Prodigy®/CME Machine Controller Boards provide high performance motion control for medical, scientific, automation, industrial, and robotic applications. Available in 1, 2, 3, and 4-axis configurations, these boards support DC brush, brushless DC, and step motors and allow user-written C-language code to be downloaded and run directly on the board. The Prodigy/CME Machine Controller has on-board Atlas® amplifiers that eliminate the need for external amplifiers. To build a fully functioning system only a power supply, motors, and cabling are needed.

**Built on the Magellan Motion Control IC**
Based on PMD’s industry-leading Magellan® Motion Processor, the Prodigy/CME Machine Controller boards provide user-selectable profile modes including S-curve, trapezoidal, velocity contouring, and electronic gearing with on-the-fly parameter change. Servo loop compensation utilizes a full 32-bit position error, PID with velocity and acceleration feedforward, integration limit and dual biquad filters for sophisticated control of complex loads.

**On-Board Amplifiers**
Up to four on-board Atlas amplifiers provide high performance amplification for even the most demanding applications. These compact and powerful units provide field oriented control, safety monitoring, and industry-leading drive efficiencies.

**Easy to Use and Program**
The Pro-Motion® GUI makes it easy to set-up and analyze system parameters and motion performance. PMD’s C-Motion and VB-Motion® libraries simplify the program development process and allow the use of industry standard C/C++ or Visual Basic programming languages.

**FEATURES**
- Complete all-in-one machine controller
- Available in 1, 2, 3, and 4-axis configurations
- Uses PMD’s advanced Magellan® Motion Processor
- Supports DC brush, brushless DC, and step motors
- On-board high performance Atlas® amplifiers
- S-curve, trapezoidal, electronic gearing, and velocity-contouring
- Ethernet, CANbus and serial communications
- Board-level execution of user application code at 96 MIPS
- High speed loop rate: 50 μsec/axis
- Up to 256 microsteps per full step resolution
- Up to 1KW peak output power per axis
- Extensive fault detection including over and undervoltage, motor short, and overtemp
- Single voltage supply drives motors and board logic
- Incremental quadrature and Absolute SSI encoder support
- 6-step commutation and field oriented control modes
- Profile and servo changes on-the-fly
- Advanced PID filter with feedforward and dual biquad filters
- High-speed hardware performance trace (up to 468 KB)
- 8 channels of high precision 16-bit analog input and output
- 12+ channels of general purpose digital I/O
- Two directional limit switches, high speed index, and home inputs per axis
- C-Motion Engine development tools
- Support for external amplifiers via +/- 10V analog output
- Includes Pro-Motion®, C-Motion® and VB-Motion® development software

**CONFIGURATION**

```
<table>
<thead>
<tr>
<th>System Host*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encoder</td>
</tr>
<tr>
<td>Motor</td>
</tr>
<tr>
<td>Encoder</td>
</tr>
<tr>
<td>Motor</td>
</tr>
<tr>
<td>Encoder</td>
</tr>
<tr>
<td>Motor</td>
</tr>
<tr>
<td>Encoder</td>
</tr>
<tr>
<td>Motor</td>
</tr>
</tbody>
</table>

Axis 1
Axis 2
Axis 3
Axis 4
```

*System host optional
**Technical Overview**

- **MAGELLAN® Motion Control IC**

- **C-Motion® Engine**

- **High-Speed Internal Bus**

- **Reset logic**

- **Dual-port Trace & Profile RAM Storage**

- **I/O decode**

- **Digital signal conditioning**

- **Quad A, B, Index SSI Data, Clock**

- **Brushless DC Step Motor**

- **Analog in**

- **Analog Out**

- **A/D, D/A analog conditioning**

- **Amplifier enable**

- **Digital I/O**

- **CANbus tranceiver**

- **Serial tranceiver**

- **Ethernet tranceiver**

- **CANbus**

- **Serial**

- **Ethernet**

### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Machine Controller</th>
<th>ATLAS® Digital Amplifiers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of axes supported</td>
<td>ATLAS® Digital amplifiers are compact single-axis amplifiers that provide high performance torque control of DC brush, brushless DC, and step motors. They are packaged in a Compact or Ultra Compact solderable module and utilize standard through-hole pins for all connections.</td>
</tr>
<tr>
<td>Supported motor types</td>
<td>DC Brush, Brushless DC, Step motor</td>
</tr>
<tr>
<td>Servo loop rates</td>
<td>51.2 µsec to 1.6 sec. Minimum depends upon number of enabled axes and use of trace</td>
</tr>
<tr>
<td>Encoder formats supported</td>
<td>Quadrature, Absolute SSI</td>
</tr>
<tr>
<td>Quadrature decode rate</td>
<td>40 Mcounts/sec</td>
</tr>
<tr>
<td>Capability for onboard amplifier</td>
<td>Yes, Atlas Digital Amplifier</td>
</tr>
<tr>
<td>Motor output signals</td>
<td>Analog ± 10V</td>
</tr>
<tr>
<td>General purpose digital I/O</td>
<td>8 bi-directional, 4 input, 4 output</td>
</tr>
<tr>
<td>General purpose analog input</td>
<td>8 16-bit channels (± 10V)</td>
</tr>
<tr>
<td>General purpose analog outputs</td>
<td>8 16-bit channels (± 10V)</td>
</tr>
<tr>
<td>Limit switches</td>
<td>2 per axis: one for each direction of travel</td>
</tr>
<tr>
<td>User program memory</td>
<td>256 KB Flash / 8 KB RAM</td>
</tr>
<tr>
<td>User program stack memory</td>
<td>8 KB RAM</td>
</tr>
<tr>
<td>Dual ported RAM</td>
<td>128 KB or 468 KB (enhanced memory option)</td>
</tr>
<tr>
<td>Communication modes</td>
<td>Serial, CANbus, Ethernet</td>
</tr>
<tr>
<td>Dimensions</td>
<td>7.80” x 4.88” x .78” (19.8cm x 12.4cm x 1.98cm)</td>
</tr>
<tr>
<td>On-board amplifier voltage range</td>
<td>12 - 56V</td>
</tr>
<tr>
<td>On-board amplifier continuous current output</td>
<td>DC Brush Motor: 14 ADC Brushless DC Motor: 10 Arms Step motor: 9Arms</td>
</tr>
<tr>
<td>Voltage Input</td>
<td>12-56 VDC</td>
</tr>
<tr>
<td>Microstepping resolution</td>
<td>256</td>
</tr>
<tr>
<td>PWM frequency</td>
<td>20, 40, 80 kHz</td>
</tr>
<tr>
<td>Current Loop rate</td>
<td>20 kHz</td>
</tr>
<tr>
<td>Power rating options</td>
<td>75W, 250W, 500W</td>
</tr>
<tr>
<td>Ultra Compact size</td>
<td>1.05” x 1.05” x .53” (27mm x 27mm x 13mm)</td>
</tr>
<tr>
<td>Compact size</td>
<td>1.52” x 1.52” x .60” (39mm x 39mm x 15mm)</td>
</tr>
</tbody>
</table>

### Profile modes

- **S-curve point-to-point:** Position, velocity, acceleration, deceleration, jerk
- **Trapezoidal point-to-point:** Position, velocity, acceleration, deceleration
- **Velocity-contouring:** Velocity, acceleration, deceleration

**Electronic gearing:**
- Encoder trajectory position of one axis used to drive a second axis. Master and slave axes and gear ratio parameters

**Filter modes**
- Scalable PID with Velocity, Acceleration feedforward, Integration limit, Offset bias, Dual biquad filter, Settable derivative sampling time, Output motor command limiting.
Development Tools

1. EASY START-UP
Developers Kit

INCLUDES
- Prodigy Machine Controller Developer Kit
- Pro-Motion software
- Software Development Kit (SDK) with C-Motion
- Complete manual set
- Complete cable and prototyping connector set

2. TUNE & OPTIMIZE
Pro-Motion® GUI

Pro-Motion is a sophisticated, easy-to-use Windows-based exerciser program for use with PMD motion control ICs, modules, and boards.

FEATURES
- Motion oscilloscope graphically displays processor parameters in real-time
- Autotuning
- Ability to save and load settings
- Axis wizard
- Distance and time units conversion
- Motor-specific parameter setup
- Axis shuttle performs programmable motion between two positions
- Communications monitor echoes all commands sent by Pro-Motion to the board
- Advanced Bode analysis for frequency machine response

3. BUILD THE APP
C-Motion®

C-Motion is a complete, easy-to-use, motion programming language that includes a source library containing all the code required for communicating with PMD motion ICs, board, and modules.

C-MOTION FEATURES INCLUDE:
- Extensive library of commands for virtually all motion design needs
- Develop embeddable C/C++ applications
- Complete, functional examples
- Supports PC/104, serial, CAN, Ethernet, and SPI communications

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

```
// 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);
SetTraceVariable(hAxis1, PMDTraceVariable2, PMDAxis1);
SetTraceVariable(hAxis1, PMDTraceVariable3, PMDAxis1);

// 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);

// start the motion
Update(hAxis1);
```
### PMD PRODUCT FAMILY OVERVIEW

#### FOR ORDERING PRODIGY MACHINE CONTROLLERS

<table>
<thead>
<tr>
<th>JUNO® VELOCITY &amp; TORQUE CONTROL ICS</th>
<th>MAGELLAN® MOTION CONTROL ICS</th>
<th>ATLAS® DIGITAL AMPLIFIERS</th>
<th>PRODIGY® MOTION BOARDS</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</td>
<td>1,2,3,4</td>
</tr>
</tbody>
</table>
| **Motor Types** | • Brushless DC  
• DC Brush  
• Step Motor | • Brushless DC  
• DC Brush  
• Step Motor | • Brushless DC  
• DC Brush  
• Step Motor | • Brushless DC  
• DC Brush  
• Step Motor | • Brushless DC  
• DC Brush  
• Step Motor |
| **Format** | • 64-pin TQFP  
• 56-pin VQFN | • 144-pin TQFP  
• 100-pin TQF  
• 19-pin solderable module | • 20-pin solderable module  
• PC/104  
• Standalone  
• Machine Controller | • Full enclosed module |
| **Voltage** | 3.3 V | 3.3 V | 12-56 V | 5 V: PC/104 and Standalone 12-56 V: Machine Controller | 12-56 V / 20-195 V |
| **Communication** | • Standalone  
• RS232/485  
• CANbus  
• SPI | • Parallel  
• RS232/485  
• CANbus  
• SPI | • SPI  
• Ethernet  
• RS232/485  
• CANbus  
• PC/104 bus | • Ethernet  
• RS232/485  
• CANbus |
| **Features** | • Velocity control  
• Torque/current control  
• Field oriented control  
• Multi-motor support | • Position control  
• Torque/current control  
• Field oriented control  
• Profile generation  
• Multi-motor support  
• Network communications | • Torque/current control  
• Field oriented control  
• Pulse and direction input  
• Multi-motor support  
• MOSFET amplifier | • Position control  
• Torque/current control  
• Field oriented control  
• Profile generation  
• Pulse and direction input  
• MOSFET amplifier  
• Downloadable user code | • Position control  
• Torque/current control  
• Field oriented control  
• Profile generation  
• Pulse and direction input  
• MOSFET amplifier  
• Downloadable user code |
| **Motion Language** | C-Motion® | C-Motion® | C-Motion® | C-Motion® | C-Motion® |

C-Motion® is the common motion language for all Performance Motion Devices products.

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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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