

M DRIVE 23™

MOTOR+DRIVER

MOTION CONTROL



FEATURES

- Integrated Microstepping Driver, Motion Controller and NEMA 23 High Torque 1.8° Stepping Motor
- +12 to +48 VDC Input Voltage
- Low Cost
- Extremely Compact
- Available Configurations:
 - Single Shaft*
 - Linear Actuator
 - Internal Magnetic Encoder for Closed Loop Control*
 - Control Knob for Manual Positioning*
 - Integrated Planetary Gearbox*
- Three Stack Sizes Available*
- Single Supply
- Microstep Resolution up to 51,200 Steps Per Rev
- Open Loop or Optional Closed Loop Control
- Programmable Motor Run and Hold Currents
- Four +5 to +24 VDC I/O Lines
- One 10 Bit Analog Input
- 0 to 5MHz Step Clock Rate Selectable in 0.59Hz Increments
- RS-485 Communications with Selectable Baud Rate to 115K
- 62 Software Addresses for Multi-Drop Communications
- Simple 1 to 2 Character Instructions
- Pluggable Terminal Strip or 12.0" (30.5cm) Flying Lead Interface

*Rotary Motor Only

DESCRIPTION

The MDrive23 Motion Control offers the system designer a low cost, intelligent motion controller integrated with a NEMA 23 high torque stepping motor and a +12 to +48 volt microstepping driver.

The MDrive23 Motion Control adds a versatile array of functions by combining a complete, programmable motion controller with our already compact and cost effective standard MDrive23, adding little cost and no increase in size. Standard offerings include four +5 to +24 volt general purpose I/O lines, one 10 bit analog input, 0 to 5MHz step clock rate, microstep resolution up to 51,200 steps per revolution, and a full featured easy-to-program instruction set.

The MDrive23 Motion Control communicates over RS-485 which allows for point-to-point or multiple unit configurations utilizing one communication port. Addressing and hardware support up to 62 uniquely addressed units communicating over a single line. Baud rate is selectable from 4,800 to 115K.

The MDrive23 Motion Control is available with optional closed loop control. The closed loop configuration adds a 512 line (2048 edge) magnetic encoder with index mark, internal to the MDrive so there is no increase in length. Functionality increases with the addition of stall detection, position maintenance, and find index mark.

In addition to an encoder option, available motor configurations include a single shaft rotary motor, a dual shaft rotary motor with rear control knob for manual positioning, a planetary gearbox, or a long life Acme screw linear actuator. Rotary versions are available in single, double and triple stack sizes: 18, 22 & 31. Interface connections are accomplished using either a 7 position pluggable terminal strip or 12.0" (30.5 cm) flying leads.

The MDrive23 Motion Control is a compact, powerful and inexpensive solution that will reduce system cost, design and assembly time for a large range of stepping motor applications.

MDRIVE 23 MOTION CONTROL SPECIFICATIONS

GENERAL SPECIFICATIONS

Input Voltage (+V)	Range.....+12 to +48 VDC <i>Graph illustrates power supply current requirements (maximum) per MDrive23. Actual power supply current will depend on voltage and load.</i>	
Analog Input	Resolution 10 Bit Voltage Range..... 0 to +5 VDC or 4-20 mA	
General Purpose I/O	Number/Type 4/Open Collector Logic Range +5 to +24 VDC Output Sink Current 700 mA Protection Over Temp, Short Circuit, Inductive Clamp	
Communication	Type RS-485 Baud Rate 4800 to 115K	
Motion	Resolution – Open Loop Configuration # of Settings 14 Steps Per Rev 400, 800, 1000, 1600, 2000, 3200, 5000, 6400, 10000, 12800, 25000, 25600, 50000, 51200 Resolution – Closed Loop Configuration (optional) Steps Per Rev 51200 Encoder (optional) Type Internal, Magnetic Resolution 512 Lines/2048 Edges Per Rev Counters Type Position, Encoder/32 Bits Edge Rate (Max) 5MHz 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 and Data Storage Nonvolatile User Registers (4) 32 Bit User Program Labels and Variables 22 Math Functions +, -, x, ÷, >, =, <, <=, >=, AND, OR, XOR, NOT Branch Functions Branch & Call (conditional) Predefined I/O Functions Inputs Home, Limit Plus, Limit Minus, Go, Stop, Pause, Jog Plus, Jog Minus, Analog In Outputs Moving, Fault, Stall, Velocity Change Trip Functions Trip on Input & Trip on Position Party Mode Addresses 62 Encoder Functions Stall Detection, Position Maintenance, Find Index	
Thermal	Heat Sink Temperature (Max) 85° C Motor Temperature (Max) 100° C	

PIN/WIRE ASSIGNMENTS

CONNECTOR P1 – Pluggable Terminal Strip or Flying Leads		
PIN	FLYING LEADS	FUNCTION
1	White/Yellow	I/O 1
2	White/Orange	I/O 2
3	White/Violet	I/O 3
4	White/Blue	I/O 4
5	Green	ANALOG INPUT
6	Black	POWER GROUND
7	Red	+V (+12 TO +48 VDC)

CONNECTOR P2 (RS-485) – 10 Pin Pin-Header	
PIN	FUNCTION
1-5	NO CONNECT
6	RX +
7	RX -
8	TX -
9	TX +
10	GROUND

MDRIVE23 MOTOR SPECIFICATIONS

MD2218 Single Stack

Holding Torque 90 oz-in / 64 N-cm
 Detent Torque 3.9 oz-in / 2.7 N-cm
 Rotor Inertia 0.0025 oz-in-sec² / 0.18 kg-cm²
 Weight (Motor+Driver)..... 20.1 oz / 569.8 g

MD2222 Double Stack

Holding Torque 144 oz-in / 102 N-cm
 Detent Torque 5.6 oz-in / 3.92 N-cm
 Rotor Inertia 0.0037 oz-in-sec² / 0.26 kg-cm²
 Weight (Motor+Driver)..... 24.4 oz / 691.7 g

MD2231 Triple Stack

Holding Torque 239 oz-in / 169 N-cm
 Detent Torque 9.7 oz-in / 6.86 N-cm
 Rotor Inertia 0.0065 oz-in-sec² / 0.46 kg-cm²
 Weight (Motor+Driver)..... 38.5 oz / 1091.5 g

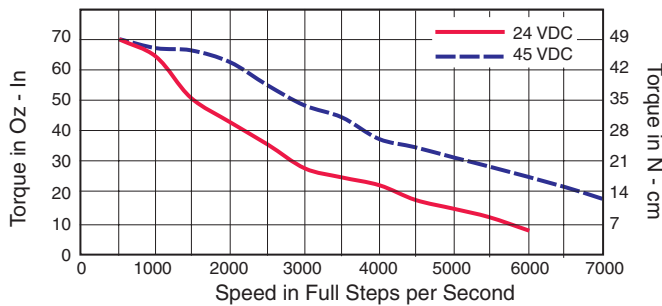
MD2218 Linear Actuator

Maximum Thrust 200 lbs / 890 N
 Maximum Screw Deflection ± 1°
 Backlash 0.005 in / 0.127 mm
 Weight (without screw)..... 20.4 oz / 578.3 g

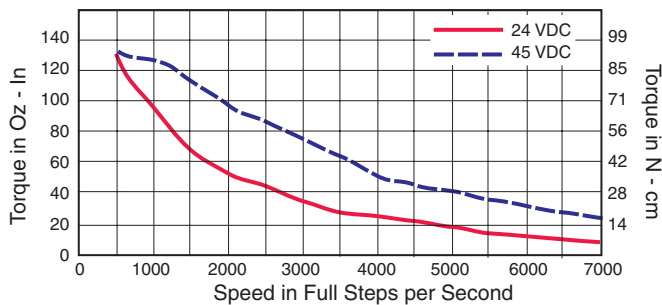
TORQUE-SPEED CURVES

Rotary Motor

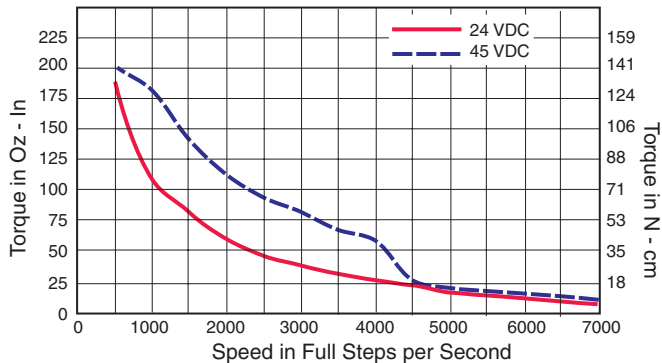
MD2218 Single Stack



MD2222 Double Stack



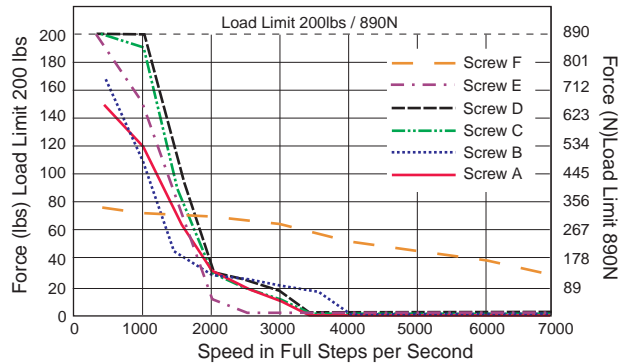
MD2231 Triple Stack



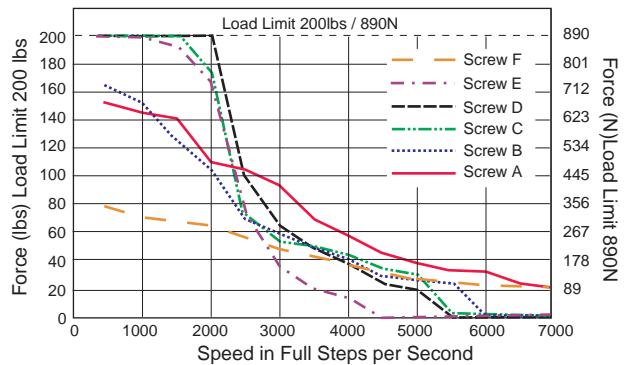
FORCE-SPEED CURVES

Linear Actuator

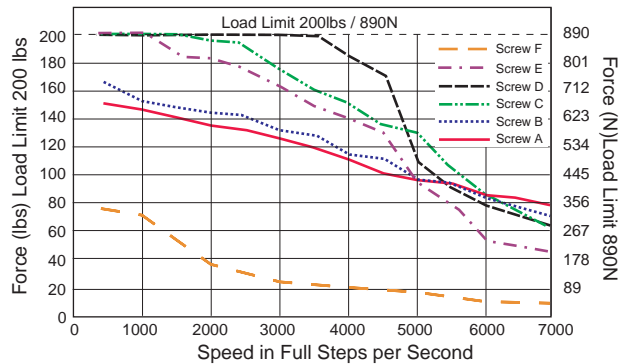
24 VDC



45 VDC



75 VDC



MDRIVE23 WITH PLANETARY GEARBOX

The MDrive23 is available with a Planetary Gearbox option developed to increase torque at lower speeds, enable better inertia matching and produce finer positional resolutions. These efficient, low maintenance Planetary Gearbox come fully assembled with the MDrive and are offered in a large number of

reduction ratios in 1-, 2- and 3-stage configurations. An optional NEMA Flange allows mounting the Planetary Gearbox to the load using a standard NEMA bolt circle. Planetary Gearbox may be combined with other MDrive23 options, however are unavailable on Linear Actuator versions.

Parameters

	1-Stage	2-Stage	3-Stage
Permitted Output Torque (oz-in/Nm)	566/4.0	1699/12.0	3540/25.0
Gearbox Efficiency	0.80	0.75	0.70
Maximum Backlash (degree)	0.70°	0.75°	0.80°

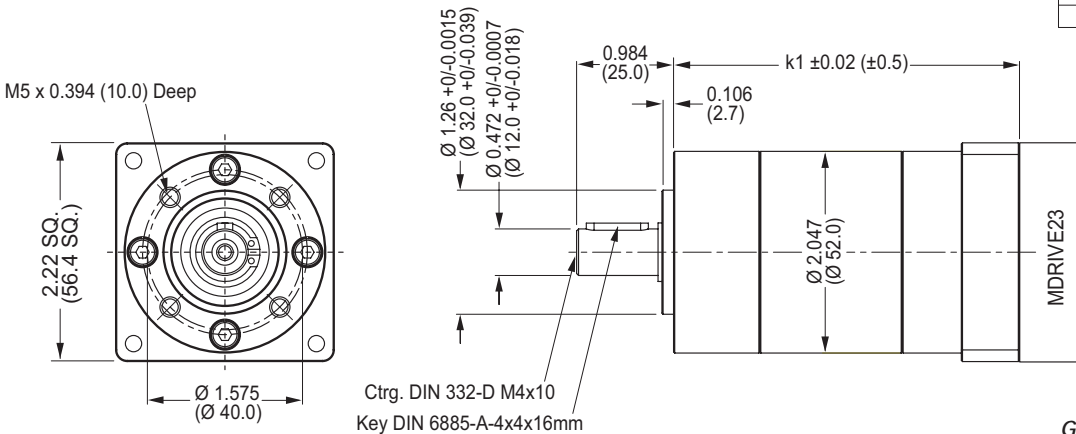
Output Side with Ball Bearing

Maximum Load, Radial (lb-force/N)	45/200	72/320	101/450
Maximum Load, Axial (lb-force/N)	13/60	22/100	34/150
Weight - Gearbox Only (oz/g)	25.0/711	32.2/914	39.4/1117
Weight - Gearbox & NEMA Flange (oz/g)	25.9/735	33.3/945	40.7/1155

PLANETARY GEARBOX MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

Planetary Gearbox for MDrive23



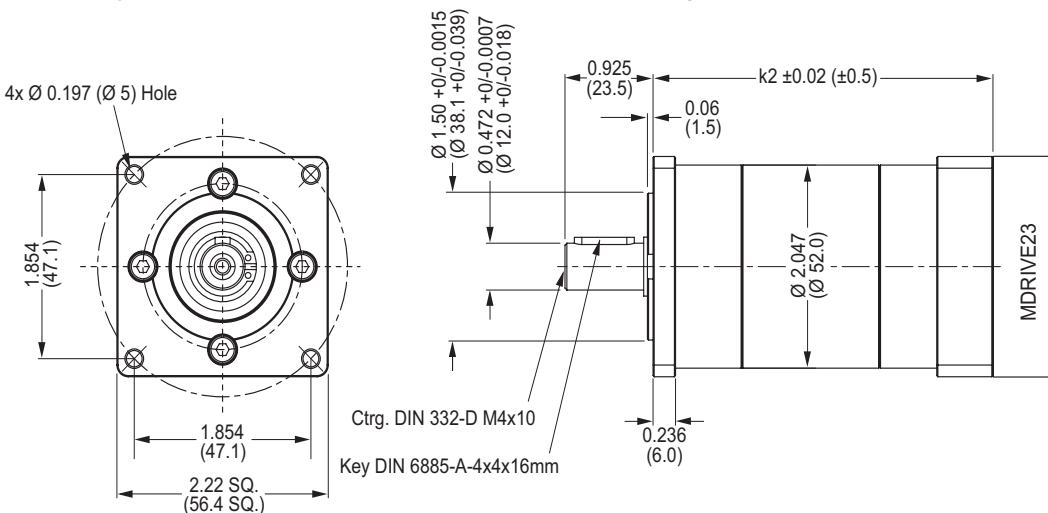
Gearbox Ratios (Rounded)

1-Stage	2-Stage	3-Stage
3.70:1	13.73:1	50.89:1
5.18:1	15.88:1	58.85:1
6.75:1	18.36:1	68.06:1
19.20:1	71.16:1	
22.20:1	78.71:1	
25.01:1	92.70:1	
26.85:1	95.17:1	
28.93:1	99.50:1	
34.97:1	107.20:1	
45.56:1	115.07:1	
123.97:1		
129.62:1		
139.13:1		
149.90:1		
168.84:1		
181.24:1		
195.26:1		
236.09:1		
307.54:1		

Gearbox Lengths Inches (mm)

	1-Stage	2-Stage	3-Stage
k1 Gearbox	4.315 (109.6)	5.169 (131.3)	6.024 (153.0)
k2 Gearbox w/ NEMA Flange	4.433 (112.6)	5.287 (134.3)	6.142 (156.0)

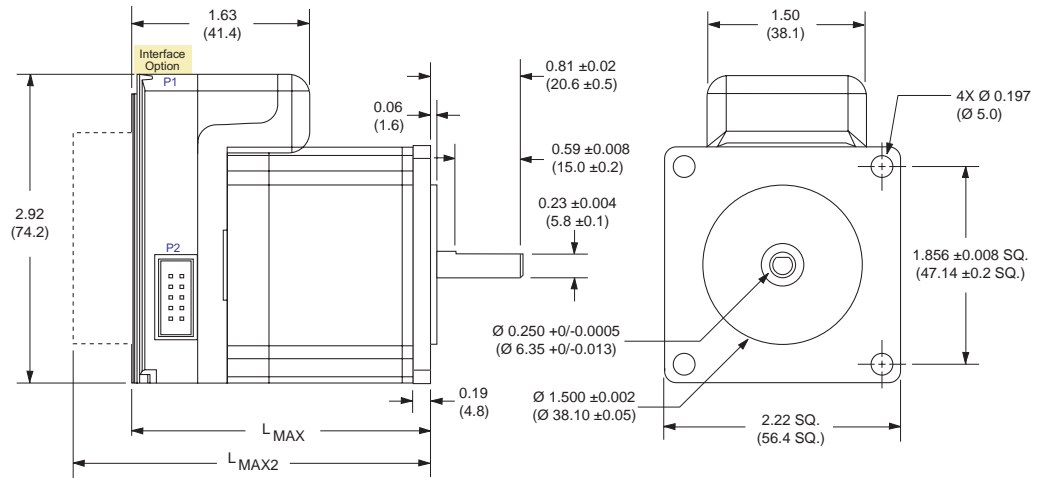
Planetary Gearbox with Optional NEMA Output Flange



MDRIVE23 MOTION CONTROL – MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

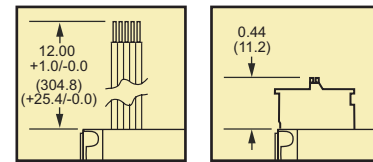
Rotary MDrive23: Single Shaft, Encoder & Control Knob Versions



MDrive Lengths Inches (mm)

Stack Size	LMAX		LMAX2	
	SINGLE SHAFT or ENCODER VERSION		CONTROL KNOB VERSION	
2218	2.63	(66.8)	3.35	(85.1)
2222	3.00	(76.2)	3.70	(94.0)
2231	3.86	(98.0)	4.57	(116.1)

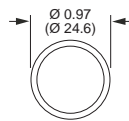
Interface Options



Flying Leads

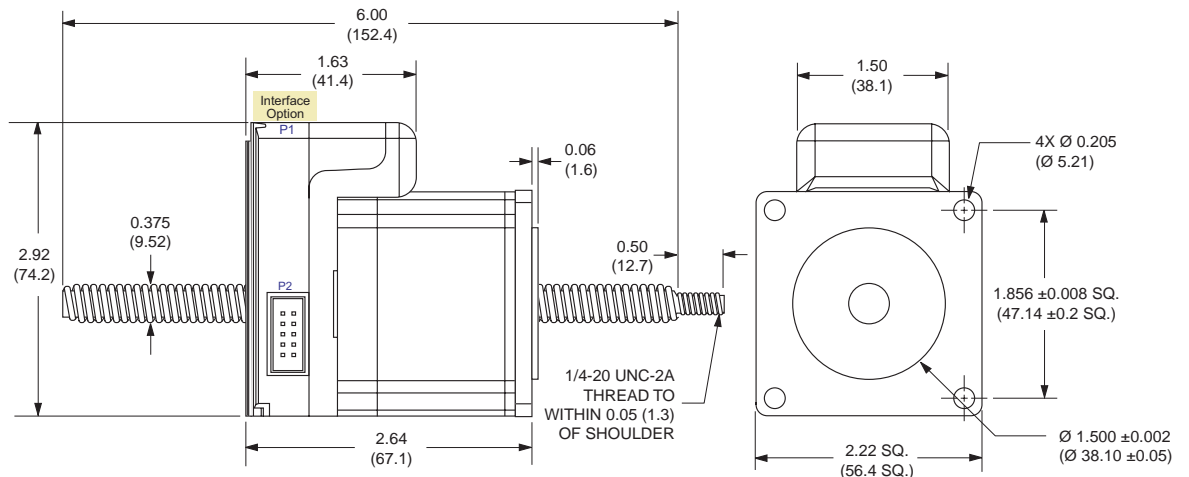
Pluggable Clamp Type Terminal Strip

L_{MAX2} Options



Control Knob

Linear Actuator MDrive23



MDRIVE23 MOTION CONTROL - OPTIONS

Control Knob

The MDrive23 is available with a factory-mounted control knob for manual shaft positioning.

Screw B..... 0.0008333"/full step
 Screw C..... 0.0005"/full step
 Screw D..... 0.0004167"/full step
 Screw E..... 0.0003125"/full step

Planetary Gearbox

Efficient, low maintenance Planetary Gearbox are offered assembled with the MDrive23. Details inside.

Standard screw length is 6.0" (152.4mm) plus the mounting end thread. Custom lengths from 2.0" to 24.0" are available without mounting end thread. Linear Actuators are Non-Captive style. Contact the factory regarding Captive Shaft or External styles.

Encoder

The MDrive23 Motion Control is available with an internal 512-line magnetic encoder with index mark.

Linear Actuator

The MDrive23 Motion Control with long life Acme Screw Linear Actuator is available with the following travel/full step:

Screw F..... 0.002"/full step
 Screw A..... 0.001"/full step

Communications Converter Cable

This convenient 6' (1.8m) accessory cable connects a PC's standard DB-9 Serial Comm Port to the MDrive's P2 Connector. An in-line RS-232 to RS-485 converter enables parameter setting to a single MDrive Motion Control. Purchase of this cable is recommended with first orders. Part No. MD-CC200-000.

ORDER INFORMATION

MDRIVE23 MOTION CONTROL	
<p>Stack Sizes 18† = Single Stack & Linear Actuator 22 = Double Stack 31 = Triple Stack</p> <p>MDI <input type="checkbox"/> 22 <input type="checkbox"/> - 4 <input type="checkbox"/> OPTION</p> <p>P = Pluggable Clamp Type Terminal Strip F = 12" Flying Leads</p>	
<p>Example #1: Part Number MDIP2231-4 is an MDrive23 Motion Control with Pluggable Interface, NEMA 22 motor, stack size 31, and +12 to +48 VDC input voltage range.</p>	

OPTIONS		
Control Knob	N	Example #2: MDIP2231-4N Adds a Control Knob to the part shown in example #1.
Planetary Gearbox	G <input type="text"/> Gearbox Ratio Rounded to Nearest Whole Number	Example #3: MDIP2231-4G5 Rounding ratio to the nearest whole number, the above adds a Planetary Gearbox with 5.18:1 ratio to the part shown in example #1. Add -F if optional NEMA Flange is desired.
Internal Encoder	E	Example #4: MDIP2231-4E Adds an internal 512 line magnetic encoder to the part shown in example #1.
Linear Actuator†	L <input type="checkbox"/> <input type="checkbox"/> Screw Type (Travel/Full Step) F = 0.002" A = 0.001" B = 0.0008333" C = 0.0005" D = 0.0004167" E = 0.0003125" Custom Screw Length Range 2.0" to 24.0" Format XX.X eg. 08.5 for an 8.5" Screw (6.0" Screw Length Standard)	Example #5: MDIP2218-4LB10.5 MDrive23 Motion Control Linear Actuator with a 0.0008333"/Full Step Acme Screw custom cut to 10.5". MAY NOT be combined with other options. <i>Note: MDrive23 Linear Actuator Available ONLY in Stack Size 18</i>

†Linear Actuator Available **ONLY** in Stack Size 18. (MDIX2218LX)



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