

MDrive[®] Plus

Stepper motors with integrated electronics



MDrive 23 Plus Speed Control
with programmable velocity control

MDrive® Plus

Speed Control

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Presentation

The MDrive® Plus Speed Control with programmable velocity control is a 1.8° 2-phase stepper motor with on-board control electronics. The velocity control uses voltage, current, or PWM analog input signal modes.

Settings for MDrive Plus Speed Control products may be changed on-the-fly or downloaded and stored in nonvolatile memory using the IMS SPI Motor Interface software provided. This eliminates the need for external switches or resistors. Parameters are changed via an SPI port.

Application areas

The MDrive Plus Speed Control with programmable velocity control is ideal for machine builders who want an optimized motor with on-board electronics. The integrated electronics of the MDrive Plus Speed Control with programmable velocity control reduces the potential for problems due to electrical noise by eliminating the cable between motor and drive.

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

Features

- Highly integrated microstepping drive and high torque 1.8° 2-phase stepper motor
- Advanced current control for exceptional performance and smoothness
- Single supply: from +12 up to +75 VDC
- Cost effective
- Extremely compact
- 20 microstep resolutions up to 51,200 steps per rev including: Degrees, Metric, Arc Minutes
- 10-bit analog speed control inputs accept:
 - 0 to +5 VDC
 - 0 to +10 VDC
 - 4 to 20 mA
 - 0 to 20 mA
 - 15 to 25 kHz PWM
- Automatic current reduction
- Electronically configurable:
 - Motor run/hold current
 - Microstep resolution
 - Acceleration/deceleration
 - Initial and maximum velocity
 - Hold current delay time/motor settling delay time
 - Programmable filtering for the stop/start input
- Available options:
 - Encoder
 - Control knob for manual positioning
- Several motor stack lengths available
- Setup parameters may be switched on-the-fly
- Numerous connector interface choices
- Graphical user interface provided for quick and easy parameter setup

MDrive® Plus Speed Control with programmable velocity control

| Plus specifications | | | MDrive 17 | MDrive 23 (1) | MDrive 23 (1) | MDrive 34 |
|---------------------|-------------------------------|-------------------------------|--|---------------|---------------|--|
| Input power | Voltage | VDC | 12 to 48 | 12 to 75 | 12 to 60 | 12 to 75 |
| | Current maximum (2) | | 2A | 2A | 3.5A | 4A |
| Thermal | Operating temp non-condensing | Heat sink | -40° to +85°C | | | -40° to +75°C |
| | | Motor | -40° to +100°C | | | -40° to +90°C |
| Speed control | Input | | 0 to +5 VDC (4), 0 to +10 VDC, 4 to 20 mA, 0 to 20 mA, or 15 to 25 kHz PWM | | | Speeds A1 and A2: 0 to +5 VDC (4), 0 to +10 VDC, 4 to 20 mA, or 0 to 20 mA |
| | A/D resolution | | 10 bit | | | 10 bit |
| Logic input | Low level | | 0 to +0.8 VDC | | | 0 to +0.8 VDC |
| | High level | | +2.0 to +5.0 VDC | | | +5.0 to +24.0 VDC |
| | Internal pull-up resistance | | 20 kΩ (to +3.3 VDC) | | | not applicable |
| | Optically isolated | | no | | | yes |
| | Configurable | | sinking | | | sourcing or sinking |
| Logic output | Step clock / direction | Open drain source maximum | not applicable | | | +100 VDC |
| | | Open drain current continuous | not applicable | | | 100 mA |
| | | Output pulse width | not applicable | | | 100 nSec to 12.8 μSec software configurable |
| Motion | Oscillator frequency maximum | | 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 (4) | | | | | |
|----------------------|--|---------------------------|--|------------------------|-------------|
| SPI communication | | Function | Range | Units | Default |
| A1 (5) | | Analog input mode | 0 to +5 VDC, 0 to +10 VDC, 4 to 20 mA, 0 to 20 mA, or 15 to 25 kHz PWM | — | 0 to +5 VDC |
| ACCL | | Acceleration | 91 to 1.5 X 10 ⁹ | steps/sec ² | 1,000,000 |
| C (7) | | Joystick center | 1 to 1022 | counts | 0 |
| CLK OUT (6) | | Clock out | none, step/dir, quadrature, up/down | — | none |
| DB (8) | | Analog deadband | 0 to 255 | counts | 1 |
| DECL | | Deceleration | 91 to 1.5 X 10 ⁹ | mSec | 500 |
| DIR | | Motor direction override | Clockwise (cw)/counterclockwise (ccw) | — | cw |
| FAULT | | Fault/checksum error | error code | — | none |
| FS (8) | | Analog full scale | 1 to 1023 | counts | 1023 |
| HCDT | | Hold current delay time | HCDT + MSDT <= 65535 | milliseconds | 500 |
| IF (8) | | Analog input filter | 1 to 1000 | counts | 1 |
| | | Source | A1 spd/A2 spd or PWM 15 to 25 kHz | — | A1&A2 |
| IMODE (6) | | Analog input, A1&A2 spds | 0 to +5 VDC, 0 to +10 VDC, 4 to 20 mA, 0 to 20 mA | volts or current | 0 to +5 VDC |
| | | Motor hold current | 0 to 100 | percent | 5 |
| MRC | | Motor run current | 1 to 100 | percent | 25 |
| MSDT | | Motor settling delay time | MSDT + HCDT <= 65535 | milliseconds | 0 |
| 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 |
| STEPW (6) | | Step width | 0 (square wave), 100 nSec to 12.8 μSec | nSec | 550 nSec |
| SSD | | Stop/start debounce | 0 to 255 | milliseconds | 0 |
| VI | | Initial velocity | 0 to <VM | steps/sec | 1000 |
| VM | | Maximum velocity | VI to 5,000,000 | steps/sec | 768,000 |
| TEMP (6) | | Warning temperature | 0 to 85°C | °C | 80°C |
| USER ID | | User ID | customizable | 1-3 characters | IMS |

(1) Only quad stack NEMA 23 motors have +12 to +60 VDC drives, all other NEMA 23 motors have +12 to +75 VDC drives.

(2) Adjusting the microstep resolution can increase the range.

(3) 10 kΩ potentiometer resistance.

(4) 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.

(5) Only with MDrive17 & MDrive23 products.

(6) Only with MDrive34 products.

(7) Separate analog inputs for A1 and A2 speeds with MDrive 34 products.

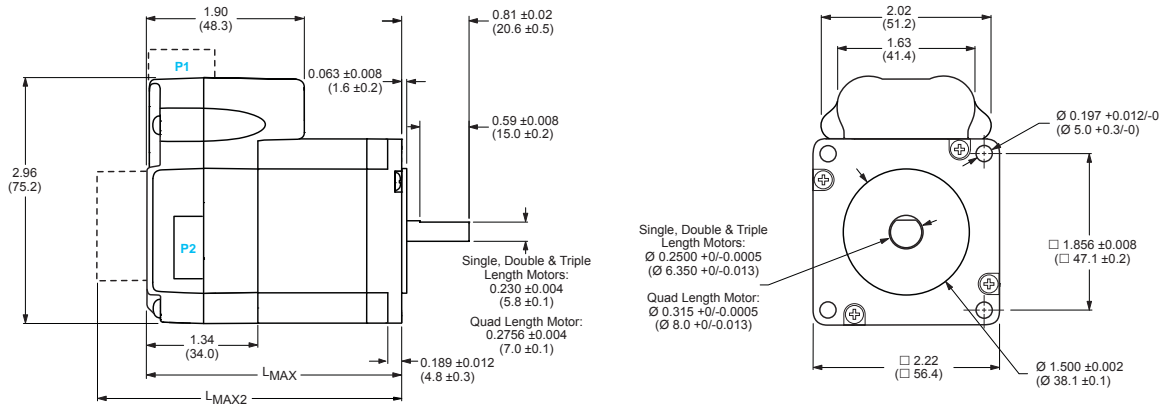


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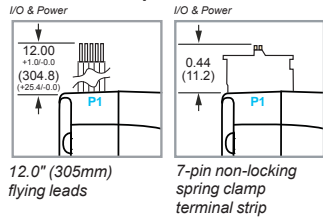
– Plus – mechanical specifications, dimensions in inches (mm)



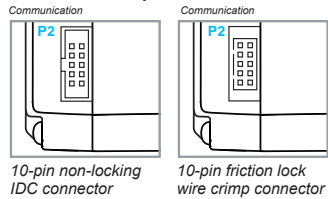
| Motor stack length | Lmax (1) | Lmax2 (2) |
|--------------------|---------------|---------------|
| Single | 2.65 (67.31) | 3.36 (85.34) |
| Double | 3.02 (76.71) | 3.73 (94.74) |
| Triple | 3.88 (98.55) | 4.59 (116.59) |
| Quad | 5.28 (134.15) | 5.99 (152.19) |

(1) Single shaft.
 (2) Control knob or external encoder.

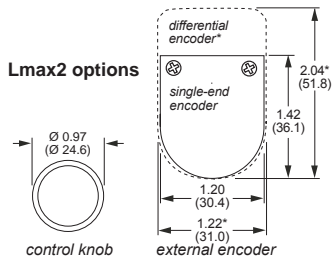
P1 connector options



P2 connector options



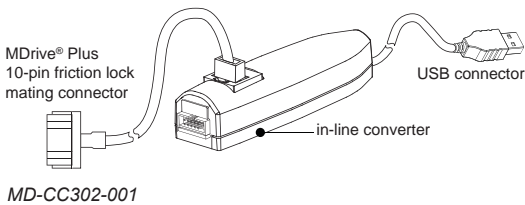
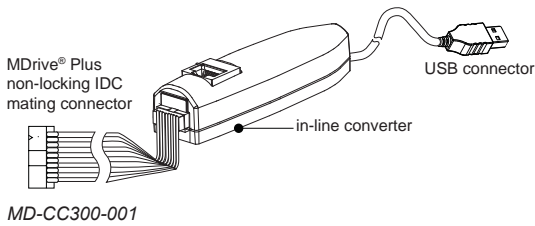
Lmax2 options



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Installation accessories

| Description | Length feet (m) | Part number |
|-------------|-----------------|-------------|
|-------------|-----------------|-------------|

QuickStart Kit

For rapid design verification, all-inclusive QuickStart Kits include connectivity, instructions and CD for MDrive Plus initial functional setup and system testing.

- For all MDrive23 Speed Control products. — add "K" to part number (1)

Communication converter

Electrically isolated, in-line converter pre-wired with mating connector to conveniently set/program communication parameters for a single MDrive Plus 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 kit

Connectors for assembly of cables, cable material not supplied. Sold in lots of 5. Manufacturer's crimp tool recommended for crimp connectors.

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

Encoder cables

Pre-wired mating connector with other cable end open.

- | | | |
|--|-----------|------------|
| ■ For external single-end encoder | 1.0 (0.3) | ED-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

(1) See next page.



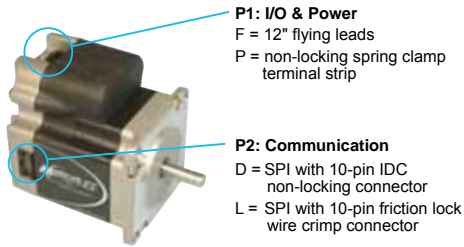
Connectivity details: www.imshome.com/connect.html

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| Part numbers | | | | | | | | | | | | | |
|---|--|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------|
| Example: | K | M | D | O | 1 | F | S | D | 2 | 3 | A | 7 | -E1 |
| QuickStart Kit K = kit option, or leave blank if not wanted | K | M | D | O | 1 | F | S | D | 2 | 3 | A | 7 | -E1 |
| MDrive Plus version MDO = Speed Control | K | M | D | O | 1 | F | S | D | 2 | 3 | A | 7 | -E1 |
| Input 1 = Plus, standard features | K | M | D | O | 1 | F | S | D | 2 | 3 | A | 7 | -E1 |
| P1 connector — I/O & power F = flying leads P = pluggable | K | M | D | O | 1 | F | S | D | 2 | 3 | A | 7 | -E1 |
| Communication S = SPI | K | M | D | O | 1 | F | S | D | 2 | 3 | A | 7 | -E1 |
| P2 connector — communication D = IDC L = wire crimp | K | M | D | O | 1 | F | S | D | 2 | 3 | A | 7 | -E1 |
| Motor size 23 = NEMA 23 (2.3" / 57 mm) | K | M | D | O | 1 | F | S | D | 2 | 3 | A | 7 | -E1 |
| Motor length A = single stack B = double stack C = triple stack D = quad stack | K | M | D | O | 1 | F | S | D | 2 | 3 | A | 7 | -E1 |
| 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 | -E1 |
| Options Leave blank if not wanted Options may not be combined | | | | | | | | | | | | | -E1 |
| -E | = external optical encoder with 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 | | | |
| -N | = rear control knob for manual positioning | | | | | | | | | | | | |

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

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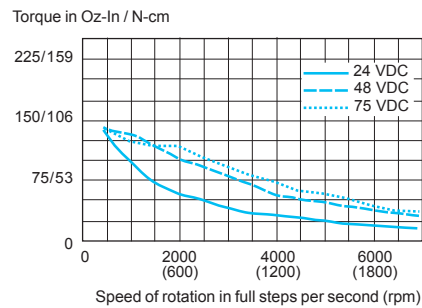
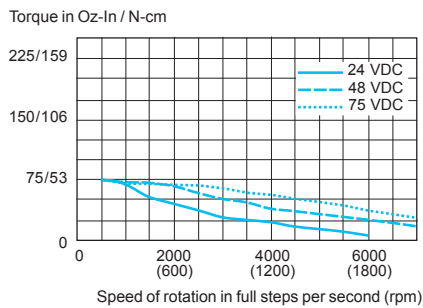
Motor specifications MDrive 23

| | | Holding torque | Detent torque | Rotor inertia | Weight (motor + driver) |
|--------------------|--------|-----------------------------|---------------------------|--|-------------------------|
| Motor stack length | Single | 90.0 oz-in / 64.0 N-cm | 3.9 oz-in / 2.7 N-cm | 0.0025 oz-in-sec ² / 0.18 kg-cm ² | 21.6 oz / 612.3 g |
| | Double | 144.0 oz-in / 102.0 N-cm | 5.6 oz-in / 3.92 N-cm | 0.0037 oz-in-sec ² / 0.26 kg-cm ² | 26.4 oz / 748.4 g |
| | Triple | 239.0 oz-in / 169.0 N-cm | 9.7 oz-in / 6.86 N-cm | 0.0065 oz-in-sec ² / 0.46 kg-cm ² | 39.2 oz / 1111.3 g |
| | Quad | 283.0 oz-in / 200.0 N-cm | 14.2 oz-in / 10.0 N-cm | 0.0108 oz-in-sec ² / 0.76 kg-cm ² | 61.6 oz / 1746.3 g |

Speed torque characteristics MDrive 23

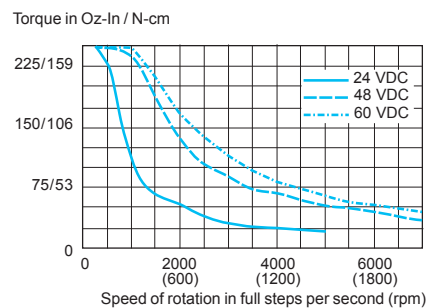
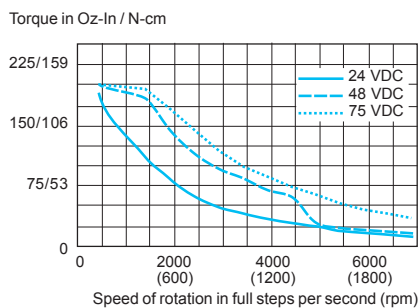
Single stack length

Double stack length



Triple stack length

Quad stack length



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