

## FEATURES

- Integrated Half/Full Step Driver and NEMA 14 High Torque 1.8° Stepping Motor
- +12 to +48 VDC Input Voltage
- Low Cost
- Extremely Compact
- Optically Isolated Logic Inputs will Accept +5 to +24 VDC Signals, Sourcing or Sinking
- Automatic Current Reduction
- Configurable:
  - Motor Run/Hold Current
  - Motor Direction vs. Direction Input
  - Half/Full Step
- Available Configurations:
  - Single Shaft\*
  - Long Life Linear Actuator
  - Optical Encoder\*
  - Control Knob For Manual Positioning\*
  - Integrated Planetary Gearbox\*
- Single Supply
- Interface Uses a 12 Position, Pluggable 2mm Pin and Receptacle (C Connector)
- Graphical User Interface (GUI) for Quick and Easy Parameter Setup

\* Rotary Motor Only

## DESCRIPTION

The MDrive NEMA 14 high torque Integrated Motor and Driver is ideal for designers who want the simplicity of a motor with on-board electronics, but without the expense of an indexer on each axis. The low cost MDrive14 offers the system designer the best method of control. The MDrive14's integrated electronics eliminate the need to run the motor cabling through the machine, reducing the potential for problems due to electrical noise.

The MDrive14 uses a NEMA 14 frame size 1.8° high torque stepping motor combined with a half/full step drive. Setup parameters include Motor Resolution, Motor Direction with respect to the direction input, and Run/Hold currents. These settings may be changed, downloaded and stored in nonvolatile memory with the use of a simple GUI which is provided. This eliminates the need for external switches or resistors. Parameters are changed via an SPI port located on connector P1. Operating voltage for the MDrive14 ranges from +12 to +48 VDC.

The versatile, compact MDrive14 is available in multiple configurations to fit various system needs. These options include a single shaft rotary motor, a dual shaft rotary motor available with optical encoder or control knob, a planetary gearbox, or a long life Acme screw linear actuator. Interface connections are accomplished using a 12 position

keyed and locking pin and receptacle.

The MDrive14 is a compact, powerful and inexpensive solution that will reduce system cost, design and assembly time for a large range of stepping motor applications.

## CONFIGURING

The IMS Motor Interface software is an easy to install and use GUI for configuring the MDrive14 from a computer parallel/SPI port. GUI access is via the IMS SPI Interface included on the CD shipped with the product

The IMS Motor Interface features:

- Easy installation.
- Automatic detection of MDrive version and communication configuration.
- Will not set out-of-range values.
- Tool-tips display valid range setting for each option.
- Single screen interface (*below*).



The IMS Motor Interface GUI simplifies MDrive configuring with a single screen interface.

# MDRIVE14 SPECIFICATIONS

## GENERAL SPECIFICATIONS

Input Voltage (+V) Range*	.....	+12 to +48 VDC
Isolated Inputs	.....	Step Clock, Direction & Enable
Isolated Input Voltage Range (Sourcing or Sinking)	.....	+5 to +24 VDC
Step Frequency (Max)	.....	1 MHz
Steps per Revolution	.....	200, 400
Heat Sink Temperature (Max)	.....	85° C
Motor Temperature (Max)	.....	100° C

\* Power supply current requirements = 0.6A (maximum) per MDrive14. Actual power supply current will depend on voltage and load.

## PARAMETERS

SETUP PARAMETERS				
NAME	FUNCTION	RANGE	UNITS	DEFAULT
MHC	Motor Hold Current	0 to 100	percent	5
MRC	Motor Run Current	1 to 100	percent	25
HFUL	Resolution	Half Step / Full Step	--	Full Step
HCDT	Hold Current Delay Time	2 to 65535, or 0	mSec.	500 mSec.
DIR	Motor Direction	CCW / CW	--	0 (CW)

All parameters are set using the supplied IMS Motor Interface GUI.  
An optional Parameter Setup Cable is recommended with first orders.

## PIN ASSIGNMENTS

CONNECTOR P1	
PIN	FUNCTION
1	SPI MASTER OUT - SLAVE IN
2	SPI CHIP SELECT
3	SPI MASTER IN - SLAVE OUT
4	COMMUNICATION GROUND
5	SPI CLOCK
6	+5 VDC OUTPUT
7	CW / CCW DIRECTION INPUT
8	ENABLE INPUT
9	STEP CLOCK INPUT
10	OPTOCOUPLER REFERENCE
11	+V (+12 TO +48 VDC)
12	POWER GROUND

## ENCODER PIN ASSIGNMENTS

ENCODER - Single-End	
PIN	FUNCTION
1	GROUND
2	INDEX
3	CHANNEL A
4	+5 VDC INPUT
5	CHANNEL B

ENCODER - Differential	
PIN	FUNCTION
1	NO CONNECT
2	+5 VDC INPUT
3	GROUND
4	NO CONNECT
5	CHANNEL A -
6	CHANNEL A +
7	CHANNEL B -
8	CHANNEL B +
9	INDEX -
10	INDEX +

Optional Encoder Cables available.

# MDRIVE14 MOTOR SPECIFICATIONS

## MD1410 Single Stack

Holding Torque ..... 10 oz-in / 7.0 N-cm  
 Detent Torque ..... 1.4 oz-in / 1.0 N-cm  
 Rotor Inertia ..... 0.00017 oz-in-sec<sup>2</sup> / 0.012 kg-cm<sup>2</sup>  
 Weight (Motor+Driver)..... 6.0 oz / 170.1 g

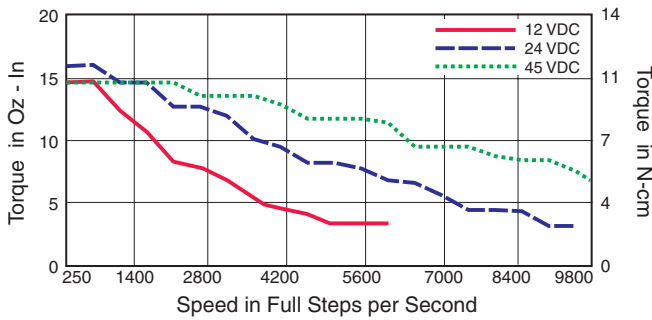
## MD1414 Linear Actuator

Maximum Thrust ..... 50 lbs / 222 N  
 Maximum Screw Deflection ..... ± 1°  
 Backlash ..... 0.005 in / 0.127 mm  
 Weight (without screw)..... 6.4 oz / 181.4 g

## TORQUE-SPEED CURVES

### Rotary Motor

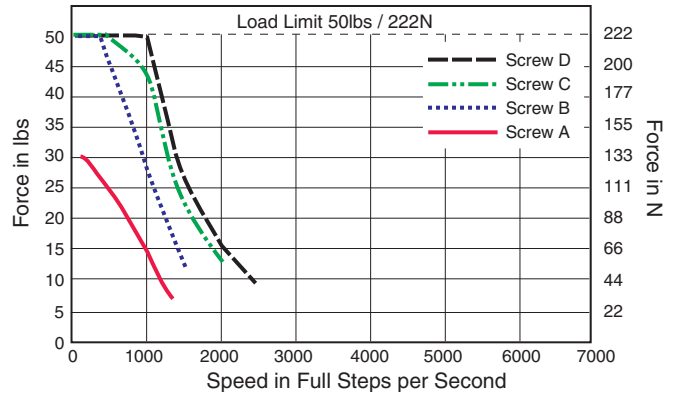
#### MD1410 Single Stack



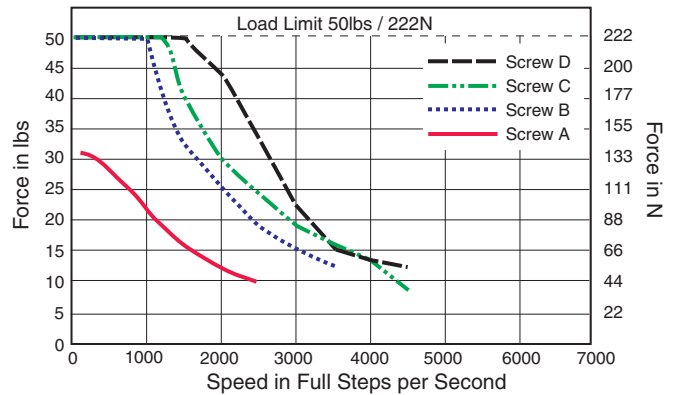
## FORCE-SPEED CURVES

### Linear Actuator

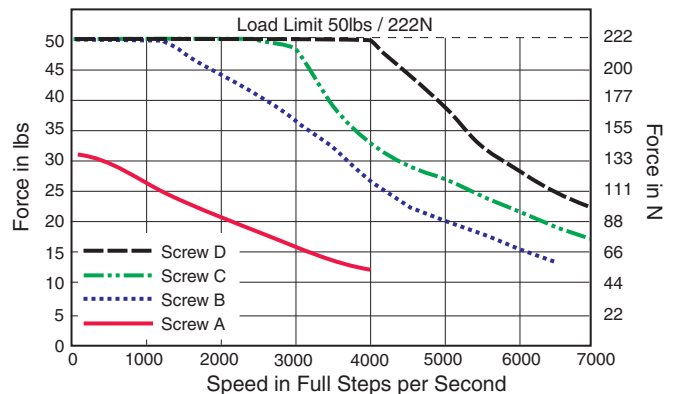
#### 12 VDC



#### 24 VDC



#### 45 VDC



## MDRIVE14 WITH PLANETARY GEARBOX

The MDrive14 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 MDrive14 options, however are unavailable on Linear Actuator versions.

### Parameters

	1-Stage	2-Stage	3-Stage
Permitted Output Torque (oz-in/Nm)	106/0.75	318/2.25	637/4.50
Gearbox Efficiency	0.80	0.75	0.70
Maximum Backlash (degree)	1.5°	2.0°	2.5°

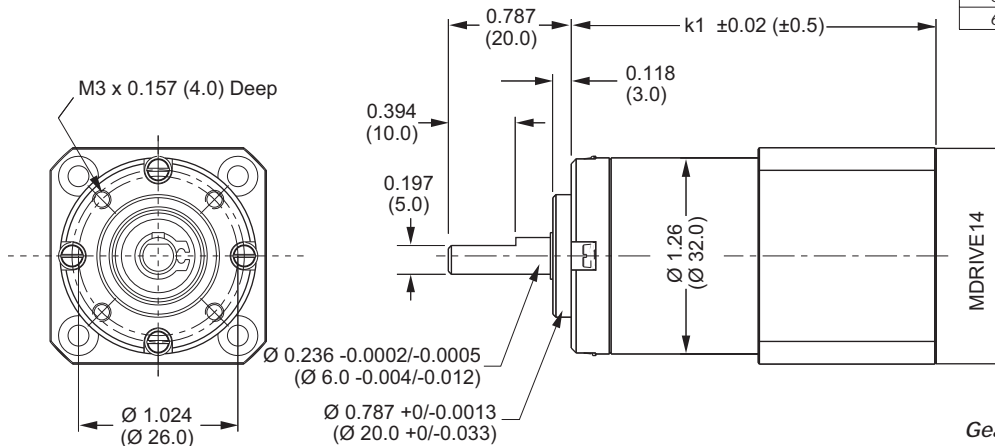
### Output Side with Ball Bearing

Maximum Load, Radial (lb-force/N)	9.0/40	15.7/70	22.0/100
Maximum Load, Axial (lb-force/N)	2.2/10	4.5/20	6.7/30
Weight - Gearbox Only (oz/g)	5.7/162	7.5/213	9.3/264
Weight - Gearbox & NEMA Flange (oz/g)	5.9/168	7.8/221	9.6/273

## PLANETARY GEARBOX MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

### Planetary Gearbox for MDrive14



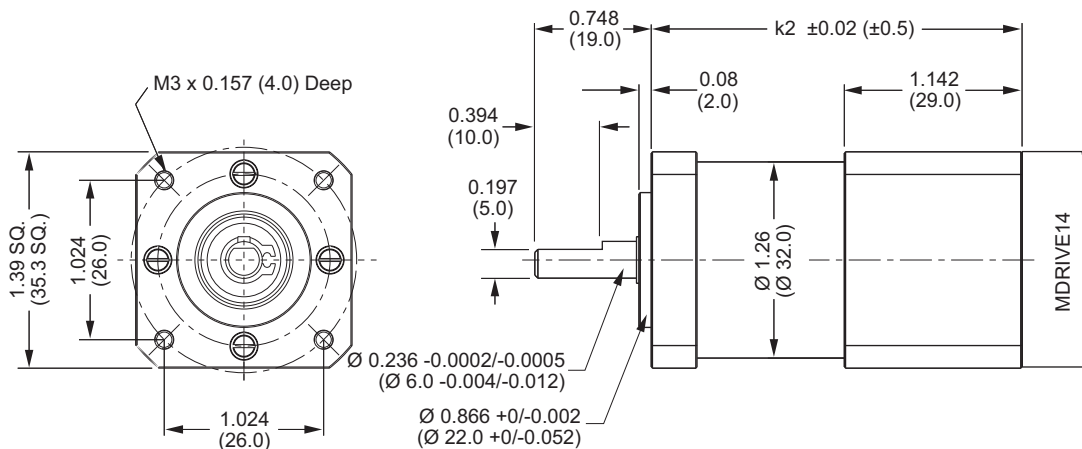
### Gearbox Ratios (Rounded)

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	1.969 (50.0)	2.343 (59.5)	2.717 (69.0)
k2 Gearbox w/ NEMA Flange	2.008 (51.0)	2.382 (60.5)	2.756 (70.0)

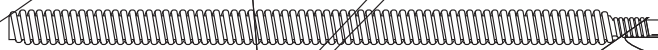
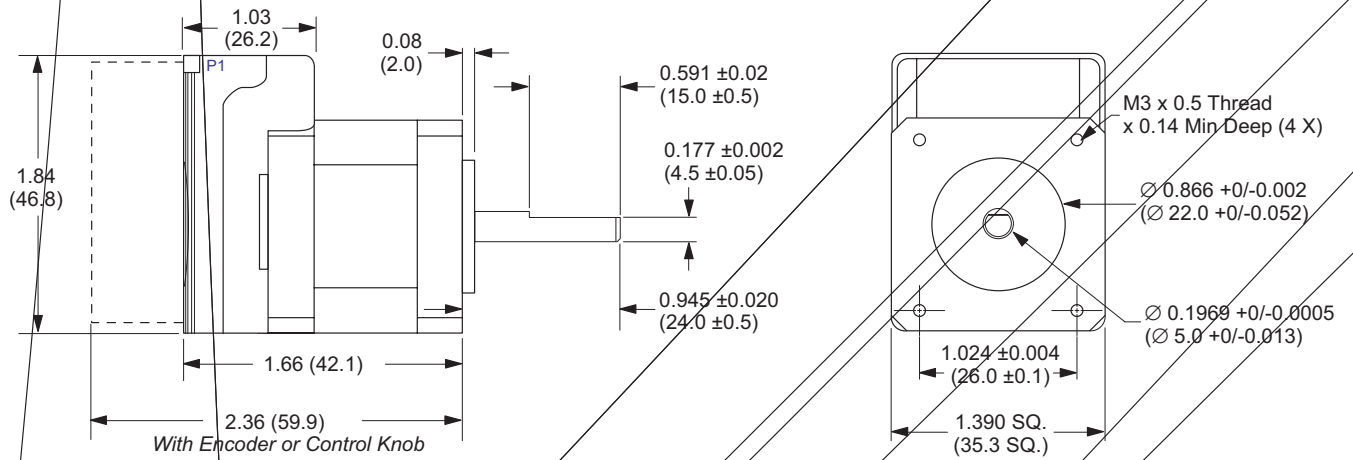
### Planetary Gearbox with Optional NEMA Output Flange



# MDRIVE14 - MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

## Single Shaft, Control Knob & Encoder Versions



M4 X 0.7  
Thread to within  
0.03 (0.76) of Shoulder

## MDRIVE14 – OPTIONS

### Control Knob

The MDrive14 is available with a factory-mounted rear control knob for manual shaft positioning.

### Planetary Gearbox

Efficient, low maintenance Planetary Gearbox are offered assembled with the MDrive14. Details inside.

### Encoder

The MDrive14 is available with a factory-mounted optical encoder. Available line counts are 100, 200, 250, 400, 500 or 1000. All encoders, except the 1000 line, have an index mark. Encoders are available in both single-end and differential configurations. Order optional Encoder Cables separately:

Single-end Cable (12"/30.5cm) ..... ES-CABLE-2  
 Differential Cable (36"/91.5cm) ..... ED-CABLE-2

### Linear Actuator

The MDrive14 with long life Acme Screw Linear Actuator is available with the following travel/full step:

Screw A ..... 0.00125"/full step  
 Screw B ..... 0.000625"/full step

Screw C ..... 0.0003125"/full step  
 Screw D ..... 0.00015625"/full step  
 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.





### Parameter Setup Cable and Adapter

The optional Parameter Setup Cable Part No. MD-CC100-000 plus Adapter Part No. MD-ADP-14C are recommended with first order. The 6' (1.8m) Cable eliminates the need to wire communications to connect to a standard DB-25 PC Parallel/SPI port, and includes built-in logic level shifting circuitry to accommodate the 3.3v ports on some PCs. The 12" (30.5cm) Adapter connects the Cable to the MDrive's P1 connector.

### Prototype Development Cable

For MDrive testing and development, the 12" (30cm) Prototype Development Cable plugs into the MD-ADP-14C Adapter and has flying leads for connection to the user interface. Part No. ADP-2012-FL.

## ORDER INFORMATION

MDRIVE 14	OPTIONS		
<p>Stack Sizes 10 = Single Stack 14 = Linear Actuator†</p> <p><b>MDBC 14</b> </p>	Control Knob	<b>N</b>	<b>Example #2: MDBC1410N</b> Adds a Control Knob to the part shown in example #1.
	Planetary Gearbox	<b>G</b>  Gearbox Ratio Rounded to Nearest Whole Number	<b>Example #3: MDBC1410G5</b> 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.
	Encoder	<b>E</b>  S = Single End    Line Counts: 100, <b>200</b> , D = Differential    250, 400, <b>500</b> , 1000	<b>Example #4: MDBC1410ED500</b> Adds a 500 line count Differential Encoder to the part shown in example #1.
	Linear Actuator†	<b>L</b>  Screw Type (Travel/Full Step)    Custom Screw Length A = 0.00125"    Range 2.0" to 24.0" B = 0.000625"    Format XX.X C = 0.0003125"    eg. 08.5 for an 8.5" Screw D = 0.00015625"    (6.0" Screw Length Standard)	<b>Example #5: MDBC1414LC10.5</b> Microstepping MDrive14 Linear Actuator with a 0.0003125"/Full Step Acme Screw custom cut to 10.5". MAY NOT be combined with other options. <i>Note: MDrive14 Linear Actuator Available ONLY in Stack Size 14</i>
<p><b>Example #1:</b> Part Number <b>MDBC1410</b> is an MDrive14 Half/Full Step (B) with C Connector, NEMA 14 motor, stack size 10.</p>			

†Linear Actuator Available **ONLY** in Stack Size 14. (MDBC1414LX)



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