

MDrive[®] Plus

Stepper motors with integrated electronics



MDrive 17 Plus Step/direction input



MDrive® Plus with step /direction input

Presentation

The MDrive® Plus with step/direction input is a 1.8° 2-phase stepper motor with on-board control electronics. Step/direction signals of a master controller, e.g. a motion controller, or A/B signals of an encoder are converted directly into motion.

Settings for MDrive Plus step /direction input products may be changed on-the-fly or downloaded and stored in nonvolatile memory using the IMS SPI Motor Interface software provided. This eliminates the need for external switches or resistors. Parameters are changed via an SPI port.

Application areas

The MDrive Plus with step/direction input is ideal for machine builders who want an optimized motor with on-board electronics. The integrated electronics of the MDrive Plus with step/direction input 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

- 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 up to 51,200 steps per rev including: Degrees, Metric, Arc Minutes
- Optically isolated input options:
 - Universal +5 to +24 VDC signals, sourcing or sinking
 - Differential +5 VDC signals (1)
- Automatic current reduction
- Configurable:
 - Motor run / hold current
 - Motor direction via direction input
 - Microstep resolution
 - Clock type: step and direction, quadrature, step up and step down, clockwise and counterclockwise (1)
 - Programmable digital filtering for clock and direction inputs
- Available options:
 - Long life linear actuators (2)
 - Hybrid Motion Technology™ (2)
 - Encoders
 - Control knob for manual positioning
 - Industrial connectors with IP54 rating (3)
- Several motor stack lengths available
- Setup parameters may be switched on-the-fly
- Numerous connector interface choices
- Graphical user interface provided for quick and easy parameter setup

(1) CW/CCW input unavailable for MDrive34 or MDrive34ac products.

(2) See separate documentation.

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

Plus specifications

			MDrive 14	MDrive 17	MDrive 23 (1)	MDrive 23 (1)	MDrive 34	MDrive 34 ac	
Input power	Voltage	VDC	12 to 48	12 to 48	12 to 75	12 to 60	12 to 75	—	—
		VAC	—	—	—	—	—	120	240
	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		
Temp output warning	Open-drain type		not applicable				+5 to +24 VDC, 50 mA current		
Protection	Type		not applicable				- Thermal - Over voltage/current		
Isolated input	Universal		Voltage range: +5 to +24 VDC sourcing or sinking step clock, direction and enable						
	Differential		Voltage range: +5 VDC clockwise and counterclockwise				not applicable		
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, clockwise / counterclockwise				Step/direction, quadrature, step up/step down		
	Step frequency		2 MHz default / 5 MHz maximum				2 MHz default		
	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/ustep), 21600 (1 arc minute/ustep), 25400 (0.001 mm/ustep)							

Setup parameters (3)

SPI communication		Function	Range	Units	Default
MHC	MHC	Motor hold current	0 to 100	percent	5
	MRC	Motor run current	1 to 100	percent	25
MSEL	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	DIR	Motor direction override	0/1	—	CW
HCDT	HCDT	Hold current delay time	0 or 2–65535	mSec	500
CLK TYPE	CLK TYPE	Clock type	Step/Dir, Quadrature, Up/Down, CW/CCW	—	Step/Dir
CLK IOF	CLK IOF	Clock and direction filter	50 nS to 12.9 µS (10 MHz to 38.8 kHz)	nS (MHz)	200 nS (2 MHz)
USER ID	USER ID	User ID	Customizable	1–3 characters	IMS
EN ACT	EN ACT	Enable active	High/Low	—	High
WARN TEMP (4)	WARN TEMP (4)	Over temperature warning	0 to 125°C	°C	80°C

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

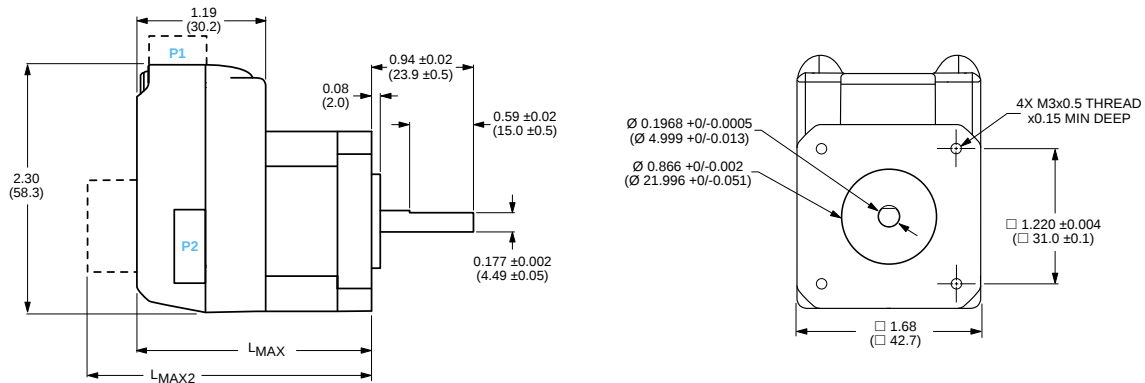
(2) Actual power supply current will depend on voltage and load.

(3) 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.

(4) Only with MDrive34 and MDrive34ac products.



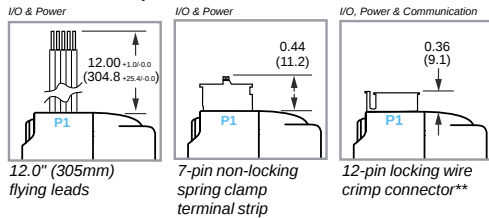
– Plus – mechanical specifications, dimensions in inches (mm)



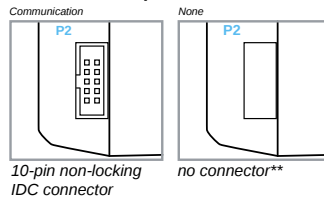
Motor stack length	Lmax (1)	Lmax2 (2)
Single	2.20 (55.9)	2.79 (70.9)
Double	2.43 (61.7)	3.02 (76.7)
Triple	2.77 (70.4)	3.37 (85.6)

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

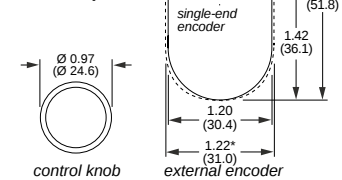
P1 connector options



P2 connector options

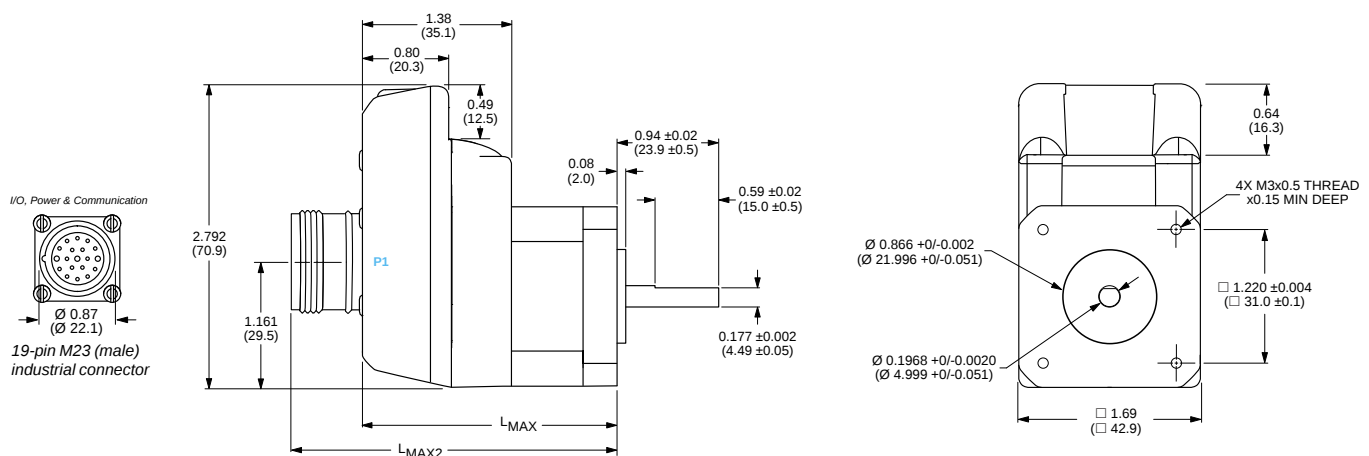


Lmax2 options

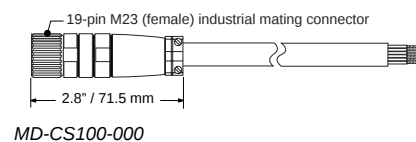
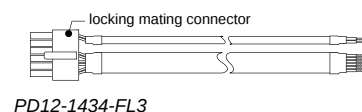
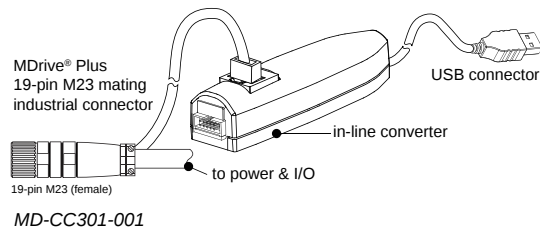
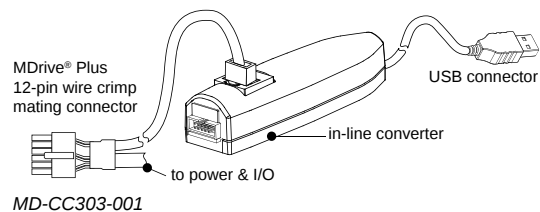
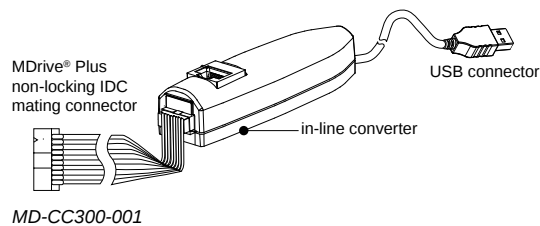


**12-pin locking wire crimp connector at P1 eliminates the P2 connector

– Plus with industrial connector – mechanical specifications, dimensions in inches (mm)



Motor stack length	Lmax	Lmax2
Single	2.48 (63.00)	3.15 (80.00)
Double	2.71 (68.83)	3.38 (85.85)
Triple	3.04 (77.22)	3.71 (94.23)



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 all MDrive17 step/direction input 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-CC300-001
■ Mates to 12-pin locking wire crimp connector	12.0 (3.6)	MD-CC303-001
■ Mates to 19-pin male M23 industrial connector	12.0 (3.6)	MD-CC301-001

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)	PD12-1434-FL3
■ Mates to 19-pin male M23 industrial connector with straight termination for I/O, communication and power	13.0 (4.0)	MD-CS100-000
■ Mates to 19-pin male M23 industrial connector with right angle termination for I/O, communication and power	13.0 (4.0)	MD-CS101-000

Encoder cables (2)

Pre-wired mating connector with other cable end open.

■ For external single-end optical encoder with non-locking connector	1.0 (0.3)	ED-CABLE-2
■ For external differential optical encoder with locking connector	6.0 (1.8)	ED-CABLE-6

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 non-locking IDC connector for communication	—	CK-01
■ 12-pin locking wire crimp connector for I/O, communication and power	—	CK-03

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 step/direction input products — DPM75

(1) See next page.

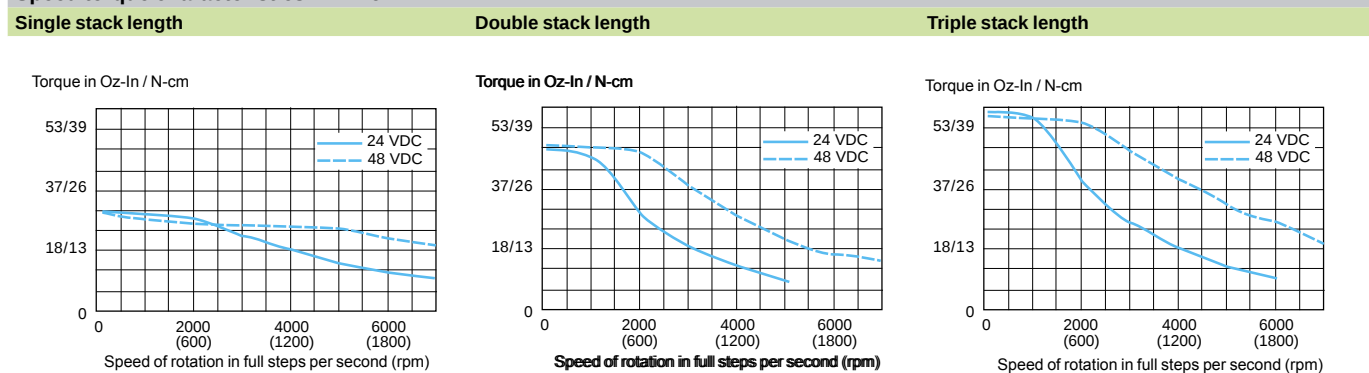


Connectivity details: www.imschneider.com/connect.html

Motor specifications MDrive17

		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 MDrive17





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 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) 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

			MDrive 14	MDrive 17	MDrive 23 (1)	MDrive 23 (1)	MDrive 34	MDrive 34ac
Input power	Voltage	VDC	12 to 48	12 to 48	12 to 75	12 to 60	12 to 75	—
		VAC	—	—	—	—	—	120
	Current maximum (2)		1A	2A	2A	3.5A	4A	95 to 132 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 When input voltage is removed, maintains power only to control and feedback circuits.		
	Resolution	10 bit		
Analog input	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	
		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	
	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 (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 Plus² versions.

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

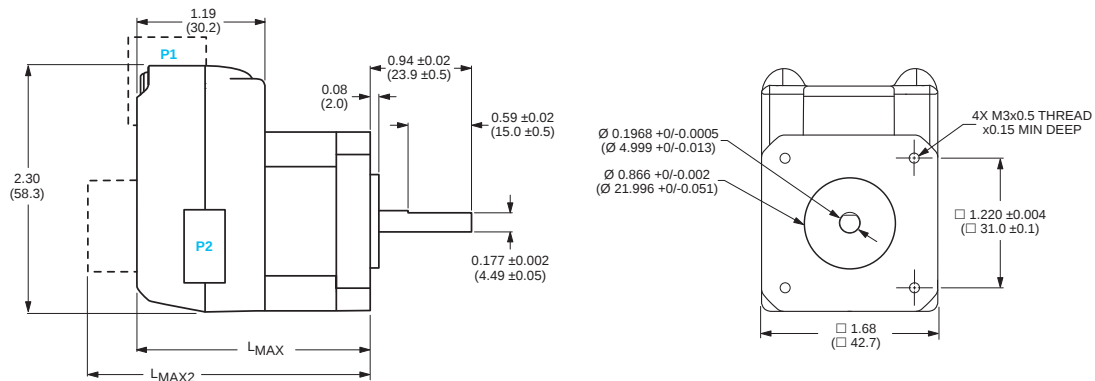
See User Manual for complete details: www.imshome.com/manuals.html



MDrive® 17 Plus

Motion Control
fully programmable

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

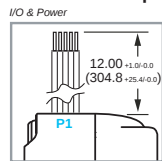


Motor stack length	Lmax (1)	Lmax2 (2)
Single	2.20 (55.9)	2.79 (70.9)
Double	2.43 (61.7)	3.02 (76.7)
Triple	2.77 (70.4)	3.37 (85.6)

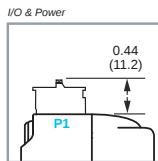
(1) *Single shaft or internal encoder.*

- (1) Single knob or internal encoder.
- (2) Control knob or external encoder.

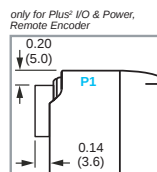
P1 connector options



12.0" (305mm)
flying leads

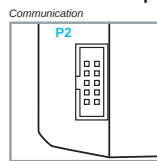


7-pin non-locking
spring clamp
terminal strip

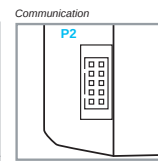


16-pin locking wire
crimp connector

P2 connector options

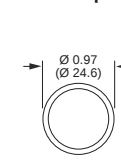


10-pin non-locking
IDC connector



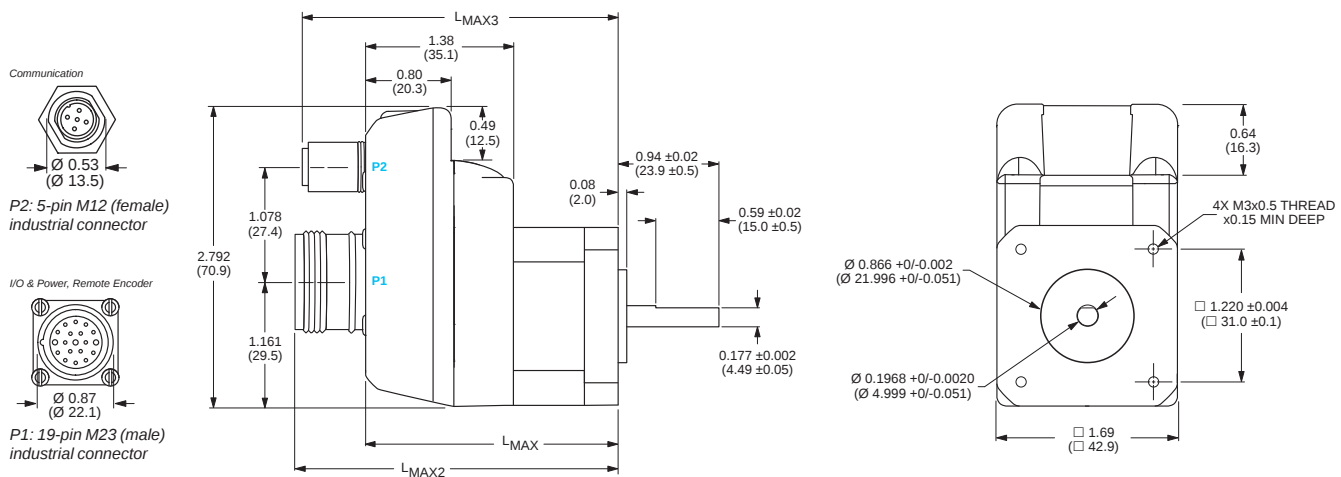
10-pin friction lock
wire crimp connector

Lmax2 option



control knob

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

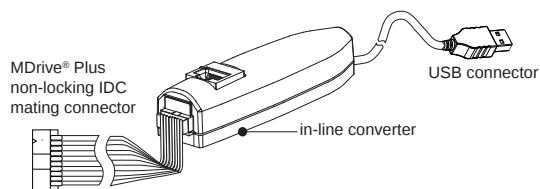


Motor stack length	Lmax	Lmax2	Lmax3
Single	2.48 (63.00)	3.15 (80.00)	3.08 (78.23)
Double	2.71 (68.83)	3.38 (85.85)	3.31 (85.10)
Triple	3.04 (77.22)	3.71 (94.23)	3.64 (92.46)

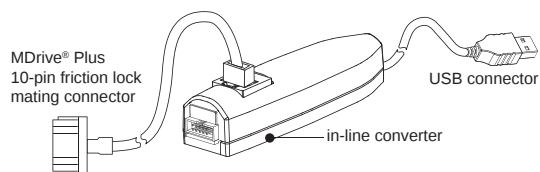
MDrive® 17 Plus

Motion Control

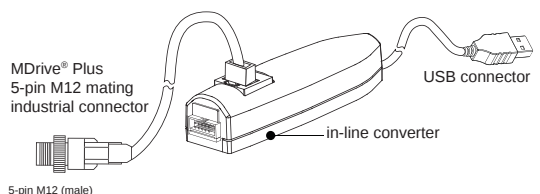
fully programmable



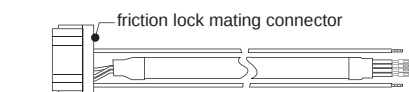
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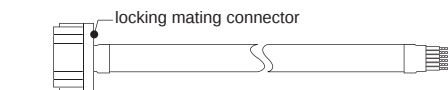
MD-CC402-001



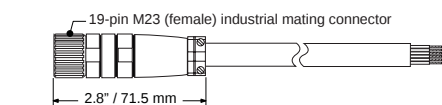
MD-CC401-001



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 include connectivity, instructions and CD 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 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
■ 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.

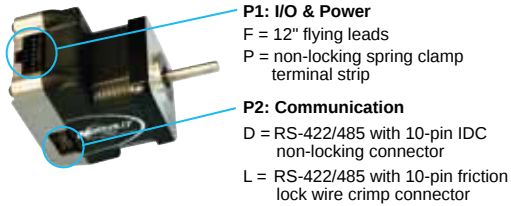
- For all MDrive17 Motion Control products — DPM75

(1) See next page.

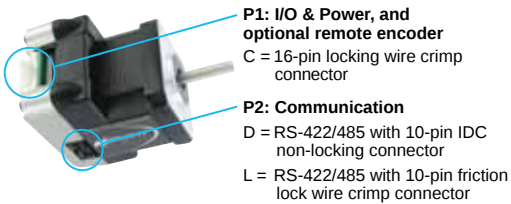


Connectivity details: www.imshome.com/connect.html

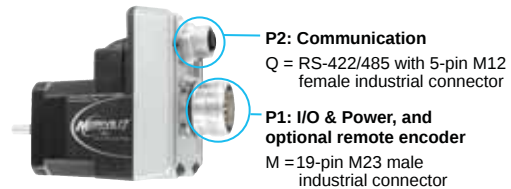
MDrive® 17 Plus



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	K	M	D	I	1	F	R	D	1	7	A	4	-EQ
-EQ = internal encoder, 512-line internal magnetic encoder with index mark	K	M	D	I	1	F	R	D	1	7	A	4	-EQ
-EE = remote encoder interface, differential encoder to be provided by user Available with Plus ² versions only. May not be combined with internal encoder option.	K	M	D	I	1	F	R	D	1	7	A	4	-EQ
-N = rear control knob for manual positioning (3)	K	M	D	I	1	F	R	D	1	7	A	4	-EQ

(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.



Easy MDrive part numbers via an interactive tool at:
www.imshome.com/MDrivePlus.html

Motor specifications MDrive17

		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 MDrive17

