PC/DSP-Series Motion Controller C Programming Guide

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Motion Engineering, Inc.
520 East Montecito Street • Santa Barbara, CA 93103 • (805) 962-5409/Fax: (805) 962-8001

1.0 INTRODUCTION

1.1 Customer Support

Motion Engineering takes customer service seriously: We want your system to work! Our staff of applications engineers are knowledgeable and dedicated to answering any questions you may have in getting your system up and running. Please feel free to call -- we only ask that you take the time to read the Installation and Programming manuals to make sure that information in the manual has not been overlooked.

1.2 Software Updates

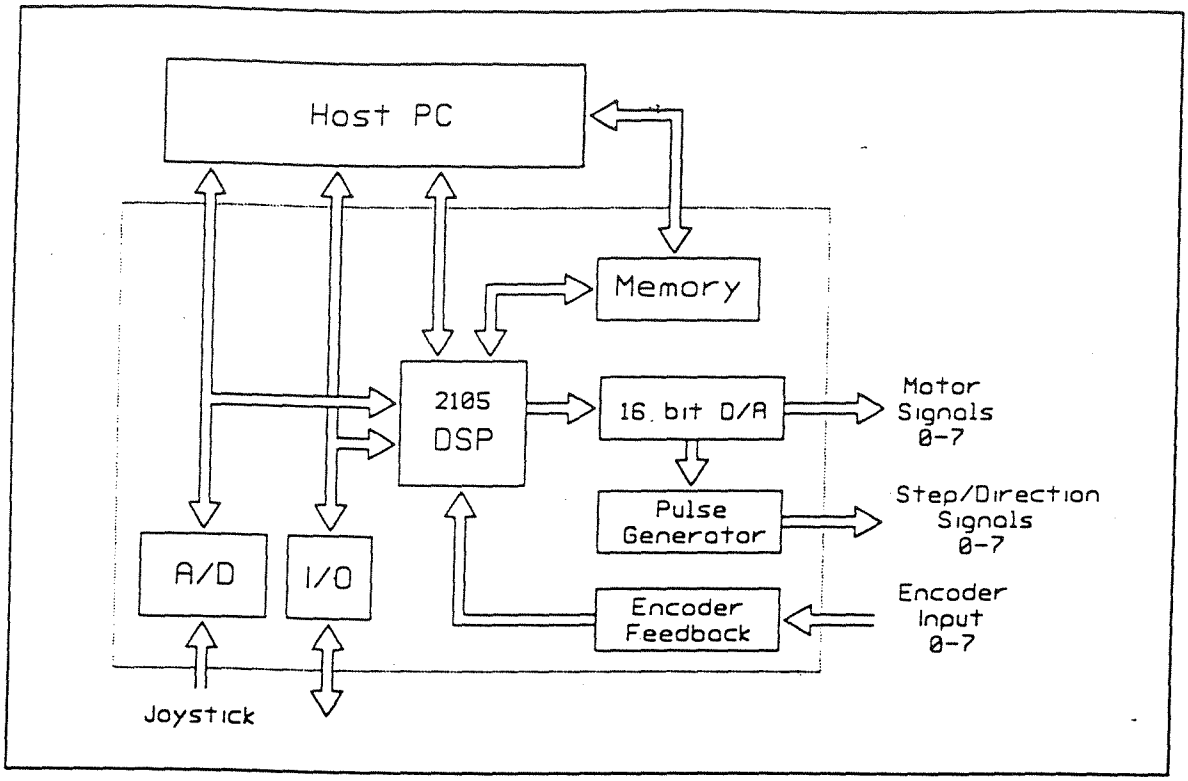
The PC/DSP software is being continuously upgraded by Motion Engineering. New features are being implemented, performance enhanced and new applications being developed every month. Contact us for the latest software release or list of new features.

The PC/DSP board has non-volatile memory space to store configuration and tuning parameters for each axis. Future versions of the SETUP program will give users the ability to store the tuning and axis parameters. Users may set the configuration and tuning parameters in their programs, however, with the functions included in the library.

Note that all "firmware" can be downloaded to the board from disk; hence, the PC/DSP can be easily upgraded. Upcoming features include on-board storage of configuration and tuning parameters; continuous motion graphic tuning; S-curve acceleration; and support for absolute encoders and resolvers. Contact Motion Engineering for details.

1.3 Design Summary

The PC/DSP utilizes the Analog Devices ADSP-2105 IC for on-board computing power. The DSP handles all servo loop calculations for up to 8 axes in addition to coordinating I/O functions. A block diagram of the internal architecture follows:



The PC/DSP design allows the PC CPU to directly access the DSP, memory, and I/O registers.

The PC/DSP uses a unique architecture to provide advanced capabilities without excessive complexity. If you are familiar with other board-level motion controllers, please pay particular attention to the sections describing open architecture and the programming libraries.

HARDWARE FEATURES

* Control up to 8 axes per board
* One card can control any of the following motor types with no software changes:
  - Brush Servo
  - Brushless Servo
  - Open-loop Stepper
  - Closed-loop Stepper
* Up to 56 bits of user I/O are available with headers conforming to Opto-22 standards
* Servo output: +/- 10 v analog, 16 bit resolution
* Stepper output: Step/direction to 4.0 MHz with up to 2 PPS velocity resolution over the entire range
* 6.7 MHz encoder inputs
* 8 Analog input channels
* Multiple boards can be installed in a single PC
* Stand-alone control via optional RS-232 packaging

SOFTWARE FEATURES

* 2nd Order filter with velocity feed-forward and acceleration feed-forward
* Linear or S-curve acceleration
* Continuous contouring with unlimited number of vectors - motion can be reversed on-path
* Change acceleration, velocity, filter parameters on-the-fly
* Open software architecture: Path generation performed in the PC CPU with C and BASIC function libraries (including sources)
* 48 bit actual position register, 32 bit velocity, acceleration, and jerk registers,
* Dual-loop control with user-defined algorithms
* User-definable home and limit switch polarity and actions
* Programmable software limits for position, velocity, acceleration, position error and torque

SPEED AND PRECISION

* 40 MHz DSP on-board
* Loop update rate: 4.0 kHz (4 Axes), 2.0 kHz (8 axes)
* Fast data transfer to PC through dual-ported (shared) memory
* Latch positions on-the-fly in under 1 usec

1.4 Open Architecture

Open architecture takes full advantage of the power, memory and peripherals available with the modern PC. Open architecture puts more functionality into the PC and standard programming languages such as C, PASCAL or QuickBASIC.

Users are no longer restricted by firmware commands stored in EPROM. Applications are no longer hindered by slow internal ASCII communications.

User programs running in the host CPU directly access I/O mapped registers which control and monitor the motion of each axis. The PC/DSP chip constantly polls the PC memory for new instructions. Detailed position and other commands (I/O status, etc.) are buffered on-board or executed immediately.

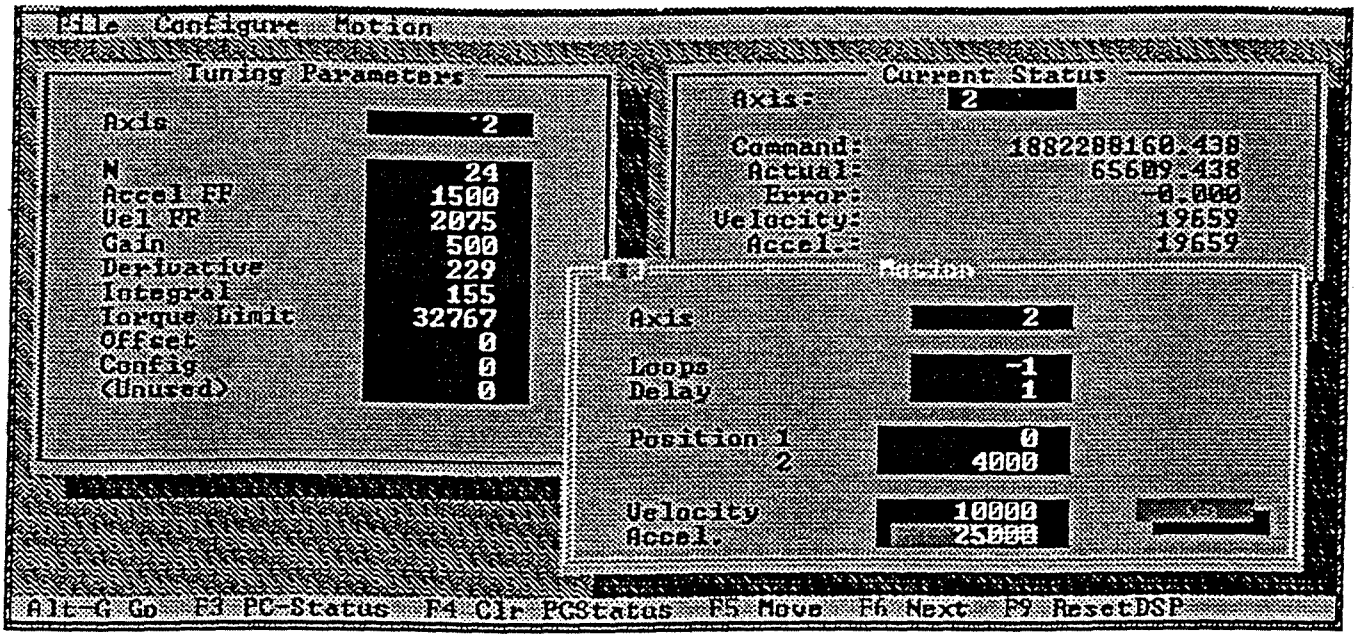
With open architecture, users can:

* Write all application software with their familiar development tools under PC-DOS
* Create special functions using DOS-based programming
* Execute continuous path lengths of essentially unlimited length, not limited by board memory
* Tightly integrate motion with other events controlled or monitored by PC peripherals

plus many other functions or applications simply **not possible** with other controllers.

1.5 The SETUP Program

The PC/DSP is provided with an extremely powerful setup program which allows users to configure and tune the controller. A typical SETUP.EXE screen follows:



A Typical SETUP.EXE Screen Showing Tuning Parameters,
Status of Axis and Motion Commands for One Axis

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