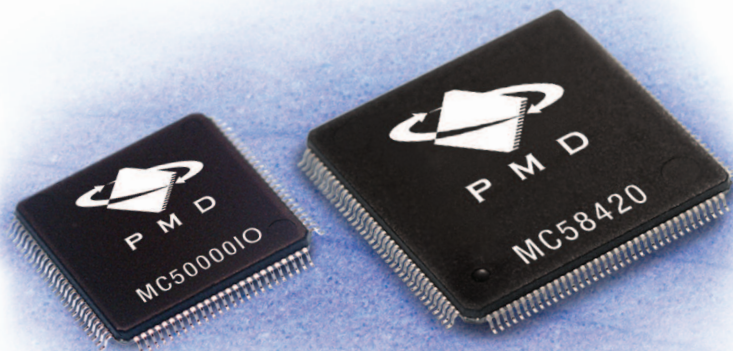


P M D

PERFORMANCE MOTION DEVICES

# The Magellan Family of Motion Processors



## The Magellan™ Family of Motion Processors

provides high-performance chip-based motion control for scientific, automation, industrial, and robotic applications. Available in 1, 2, 3, and 4-axis versions, these flexible, programmable devices control DC brush, brushless DC, microstepping, and pulse and direction motors.

Magellan Motion Processors are complete motion controllers requiring only an external amplifier to be functional. They are driven by a host using either an 8 or 16-bit parallel bus, CANBus 2.0B, or an asynchronous serial port. User selectable profiling modes include S-curve, trapezoidal, velocity contouring and electronic gearing. 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.

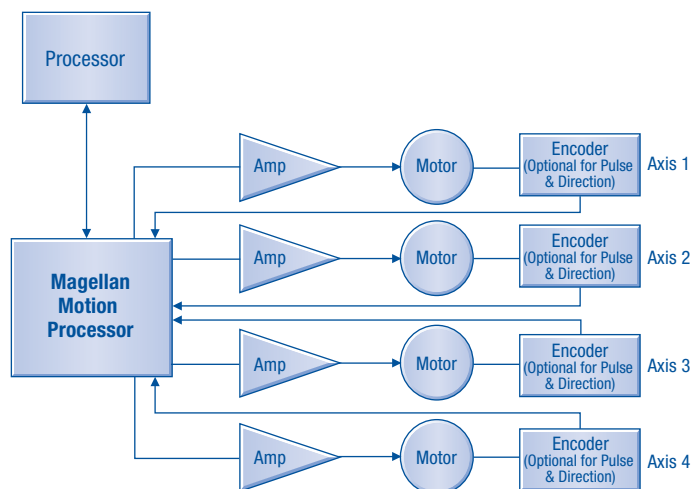
With over 130 commands, the Magellan Motion Processors provide a flexible and powerful instruction set to initialize and control the motion application, monitor ongoing performance, and synchronize overall machine behavior. Working with the Magellan devices, PMD's powerful Pro-Motion® GUI makes it easy to graph and analyze system performance, while C-Motion® allows you to develop your own application using C/C++.

Two versions of the Magellan are offered. The multi-motor MC58000 Series can control DC brush, brushless DC, microstepping and pulse and direction motors with motor type selectable on a software, axis by axis basis. The MC55000 Series is dedicated to pulse and direction output. Magellan Motion Processors come in a single-IC, single-axis version, or in a two-IC, multi-axis version. The IC's are packaged in a 144-pin TQFP, and a 100-pin TQFP. These devices operate at 3.3 V.

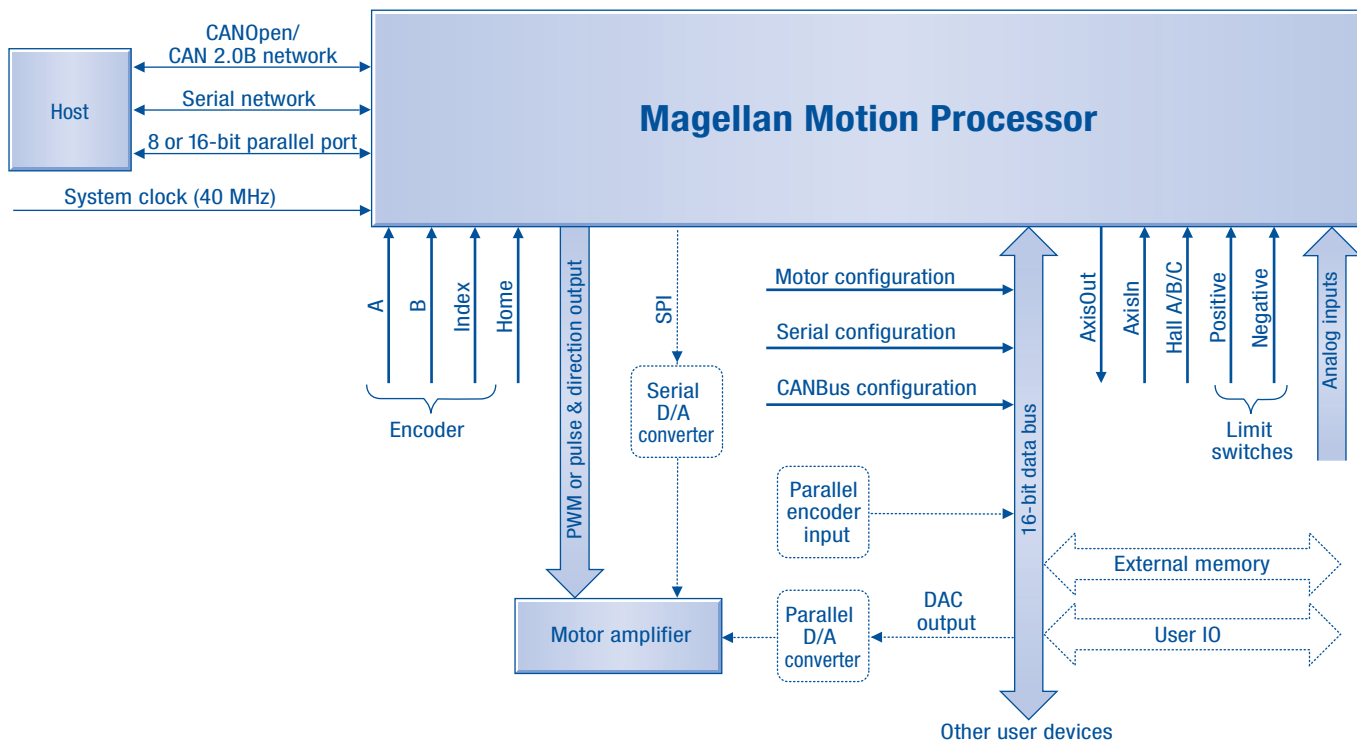
## FEATURES

- Available in 1, 2, 3 and 4-axis versions
- Supports DC brush, brushless DC, microstepping and pulse & direction motors
- Parallel IO, CANBus, serial point-to-point, serial multi-drop host communications
- S-curve, trapezoidal, velocity contouring, and electronic gearing profiles
- Separately programmable acceleration and deceleration values
- Velocity, position and acceleration changes on-the-fly
- Dual loop encoder input
- 6 step (hall based) and sinusoidal commutation for brushless motors
- High Speed (up to 5 M-pulses/sec) pulse & direction output
- Advanced PID filter with velocity and acceleration feedforward
- Programmable dual biquad filters
- Incremental encoder quadrature input (up to 8 Mcounts/sec)
- SPI and parallel DAC output
- Parallel input for absolute encoder or resolver
- 10-bit 20 kHz PWM or 16-bit DAC motor control output to amplifier
- PLC-style programmable inputs and outputs
- 8 10-bit general-purpose analog inputs
- Two directional limit switches, index input, and home indicator per axis
- Axis settled indicator, tracking window and automatic motion error detection
- Single-IC (single axis) or two-IC (multi-axis) versions
- Packaged in 144-pin and 100-pin TQFP (thin quad flat pack)
- 3.3 V operation

## CONFIGURATION



# Technical Overview



## SPECIFICATIONS

### Available Configurations

1, 2, 3 or 4 axes

### Velocity Range

0 to 32,767 counts/sample with a resolution of 1/65,536 counts/sample

### Position Range

-2,147,483,648 to +2,147,483,647 counts

### Acceleration and Deceleration Range

0 to +32,767 counts/sample<sup>2</sup> with a resolution of 1/65,536 counts/sample<sup>2</sup>

### Jerk Range

0 to 1/2 counts/sample<sup>3</sup> with a resolution of 1/4,294,967,296 counts/sample<sup>3</sup>

### Electronic Gear Ratio Range

-32,768 to +32,767 (negative and positive direction) with a resolution of 1/65,536

### Servo Loop Timing Range

50  $\mu$ sec to 1600 msec

### Profile Modes

**S-curve point-to-point** (Velocity, acceleration, jerk, and position)

**Trapezoidal point-to-point** (Velocity, acceleration, deceleration, and position)

**Velocity-contouring** (Velocity, acceleration, and deceleration)

**Electronic Gearing** (Encoder position of one axis used to drive a second axis)

### Filter Modes

Scalable PID with Vel & Acc feedforward, integration limit, output bias, and dual bi-quad filter

### Minimum Servo Loop Timing

50 – 75  $\mu$ sec/axis, based on no. of axes

### Position Error Resolution

32 bits

### Hall Sensor inputs

3 Hall effect inputs per axis

### Commutation Rate

10 kHz

### Limit Switches

2 per axis: one for each direction of travel

### Motor Output Modes

**PWM:** 10-bit resolution at 20 kHz

**Parallel DAC:** 16 bits

**SPI serial DAC:** 16 bits

**Pulse and Direction:** output up to 5 M-pulses/sec

### Maximum Encoder Rate

**Incremental** up to 8 Mcounts/sec

**Parallel-word** up to 160 Mcounts/sec

### Parallel Encoder Word Size

16 bits

### Position-Capture Triggers

2 per axis: index and home signals

### Analog Input

8 10-bit analog inputs

### User Defined I/O

256 16-bit data addresses

### Storage Temperature ( $T_s$ )

-65° C to 150° C

### Operating Temperature ( $T_a$ )

-40° C to 85° C

### Operating Current ( $I_{dd}$ )

129mA (typical)

### Nominal Clock Frequency ( $F_{clk}$ )

40.0 MHz

### Supply Voltage Limits ( $V_{CC}$ )

-0.3 V to +4.6 V

### Supply Voltage Operating Range ( $V_{CC}$ )

3.0 V to 3.6 V

### Analog Inputs

0 to 3.3 V

### Dimensions

CP: 20 mm sq, IO: 14 mm sq

# Development Tools

## DEVELOPER'S KIT



PMD's Magellan Motion Processor Developer's Kit is an integrated board and software package used to develop application software and to exercise the system's hardware components. To construct a complete general-purpose motion exerciser/test bed, only an external amplifier is needed.

The Developer's Kit includes the user's choice of a specific Magellan Motion Processor. The kit also includes PMD's powerful Pro-Motion GUI, an interactive Windows™ based exerciser and data capture program, and C-Motion, which simplifies the development of motion applications.

### Features

- PCI 4-axis motion card
- Supports all Magellan Motion Processors
- Includes complete board schematics in PDF and ORCAD format, with MAXPLUS II schematics for the on-board PLD
- Includes C-Motion® Application Program Interface (API), Pro-Motion® Graphical User Interface (GUI), C source code for developing applications using the Magellan Motion Processor in either a Windows or an embedded environment
- Serial port with baud rates up to 416K
- Dual-port RAM for on-board trace capability

## C-MOTION® SOFTWARE

C-Motion is a "C" source code library that provides a convenient set of callable routines for controlling your Magellan Motion Processor.

### Features

- Axis virtualization
- Communicate to multiple processors
- Easily linked to any VB or C/C++ application

**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, PMDTrace1, PMDAxis1, PMDTraceActualPosition);
SetTraceVariable(hAxis1, PMDTrace3, PMDAxis1, PMDTraceActualVelocity);
SetTraceVariable(hAxis1, PMDTrace4, PMDAxis1, PMDTraceCommandedVelocity);

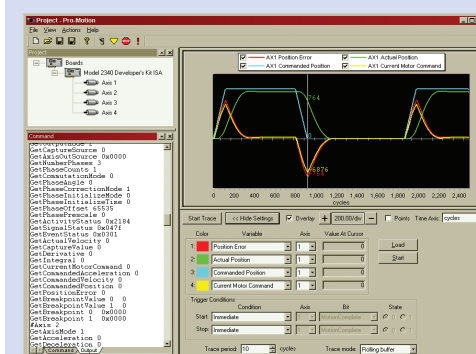
// set the trace to begin when we issue the next update command
SetTraceStart(hAxis1, PMDTraceConditionUpdate);

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

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

// start the motion
Update(hAxis1);
```

## PRO-MOTION® GUI



Pro-Motion is a sophisticated, easy-to-use Windows-based exerciser program for use with Magellan based chips and cards.

### Features

- Motion oscilloscope graphically displays processor parameters in real-time
- Interactive servo tuning
- 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
- Command window for direct text command entry
- Communications monitor echoes all commands sent by Pro-Motion to the card

## FAMILY FEATURES

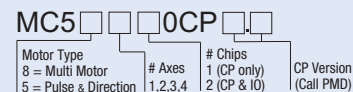
	MOTOR CONTROL IC	NAVIGATOR/PILOT	MAGELLAN	MOTION CARDS
<b>No. Axes</b>	1	1, 2, 4	1, 2, 3, 4	1, 2, 3, 4
<b>Format</b>	<ul style="list-style-type: none"> <li>• 64-pin PQFP</li> </ul>	<ul style="list-style-type: none"> <li>• 132-pin PQFP</li> <li>• 100-pin PQFP</li> </ul>	<ul style="list-style-type: none"> <li>• 144-pin TQFP</li> <li>• 100-pin TQFP</li> </ul>	<ul style="list-style-type: none"> <li>• PCI</li> <li>• PC/104</li> </ul>
<b>Voltage</b>	3.3 V	5 V	3.3 V	5 V
<b>Function</b>	<ul style="list-style-type: none"> <li>• Velocity control</li> <li>• Torque control</li> <li>• Commutation</li> <li>• Current feedback</li> </ul>	<ul style="list-style-type: none"> <li>• Position control</li> <li>• Profile generation</li> <li>• Commutation</li> </ul>	<ul style="list-style-type: none"> <li>• Position control</li> <li>• Profile generation</li> <li>• Commutation</li> <li>• Network communication</li> <li>• Multi-motor support</li> </ul>	<ul style="list-style-type: none"> <li>• Position control</li> <li>• Profile Generation</li> <li>• Commutation</li> <li>• Signal Conditioning</li> <li>• Analog Output</li> <li>• Trace Buffer</li> </ul>
<b>Motor Types</b>	<ul style="list-style-type: none"> <li>• Brushless DC</li> </ul>	<ul style="list-style-type: none"> <li>• DC brush</li> <li>• Brushless DC</li> <li>• Microstepping</li> <li>• Pulse &amp; direction</li> </ul>	<ul style="list-style-type: none"> <li>• DC brush</li> <li>• Brushless DC</li> <li>• Microstepping</li> <li>• Pulse &amp; direction</li> </ul>	<ul style="list-style-type: none"> <li>• DC brush</li> <li>• Brushless DC</li> <li>• Microstepping</li> <li>• Pulse &amp; direction</li> </ul>
<b>Communication</b>	<ul style="list-style-type: none"> <li>• Standalone</li> <li>• Serial</li> </ul>	<ul style="list-style-type: none"> <li>• Parallel</li> <li>• Serial point-to-point</li> <li>• Serial multi-drop</li> </ul>	<ul style="list-style-type: none"> <li>• Parallel</li> <li>• Serial point-to-point</li> <li>• Serial multi-drop</li> <li>• CANBus</li> </ul>	<ul style="list-style-type: none"> <li>• Through bus</li> </ul>
<b>Loop Rate</b>	20 kHz	100 – 150 µsec/axis	50 - 75 µsec/axis	50 - 150 µsec/axis

## PART NUMBER SUMMARY

No. of Axes	DC Brushed, Brushless DC, Microstepping, Pulse & Direction		Pulse & Direction	
	2 IC	1 IC	2 IC	1 IC
1	MC58120	MC58110	MC55120	MC55110
2	MC58220	—	MC55220	—
3	MC58320	—	MC55320	—
4	MC58420	—	MC55420	—

## HOW TO ORDER

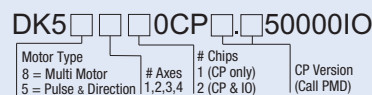
### CP (1 or 2 chip configuration)



### IO (2 chip configuration only)

MC50000IO

### Developer's Kit



*When ordering a single-chip configuration, only the CP part number is necessary. For two-IC configurations, both the CP and IO part numbers are required.*



### Performance Motion Devices, Inc.

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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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