



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
- Single Motor Length 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 **MDrive14Plus 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.

Motor configurations include a single length rotary and a linear actuator with long life Acme screw**. Rotary motors may include an encoder, control knob or planetary gearbox. 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> | |
| | Universal | Voltage Range: +5 to +24 VDC Sourcing or Sinking Step Clock, Direction and Enable | |
| ISOLATED INPUT | Differential | Voltage Range: +5 VDC Clockwise and Counterclockwise | |
| | Digital Filter Range | 50 nS to 12.9 μ S (10 MHz to 38.8 kHz) | |
| MOTION | 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/ μ step), 21600 (1 arc minute/ μ step), 25400 (0.001mm/ μ step) |
| 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 | μ steps 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 μ S (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 | 0.000241 oz-in-sec ² / 0.0170 kg-cm ² | 5.29 oz / 150.0 g |

ENCODER PIN ASSIGNMENTS

External Encoder

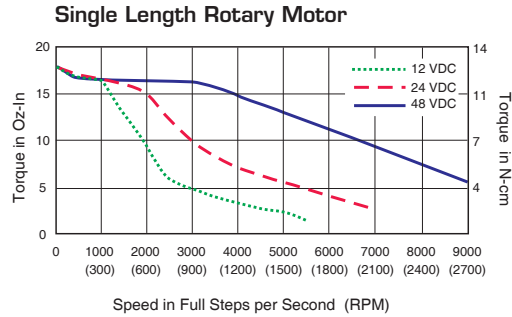
| Pluggable Interface | DIFFERENTIAL ENCODER <i>with locking connector feature</i> | SINGLE-END ENCODER |
|---------------------|---|--------------------|
| | Function | Function |
| Pin 1 | No Connect | Ground |
| Pin 2 | +5 VDC Input | Index |
| Pin 3 | Ground | Channel A |
| Pin 4 | No Connect | +5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

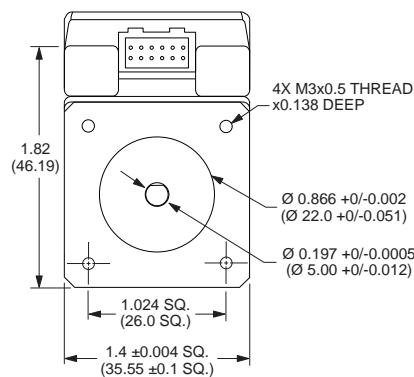
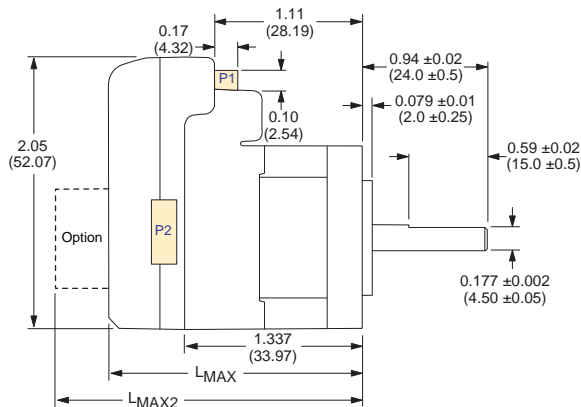
| P2: OPTIONAL INTERNAL DIFFERENTIAL ENCODER | |
|--|--------------|
| Wire Crimp | Function |
| Pin 1 | Ground |
| Pin 2 | Channel A + |
| Pin 3 | Channel A - |
| Pin 4 | Channel B + |
| Pin 5 | Channel B - |
| Pin 6 | Index + |
| Pin 7 | Index - |
| Pin 8 | +5 VDC Input |
| Pin 9 | No Connect |
| Pin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

P2 present only with internal encoder option.

MECHANICAL SPECIFICATIONS

Dimensions in Inches (mm)

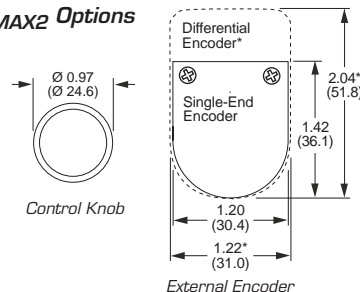
MDrive14Plus Microstepping



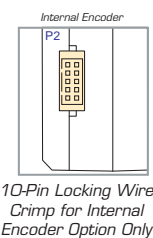
MDrive Lengths Inches (mm)

| LMAX | LMAX2 |
|---|--|
| SINGLE SHAFT, INTERNAL ENCODER or LINEAR ACTUATOR VERSION | CONTROL KNOB or EXTERNAL ENCODER VERSION |
| 1.91 (48.51) | 2.61 (66.29) |

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 CrimpMD-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 CrimpPD12B-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 CrimpCK-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 | EWL | 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

CSZ14A4

-

OPTION

QuickStart Kit
details above

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

Optional NEMA Flange

Refer to gearbox page for complete table of ratios and part numbers.

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

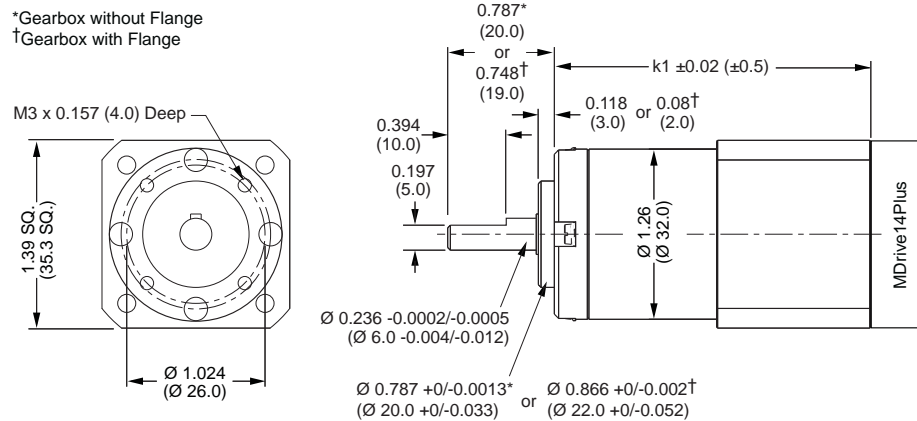
The MDrive14Plus is available with a Planetary Gearbox option developed to increase torque at lower speeds, enable better inertia matching and produce finer positional resolutions. These efficient, low maintenance Planetary Gearbox come fully assembled with the MDrive and are offered in a large number 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 |

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) |

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 |

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

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