								
General purpose I/O	Number	4								
	Type	sourcing or sinking inputs, or sinking outputs								
	Logic range	Inputs and outputs tolerant to +24 VDC, inputs TTL level compatible								
	Output sink current	Up to 600 mA								
	Protection	Over temp, short circuit, transient over voltage, inductive clamp								
Communication	Type	RS-422/485								
	Baud rate	4.8 to 115.2 kbps								
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)							
	Closed loop configuration (requires encoder option)	Encoder resolution	512 lines/2048 edges per rev							
		Counters	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							
	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							
		Outputs	moving, fault, stall, velocity change, general purpose							
Trip functions		Trip on input, trip on position, trip on time, trip capture, trip on relative position								
Party mode addresses		62 (4)								
Encoder functions	Stall detection, position maintenance, find index									

Expanded Plus² specifications

General purpose I/O	Number	8 (or 4 with either remote encoder option or Modbus/TCP protocol)						
	Type	sourcing or sinking outputs / inputs						
	Logic range	Sourcing outputs +12 to +24 VDC, inputs and sinking outputs tolerant to +24 VDC, inputs TTL level compatible						
	Output sinking current	Up to 600 mA						
Communication	Type	RS-422/485 or Modbus/TCP (5)						
Motion	Electronic gearing	Range/resolution/ threshold – external clock in (6)		0.001 to 2.000/32 bit/TTL				
		Input filter range		50 nS to 12.9 μS (10 MHz to 38.8 kHz)				
		Range – secondary clock out (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				
	Closed loop configuration (requires remote encoder)	Trip output – speed / resolution / threshold		150 nS / 32 bit / TTL				
		Steps per revolution		Same as Standard Plus specification shown in section above				
		Encoder type		User-supplied differential encoder				
		Encoder resolution		User-defined				

(1) Only quad stack NEMA 23 motors have +12 to +60 VDC drives, all other NEMA 23 motors have +12 to +75 VDC drives.

(2) Only available as Plus² products.

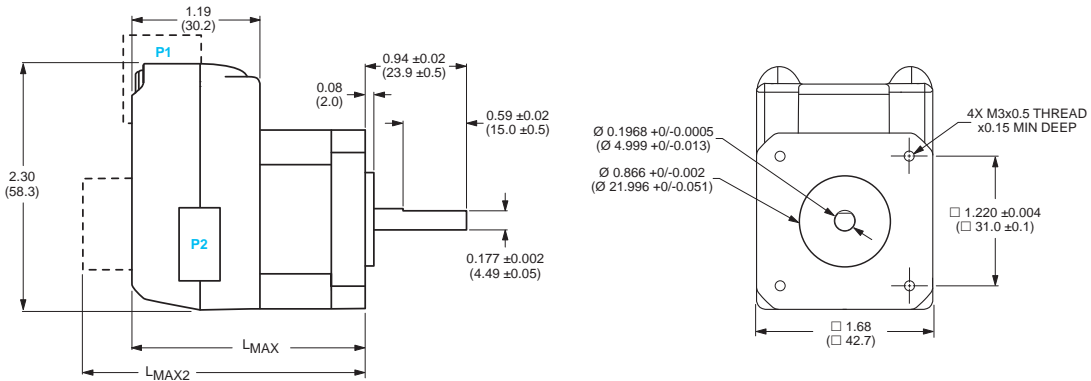
(3) Actual power supply current will depend on voltage and load.

(4) Not available with Modbus/TCP products.

(5) Modbus/TCP only available with MDrive23 Plus² products.

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

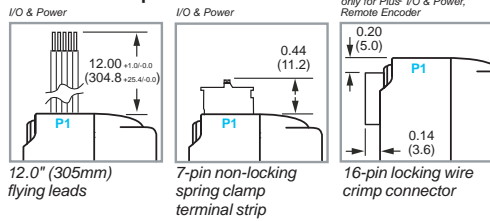
– Plus & Plus² – mechanical specifications, dimensions in inches (mm)



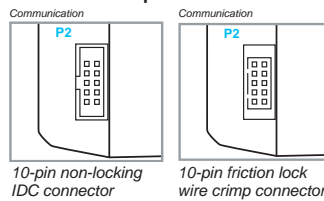
Motor stack length	L _{max} (1)	L _{max} (2)
Single	2.20 (55.9)	2.79 (70.9)
Double	2.43 (61.7)	3.02 (76.7)
Triple	2.77 (70.4)	3.37 (85.6)

(1) Single shaft or internal encoder.
 (2) Control knob (max. torque 20 lb-in / 2.3 N-m) or external encoder.

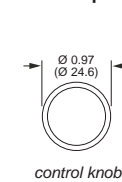
P1 connector options



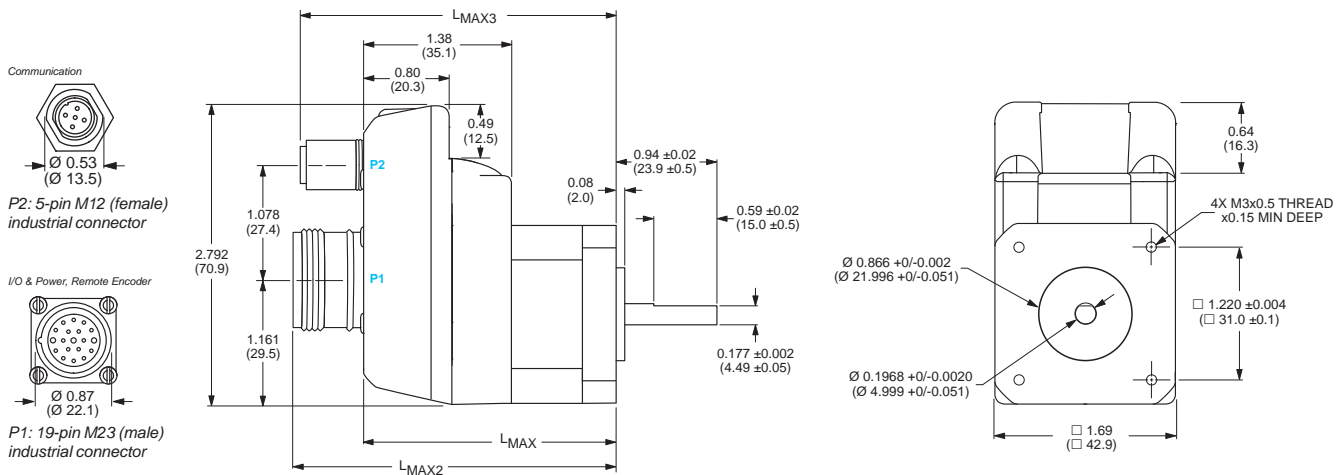
P2 connector options



L_{max2} option



– Plus² with industrial connectors – mechanical specifications, dimensions in inches (mm)

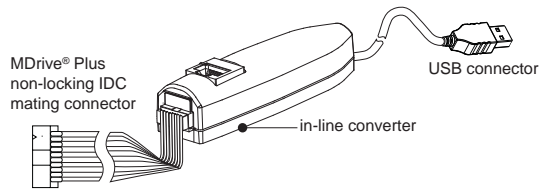


Motor stack length	L _{max}	L _{max2}	L _{max3}
Single	2.48 (63.00)	3.15 (80.00)	3.08 (78.23)
Double	2.71 (68.83)	3.38 (85.85)	3.31 (85.10)
Triple	3.04 (77.22)	3.71 (94.23)	3.64 (92.46)

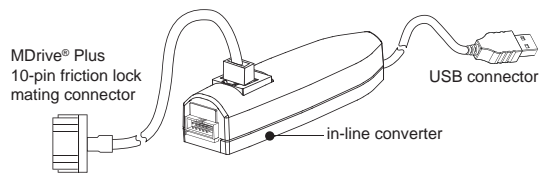
MDrive® 17 Plus

Motion Control

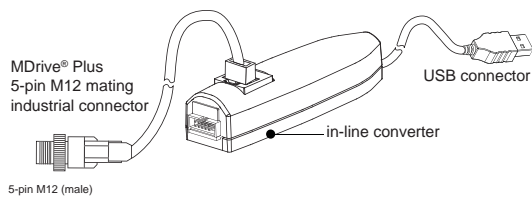
fully programmable



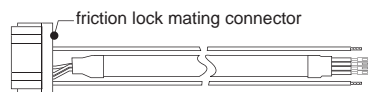
MD-CC400-001



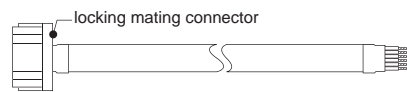
MD-CC402-001



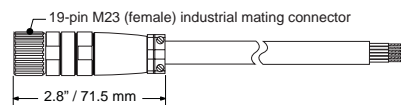
MD-CC401-001



PD10-1434-FL3



PD16-1417-FL3



MD-CS100-000

Installation 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 MDrive17 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 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
■ Mates to 5-pin female M12 industrial connector	12.0 (3.6)	MD-CC401-001

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 I/O, power and remote encoder option	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
■ Mates to 19-pin male M23 industrial connector with straight termination for I/O, power and remote encoder option	13.0 (4.0)	MD-CS100-000
■ Mates to 19-pin male M23 industrial connector with right angle termination for I/O, power and remote encoder option	13.0 (4.0)	MD-CS101-000

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
■ 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 MDrive17 Motion Control products — DPM75

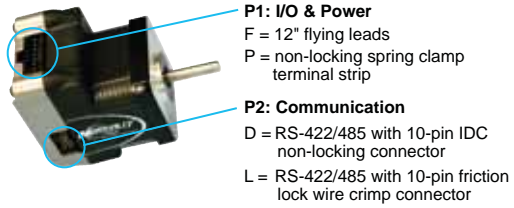
(1) See next page.

MDrive® 17 Plus

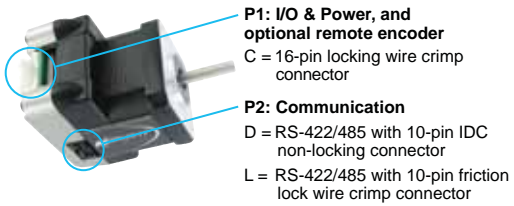
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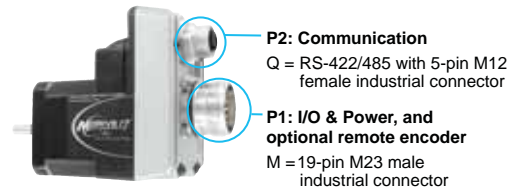
MDrive® 17 Plus



MDrive® 17 Plus²



MDrive® 17 Plus²
with industrial connectors



Part numbers												
Example:	K	M	D	I	1	F	R	D	1	7	A	4 -EQ
QuickStart Kit K = kit option, or leave blank if not wanted	K	M	D	I	1	F	R	D	1	7	A	4 -EQ
MDrive Plus version MDI = Motion Control	K	M	D	I	1	F	R	D	1	7	A	4 -EQ
Input 1 = Plus, standard features 3 = Plus ² , expanded features 4 = Plus ² , expanded features, with industrial connectors, IP54-rated	K	M	D	I	1	F	R	D	1	7	A	4 -EQ
P1 connector F = flying leads P = pluggable C = wire crimp (1) M = M23 industrial connector (2)	K	M	D	I	1	F	R	D	1	7	A	4 -EQ
Communication R = RS-422/485	K	M	D	I	1	F	R	D	1	7	A	4 -EQ
P2 connector D = IDC L = wire crimp Q = M12 industrial connector (2)	K	M	D	I	1	F	R	D	1	7	A	4 -EQ
Motor size 17 = NEMA 17 (1.7" / 42 mm)	K	M	D	I	1	F	R	D	1	7	A	4 -EQ
Motor length A = single stack B = double stack C = triple stack	K	M	D	I	1	F	R	D	1	7	A	4 -EQ
Drive voltage 4 = +12 to +48 VDC	K	M	D	I	1	F	R	D	1	7	A	4 -EQ
Options Leave blank if not wanted Options may be combined, unless noted												-EQ
-EQ												= internal encoder, 512-line internal magnetic encoder with index mark
-EE												= remote encoder interface, differential encoder to be provided by user <i>Available with Plus² versions only. May not be combined with internal encoder option.</i>
-N												= rear control knob for manual positioning (3)

(1) Only available with Plus² products without industrial connectors.

(2) Only available with Plus² products with industrial connectors.

(3) Not available with industrial connector products.

MDrive[®] 17 Plus

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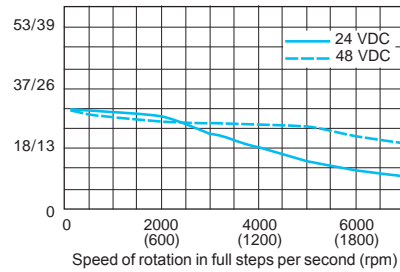
Motor specifications MDrive 17

		Holding torque	Detent torque	Rotor inertia	Weight (motor + driver)
Motor stack length	Single	32.0 oz-in / 22.6 N-cm	1.66 oz-in / 1.17 N-cm	0.00053 oz-in-sec ² / 0.038 kg-cm ²	10.4 oz / 294.8 g
	Double	60.0 oz-in / 42.4 N-cm	2.08 oz-in / 1.47 N-cm	0.00080 oz-in-sec ² / 0.057 kg-cm ²	12.0 oz / 340.2 g
	Triple	74.9 oz-in / 52.9 N-cm	3.47 oz-in / 2.45 N-cm	0.00116 oz-in-sec ² / 0.082 kg-cm ²	15.2 oz / 430.9 g

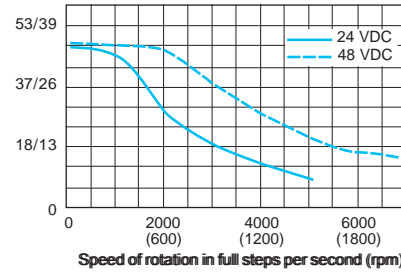
Speed torque characteristics MDrive 17

Single stack length Double stack length Triple stack length

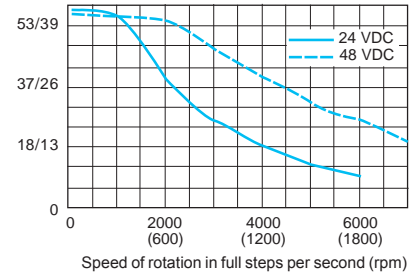
Torque in Oz-In / N-cm



Torque in Oz-In / N-cm



Torque in Oz-In / N-cm



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