MDrive® Plus

Stepper motors with integrated electronics

MDrive 17 Plus Step/direction input
**Presentation**

The MDrive® Plus with step/direction input is a 1.8° 2-phase stepper motor with on-board control electronics. Step/direction signals of a master controller, e.g. a motion controller, or A/B signals of an encoder are converted directly into motion.

Settings for MDrive Plus step/direction input 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 with step/direction input is ideal for machine builders who want an optimized motor with on-board electronics. The integrated electronics of the MDrive Plus with step/direction input 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 or 120 and 240 VAC
- 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 (1)
- Automatic current reduction
- Configurable:
  - Motor run / hold current
  - Motor direction via direction input
  - Microstep resolution
  - Clock type: step and direction, quadrature, step up and step down, clockwise and counterclockwise (1)
  - Programmable digital filtering for clock and direction inputs
- Available options:
  - Long life linear actuators (2)
  - Hybrid Motion Technology™ (2)
  - Encoders
  - Control knob for manual positioning
  - Industrial connectors with IP54 rating (3)
- 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

(1) CW/CCW input unavailable for MDrive34 or MDrive34ac products.
(2) See separate documentation.
(3) Industrial connectors are unavailable for MDrive14 or MDrive34 products.
## Specifications

### MDrive® Plus
Step / direction input

#### Plus specifications

<table>
<thead>
<tr>
<th><strong>Input power</strong></th>
<th><strong>Voltage</strong></th>
<th><strong>MDrive 14</strong></th>
<th><strong>MDrive 17</strong></th>
<th><strong>MDrive 23 (1)</strong></th>
<th><strong>MDrive 23 (1)</strong></th>
<th><strong>MDrive 34</strong></th>
<th><strong>MDrive 34 ac</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VDC</strong></td>
<td>12 to 48</td>
<td>12 to 48</td>
<td>12 to 75</td>
<td>12 to 60</td>
<td>12 to 75</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td><strong>VAC</strong></td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>120</td>
<td>240</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Current maximum (2)</strong></th>
<th><strong>1A</strong></th>
<th><strong>2A</strong></th>
<th><strong>2A</strong></th>
<th><strong>3.5A</strong></th>
<th><strong>4A</strong></th>
<th><strong>95 to 132 VAC @ 50/60 Hz</strong></th>
<th><strong>95 to 264 VAC @ 50/60 Hz</strong></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Thermal</strong></th>
<th><strong>Operating temp</strong></th>
<th><strong>Heat sink</strong></th>
<th><strong>—40° to +85°C</strong></th>
<th><strong>—40° to +75°C</strong></th>
<th><strong>—40° to +100°C</strong></th>
<th><strong>—40° to +90°C</strong></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Protection</strong></th>
<th><strong>Type</strong></th>
<th><strong>Universal</strong></th>
<th><strong>Voltage range: +5 to +24 VDC sourcing or sinking step clock, direction and enable</strong></th>
<th><strong>Differential</strong></th>
<th><strong>Voltage range: +5 VDC clockwise and counterclockwise</strong></th>
<th><strong>not applicable</strong></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Isolated input</strong></th>
<th><strong>Digital filter range</strong></th>
<th><strong>50 nS to 12.9 μS (10 MHz to 38.8 kHz)</strong></th>
<th><strong>Clock types</strong></th>
<th><strong>Step / direction, quadrature, step up / step down, clockwise / counterclockwise</strong></th>
<th><strong>Step / direction, quadrature, step up / step down</strong></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Motion</strong></th>
<th><strong>Step frequency</strong></th>
<th><strong>2 MHz default / 5 MHz maximum</strong></th>
<th><strong>Resolution</strong></th>
<th><strong>Number of settings</strong></th>
<th><strong>20</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Setup parameters (3)</strong></th>
<th><strong>SPI communication</strong></th>
<th><strong>Function</strong></th>
<th><strong>Range</strong></th>
<th><strong>Units</strong></th>
<th><strong>Default</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>MHC</td>
<td>Motor hold current</td>
<td>0 to 100</td>
<td>percent</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>MRC</td>
<td>Motor run current</td>
<td>1 to 100</td>
<td>percent</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>MSEL</td>
<td>Microstep resolution</td>
<td>1, 2, 4, 5, 6, 8, 10, 16, 25, 32, 50, 64, 100, 108, 125, 127, 128, 180, 200, 250, 256</td>
<td>ussteps per full step</td>
<td>256</td>
<td></td>
</tr>
<tr>
<td>DIR</td>
<td>Motor direction override</td>
<td>0 / 1</td>
<td>—</td>
<td>CW</td>
<td></td>
</tr>
<tr>
<td>HCDT</td>
<td>Hold current delay time</td>
<td>0 or 2 – 65535</td>
<td>mSec</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>CLK TYPE</td>
<td>Clock type</td>
<td>Step / Dir, Quadrature, Up / Down, CW / CCW</td>
<td>—</td>
<td>Step / Dir</td>
<td></td>
</tr>
<tr>
<td>CLK IOF</td>
<td>Clock and direction filter</td>
<td>50 nS to 12.9 μS (10 MHz to 38.8 kHz)</td>
<td>nS (MHz)</td>
<td>200 nS (2 MHz)</td>
<td></td>
</tr>
<tr>
<td>USER ID</td>
<td>User ID</td>
<td>Customizable</td>
<td>1–3 characters</td>
<td>IMS</td>
<td></td>
</tr>
<tr>
<td>EN ACT</td>
<td>Enable active</td>
<td>High / Low</td>
<td>—</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>WARN TEMP (4)</td>
<td>Over temperature warning</td>
<td>0 to 125°C</td>
<td>°C</td>
<td>80°C</td>
<td></td>
</tr>
</tbody>
</table>

(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) Actual power supply current will depend on voltage and load.
(3) 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.
(4) Only with MDrive34 and MDrive34ac products.
-- Plus – mechanical specifications, dimensions in inches (mm)

Motor stack length | Lmax (1) | Lmax2 (2)
--- | --- | ---
Single | 2.20 (55.9) | 2.79 (70.9)
Double | 2.43 (61.7) | 3.02 (76.7)
Triple | 2.77 (70.4) | 3.37 (85.6)

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

P1 connector options
- 12.0" (305mm) flying leads
- 7-pin non-locking spring clamp terminal strip
- 12-pin locking wire crimp connector**

P2 connector options
- 10-pin non-locking IDC connector
- no connector**

Lmax2 options
- Ø 0.32 (8.1)
- 1.20 (30.5)
- 1.22 (31.0)

**12-pin locking wire crimp connector at P1 eliminates the P2 connector

-- Plus with industrial connector – mechanical specifications, dimensions in inches (mm)

Motor stack length | Lmax | Lmax2
--- | --- | ---
Single | 2.48 (63.00) | 3.15 (80.00)
Double | 2.71 (68.83) | 3.38 (85.85)
Triple | 3.04 (77.22) | 3.71 (94.23)
# MDrive® 17 Plus

## Step / direction input

### Connectivity

#### 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 MDrive17 step / direction input 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 12-pin locking wire crimp connector 12.0 (3.6) MD-CC303-001
- Mates to 19-pin male M23 industrial connector 12.0 (3.6) MD-CC301-001

#### Prototype development cable

Speed test/development with pre-wired mating connector with other cable end open.

- Mates to 12-pin locking wire crimp connector for I/O, communication and power 10.0 (3.0) PD12-1434-FL3
- Mates to 19-pin male M23 industrial connector with straight termination for I/O, communication and power 13.0 (4.0) MD-CS100-000
- Mates to 19-pin male M23 industrial connector with right angle termination for I/O, communication and power 13.0 (4.0) MD-CS101-000

#### Encoder cables (2)

Pre-wired mating connector with other cable end open.

- For external single-end optical encoder with non-locking connector 1.0 (0.3) ES-CABLE-2
- For external differential optical encoder with locking connector 6.0 (1.8) ED-CABLE-6

#### 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
- 12-pin locking wire crimp connector for I/O, communication and power — CK-03

#### 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 MDrive17 step / direction input products — DPM75

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(1) See next page.
### Part numbers

#### MDrive® 17 Plus

**Step / direction input**

**Example:**

- **QuickStart Kit:**
  - **Part Number:** K M D M 1 F S D 1 7 A 4 – E1
  - **Explanation:** K = kit option, or leave blank if not wanted

- **MDrive Plus version**
  - **Part Number:** K M D M 1 F S D 1 7 A 4 – E1
  - **Explanation:** MDM = Step / direction input

- **Input**
  - **Part Number:** K M D M 1 F S D 1 7 A 4 – E1
  - **Explanation:**
    - 1 = Universal input
    - 2 = Universal input with industrial connector, IP54-rated
    - 5 = Differential CW/CCW input (1)

- **P1 connector**
  - **Part Number:** K M D M 1 F S D 1 7 A 4 – E1
  - **Explanation:**
    - F = flying leads
    - P = pluggable
    - C = wire crimp
    - M = industrial connector (2)

- **Communication**
  - **Part Number:** K M D M 1 F S D 1 7 A 4 – E1
  - **Explanation:**
    - S = SPI

- **P2 connector**
  - **Part Number:** K M D M 1 F S D 1 7 A 4 – E1
  - **Explanation:**
    - D = IDC with 10-pin IDC non-locking connector
    - Z = None. Used with 12-pin locking wire crimp in position P1, which includes communication.

- **Motor size**
  - **Part Number:** K M D M 1 F S D 1 7 A 4 – E1
  - **Explanation:**
    - 17 = NEMA 17 (1.7” / 42 mm)

- **Motor length**
  - **Part Number:** K M D M 1 F S D 1 7 A 4 – E1
  - **Explanation:**
    - A = single stack
    - B = double stack
    - C = triple stack

- **Drive voltage**
  - **Part Number:** K M D M 1 F S D 1 7 A 4 – E1
  - **Explanation:**
    - 4 = +12 to +48 VDC

- **Options**
  - **Part Number:** K M D M 1 F S D 1 7 A 4 – E1
  - **Explanation:**
    - Leave blank if not wanted
    - Options may not be combined
    - – E = external optical encoder with index mark (1)
    - – N = rear control knob for manual positioning (1)

(1) Not available with industrial connector products.
(2) Only available with industrial connector products.
(3) Wire crimp connector at P1 includes communication, so the P2 designator is Z=none.
(4) Industrial connector at P1 includes communication, so the P2 designator is Z=none.
Motor performance

MDrive® 17 Plus
Step / direction input

Motor specifications MDrive 17

<table>
<thead>
<tr>
<th>Motor stack length</th>
<th>Holding torque</th>
<th>Detent torque</th>
<th>Rotor inertia</th>
<th>Weight (motor + driver)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>32.0 oz-in / 22.6 N-cm</td>
<td>1.66 oz-in / 1.17 N-cm</td>
<td>0.00053 oz-in-sec² / 0.038 kg-cm²</td>
<td>10.4 oz / 294.8 g</td>
</tr>
<tr>
<td>Double</td>
<td>60.0 oz-in / 42.4 N-cm</td>
<td>2.06 oz-in / 1.47 N-cm</td>
<td>0.00080 oz-in-sec² / 0.057 kg-cm²</td>
<td>12.0 oz / 340.2 g</td>
</tr>
<tr>
<td>Triple</td>
<td>74.9 oz-in / 52.9 N-cm</td>
<td>3.47 oz-in / 2.45 N-cm</td>
<td>0.00116 oz-in-sec² / 0.082 kg-cm²</td>
<td>15.2 oz / 430.9 g</td>
</tr>
</tbody>
</table>

Speed torque characteristics MDrive 17

<table>
<thead>
<tr>
<th>Single stack length</th>
<th>Double stack length</th>
<th>Triple stack length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque in Oz-In / N-cm</td>
<td>Torque in Oz-In / N-cm</td>
<td>Torque in Oz-In / N-cm</td>
</tr>
<tr>
<td>Speed of rotation in full steps per second (rpm)</td>
<td>Speed of rotation in full steps per second (rpm)</td>
<td>Speed of rotation in full steps per second (rpm)</td>
</tr>
</tbody>
</table>