

MDRIVE[®] 14 MOTOR+DRIVER *Plus* MICROSTEPPING

FEATURES

- Highly Integrated Microstepping Driver and NEMA 14 High Torque 1.8° Brushless Step Motor
- Advanced 2nd Generation Current Control for Exceptional Performance and Smoothness
- Single Supply: +12 to +48 VDC
- 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
- Automatic Current Reduction
- Configurable:
 - Motor Run/Hold Current
 - Motor Direction vs. Direction Input
 - Microstep Resolution
 - Clock Type: Step and Direction, Quadrature, Step Up and Step Down, Clockwise and Counterclockwise
 - Programmable Digital Filtering for Clock and Direction Inputs
- Available Options:
 - Long Life Linear Actuators**
 - Encoder: External Optical or Internal Magnetic
 - Integrated Planetary Gearbox
 - Control Knob for Manual Positioning
- 2 Rotary Motor Lengths Available
- Setup Parameters May Be Switched On-The-Fly
- Pluggable Locking Wire Crimp Interface
- Graphical User Interface (GUI) for Quick and Easy Parameter Setup

** Consult Factory for Availability.

DESCRIPTION

The **MDrive[®]14Plus Microstepping** high torque integrated motor and step and direction driver is ideal for designers who want the simplicity of a motor with on-board electronics. The integrated electronics of the MDrive14Plus eliminate the need to run motor cabling through the machine, reducing the potential for problems due to electrical noise.

The unsurpassed smoothness and performance delivered by the MDrive14-Plus Microstepping are achieved through IMS's advanced 2nd generation current control. By applying innovative techniques to control current flow through the motor, resonance is significantly dampened over the entire speed range and audible noise is reduced.

The MDrive14Plus accepts a broad input voltage range from +12 to +48 VDC, delivering enhanced performance and speed. Oversized input capacitors are used to minimize power line surges, reducing problems that can occur with long runs and multiple drive systems. An extended operating range of -40° to +85°C provides long life, trouble free service in demanding environments.

The MDrive14Plus uses a NEMA 14 frame size high torque brushless step motor integrated with a microstepping driver, and accepts up to 20 resolution settings from full to 256 microsteps per full step, including: degrees, metric and arc minutes. These settings may be changed on-the-fly or 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.

The versatile MDrive14Plus Microstepping is available in multiple configurations to fit various system needs. Rotary motor versions come in 2 lengths and may include an encoder, control knob or planetary gearbox. Long life Acme screw linear actuators** are also available. Interface connections are accomplished using locking wire crimp connectors.

MDrivePlus connectivity has never been easier with options ranging from **all-inclusive QuickStart Kits** to **individual interfacing cables** and **mating connector kits** to build your own cables. *See pg 4.*

The MDrive14Plus is a compact, powerful and cost effective motion control solution that will reduce system cost, design and assembly time for a large range of brushless step motor applications.

CONFIGURING

The IMS Motor Interface software is an easy to install and use GUI for configuring the MDrive14Plus from a computer's USB port. GUI access is via the IMS SPI Motor Interface available at www.imshome.com.

- The IMS SPI 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.
 - Simple screen interfaces.

MDrive14Plus MICROSTEPPING

STANDARD SPECIFICATIONS

INPUT VOLTAGE (+V)	Range	+12 to +48 VDC <i>Power supply current requirements = 1A (maximum) per MDrive14Plus. Actual power supply current will depend on voltage and load.</i>	
	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	
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 Frequency	2 MHz Default / 5 MHz Max	
	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)	
THERMAL	Operating Temperature	Heat Sink	-40° to +85°C (non-condensing)
		Motor	-40° to +100°C (non-condensing)

SETUP PARAMETERS

	Function	Range	Units	Default
MHC	Motor Hold Current	0 to 100	percent	5
MRC	Motor Run Current	1 to 100	percent	25
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	Motor Direction Override	0/1	—	CW
HCDT	Hold Current Delay Time	0 or 2-65535	mSec	500
CLK TYPE	Clock Type	Step/Dir, Quadrature, Up/Down, CW/CCW	—	Step/Dir
CLK IOF	Clock and Direction Filter	50 nS to 12.9 μS (10 MHz to 38.8 kHz)	nS (MHz)	200 nS (2.5 MHz)
USER ID	User ID	Customizable	1-3 characters	IMS
EN ACT	Enable Active	High/Low	—	High

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.

MOTOR SPECIFICATIONS

	Holding Torque	Detent Torque	Rotor Inertia	Weight (Motor+Driver)
SINGLE LENGTH	18.0 oz-in / 12.71 N-cm	2.0 oz-in / 1.4 N-cm	0.000278 oz-in-sec ² / 0.0199 kg-cm ²	5.29 oz / 150.0 g
TRIPLE LENGTH	36.0 oz-in / 25.0 N-cm	4.4 oz-in / 3.1 N-cm	0.000801 oz-in-sec ² / 0.0566 kg-cm ²	12.8 oz / 380.0 g

ENCODER PIN ASSIGNMENTS

External Encoder

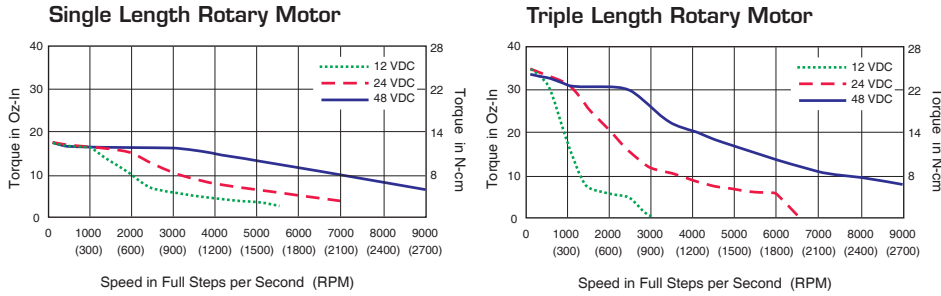
Pluggable Interface	DIFFERENTIAL ENCODER	SINGLE-END ENCODER
	<i>with locking connector feature</i>	
	Function	Function
Pin 1	No Connect	Ground
Pin 2	+5 VDC Input	Index
Pin 3	Ground	Channel A
Pin 4	No Connect	+5 VDC Input
Pin 5	Channel A -	Channel B
Pin 6	Channel A +	
Pin 7	Channel B -	
Pin 8	Channel B +	
Pin 9	Index -	
Pin 10	Index +	

Optional encoder cables are available.

Internal Encoder

An internal differential encoder option is available. See Wire/Pin Assignments on the following page for connection details.

MOTOR PERFORMANCE — Speed-Torque



PIN ASSIGNMENTS — MDrive14Plus Microstepping

P1: I/O, POWER & COMM CONNECTOR		
Wire Crimp	Function	
	Universal Input	Differential Input <i>Clockwise/Counterclockwise</i>
Pin 1	Power Ground	Power Ground
Pin 2	+V (+12 to +48 VDC)	+V (+12 to +48 VDC)
Pin 3	Optocoupler Reference	CW +
Pin 4	Step Clock Input	CW -
Pin 5	Enable Input	CCW +
Pin 6	CW/CCW Direction Input	CCW -
Pin 7	+5 VDC Output	+5 VDC Output
Pin 8	SPI Clock	SPI Clock
Pin 9	Communications Ground	Communications Ground
Pin 10	SPI Master Out - Slave In	SPI Master Out - Slave In
Pin 11	SPI Chip Select	SPI Chip Select
Pin 12	SPI Master In - Slave Out	SPI Master In - Slave Out

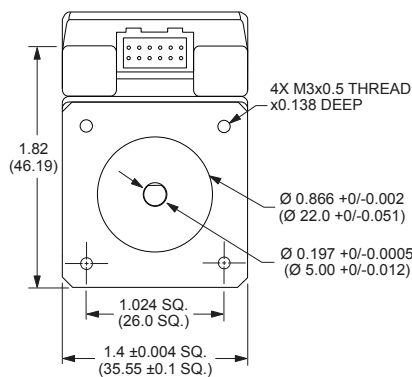
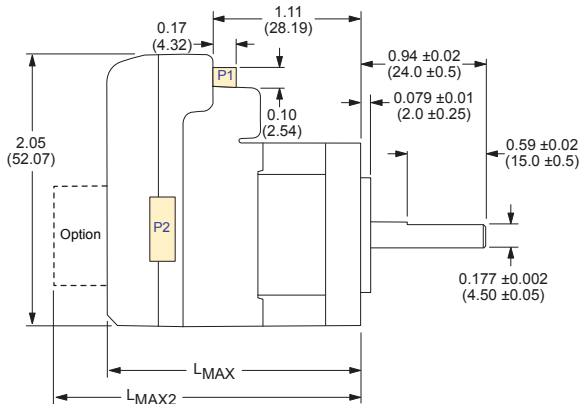
P2: OPTIONAL INTERNAL DIFFERENTIAL ENCODER		
Wire Crimp	Function	
Pin 1	Ground	
Pin 2	Channel A +	
Pin 3	Channel A -	
Pin 4	Channel B +	
Pin 5	Channel B -	
Pin 6	Index +	
Pin 7	Index -	
Pin 8	+5 VDC Input	
Pin 9	No Connect	
Pin 10	No Connect	

P2 present only with internal encoder option.

MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

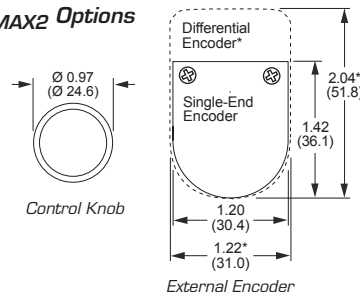
MDrive14Plus Microstepping



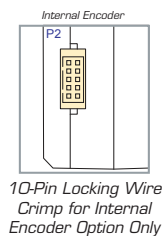
MDrive Lengths Inches (mm)

Motor Length	LMAX	LMAX2
	SINGLE SHAFT, INTERNAL ENCODER, or LINEAR ACTUATOR	CONTROL KNOB or EXTERNAL ENCODER
Single	1.93 (49.02)	2.62 (66.55)
Triple	3.03 (76.96)	3.73 (94.74)

LMAX2 Options



P2 Connector



ORDER INFORMATION — MDrive14Plus Microstepping

CONNECTIVITY

- new QuickStart Kit**
For rapid design verification, all-inclusive QuickStart Kits have communication converter, prototype development cable, instructions and CD for MDrivePlus initial functional setup and system testing.
- new Communication Converter**
Electrically isolated, in-line converters pre-wired with mating connectors to conveniently set/program communication parameters for a single MDrivePlus via a PC's USB port. Length 12.0' (3.6m).
Mates to connector:
12-Pin Wire Crimp MD-CC305-001
- Prototype Development Cable**
Speed test/development with pre-wired mating connectors that have flying leads other end. Length 10.0' (3.0m).
Mates to connector:
12-Pin Wire Crimp PD12B-1434-FL3
- new Mating Connector Kit**
Use to build your own cables. Kit contains 5 mating shells with pins. Cable not supplied. Manufacturer's crimp tool recommended.
Mates to connector:
12-Pin Wire Crimp CK-08

** Consult Factory for Availability.

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

OPTIONS

Linear Actuator**
The MDrive14Plus is offered with numerous linear actuator styles and options to satisfy a broad range of linear motion applications. Contact the factory for details or see: www.imshome.com/mdriveplus_linear_actuator.html

External Encoder
External optical encoders, single-end or differential, are offered factory-mounted with the MDrive14Plus. All encoders come with an index mark. Refer to the table below.

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	EVL	EDL	EHL	EXL	EJL	EYL

Optional encoder cables are available. Order separately.
Single-end Cable (12.0"/30.5cm)..... ES-CABLE-2
Differential Locking Cable (6.0'/1.8m) ED-CABLE-6

Internal Encoder
Internal differential magnetic encoders with index mark are available.


Line Count	100	200	250	256	400	500	512	800	1000
Differential part#	EAM	EBM	ECM	EWM	EDM	EHM	EXM	EFM	EJM

An optional encoder cable is available. Order separately.
Internal Encoder Cable (10.0'/3.0m) PD10-3400-FL3

Control Knob
The MDrive14Plus is available with a factory-mounted rear control knob for manual shaft positioning.

Planetary Gearbox
Efficient, low maintenance planetary gearboxes are offered assembled with the MDrive14Plus. Refer to details and part numbers on the back cover.

PART NUMBERING



Plus
base version

K MDM CSZ14 4 - **OPTION**

QuickStart Kit
details above

Motor
A = Single Length & Linear Actuator**
C = Triple Length

Input Version
1 = Universal
5 = Differential

P1: I/O, Power & Communications
12-Pin Locking Wire Crimp

Example #1: Part Number **MDM1CSZ14A4** is an MDrive14Plus Microstepping with Universal Input, 12-pin pluggable locking wire crimp connector for I/O, power and communications interface, and NEMA 14 single length motor.

**Consult Factory for Availability.

OPTIONS

Linear Actuator** -L
For complete product specifications, see: www.imshome.com/mdriveplus_linear_actuator.html

External Encoder -E
Refer to external encoder table above for line counts and part numbers.
Example: **MDM1CSZ14A4-EHL** adds an external 500-line count differential optical encoder with index mark to example #1.

Internal Encoder -E
Refer to internal encoder table above for line counts and part numbers.
Example: **MDM1CSZ14A4-ECM** adds an internal 250-line count differential magnetic encoder with index mark to example #1.

Control Knob -N
Example: **MDM1CSZ14A4-N** adds a rear control knob for manual positioning to example #1.

Planetary Gearbox -G -F
Refer to gearbox page for complete table of ratios and part numbers. Optional NEMA Flange
Example: **MDM1CSZ14A4-G1A2** adds a 1-stage planetary gearbox with 5.18:1 ratio to example #1. Add -F for optional NEMA flange.

MDrive14PLUS WITH PLANETARY GEARBOX

The MDrive14Plus 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 Output Flange allows mounting the Planetary Gearbox to the load using a standard NEMA bolt circle. Planetary Gearbox may be combined with other MDrive14Plus options, however are unavailable with Linear Actuators.

Planetary Gearbox Parameters

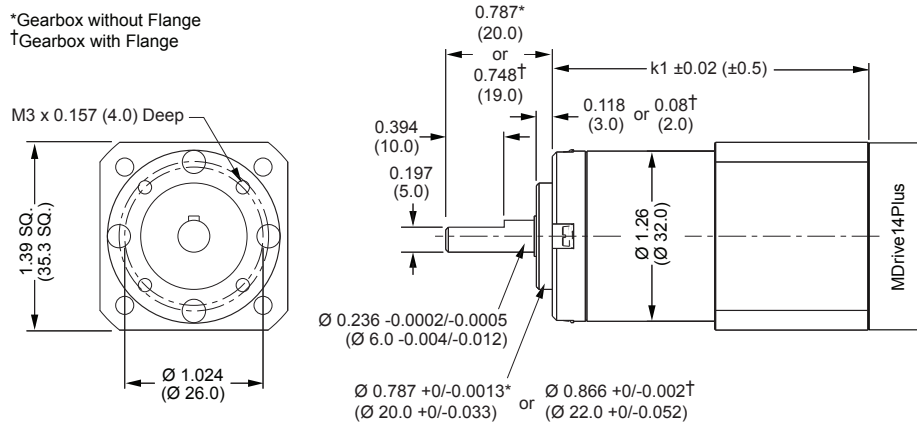
	Permitted Output Torque (oz-in/Nm)	Gearbox Efficiency	Maximum Backlash	Output Side with Ball Bearing			
				Maximum Load (lb-force/N)		Weight (oz/g)	
				Radial	Axial	Gearbox	with Flange
1-STAGE	106/0.75	0.80	1.5°	9.0/40	2.2/10	5.7/162	5.9/168
2-STAGE	318/2.25	0.75	2.0°	15.7/70	4.5/20	7.5/213	7.8/221
3-STAGE	637/4.50	0.70	2.5°	22.0/100	6.7/30	9.3/264	9.6/273

Ratios and Part Numbers

Planetary Gearbox	Ratio (Rounded)	Part Number**
1-Stage	3.71:1	G1A1
1-Stage	5.18:1	G1A2
1-Stage	6.75:1	G1A3
2-Stage	13.73:1	G1A4
2-Stage	15.88:1	G1A5
2-Stage	18.37:1	G1A6
2-Stage	19.20:1	G1A7
2-Stage	22.21:1	G1A8
2-Stage	25.01:1	G1A9
2-Stage	26.85:1	G1B1
2-Stage	28.93:1	G1B2
2-Stage	34.98:1	G1B3
2-Stage	45.56:1	G1B4
3-Stage	50.89:1	G1B5
3-Stage	58.86:1	G1B6
3-Stage	68.07:1	G1B7
3-Stage	71.16:1	G1B8
3-Stage	78.72:1	G1B9
3-Stage	92.70:1	G1C1
3-Stage	95.18:1	G1C2
3-Stage	99.51:1	G1C3
3-Stage	107.21:1	G1C4
3-Stage	115.08:1	G1C5
3-Stage	123.98:1	G1C6
3-Stage	129.62:1	G1C7
3-Stage	139.14:1	G1C8
3-Stage	149.90:1	G1C9
3-Stage	168.85:1	G1D1
3-Stage	181.25:1	G1D2
3-Stage	195.27:1	G1D3
3-Stage	236.10:1	G1D4
3-Stage	307.55:1	G1D5

Planetary Gearbox for MDrive14Plus

Dimensions in Inches (mm)



Gearbox Lengths Inches (mm)

	k1	
	GEARBOX*	with FLANGE†
1-Stage	1.969 (50.0)	2.008 (51.0)
2-Stage	2.343 (59.5)	2.382 (60.5)
3-Stage	2.717 (69.0)	2.756 (70.0)

**Include optional planetary gearbox by adding -G plus 3 characters to the end of an MDrive part number.

U.S.A. SALES OFFICES

Eastern Region
Tel. 862 208-9742 - Fax 973 661-1275
e-mail: jroake@imshome.com

Central Region
Tel. 260 402-6016 - Fax 419 858-0375
e-mail: dwaksman@imshome.com

Western Region
Tel. 602 578-7201
e-mail: dweisenberger@imshome.com

IMS ASIA PACIFIC OFFICE

30 Raffles Pl., 23-00 Chevron House, Singapore 048622
Tel. +65/6233/6846 - Fax +65/6233/5044
e-mail: wlee@imshome.com

IMS EUROPEAN SALES MANAGEMENT

4 Quai Des Etoits
69005 Lyon, France
Tel. +33/4 7256 5113 - Fax +33/4 7838 1537
e-mail: bmartinez@imshome.com

IMS UK Sales

Machine Technology Centre, Blackhill Drive
Wolverton, Milton Keynes MK12 5TS
Tel. +44/0 1908 628000 - Fax +44/0 1908 628001
e-mail: mcheckley@imshome.com

TECHNICAL SUPPORT

Tel. +00 (1) 860 295-6102 - Fax +00 (1) 860 295-6107
e-mail: etech@imshome.com

Intelligent Motion Systems, Inc.

370 North Main Street, P.O. Box 457
Marlborough, CT 06447 - U.S.A.
Tel. +00 (1) 860 295-6102 - Fax +00 (1) 860 295-6107
e-mail: info@imshome.com
http://www.imshome.com