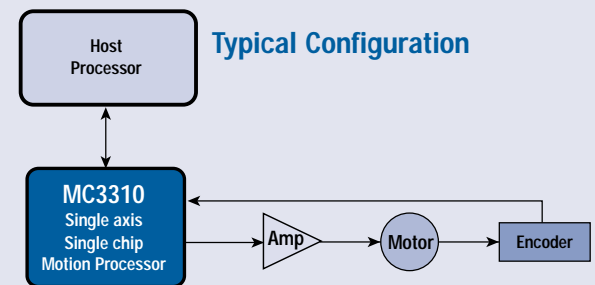




# Pilot™ Motion Processor For Brushless Servo Motion Control MC3310

## Features

- Available in 1-axis configuration.
- 6-step (Hall-based) or sinusoidal commutation.
- Supports 2 or 3-phase brushless motors.
- Motion profiles include S-curve, trapezoidal, velocity contouring and user-defined.
- Asymmetric acceleration and deceleration to custom program a trapezoidal motion profile.
- Advanced PID filter with velocity and acceleration feedforward, bias offset and 32-bit position error.
- Velocity and acceleration changes on-the-fly for trapezoidal and velocity contouring profiles.
- Incremental encoder quadrature input and parallel input for absolute encoder or resolver.
- Parallel and Serial (point-to-point or multi-drop) communications interface.
- Trace capabilities for system performance checks, servo-tuning, maintenance and diagnostics.
- 9-bit, 20kHz PWM or 16-bit DAC motor control output to amplifier.
- Advanced breakpoint capability allows precise sequencing of events.
- PLC-style programmable inputs and outputs, including one programmable input and one output.
- 256 16-bit word I/O locations for user defined peripherals.
- 8 general-purpose analog inputs.
- Two-directional limit switches, index input and home indicator.
- Axis settled indicator and tracking window in addition to automatic motion error detection.
- Comprised of a single 132-pin device (surface mount CMOS technology).
- Available in commercial and industrial temperature versions.



## General Description

The Pilot single-axis, single chip motion processor for brushless servo motor control is ideal for embedded systems for industrial control, automation and robotic applications. The chip is a 132-pin device, surface mount CMOS technology and powered by 5 volts. The motion processor is driven by a host microprocessor through an asynchronous bi-directional serial port or through a 16-bit microprocessor-style parallel interface, giving users the ability to offload resource intensive motion control functions from the application's host.

The MC3310 provides sinusoidal commutation of 2 or 3-phase brushless motors. Initialization is achieved using Hall-based sensors or with the motion processor's own algorithm. In addition, the chip accepts incremental quadrature encoder signals for position input and outputs the sinusoidally commutated motor signals. The motion processor has a pre-programmed PID filter with feedforward velocity and acceleration that can be scaled and a bias offset. The chip also supports a 32-bit position error. The PID filter operates at 150 µsec loop cycle time. Trace capabilities provide on-the-fly data storage to an external RAM for analyzing system performance, tuning servo filters and performing maintenance and diagnostics.

With over 150 commands, PMD's instruction set offers flexibility and versatility to board designers and software applications programmers. Instructions are used to initialize and control the motion processor. User selectable profiling modes supported by the motion processor include S-curve, trapezoidal, velocity contouring and user-defined. The MC3310 accepts input parameters such as position, velocity and acceleration from the host and generates a corresponding trajectory.

The motion processor accepts feedback from an incremental encoder at 5 megacounts per second or from an absolute encoder or resolver at 160 megacounts per second. 16-bit DAC or 9-bit, 20kHz PWM compatible output signals are supported.

Multiple breakpoints offer precise sequencing and control of events by the application program. PLC-style instructions are provided, which operate on inputs and set outputs. The instructions use Event, Activity and Signal registers. Input signals include two limit switches (one for each direction of travel), home indicator and a general-purpose programmable input. One general-purpose programmable output signal is also provided. Eight general-purpose analog (0-5 V), and 256 (16-bit wide) general-purpose discrete inputs/outputs are available.

## Technical Specifications

<b>Available configurations</b>	1 axis
<b>Operating modes</b>	<b>Closed loop</b> (motor command is driven from output of servo filter) <b>Open loop</b> (motor command is driven from user-programmed register)
<b>Position range</b>	-2,147,483,648 to +2,147,483,647 counts
<b>Velocity range</b>	-32,768 to +32,767 counts/sample with a resolution of 1/65,536 counts/sample
<b>Acceleration and deceleration ranges</b>	-32,768 to +32,767 counts/sample <sup>2</sup> with a resolution of 1/65,536 counts/sample <sup>2</sup>
<b>Jerk range</b>	0 to 1/2 counts/sample <sup>3</sup> , with a resolution of 1/ 4,294,967,296 counts/sample <sup>3</sup>
<b>Profile modes</b>	<b>S-curve point-to-point</b> (Velocity, acceleration, jerk and position parameters) <b>Trapezoidal point-to-point</b> (Velocity, acceleration, deceleration and position parameters) <b>Velocity-contouring</b> (Velocity, acceleration and deceleration parameters) <b>User-defined</b> (Velocity, acceleration, jerk, time and position parameters)
<b>Filter Modes</b>	Scalable PID + velocity feedforward + acceleration feedforward + bias Also includes integration limit, settable derivative sampling time and output motor command limiting
<b>Filter parameter resolution</b>	16 bits
<b>Motor output modes</b>	<b>PWM:</b> 9-bit resolution at 20 kHz <b>DAC:</b> 16 bits
<b>Maximum encoder rate</b>	<b>Incremental:</b> Up to 5 Mcounts/sec <b>Parallel-word:</b> Up to 160.0 Mcounts/sec
<b>Parallel encoder word size</b>	16 bits
<b>Parallel encoder read rate</b>	20 kHz
<b>Hall sensor inputs</b>	3 Hall effect inputs (TTL level signals)
<b>Commutation rate</b>	20 kHz
<b>Servo loop timing range</b>	153 µsec to 3355 msec
<b>Minimum servo loop time</b>	153 µsec (nominal; exact time is 153.6 µsec)
<b>Limit switches</b>	2; one for each direction of travel
<b>Position-capture triggers</b>	2; index and home signals
<b>Analog input</b>	8 10-bit analog inputs
<b>User-defined discrete I/O</b>	256 16-bit wide user-defined I/O
<b>Number of host Instructions</b>	152



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MC3310DS2.0-1202

## Environmental and Electrical Ratings

<b>Storage Temperature (<math>T_S</math>)</b>	-55° C to 150° C
<b>Operating Temperature (<math>T_A</math>)</b>	0° C to 70° C*
<b>Power Dissipation (<math>P_d</math>)</b>	650 mW
<b>Nominal Clock Frequency (<math>F_{CLK}</math>)</b>	20.0 MHz
<b>Supply Voltage Limits (<math>V_{CC}</math>)</b>	-0.3 V to +7.0 V
<b>Supply Voltage Operating Range (<math>V_{CC}</math>)</b>	4.75 V to 5.25 V

\* An industrial version with an operating range of -40°C to 85°C is also available. Please contact PMD for more information.