

# MDrive® Plus

## MDO•23 Speed Control

### Product overview

MDrive® Plus Speed Control products integrate 1.8° 2-phase stepper motor, programmable velocity control, drive electronics and optional encoder. Programmable velocity control uses voltage, current, or PWM analog input signal modes.

Product settings may be changed on-the-fly, or downloaded and stored in nonvolatile memory using the SPI Motor Interface software provided. This eliminates the need for external switches or resistors. Parameters are changed via an SPI port.

### Application areas

MDrive Plus products deliver reliable performance for new and existing motion control applications. Satisfying the requirements for a wide range of machine builders.

Simplify your machine design and reduce cabinet size 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.

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



MDO•23 MDrive Plus Speed Control products: integrated NEMA23 motor and controls, IP20-rated

### General features

Compact integrated microstepping drive, programmable velocity control and NEMA23 1.8° 2-phase stepper motor	
Advanced current control for exceptional performance and smoothness	
+12 up to +75 VDC single supply	
20 microstep resolutions up to 51,200 steps per rev including: Degrees, Metric, Arc Minutes	
Electronically configurable	
Communication	SPI
Protection	IP20 rating
10 bit analog speed control input	0 to +5 VDC
	0 to +10 VDC
	4 to 20 mA
	0 to 20 mA
Available options	Motor stack lengths
	Connector options
	Encoders
	Rear control knob for manual positioning
Graphical user interface provided for quick and easy parameter setup	

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### Specifications

Communication	Protocol type		SPI
Input power	Voltage	VDC	+12...+75 for motor stack lengths: single, double, triple +12...+60 for motor stack length: quad
	Current maximum (1)	Amp	2.0 for motor stack lengths: single, double, triple 3.5 for motor stack length: quad
Motor	Frame size	NEMA	23
		inches	2.3
		mm	57
	Holding torque	oz-in	90...283
		N-cm	64 ... 200
Length	stack sizes	1, 2, 3 & 4	
Thermal	Operating temp non-condensing	Heat sink maximum	85°C
		Motor maximum	100°C
Protection	Type	IP rating	IP20
Speed control (2)	A/D resolution		10 bit
	Input		0 to +5 VDC, 0 to +10 VDC, 0-20 mA, 4-20 mA
Logic input	Low level		0 to +0.8 VDC
	High level		+2.0 to +5.0 VDC
	Internal pull-up resistance		20 kΩ (to +3.3 VDC)
	Optically isolated		no
	Configurable		sinking
Logic output	Step clock/direction		not applicable
Motion	Oscillator frequency max		5 MHz
	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)
Setup parameters (2)	Function	Default setting / units	Range
	A1/analog input mode	0 to +5 VDC	0 to +5 VDC, 0 to +10 VDC, 4 to 20 mA, or 0 to 20 mA
	ACCL/acceleration	1,000,000 steps/sec <sup>2</sup>	91 to 1.5 X 10 <sup>9</sup>
	DB/analog deadband	1 count	0 to 255
	DECL/deceleration	500 mSec	91 to 1.5 X 10 <sup>9</sup>
	DIR/motor direction override	cw	clockwise (cw)/counterclockwise (ccw)
	FAULT/checksum error	none	error code
	FS/analog full scale	1023 counts	1 to 1023
	HCDT/hold current delay time	500 milliseconds	HCDT + MSDT <= 65535
	IF/analog input filter	1 count	1 to 1000
	MHC/motor hold current	5 %	0 to 100%
	MRC/motor run current	25 %	1 to 100%
	MSDT/motor settling delay time	0 milliseconds	MSDT + HCDT <= 65535
	MSEL/μstep resolution	256 μstep per full step	1, 2, 4, 5, 8, 10, 16, 25, 32, 50, 64, 100, 108, 125, 127, 128, 180, 200, 250, 256
	SSD/stop/start debounce	0 milliseconds	0 to 255
	VI/initial velocity	1000 steps/sec	0 to <VM
	VM/maximum velocity	768,000 steps/sec	VI to 5,000,000
USER ID/user ID	IMS / 1-3 characters	customizable	

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

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



See User Manual for complete details: [www.motion.schneider-electric.com/manuals.html](http://www.motion.schneider-electric.com/manuals.html)

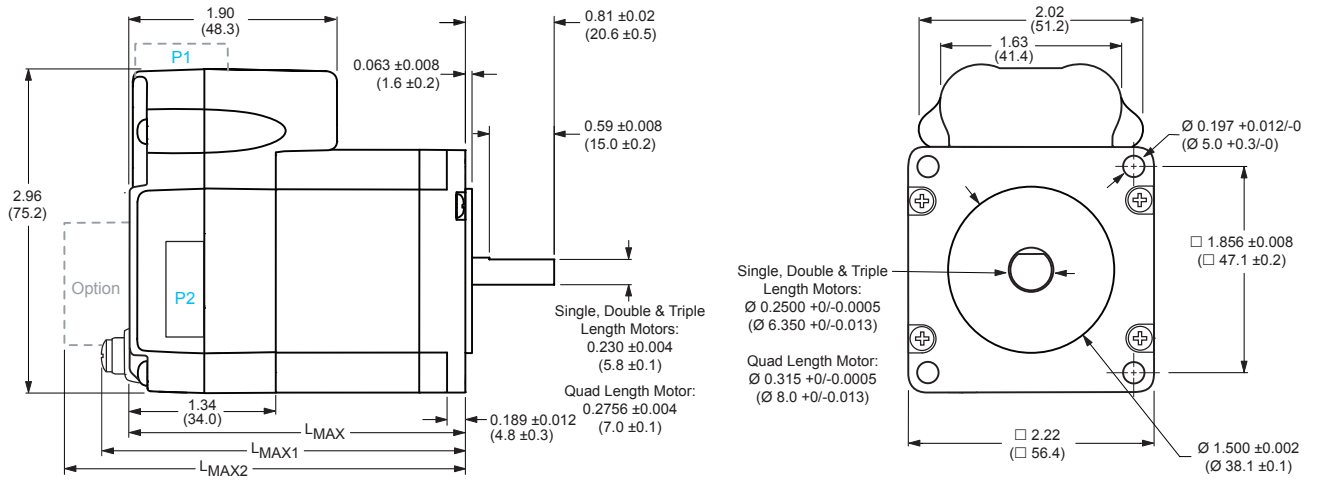
# MDrive Plus

## MDO•23 Speed Control

### Dimensions

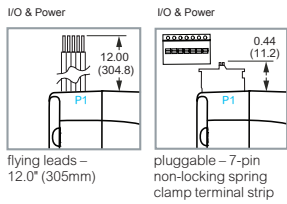
#### MDO•23 NEMA23 motor, IP20-rated

inches (mm)

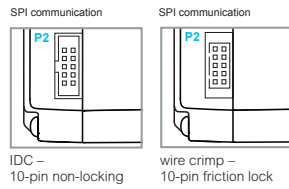


Motor stack length	L <sub>max</sub>	L <sub>max1</sub>	L <sub>max2</sub>
Single	2.65 (67.31)	2.85 (72.39)	3.36 (85.34)
Double	3.02 (76.71)	3.22 (81.79)	3.73 (94.74)
Triple	3.88 (98.55)	4.08 (103.63)	4.59 (116.59)
Quad	5.28 (134.15)	5.48 (139.19)	5.99 (152.19)

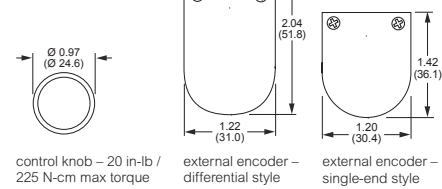
#### P1 connector options



#### P2 connector options

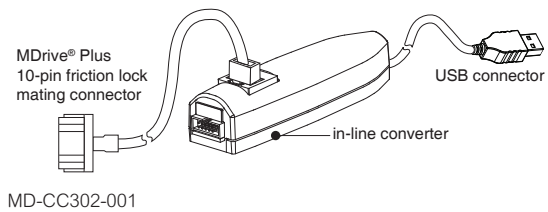
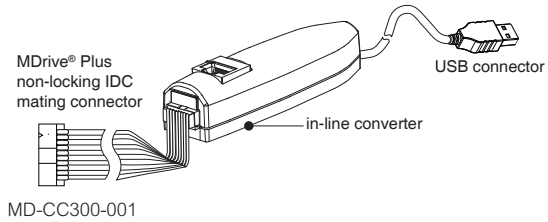


#### L<sub>max2</sub> option



# MDrive Plus

## MDO•23 Speed Control



## 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 MDrivePlus initial functional setup and system testing.

For all MDrive23 Speed 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 MDrivePlus via a PC's USB port.

Mates to 10-pin non-locking IDC connector	12.0 (3.6)	MD-CC300-001
Mates to 10-pin friction lock wire crimp connector	12.0 (3.6)	MD-CC302-001

### 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.

10-pin friction lock wire crimp connector for communication	—	CK-02
10-pin non-locking IDC connector for communication	—	CK-01

### Encoder cables

Pre-wired mating connector with other cable end open.

For external single-end encoder	1.0 (0.3)	ES-CABLE-2
For external differential encoder, locking cable	6.0 (1.8)	ED-CABLE-6

### Drive protection module

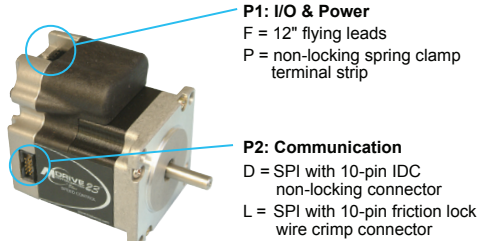
Limits surge current and voltage to a safe level when DC input power is switched on-and-off to an MDrive Plus.

For all MDrive23 Speed Control products	—	DPM75
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## MDO•23 Speed Control

MDrive® 23 Plus IP20



**P1: I/O & Power**  
 F = 12" flying leads  
 P = non-locking spring clamp terminal strip

**P2: Communication**  
 D = SPI with 10-pin IDC non-locking connector  
 L = SPI with 10-pin friction lock wire crimp connector

### Part numbers

#### IP20-rated products

example part number	K M D O 1 F S D 2 3 A 7 -N												
QuickStart Kit K = kit option, omit from part number if unwanted	K	M	D	O	1	F	S	D	2	3	A	7	-N
MDrivePlus version MDO = Speed Control	K	M	D	O	1	F	S	D	2	3	A	7	-N
Input 1 = Plus version with universal input	K	M	D	O	1	F	S	D	2	3	A	7	-N
P1 connector F = flying leads P = pluggable	K	M	D	O	1	F	S	D	2	3	A	7	-N
Communication type S = SPI	K	M	D	O	1	F	S	D	2	3	A	7	-N
P2 connector D = IDC L = wire crimp	K	M	D	O	1	F	S	D	2	3	A	7	-N
Motor size 23 = NEMA 23 2.3" / 57mm	K	M	D	O	1	F	S	D	2	3	A	7	-N
Motor length A = single stack B = double stack C = triple stack D = quad stack (1)	K	M	D	O	1	F	S	D	2	3	A	7	-N
Drive voltage (1) 7 = +12 to +75 VDC 6 = +12 to +60 VDC	K	M	D	O	1	F	S	D	2	3	A	7	-N
Options — omit from part number if unwanted													-N
-N = rear control knob for manual positioning													
-E_ = external optical encoder w/ index mark													
	line count	100	200	250	256	400	500	512	1000	1024			
	single-end part #	E1	E2	E3	EP	E4	E5	EQ	E6	ER			
	differential part #	EAL	EBL	ECL	EWL	EDL	EHL	EXL	EJL	EYL			

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

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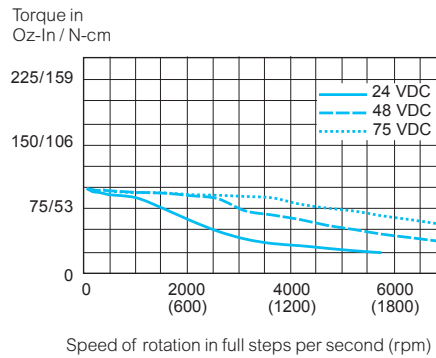
## MDO•23 Speed Control

### Motor performance

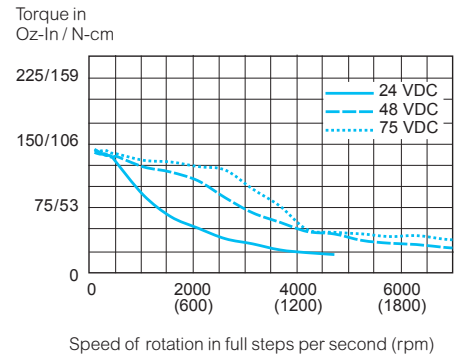
MD•23 NEMA 23 motor specifications	Motor	Stack length	Single	Double	Triple	Quad
			oz-in	Double	Triple	Quad
Holding torque		oz-in	90	144	239	283
		N-cm	64	102	169	200
Detent torque		oz-in	3.9	5.6	9.7	14.2
		N-cm	2.7	3.9	6.9	10.0
Rotor inertia		oz-in-sec <sup>2</sup>	0.0025	0.0037	0.0065	0.0108
		kg-cm <sup>2</sup>	0.18	0.26	0.46	0.76
Weight (motor+driver)		oz	21.6	26.4	39.2	62
		g	612	748	1111	1746

MD•23 NEMA 23 speed torque (1)

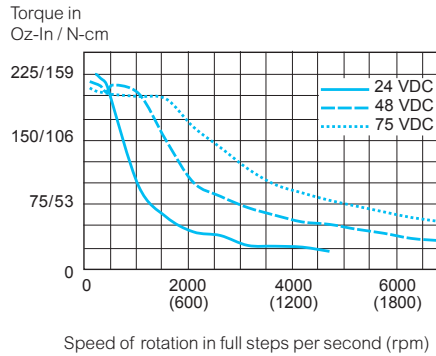
Single stack length



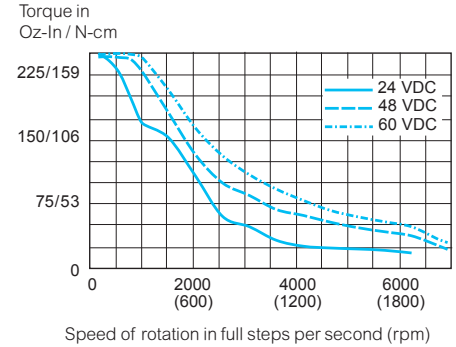
Double stack length



Triple stack length



Quad stack length



(1) Test conditions: 100% current with damper simulating load.