ION® Digital Drives are compact, fully enclosed modules that provide high performance motion control, network connectivity and power amplification. Two power output levels are available: the ION 500 is rated at 500 Watts and the ION 3000 is rated at 3000 Watts. Various ION models are available to drive DC brush, brushless DC, and step motors.

**High Power Density**
Using advanced MOSFETs and surface mount technology, ION provides very high power density in a rugged, flexible form factor. It performs profile generation, servo compensation, stall detection, field oriented control, digital torque control and many other motion control functions. ION drives provide CANBus or serial communications and are ideal for medical, scientific, semiconductor, automation, industrial and robotic applications. User selectable profiling modes include S-curve, trapezoidal, velocity contouring and electronic gearing.

**Advanced Motion Control Feature Set**
The ION Digital Drive accepts commands over the network such as position, velocity, acceleration and jerk from the host and generates a corresponding trajectory on-the-fly. Servo loop compensation utilizes a full 32-bit position error, PID with velocity and acceleration feedforward, integration limit and dual bi-quad filters for sophisticated control of complex loads. Additional features include limit switches, breakpoints, secondary encoder input for master-slave and electronic gearing applications, as well as general purpose inputs and outputs.

**Built on the Magellan™ Motion Processor**
ION’s Magellan Motion Processor provides a powerful instruction set to initialize and control the motion application, monitor performance, and synchronize overall drive behavior. Working with the ION Digital Drive, PMD’s powerful Pro-Motion® GUI makes it easy to graph and analyze system performance, while C-Motion® and VB-Motion® allow you to develop your own application using C/C++ or Visual BASIC.

**Features**
- Enhanced Magellan™ instruction set
- Complete single axis motion module
- All digital drive
- DC brush, brushless DC and step motor versions
- CANbus or serial communications
- S-curve, trapezoidal, velocity contouring, electronic gearing profiles
- Pulse & direction input (ION 3000 W model only)
- Compact, powerful package
- 500 W or 3000 W power rating
- Up to 20 A continuous, up to 30 A peak current
- 12-56 volt or 20-195 volt single power source
- High-efficiency MOSFETs
- 40 kHz PWM frequency
- 102 µsec servo loop rate
- Auxiliary encoder input supports gearing & dual loop applications
- Position and current loops
- Field oriented control
- Sinusoidal commutation
- Stall detection & auto current reduction
- Includes Pro-Motion, C-Motion and VB-Motion software
- Separately programmable acceleration and deceleration value changes on-the-fly
- Advanced PID filter with velocity and acceleration feedforward
- Programmable dual bi-quad filters
### Specifications

<table>
<thead>
<tr>
<th>Specifications</th>
<th>ION 500</th>
<th>ION 3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supported motor types</td>
<td>DC brush, brushless DC, step motor</td>
<td>DC brush, brushless DC, step motor</td>
</tr>
<tr>
<td>Voltage input</td>
<td>12 – 56 VDC</td>
<td>20 – 195 VDC</td>
</tr>
<tr>
<td>DC Brush Continuous current output</td>
<td>9.8 ADC</td>
<td>20 ADC</td>
</tr>
<tr>
<td>DC Brush Peak current output</td>
<td>21 ADC (2 sec)</td>
<td>30 A (per phase)</td>
</tr>
<tr>
<td>DC Brush Continuous power output</td>
<td>500 W</td>
<td>3000 W</td>
</tr>
<tr>
<td>Brushless DC Continuous current output</td>
<td>8 A rms</td>
<td>15 A rms</td>
</tr>
<tr>
<td>Brushless DC Peak current output</td>
<td>15 A rms (2 sec)</td>
<td>30 A (per phase)</td>
</tr>
<tr>
<td>Brushless DC Continuous power output</td>
<td>500 W</td>
<td>2500 W</td>
</tr>
<tr>
<td>Step Continuous current output</td>
<td>5 A rms</td>
<td>10 Arms</td>
</tr>
<tr>
<td>Step Continuous power output</td>
<td>350 W</td>
<td>1500 W</td>
</tr>
<tr>
<td>Supported communications options</td>
<td>RS232/485 and CANbus (isolated)</td>
<td>RS232/485 and CANbus (isolated)</td>
</tr>
<tr>
<td>Brushless DC commutation modes</td>
<td>Sinusoidal, 6-step, field oriented control</td>
<td>Sinusoidal, 6-step, field oriented control</td>
</tr>
<tr>
<td>Microstepping resolution</td>
<td>256 µsteps/step</td>
<td></td>
</tr>
<tr>
<td>PWM frequency</td>
<td>20 kHz or 40 kHz (user selectable)</td>
<td></td>
</tr>
<tr>
<td>Maximum encoder rate</td>
<td>10 M counts/sec</td>
<td></td>
</tr>
<tr>
<td>Loop rates</td>
<td>Commutation &amp; current loop: 51.2 µsec</td>
<td>102.4 µsec to 1.6 sec</td>
</tr>
<tr>
<td>Power connectors:</td>
<td>Motor: 5-pin Molex MiniFit Jr.</td>
<td>3-pin Phoenix PC4/3-G-7.62</td>
</tr>
<tr>
<td>Comm. connector:</td>
<td>RS232/485 version: DB9</td>
<td></td>
</tr>
<tr>
<td>Encoder &amp; I/O power</td>
<td>5V @ 300 mA Short circuit protected</td>
<td></td>
</tr>
<tr>
<td>Safety:</td>
<td>Short circuit protection: line-to-line, line-to-power supply and line-to-case</td>
<td></td>
</tr>
<tr>
<td>Environmental:</td>
<td>Operating temperature: 0°C to 50°C</td>
<td>-20°C to 85°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>0 to 95% RH (non-condensing)</td>
<td></td>
</tr>
<tr>
<td>Altitude</td>
<td>Up to 2000 meters without derating</td>
<td></td>
</tr>
<tr>
<td>Compliance:</td>
<td>CE marked: EN60204-1, EN55011, EN61000-6-1, EN61000-6-3</td>
<td></td>
</tr>
</tbody>
</table>

### Mechanical

**ION 500**
- Dimensions: 4.3 (109.2 mm) x 3.03 (76.9 mm)
- Height: 1.48 (37.5 mm)
- Weight: 0.6 lb (0.28 kg)
- Enclosure protection: IP20
- Mechanical options: DIN Rail: mounting adapter

**ION 3000**
- Dimensions: 5.75 (146 mm) x 3.88 (98.5 mm)
- Height: 1.63 (41.4 mm)
- Weight: 1 lb (0.5 kg)
- Enclosure protection: IP20
- Mechanical options: DIN Rail: Not Available

### Profile modes

<table>
<thead>
<tr>
<th>S-curve point-to-point:</th>
<th>Position, velocity, acceleration, deceleration, jerk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trapezoidal point-to-point:</td>
<td>Position, velocity, acceleration, deceleration</td>
</tr>
<tr>
<td>Velocity-contouring:</td>
<td>Velocity, acceleration, deceleration</td>
</tr>
<tr>
<td>Stepper emulation:</td>
<td>Step &amp; direction (ION 3000 model only)</td>
</tr>
</tbody>
</table>

### Filter parameters

Scalable PD with Vel + Acc feedforward, integration limit, offset bias, dual biquad filter, and settable derivative sampling time

### Position error tracking

Motion error window allows axis to be stopped upon exceeding programmable window. Tracking window allows flag to be set if axis exceeds a programmable position window.

### Digital current loop

Scalable PI with integration limit, torque control, I2t current limiting
C-Motion® is a complete motion programming language that includes a source library containing all the code required for communicating with PMD motion processors, cards and digital drives. C-Motion features include:

- Ability to communicate with multiple PMD motion processors
- Library to develop C/C++ applications
- Supports 16/16, 8/16 and 8/8 parallel communication modes
- Supports serial communication
- Supports Windows ISA and PCI driver communication modes

Example C-Motion code for executing a profile and tracing some processor variables:

```
// set the trace buffer wrap mode to a one time trace
SetTraceMode(hAxis1, PMDTraceOneTime);

// set the processor variables that we want to capture
SetTraceVariable(hAxis1, PMDTraceVariable1, PMDAxis1, PMDTraceActualPosition);
SetTraceVariable(hAxis1, PMDTraceVariable2, PMDAxis1, PMDTraceActualVelocity);
SetTraceVariable(hAxis1, PMDTraceVariable3, PMDAxis1, PMDTraceCommandedVelocity);

// set the trace to begin when we issue the next update command
SetTraceStart(hAxis1, PMDTraceConditionNextUpdate);

// set the trace to stop when the MotionComplete event occurs
SetTraceStop(hAxis1, PMDTraceConditionEventStatus, PMDEventMotionCompleteBit, PMDTraceStateHigh);

SetProfileMode(hAxis1, PMDTrapezoidalProfile);

// set the profile parameters
SetPosition(hAxis1, 200000);
SetVelocity(hAxis1, 0x200000);
SetAcceleration(hAxis1, 0x1000);
SetDeceleration(hAxis1, 0x1000);
```

Pro-Motion® GUI

Pro-Motion is a sophisticated, easy-to-use Windows-based exerciser program for use with the ION Digital Drive and other PMD motion control ICs and cards. Features:

- Motion oscilloscope graphically displays processor parameters in real-time
- Autotuning
- Ability to save and load settings
- Distance and time units conversion
- Motor-specific parameter setup

Features:

- Axis shuttle performs continuous back and forth motion between two positions
- Communications monitor echoes all commands sent by Pro-Motion to the drive

ION 500 or ION 3000 — Fully enclosed motion control module. Available in DC brush, brushless DC and step motor versions.

Pro-Motion CD — Software and User’s Guide.

ION Digital Drive Documentation

Communications Port Cable — Serial (RS232 and RS485) or CAN (RS485) and CAN terminator.

Also includes (not pictured):

- Stub Cable Set — DC bus power cable (ION 500 model only), 5-wire motor cable (ION 500 model only), feedback cable, auxiliary encoder cable and I/O cable.
- Development Software CD — C-Motion and VB-Motion code development software, and complete Magellan/ION documentation.
- Heatsink — Recommended when the module is not panel mounted or is operating in high ambient environments. It is especially effective when forced air cooling is available (ION 500 model only).
- DIN Rail Adapter — Attaches to the module via self mounting clip (for ION 500 model only).
### PMD PRODUCT OVERVIEW

<table>
<thead>
<tr>
<th>MOTOR CONTROL IC</th>
<th>MAGELLAN™</th>
<th>PRODIGY MOTION CARDS</th>
<th>ION+ DIGITAL DRIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No. Axes</strong></td>
<td>1</td>
<td>1, 2, 3, 4</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td><strong>Format</strong></td>
<td>• 64-pin TQFP</td>
<td>• 144-pin TQFP</td>
<td>• ISA</td>
</tr>
<tr>
<td><strong>Voltage</strong></td>
<td>3.3 V</td>
<td>3.3 V</td>
<td>5 V</td>
</tr>
<tr>
<td><strong>Function</strong></td>
<td>• Velocity control</td>
<td>• Position control, Profile generation, Commutation, Network communications, Multi-motor support</td>
<td>• Position control, Profile generation, Commutation, Network communications, Signal conditioning, Analog output, Trace buffer</td>
</tr>
<tr>
<td><strong>Motor Types</strong></td>
<td>• Brushless DC</td>
<td>• DC brush, Brushless DC, Pulse &amp; direction, Microstep</td>
<td>• DC brush, Brushless DC, Pulse &amp; direction, Microstep</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td>• Standalone, RS232/485</td>
<td>• Parallel, RS232/485, CANbus</td>
<td>• Through bus</td>
</tr>
<tr>
<td><strong>Loop Rate</strong></td>
<td>20 kHz</td>
<td>50 - 75 μsec/axis</td>
<td>50 - 150 μsec/axis</td>
</tr>
</tbody>
</table>

### HOW TO ORDER

```
D 1 1 0 - / - V
D= Digital drive only
K= Developer’s kit
Axes
Communications
S= serial (RS232 & RS485)
C= CAN
ION 500 = 056 / 15
ION 3000 = 195 / 30
Heatsink/ mounting options
N= no heatsink/DIN rail
H= heatsink only
R= DIN rail only
B= heatsink & DIN rail
Version
Contact PMD

R= RoHS
G= Green*
N= Not compliant (Contact PMD for availability)

*Green= RoHS & no Sub/Br
```

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**About Performance Motion Devices**
Performance Motion Devices (PMD) is a worldwide leader in motion control ICs, boards and modules. Dedicated to providing cost-effective, high performance motion systems to OEM customers, PMD utilizes extensive in-house expertise to minimize time-to-market and maximize customer satisfaction.

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