

# The SMP™ Series:



# Complete Motion/Machine Control Solutions

## Overview

SMP general motion controllers provide high-end motion control (up to 32 axes), an industry-standard PLC, and a Windows-based GUI, in a single software package. These controllers are truly PC-based, providing all-software motion and machine control solutions that require no motion control/PLC boards.

This SMP series of multi-axis, high-speed controllers is ideal for motion control applications in many industries: packaging, materials handling, pick and place, converting, food processing, laser cutting/engraving, plasma cutting, wood-working, semiconductor and more.

SMP products run on Windows 2000, Windows XP or Windows XPe, and include the following components:

- The SMP Motion Engine – a real-time soft motion control engine for high-performance, highly-coordinated motion control of up to 32 axes
- The SMP Console – a Windows application that allows users to set up, tune and run an SMP system. A memory mode operation is available to program and run motion programs with a G-code like motion programming language
- Motion Development Kit (MDK) Standard Package
- A real-time kernel for Windows
- LadderWorks PLC, including:
  - The LadderWorks PLC Engine – a real-time soft PLC engine for industry-standard ladder logic control with axis modules (independent and individual positioning of PLC axes)
  - LadderWorks Console – a graphical PLC ladder diagram editor, monitor, debugger and compiler for Windows
  - PLC utility tools

SMP functions facilitate the setup, configuration, servo tuning and testing of an SMP system, as well as providing real-time monitoring of motion, I/O and PLC status.

SMP solutions offer great flexibility. Developers can easily embed their motion programming within their customized HMI application, using C/C++, Visual Basic 6.0 or .NET 2.0. In addition, some SMP products offer motion programming in a motion language similar to G code, with an SMP Motion Parser that provides powerful, automatic execution of motion programs in real-time.



SMP Product	Number of Axes	Includes memory mode operation with G-code like motion programming
SMP450	4	✓
SMP850	8	✓
SMP1600	16	
SMP3200	32	



Consult the [Soft Servo SMP Series General Motion Control Product Parts List](#) or your Soft Servo Systems sales representative regarding standard and optional features for this product.

# SMP Advantages and Features

## SMP Advantages

**Powerful and innovative.** SMP easily handles computation-heavy algorithms without additional expensive processors with unique soft motion technology that fully exploits the super-fast, super-precise (double-precision floating point) computation power of ordinary PCs.

**Fast.** Interpolation rate as fast as 0.5 ms for highly coordinated 32-axis motion. 5 msec standard PLC scan time. Plus, as the speed and power of CPUs increases, so does the speed and power of an SMP product.

**Unique technology.** A single host CPU performs all real-time servo and motion control tasks, including feedback loops, accelerations/decelerations and PLC, as well as providing the graphical user interface, program interpreting/loading, file management, data processing and network communications, all simultaneously.

**Complete coordinated motion/machine control.** Soft motion and soft PLC are integrated into a single motion/machine control application for incomparable motion and machine control.

**Easy to use software tools.** The Motion Development Kit with C/C++, Visual Basic 6.0 or .NET 2.0 APIs makes it easy to design and program customized control/GUI applications.

**Extendable.** Windows-based SMP allows customers to take advantage of sophisticated or simple user interfaces; connectivity to enterprise networks; off-the-shelf PC technology; integration with third-party Windows-based software, such as vision systems or statistical process control software; and remote diagnostic service.

**Diverse Platforms.** Many interface platforms are available for servo drive and I/O communications: EtherCAT; VersioBus™ II (not available for SMP3200); Panasonic Realtime Express™ (RTEX); MECHATROLINK™ II; MECHATROLINK™ III; CANopen; and SSCNET™ (not available for SMP1600 or SMP3200).

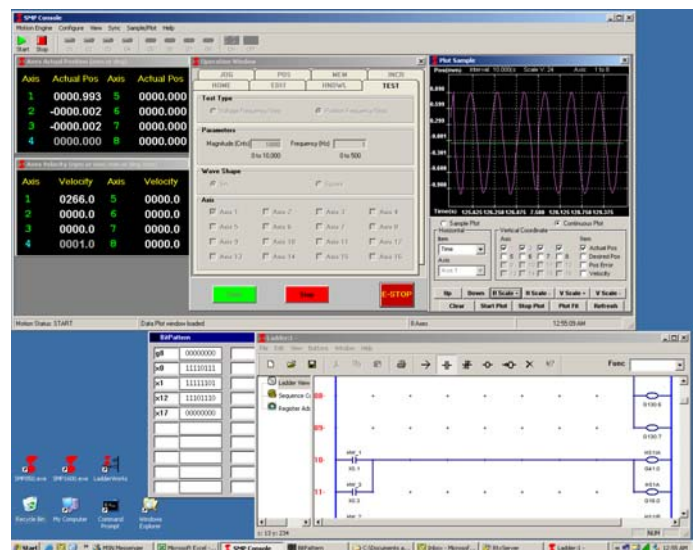
**Reduced hardware.** Emphasizing software components and taking advantage of a computer's CPU considerably reduces hardware requirements and complex interface wiring and eliminates high-priced proprietary encoder- or servo-specific interface modules, breakout boxes, and analog and encoder cables from the PC.

**Quick, simple setup and integration.** Simple cabling and connections reduce time to market, minimize maintenance and lower total cost of ownership.

**Distributed motion axis architecture.** Daisy-chainable servo and I/O interface modules for distributed control and multiple nodes.

## SMP Motion Control Features

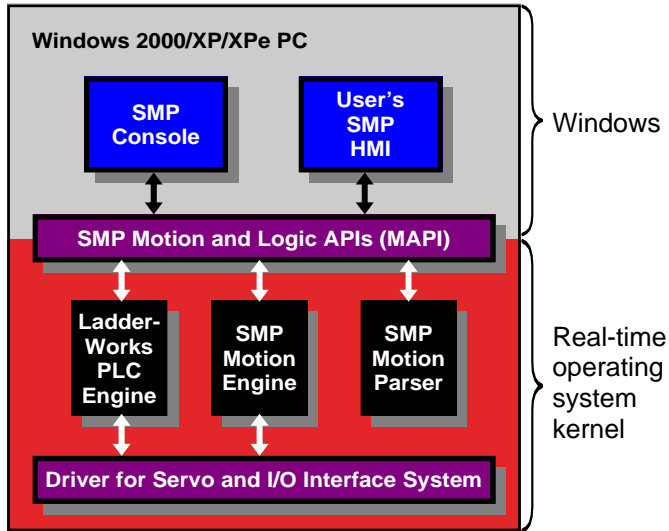
- Up to 32 axes of coordinated motion control with up to 1 ms interpolation cycle
- PLC axes for independent, individual positioning
- Linear, circular, helical and exponential interpolation
- Backlash compensation and leadscrew pitch error compensation
- Smoothing: acceleration and deceleration can be programmed for linear, bell-shaped and exponential filters
- Velocity feedforward to improve motion performance
- 16-bit analog output per axis, and opto-isolated overtravel limit switch inputs and home switch inputs for each axis (VersioBus II interface system)
- Dual-axis synchronous control for master-slave operation
- Corner deceleration control for sharper corners while maintaining high feedrates away from corners
- 1000 cycle three-dimensional dynamic look-ahead contour control (3D-DLACC) with pre-interpolation acceleration for high-speed, high-precision machining (one second look-ahead for 1 ms position feedback rate)



SMP Software Components



## SMP Software Architecture



## SMP Motion Development Kit (MDK)

SMP MDK (Standard Package included) has made it easy for users to create or customize their own SMP application in C/C++, Visual Studio 6.0 (not available for SMP3200) or .NET 2.0 for Windows 2000/XP/XPe. SMP Motion and Logic APIs with plenty of sample source code in the MDK allow customers to easily program their own GUI or text-based SMP application. These extensive APIs are provided for complete and full access to all real-time processes and resources, including device handling, system initialization, parameter settings, motion control commands, manual operation commands, automated operation commands, testing commands, I/O commands, PLC commands, motion and servo status monitoring, and many more.

The Visual Basic source code of the SMP Console, an intensive motion application for Windows, is available with the MDK.

Also available is the SMP Simulator that allows users to “play” with SMP motion products without having hardware or motors connected to the PC. The SMP Simulator can be used not only for SMP application development, but also for training end users of the developed SMP applications.

# LadderWorks PLC

## Overview

LadderWorks™ PLC is an independent, complete soft PLC package included with all SMP products and featuring:

- Ladder Diagram (LD) and Instruction List (IL) format
- 38 function blocks and 12 basic commands, simplifying the programming of complex machine functions and allowing for quick and easy creation of sequence programs
- 0.07  $\mu$  s/step (Pentium IV 2.4 GHz)
- Max 40,000 steps
- E-mail and telephone alert
- PLC utility tools for debugging, such as bit pattern display and time charts showing the history of bit signals

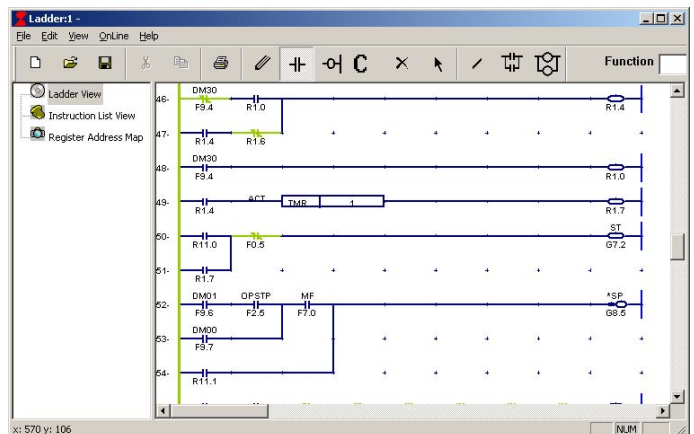
## LadderWorks PLC Engine

- Real-time soft PLC engine for industry-standard ladder logic control and execution of PLC sequence programs, seamlessly integrated with the SMP Motion Engine into a single motion/machine control application with deterministic, real-time performance
- Operates with Fanuc-compatible ladder logic
- Up to 416 opto-isolated I/O points (VersioBus II interface system)
- Operates with a 5 msec standard scan time
- Provides 100 bytes each for X and Y addresses, 400 bytes each for F and G addresses

## LadderWorks Console

LadderWorks is a user-friendly PLC ladder editor for developing, monitoring and debugging PLC sequence programs:

- Create, edit and compile PLC sequence programs
- Export PLC sequence programs in text or executable binary code according to the ladder diagram
- Quickly insert functional commands by selecting functions from a pull-down menu, and entering parameters (if any) in pop-up text boxes; insert basic instructions by pointing and clicking on symbols within the easy-to-use GUI
- Search and print ladder diagrams
- Force component values while monitoring sequence programs



# The SMP™ Console

## Overview

The SMP Console is a Windows HMI application included with all SMP solutions that allows users to set up, configure, test, tune and run SMP systems. The SMP Console provides real-time I/O, servo, and motion status monitoring. The SMP Console included with the SMP450 and the SMP850 even controls motion with a G code motion programming language.

The SMP Console controls 4, 8, 16 or 32 axes that can be used as coordinated axes (maximum 8 CNC axes), as PLC axes or as slave axes for synchronous control. SMP450 and SMP850 include a Memory Mode for memory operation with a G code-like motion language.

## Comprehensive Setup, Configuration, Servo Tuning and Testing Features

- Includes SMP system setup and configuration functions, such as driver installation, FPGA initialization, setting of servo control and servo drive parameters, etc.
- Includes test operation modes for SMP system tuning such as velocity frequency/step response and position frequency/step response in either sinusoidal or square wave
- Interactive manual PID tuning
- Enhanced data sample and plot utilities (including continuous plot), for a lively visualization of system performance
- Provides real-time monitoring of position and I/O signals
- Provides data sampling and data plotting of actual position, program position, position error and velocity
- Includes windows for viewing and setting system parameters

## Interface Features

- Incorporates simple and intuitive menu- and tab-driven HMI that is easy to learn and easy to use
- Manual motion control modes:
  - 1) Jog Mode
  - 2) Position Mode
  - 3) HandWheel Mode (manual jog with a pulse generator)
  - 4) Home Mode
  - 5) Jog Incremental Mode
- Memory Mode: real-time monitoring of motion programming execution (SMP450 and SMP850 only)
- Edit Mode for creating and editing motion programs
- Test Mode: for tuning of the SMP system
- Easy connection of equipment to business-oriented applications running on the network

## Operational Features

- High-speed block processing of 1000 blocks/sec.
- Individual axis machine lock
- Individual axis and individual direction (forward and reverse) interlock
- Handwheel feed interruption
- Manual intervention and return with manual absolute function
- Cycle start, cycle stop/feed hold
- Emergency stop
- Overtravel limits (hardware limit switches and software stroke limits)
- Machine, workpiece, local and relative coordinates
- Three homing types
- Extended G-code axis naming (X/Y/Z/A/B/C/D/E) for up to 8-axis applications (SMP850 only)
- PLC axes
- Modes of motion include jogging, manual jogging with an optional handwheel, incremental jogging, and rapid positioning
- Single block
- Optional block skip
- Dry run
- Standard T/M/B functions
- Program stop (M00)
- Optional stop (M01)
- Program rewind (M30)
- Subprogram call from a main program (M98)
- End of subprogram and return to main program (M99)



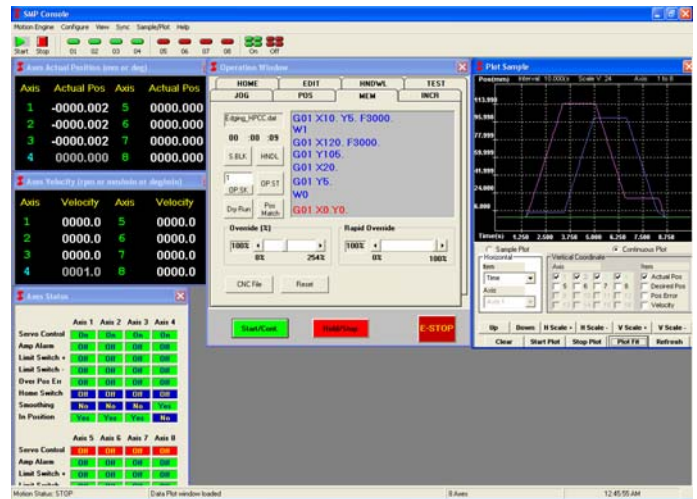
## User-Friendly Operation

Simple, colorful and Windows-based, the SMP Console allows SMP systems to be set up and used immediately, without a customized SMP application.

Designed for intuitive use by both the machine operator and the machine integrator, the SMP Console has been thoroughly tested by end users, whose feedback has been incorporated throughout the design process, and continues to be an invaluable resource as the SMP Console is constantly improved.

## Display Features

- Simple, colorful, user-friendly graphical user interface – will seem familiar because it is a Windows-based, menu-driven HMI based on multiple windows, all of which can be opened or closed as needed, with buttons, slider bars and text boxes for giving commands and accessing information



- Real-time program execution, position display and plotting
- Real-time I/O, servo, NC status and motion monitoring

# Motion Programming for SMP450 and SMP850\*

## G Codes for the SMP450 and the SMP850

- G00 Rapid traverse
- G00.1 Rapid traverse with programmable acceleration/deceleration
- G01 Linear interpolation
- G02, G03 CW/CCW circular or helical interpolation
- G02.3, G03.3 Positive/negative exponential interpolation
- G04 Dwell
- G05, G08 Dynamic look-ahead contour control on/off
- G10 Program data input
- G17-G19 XY/ZX/YZ plane selection
- G20, G21 Inch/metric data input
- G28, G29 Automatic return to/from reference point
- G30 Automatic return to 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> reference points
- G31 Skip cutting
- G40-G42 Tool radius compensation cancel/left/right
- G43, G44 Positive/negative tool length compensation
- G49 Tool length compensation cancel
- G50, G51 Scaling off/on
- G50.1, G51.1 Mirror image off/on
- G52 Local coordinate system selection
- G53 Machine coordinate system selection
- G54-G59 Workpiece coordinate system 1-6 selection
- G61 Exact stop check mode
- G64 Continuous cutting mode
- G64.1 Continuous cutting mode with block rollover
- G65 Simple macro call
- G68, G69 Coordinate system rotation on/cancel
- G90, G91 Absolute/incremental command programming
- G92 Workpiece coordinate programming
- G310, G311 Linear interpolation feedrate include/exclude rotary axes

## Extended G Code Programming Environment for the SMP450 and the SMP850

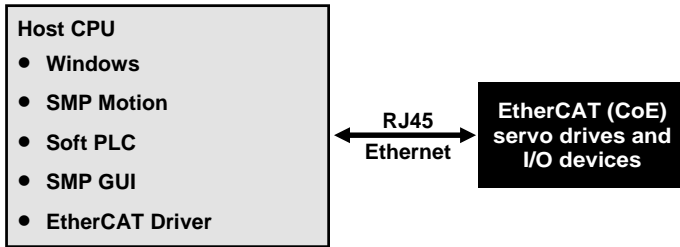
- 99 local variables
- 400 numbered global variables (their values are lost when the SMP Console restarts)
- An unlimited number of symbolic global variables, with meaningful variable naming (such as “#position”)
- 500 numbered permanent variables (their values remain when the SMP Console restarts)
- Up to 24,000 system variables
- Extensive math operations:
  - Addition, subtraction, multiplication, division (+, -, \*, /)
  - Sin, cos, tan, asin, acos, atan
  - Exponent, square root, absolute value
  - Rounding off, rounding down, rounding up
  - Natural logarithm, exponential function
  - OR, XOR, AND, NOT
  - Unlimited nesting of parenthesis
- Branching and repetition statements supported: GOTO, IF GOTO, IF THEN, IF ELSE ENDIF, WHILE
- Unlimited nesting of branching and repetition statements
- Macro calls using custom G, M and T codes

\* Not available for SMP1600.

# Servo and I/O Communications Hardware Platforms

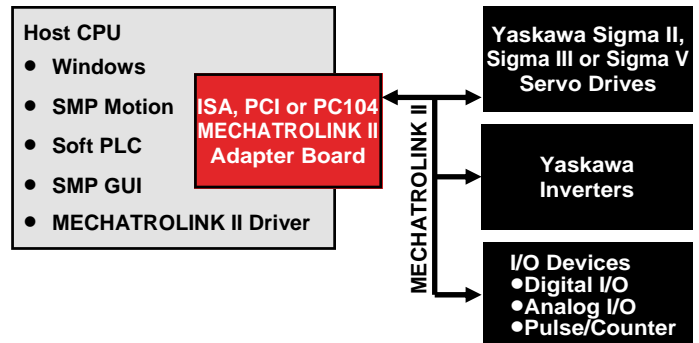
## EtherCAT Interface System

Zero hardware motion control



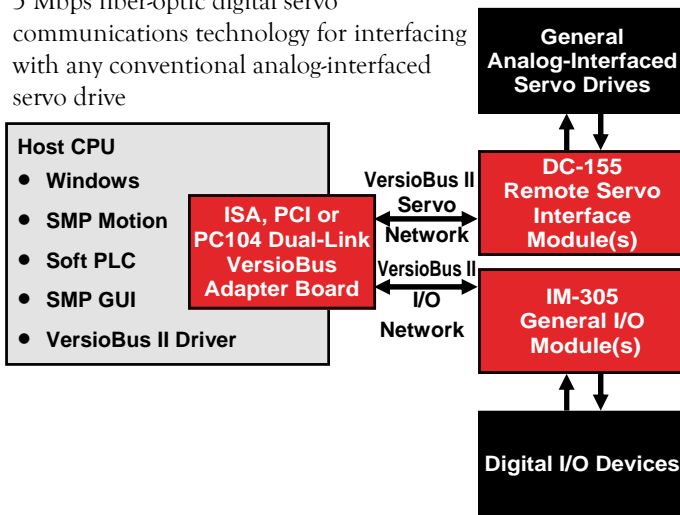
## MECHATROLINK II Interface System

Servo and I/O communications



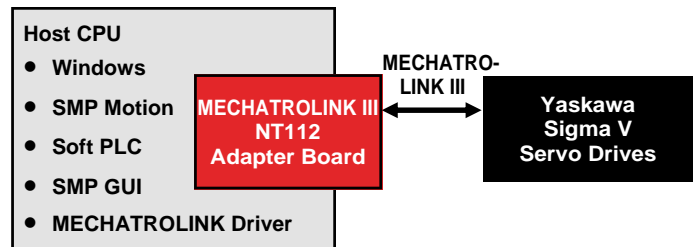
## VersioBus II Servo and I/O Communications

5 Mbps fiber-optic digital servo communications technology for interfacing with any conventional analog-interfaced servo drive



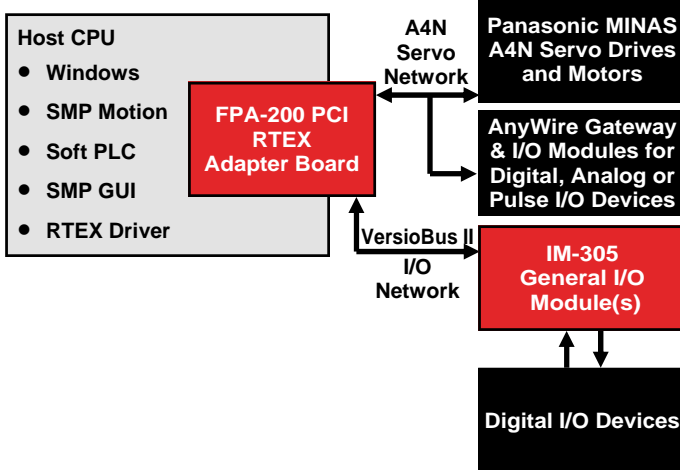
## MECHATROLINK III Interface System

100 Mbps Ethernet-based digital servo communications



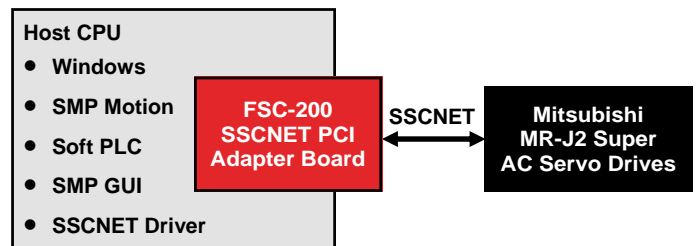
## Panasonic Realtime Express™ (RTEX)

Ethernet-based interface system, 0.5 ms to 1 ms cycle time



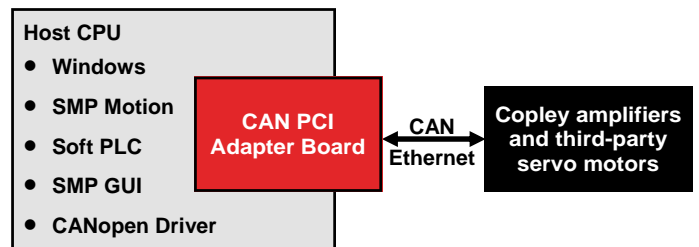
## Mitsubishi SSCNET Servo Communications

Synchronous serial communications (not available for SMP1600)



## CANopen Interface System

CANopen over simple CAN



Send inquiries to: [info\\_usa@softservo.com](mailto:info_usa@softservo.com)

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