The**ION**Digital**Drive**

> FEATURES

- Magellan® instruction set
- DC brush, BLDC & step motor versions
- Ethernet, CANbus or serial communications
- S-curve, trapezoidal, velocity contouring, electronic gearing profiles
- Pulse & direction input
- 500 W or 3000 W power rating
- Up to 20 A continuous, up to 30 A peak current
- 12-56V or 20-195V 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
- Programmable acceleration and deceleration
- Advanced PID filter with velocity and acceleration feedforward
- Programmable dual biquad filters
- +/- 10V high resolution 16-bit ADC input
- Up to 8 general purpose user inputs and 6 general purpose outputs
- Execution of C-Motion code at up to 96 MIPS
- 256 KB of programmable user code space
- C-Motion Engine development tools
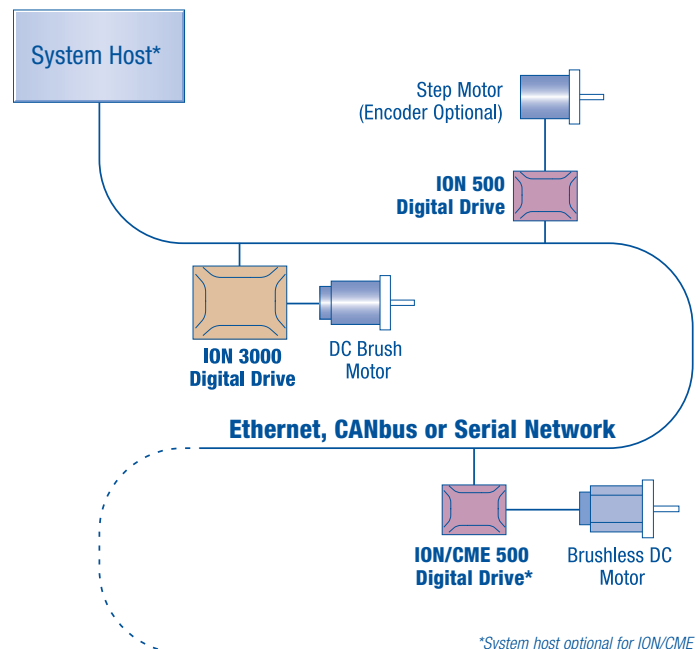
ION® Digital Drives are

compact, fully enclosed modules that provide high performance motion control, network connectivity and power amplification. Two overall power output levels are available, the ION 500 is rated at 500 Watts and the ION 3000 is rated at 3,000 Watts. All IONs can drive DC brush, brushless DC and step motors, and are ideal for medical, scientific, semiconductor, robotic, industrial and other automation applications.

Powerful Features

IONs provide very high power density in a rugged, flexible form factor. They perform profile generation, servo compensation, stall detection, field oriented control, digital torque control and many other motion control functions. Additional features include Ethernet, CANbus or serial communications, extensive general purpose digital and analog I/Os, and full programmability.
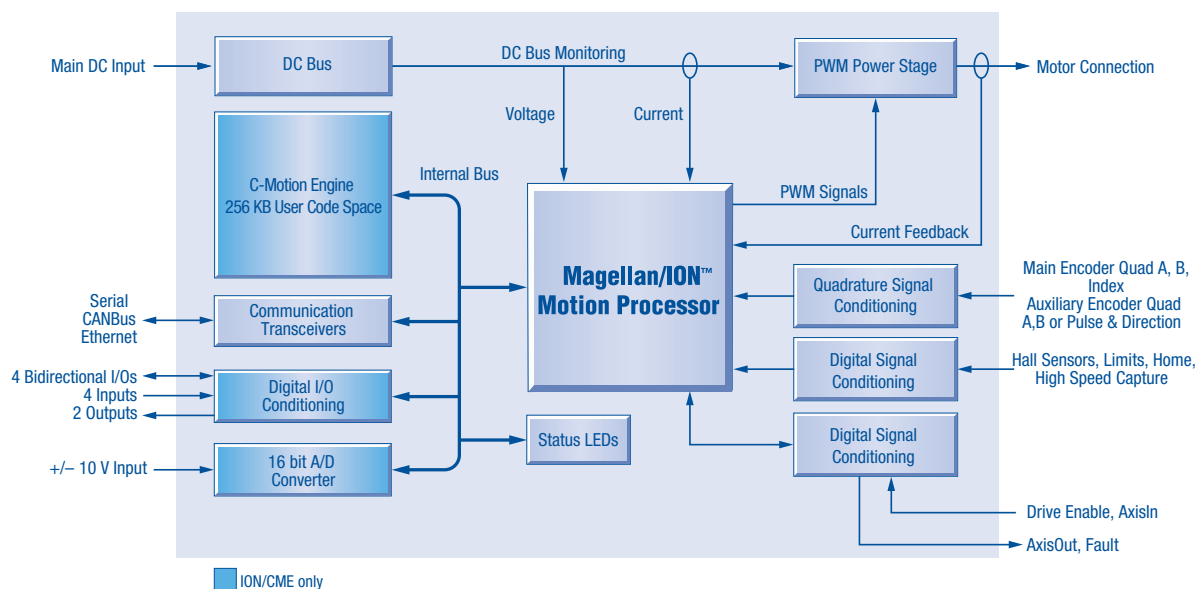
Easy To Use

Working with the ION Digital Drive, PMD's powerful Pro-Motion® GUI makes it easy to graph and analyze axis performance, while C-Motion® and VB-Motion® allow users to develop their own applications using C/C++ or Visual BASIC. Programmable versions (ION/CME) include PMD's C-Motion Engine, allowing users to directly run code on the ION, off-loading the system host or enabling stand-alone operation.

Built on the Magellan® Motion Processor

ION's Magellan Motion Processor provides a powerful instruction set to control the motion application, monitor performance and synchronize overall drive behavior. User selectable profiling modes include S-curve, trapezoidal, velocity contouring and electronic gearing. Servo loop compensation utilizes PID control, velocity and acceleration feedforward, and dual bi-quad filters. Additional features include limit switches, breakpoints, secondary encoder input for master-slave and electronic gearing applications.

> CONFIGURATION

System Host*

Step Motor (Encoder Optional)

ION 500 Digital Drive

ION 3000 Digital Drive

DC Brush Motor

Ethernet, CANbus or Serial Network

ION/CME 500 Digital Drive*

Brushless DC Motor

*System host optional for ION/CME

Block diagram labels:
- Main DC Input → DC Bus
- DC Bus Monitoring
- Voltage / Current
- PWM Power Stage → Motor Connection
- C-Motion Engine 256 KB User Code Space
- Internal Bus
- PWM Signals
- Magellan/ION™ Motion Processor
- Current Feedback
- Serial CANBus Ethernet → Communication Transceivers
- Quadrature Signal Conditioning
- Main Encoder Quad A, B, Index / Auxiliary Encoder Quad A,B or Pulse & Direction
- 4 Bidirectional I/Os / 4 Inputs / 2 Outputs → Digital I/O Conditioning
- Digital Signal Conditioning
- Hall Sensors, Limits, Home, High Speed Capture
- +/– 10 V Input → 16 bit A/D Converter
- Status LEDs
- Digital Signal Conditioning
- Drive Enable, AxisIn
- AxisOut, Fault
- ION/CME only

Filter parameters

Scalable PID 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

Specifications		ION 500	ION/CME 500	ION 3000
Supported Motor Types		DC brush, brushless DC, step motor		
Voltage Input		12-56 VDC	12-56 VDC	20-195 VDC
DC Brush Continuous current output		9.8 ADC	9.8 ADC	20 ADC
DC Brush Peak current output		21 ADC (2 sec)	21 ADC (2 sec)	30 A
DC Brush Continuous power output		500 W	500 W	3000 W
Brushless DC Continuous current output		8 A rms	8 A rms	15 A rms
Brushless DC Peak current output		15 A rms (2 sec)	15 A rms (2 sec)	30 A (per phase)
Brushless DC Continuous power output		500 W	500 W	2500 W
Step Continuous current output		5 A rms	5 A rms	30 A (per phase)
Step Continuous power output		350 W	350 W	1500 W
Supported communication options		RS232/485, CANbus, Ethernet	RS232/485, Ethernet	RS232/485, CANbus
Brushless DC commutation modes		Sinusoidal, 6-step, field oriented control		
Microstepping resolution		256 µsteps/step		
PWM frequency		20 kHz or 40 kHz (user selectable)		
Loop rates		Commutation & current loop: 51.2 µsec; Position loop & trajectory generator: 102.4 µsec to 1.6 sec		
User Programmability:	C-Motion Engine	NA	Execute CME code @ up to 96 MIPS	NA
	User Program Memory Size	NA	256 KB Flash, 8 KB RAM	NA
	External Memory	NA	40 KB RAM	NA
Signals:	Differential Inputs	Encoder A, Encoder B, Index, Aux Encoder A, Aux Encoder B		
	Digital Inputs	Hall A, Hall B, Hall C, Home, +Limit, -Limit, AxisIn, High-speed capture		
	Digital Output	AxisOut		
Additional I/Os		NA	4 digital bidirectional I/Os, 2 digital outputs, 4 digital inputs	NA
Analog Input		NA	+/- 10V range and 16 bits resolution	NA
Safety:	Short Circuit Protection	Line-to-line, line-to-power supply and line-to-case		
	Interlocks	Enable input, fault output, over/under voltage & overtemperature shutdown		
Environmental:	Operating Temperature	0 degrees to 50 degrees C		0 degrees to 40 degrees C
Compliance:	CE/RoHS	EN60204-1, EN55011, EN61000-6-1, EN61000-6-3 CE marked; RoHS compliant		
	UL	Designed to UL508c		UL Recognized
Mechanical Dimensions		4.3" (109.2 mm) x 3.03" (76.9 mm) x 1.63" (41.4 mm)		5.75" (146 mm) x 3.88" (98.5 mm) x 1.63" (41.4 mm)
Weight		0.6 lb (0.28 kg)		1 lb (0.5 kg)
Mechanical Options:	Heatsink	4.4" (109 mm) x 2.9" (74 mm) x 1" (25 mm)		NA
	DIN Rail	Mounting adapter		NA

Development Tools

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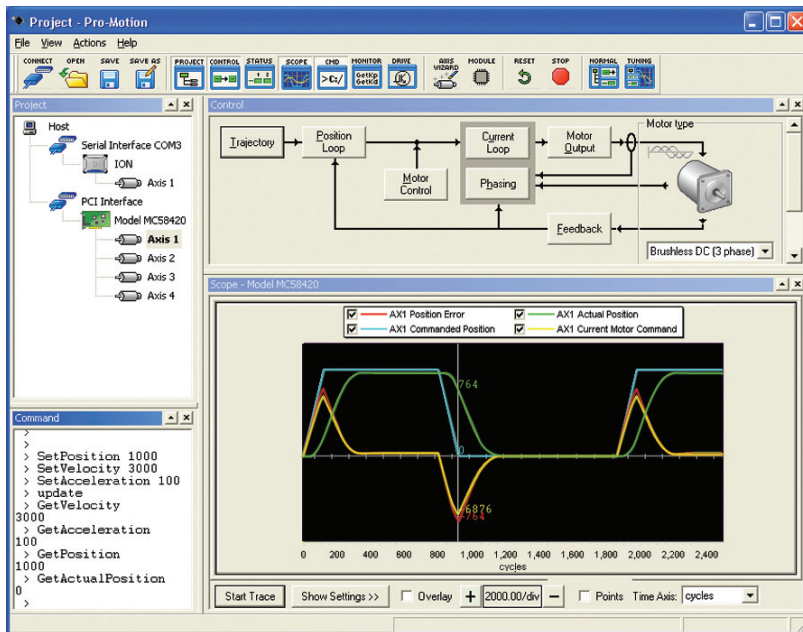
Pro-Motion is a sophisticated, easy-to-use Windows-based exerciser program for use with the ION Digital Drive and other PMD motion control ICs and cards.

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

› DEVELOPER'S KIT

Includes

- One of the following ION Drives: ION 500, ION/CME 500, or ION 3000
- Pro-Motion CD with Software & User's Guide
- ION Digital Drive Documentation
- Communications Port Cable
- Stub Cable Set
- Development Software CD with C-Motion and VB-Motion Software, and Magellan/ION Documentation

› C-MOTION® SOFTWARE

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 processors, cards and digital drives. C-Motion features include:

- Extensive library of commands for virtually all motion design needs
- Develop embeddable C/C++ applications
- Many complete, functional examples available
- Supports serial, CAN and Ethernet communications

Example C-Motion code for executing a profile and tracing some processor variables
The information captured in this example could be used for tuning the PID filter.

```
// 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);

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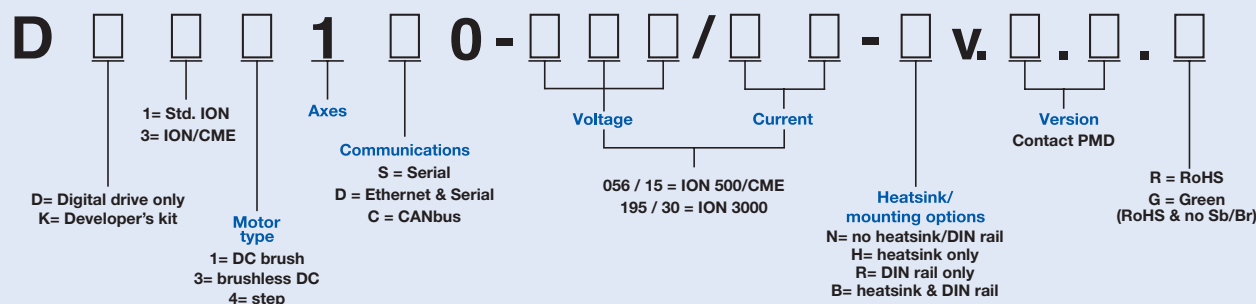
› PMD PRODUCT OVERVIEW

	MOTOR CONTROL IC	MAGELLAN®	PRODIGY® MOTION CARDS	ION® DIGITAL DRIVES
No. Axes	1	1, 2, 3, 4	1, 2, 3, 4	1
Format	• 64-pin TQFP	• 144-pin TQFP • 100-pin TQFP	• PCI • PC/104 • Standalone	• Fully enclosed module
Voltage	3.3 V	3.3 V	5 V	12 - 56 V / 20 - 195 V
Function	• Velocity control • Torque/Current control • Commutation • Field-oriented control	• Position control • Profile generation • Commutation • Network communications • Multi-motor support	• Position control • Profile generation • Commutation • Network communications • Signal conditioning • Multi-motor support • Analog output • PWM output • Trace buffer • Programmable • General purpose user I/Os	• Position control • Profile generation • Commutation • Network communications • Field oriented control • Torque/current control • Trace buffer • MOSFET amplifier • Pulse & direction input • Programmable (ION/CME only) • General purpose user I/Os (ION/CME only)
Motor Types	• Brushless DC	• DC brush • Brushless DC • Pulse & direction • Microstep	• DC brush • Brushless DC • Pulse & direction • Microstep	• DC brush • Brushless DC • Microstep
Communication	• Standalone • RS232/485	• Parallel • RS232/485 • CANbus	• PCI and PC/104 bus • Ethernet • RS232/485 • CANbus	• CANbus • Ethernet • RS232/485
Loop Rate	20 kHz – current 10 kHz – velocity	50 – 75 µsec/axis	50 – 150 µsec/axis	20 kHz – current 10 kHz – position

› HOW TO ORDER

D ☐ ☐ ☐ 1 ☐ 0 - ☐☐☐ / ☐☐ - ☐ v. ☐ . ☐ . ☐

- **D= Digital drive only**
  K= Developer's kit
- **1= Std. ION**
  3= ION/CME
- **Motor type**
  1= DC brush
  3= brushless DC
  4= step
- **Axes**
- **Communications**
  S = Serial
  D = Ethernet & Serial
  C = CANbus
- **Voltage** / **Current**
  056 / 15 = ION 500/CME
  195 / 30 = ION 3000
- **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
  (RoHS & no Sb/Br)

P M D

Performance Motion Devices, Inc.

80 Central Street, Boxborough, MA 01719
Tel: 978.266.1210 Fax: 978.266.1211
e-mail: info@pmdcorp.com
www.pmdcorp.com

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.