

# MDrive<sup>®</sup> Plus

Stepper motors with integrated electronics



**MDrive 14 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.

Programming of MDrive Plus Motion Control products with RS-422/485 interface is accomplished with MCode, simple 1 to 2 character instructions, using the IMS Terminal software tool. MDrive Plus Motion Control products may also be equipped with encoders for stall detection, position maintenance and find index mark.

MDrive Plus Motion Control programming for Ethernet is accomplished 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.

### 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 sourcing or sinking outputs
- 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 Ethernet 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 Plus<sup>2</sup>

- +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) Ethernet 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.

Standard Plus specifications									
Input power	Voltage	VDC	MDrive 14	MDrive 17	MDrive 23 (1)	MDrive 23 (1)	MDrive 34	MDrive 34ac	
		VAC	—	—	—	—	—	—	120
Current maximum (2)			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.</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, over voltage, inductive clamp							
Communication	Type	RS-422/485 or Ethernet (3)							
	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 <sup>9</sup> steps per second <sup>2</sup>						
	Software	Resolution	90.9 steps per second <sup>2</sup>						
		Program storage	Type/size	flash/6384 bytes					
User registers		Four 32 bit							
User program labels & variables		192							
Math functions		+, -, x, ÷, >, <, =, <=, >=, 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 Plus <sup>2</sup> specifications (5)									
General purpose I/O	Number	8 (or 4 when remote encoder option is selected)							
	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							
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					
		Trip output/input – speed/resolution/ threshold	150 nS/32 bit/TTL						
	Closed loop configuration (requires remote encoder)	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) Actual power supply current will depend on voltage and load.

(3) Ethernet only available with MDrive23 Plus products.

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

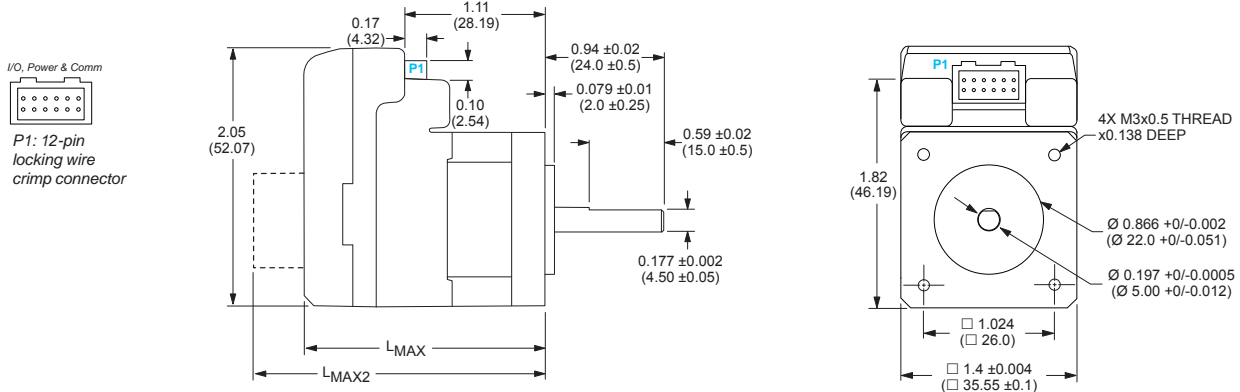
(5) MDrive34ac products available only as Plus<sup>2</sup> versions.

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

See User Manual for complete details: [www.imschneider.com/manuals.html](http://www.imschneider.com/manuals.html)



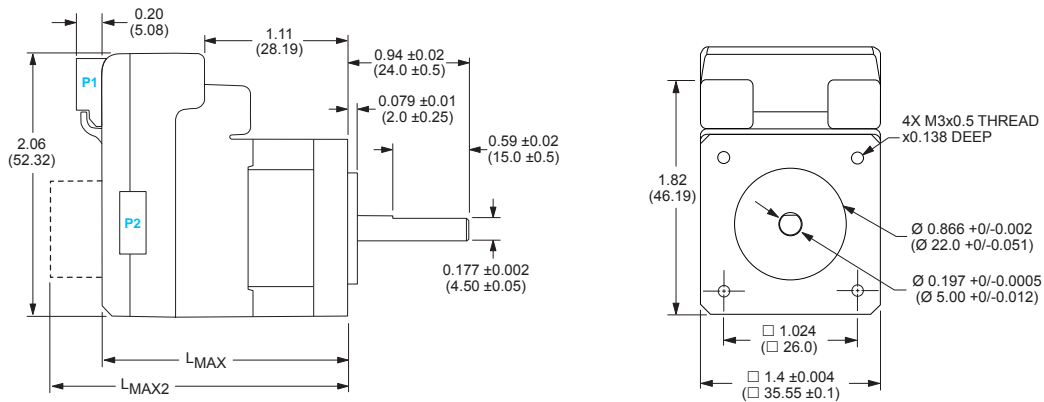
**– Plus – mechanical specifications, dimensions in inches (mm)**



Motor stack length	Lmax (1)	Lmax2 (2)
Single	1.93 (49.02)	2.62 (66.55)
Triple	3.03 (76.96)	3.73 (94.74)

(1) Single shaft or internal encoder.  
(2) Control knob.

**– Plus<sup>2</sup> – mechanical specifications, dimensions in inches (mm)**

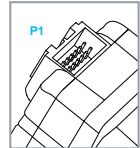


Motor stack length	Lmax (1)	Lmax2 (2)
Single	1.93 (49.02)	2.62 (66.55)
Triple	3.03 (76.96)	3.73 (94.74)

(1) Single shaft or internal encoder.  
(2) Control knob.

**P1 connector**

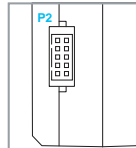
I/O & Power, Remote Encoder



16-pin locking wire crimp connector

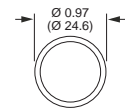
**P2 connector**

Communication

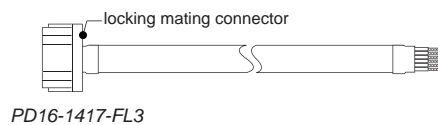
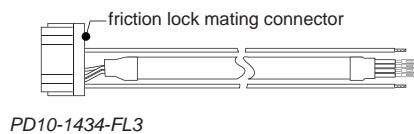
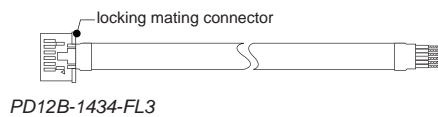
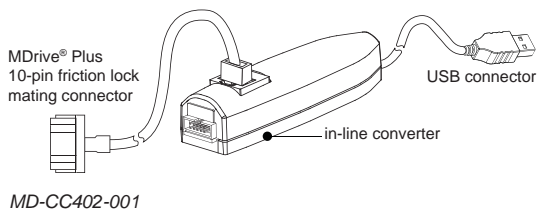
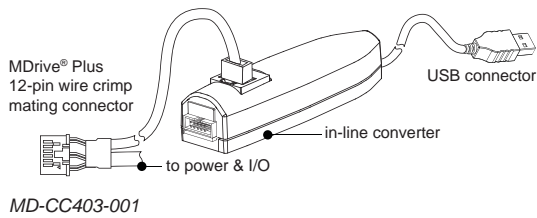


10-pin friction lock wire crimp connector

**Lmax2 option**



control knob



### Installation accessories

Description	Length feet (m)	Part number
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#### QuickStart Kit

For rapid design verification, all-inclusive QuickStart Kits include connectivity, instructions and CD for MDrive Plus initial functional setup and system testing.

- For MDrive14 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 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, communication and power         | 10.0 (3.0) | PD12B-1434-FL3 |
| ■ Mates to 10-pin friction lock wire crimp connector for communication                  | 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 kit

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, communication and power         | — | 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 MDrive14 Motion Control products | — | DPM75 |
|--|---|-------|

(1) See next page.

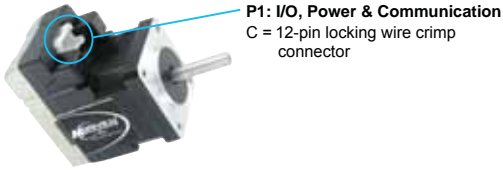


Connectivity details: [www.imshome.com/connect.html](http://www.imshome.com/connect.html)

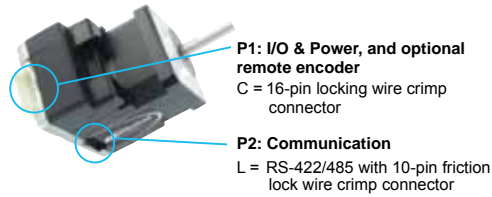
# MDrive® 14 Plus

Motion Control  
fully programmable

MDrive® 14 Plus



MDrive® 14 Plus<sup>2</sup>



Part numbers													
<b>Example:</b>	<b>K</b>	<b>M</b>	<b>D</b>	<b>I</b>	<b>1</b>	<b>C</b>	<b>R</b>	<b>Z</b>	<b>1</b>	<b>4</b>	<b>A</b>	<b>4</b>	<b>-EQ</b>
<b>QuickStart Kit</b> K = kit option, or leave blank if not wanted	K	M	D	I	1	C	R	Z	1	4	A	4	-EQ
<b>MDrive Plus version</b> MDI = Motion Control	K	M	D	I	1	C	R	Z	1	4	A	4	-EQ
<b>Input</b> 1 = Plus, standard features 3 = Plus <sup>2</sup> , expanded features	K	M	D	I	1	C	R	Z	1	4	A	4	-EQ
<b>P1 connector</b> C = wire crimp	K	M	D	I	1	C	R	Z	1	4	A	4	-EQ
<b>Communication</b> R = RS-422/485	K	M	D	I	1	C	R	Z	1	4	A	4	-EQ
<b>P2 connector</b> Z = none (only for Plus products) L = wire crimp (only for Plus <sup>2</sup> products)	K	M	D	I	1	C	R	Z	1	4	A	4	-EQ
<b>Motor size</b> 14 = NEMA 14 (1.4" / 36 mm)	K	M	D	I	1	C	R	Z	1	4	A	4	-EQ
<b>Motor length</b> A = single stack C = triple stack	K	M	D	I	1	C	R	Z	1	4	A	4	-EQ
<b>Drive voltage</b> 4 = +12 to +48 VDC	K	M	D	I	1	C	R	Z	1	4	A	4	-EQ
<b>Options</b> Leave blank if not wanted Options may be combined, unless noted												<b>-EQ</b>	
-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 Plus<sup>2</sup> versions only. May not be combined with internal encoder option.</i>												
-N	= rear control knob for manual positioning												

 Easy MDrive part numbers via an interactive tool at:  
[www.imshome.com/MDrivePlus.html](http://www.imshome.com/MDrivePlus.html)

# MDrive<sup>®</sup> 14 Plus

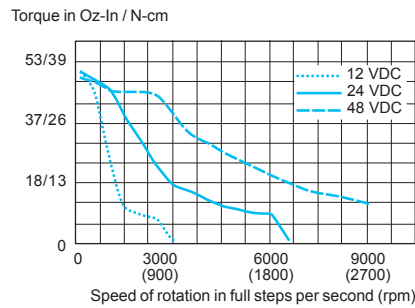
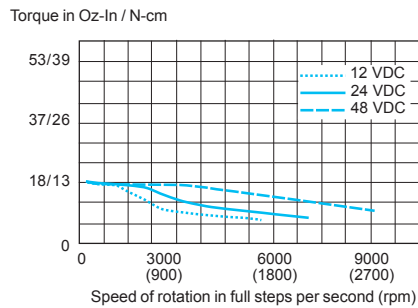
Motion Control  
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### Motor specifications MDrive 14

		Holding torque	Detent torque	Rotor inertia	Weight (motor + driver)
Motor stack length	Single	18.0 oz-in / 12.71 N-cm	2.0 oz-in / 1.4 N-cm	0.000278 oz-in-sec <sup>2</sup> / 0.0199 kg-cm <sup>2</sup>	5.29 oz / 150.0 g
	Triple	36.0 oz-in / 25.00 N-cm	4.4 oz-in / 3.1 N-cm	0.000801 oz-in-sec <sup>2</sup> / 0.0566 kg-cm <sup>2</sup>	12.8 oz / 380.0 g

### Speed torque characteristics MDrive 14

Single stack length Triple stack length



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