ServoWorks™ CNC and SMP Servo Interface Guide

Soft Servo
SYSTEMS, INC

Servo Communications Technologies

Soft Servo Systems' general motion control and CNC products are available with a choice of several servo and I/O communications hardware platforms, each with its own distinct advantages, based on different communications technologies: EtherCAT, Panasonic Realtime Express™, CANopen, VersioBus™ II fiber optics, Yaskawa MECHATROLINK™ II, Yaskawa MECHATROLINK™ III and Mitsubishi SSCNET™.

EtherCAT (Ethernet Control Automation Technology) is a fast, vendor-independent Ethernet-based realtime open network for servo and I/O communications, with a cycle time as fast as 0.5 ms.

The Panasonic Realtime Express™ (RTEX) is a high-speed (100 Mbps), real-time, Ethernet-based servo communications technology developed by Matsushita Electric Industrial (Panasonic) Co., Ltd.

CANopen is a network based on CAN (Controller Area Network) that works with Copley Control's Accelus™ and Accelnet™ digital servo amplifiers (and third-party servo motors).

VersioBus™ II, Soft Servo Systems' original breakthrough technology, was designed to interface with any conventional analog-interfaced servo drive using a single fiber-optic cable. This unique technology allows a significant reduction in the number of cables connecting to the PC.

MECHATROLINK II is an all-digital, reliable, market-proven communications technology, developed by Yaskawa Electric Corporation, the world leader of motion control.

MECHATROLINK III is a 100 Mbps Ethernet-based digital servo communications technology, also from Yaskawa Electric Corporation, that integrates up to 62 stations in one network.

Servo System Controller NETwork (SSCNET) is a high-speed, synchronous serial communications technology, developed by Mitsubishi Electric Corporation, ideal for machine tool applications.

More servo communications (such as SERCOS) are planned for the future, to meet customer needs. Also, an IEEE 1394 servo platform is available only for OEM customers.

Features Common to ALL Servo Interface Platforms

- Reduced cables — a single cable replaces encoder and analog cables to communicate with the PC

- Daisy-chainable servo drives offer distributed control and multiple nodes, allowing distance between the PC, machine and peripherals

- Simple connections and cabling for simple setup and configuration, making machine integration straightforward, and reducing cost and time to market

Specifications/ Features	EtherCAT	Real-Time Express™ (RTEX)	CANopen	VersioBus™ II
Main Advantages	Fast, no hardware required, open, economical, works with devices from many companies.	High-speed (100 Mbps), real-time Ethernet platform; excellent servo performance & high resolution; control of up to 32 axes at 0.5 ms or 1 ms cycle time; use of regular Ethernet LAN cables; high noise immunity transmission	Economically efficient, simple setup and wiring, proven technology	Digital, fiber-optic connectivity for general analog servo drives; up to 16 axes of analog servos on a single fiber-optic network; up to 416-point I/O connectivity; ultimate PC-based platform for analog servos
Servo Communications Technology	100 Mbps Ethernet	100BASE-TX full duplex Ethernet-based communications with ring topology (digital synchronous — IEEE 802.3u)	CANopen digital servo communications over simple CAN (Controller Area Network)	VersioBus II fiber-optic digital servo communications with remote analog modules
Communications Developer	Beckhoff	Matsushita Electric Industrial Co., Ltd.	European information technologies programme	Soft Servo Systems, Inc.
All Digital?	✓	✓	✓	No — serial digital communications for analog devices
Max. No. of Axes for Servo Control	32	32	32	16
Cycle Time (Interpolation Rate)	as fast as 0.5 ms	0.5 ms – 1 ms	4 ms	1 ms
Data Transfer Rate	100 Mbps	100 Mbps	1 Mbps	5 Mbps
Servo Drive Type	EtherCAT (CoE) servo drives	Panasonic MINAS A4N servo drives	Copley Accelus and Accelnet amplifiers (and third-party motors)	Conventional analog-interface servo drives (with AC & DC motors)
Encoder Type(s)	Varies depending upon servo drives	2500 pulses per revolution incremental encoders or 17-bit absolute encoders	Varies depending upon servo drives	Incremental encoders (up to 5 MHz)
PC Adapter Board	None	FPA-200 (PCI)	CAN PCI adapter card from Copley Controls	FP-85 (ISA), FP-105 (PCI) or FP-114 (PC104)
Cable Type for Servo Network	Commercial Ethernet LAN cable	Commercial Ethernet LAN cable, TIA/ EIA-568B CAT5e compliant or more	Varies — RJ45 Ethernet cables, dSub9 cables or direct wiring	VersioBus II fiber-optic cable from PC to a remote analog module
Inter-Node Max. Cable Length	No reasonable limit	60 m	No reasonable limit	10 m
Total Max. Cable Length (Network Length)	No reasonable limit	200 m	No reasonable limit	100 m

| Specifications/ Features	MECHATROLINK™ II	MECHATROLINK™ III	SSCNET™
Main Advantages	Simple, fast, reliable, versatile & economically efficient network control for high noise immunity; market-leading high-performance servo system; many third-party I/O modules available	High-speed (100 Mbps), real-time Ethernet platform; high accuracy and fast positioning; control of up to 62 axes; use of regular Ethernet LAN cables; high dynamics — smooth, vibration-free motion; easy and fast setup	Market-proven, high-speed servo network; excellent multi-axis control at 0.88 ms cycle time; ideal for performance-demanding machine tool applications
Servo Communications Technology	MECHATROLINK II digital servo communications	MECHATROLINK III Ethernet-based servo communications	SSCNET or SSCNET II synchronous serial digital servo communications
Communications Developer	Yaskawa Electric Corporation	Yaskawa Electric Corporation	Mitsubishi Electric Automation, Inc.
All Digital?	✔	✔	✔
Max. No. of Axes for Servo Control	30*	30	8 (SSCNET) or 6 (SSCNET II)
Cycle Time (Interpolation Rate)	4 ms to 8 ms	31.25 μsec to 64 ms	3.5 ms (SSCNET) or 0.88 ms (SSCNET II)
Data Transfer Rate	10 Mbps	100 Mbps	5.6 Mbps
Servo Drive Type	Yaskawa Sigma II, Sigma III and Sigma V servo drives & inverters	Yaskawa Sigma V servo drives	Mitsubishi MR-J2 Super AC servo drives
Encoder Type(s)	Absolute and incremental encoders	Absolute and incremental encoders	Absolute encoders
PC Adapter Board	NT110 (PCI) or NT115 (PC104 or ISA)	NT112 (PCI)	FSC-200 (PCI)
Cable Type for Servo Network	Shielded twisted pair MECHATROLINK II cable	Commercial Ethernet LAN cable, STP CAT5e compliant or more	SSCNET cable
Inter-Node Max. Cable Length	10 m	100 m	10 m
Total Max. Cable Length (Network Length)	50 m	100 m	30 m

* Maximum number of modules in the network; I/O devices on the network diminish the number of servo drives. Therefore, the maximum number of modules in the network = the maximum number of axes to be controlled, only if there are no I/O devices. Also, for the MECHATROLINK interface system, additional stations can be added by adding additional MECHATROLINK adapter boards: one board for 30 stations.

Specifications/ Features	EtherCAT	Real-Time Express™	CANopen	VersioBus™ II	MECHATRO-LINK™ II	MECHATRO-LINK™ III	SSCNET™
No. of Standard General Uncommitted) I/O Points	Varies — depends on whether or not the EtherCAT servo drives provide I/O	24 digital I/O points for a 4-axis system; 96 digital I/O points for a 16-axis or 32-axis system	Each Copley Accelus amplifier offers 6 digital inputs and 2 digital outputs; each Copley Accelnet amplifier of-fers 12 digital inputs and 3 digital outputs	64 digital I/O points for a 4-axis system; 160 digital I/O points for a 16-axis system	0	0	0
Works with an Optional I/O Network?	Yes, but not recom-mended (requires PC adapter board)	Yes — a VersioBus II I/O network, for an additional 256 I/O points, scalable in 64-point increments	Yes, but not recom-mended (requires second PC adapter board)	Yes — a VersioBus II I/O network, for an additional 256 I/O points, scalable in 64-point increments	Yes — a VersioBus II I/O network, for an additional 288 I/O points	Yes — a VersioBus II I/O network, for an additional 288 I/O points	Yes — a VersioBus II I/O network, for an additional 288 I/O points
Additional I/O Options	EtherCAT (CoE) I/O devices	Optional AnyWire I/O modules	Networked CANopen I/O modules	None	Optional MECHA-TROLINK II-compatible I/O modules	None	None
Maximum No. of General Digital I/O Points	No reasonable limit	672 (352 inputs, 320 outputs)	480 (384 inputs, 96 outputs)	416 (208 inputs, 208 outputs)	608 (304 inputs, 304 outputs)	288 (144 inputs, 144 outputs)	288 (144 inputs, 144 outputs)
Maximum No. of Analog I/O Points	None	None	None	32 uncommitted analog inputs	None	None	None

The EtherCAT Zero-Hardware Interface System

The EtherCAT interface system is a fast, vendor-independent Ethernet-based realtime open network for servo and I/O communications that works with CANopen over EtherCAT (CoE) servo drives and I/O devices. Up to 32 servo drives (plus additional I/O stations) can be integrated in one network, with a cycle time as fast as 0.5 ms.

This system consists of software and RJ45 Ethernet cables plugged directly into the Ethernet port on the PC, and servo drives connected in a simple, single-line daisy-chain — no hardware is required. Servo drives from different manufacturers can be connected in the same network.
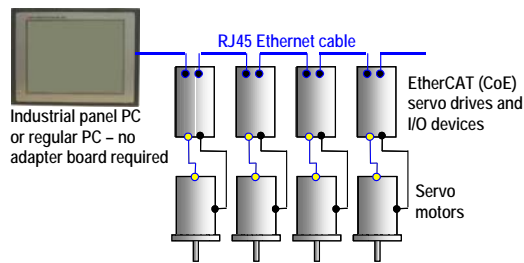
Hardware Connections in the EtherCAT Interface System

The Panasonic Realtime Express Ethernet-Based Interface System

The Panasonic Realtime Express™ (RTEX) interface system runs on high-speed, Ethernet-based digital synchronous servo communications (100 Mbps). This all-digital, minimal-hardware control architecture works with Panasonic MINAS A4N servo drive systems from Matsushita Electric Industrial Co., Ltd. This RTEX servo drive network is paired with an optional VersioBus II fiber-optic communications I/O network.

This system consists of software and a dual-link RTEX PCI adapter board that easily inserts into your PC, and requires no additional proprietary hardware components. The RTEX adapter board connects to the servo network and to an optional I/O network with one or more I/O modules for up to 32 axes of servo control and up to 672 points of general digital I/O.
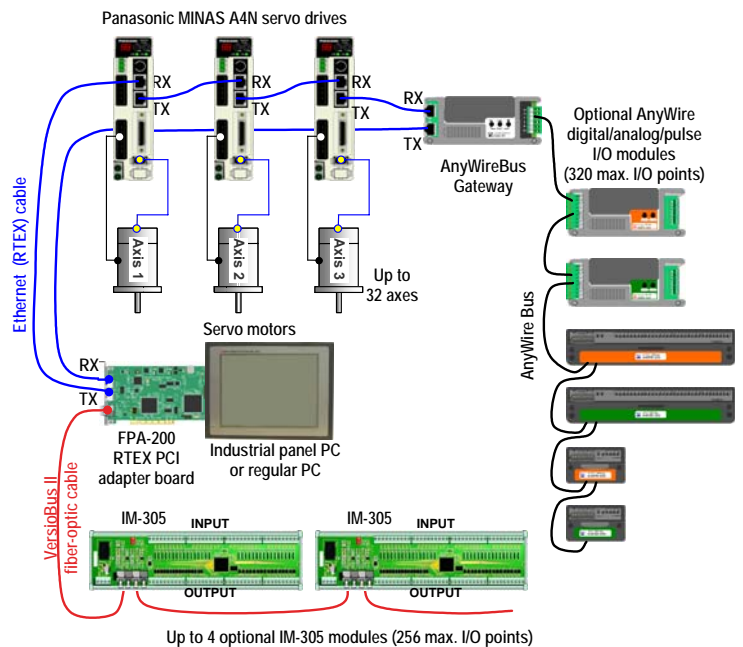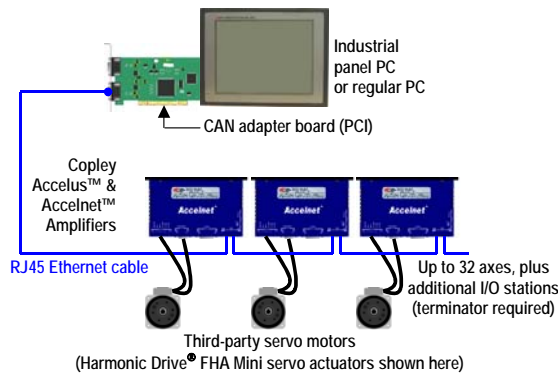

Hardware Connections in the Panasonic Realtime Express Ethernet-Based Interface System

The CANopen Interface System

The CANopen interface system is based on CANopen digital servo communications technology, and works with Copley Control's Accelus™ and Accelnet™ digital servo amplifiers (and third-party servo motors).

This system consists of software a CAN PCI adapter card from Copley Controls. Up to 32 servo drives (plus additional I/O devices) can be integrated in one network, with a cycle time of 4 ms.

**Hardware Connections in the
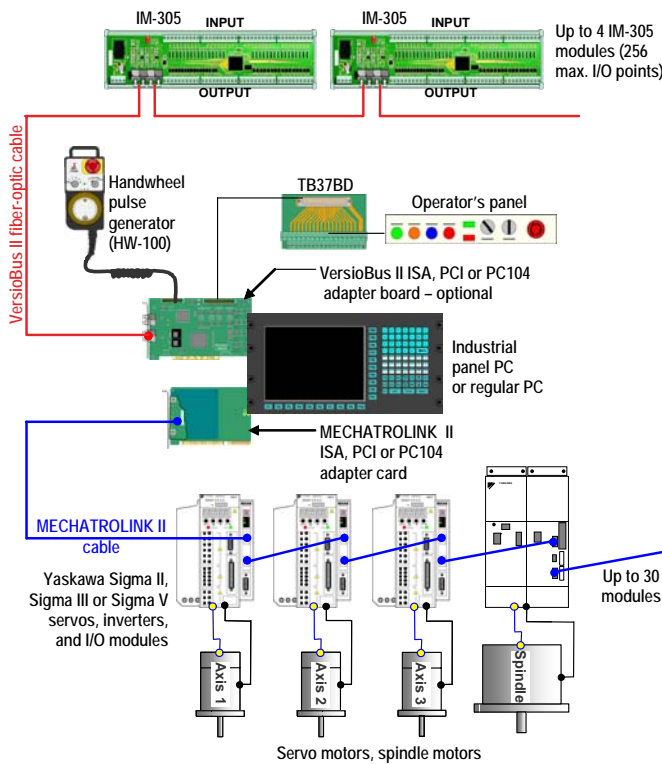CANopen Interface System**

The VersioBus II Interface System

The VersioBus II interface system runs on VersioBus™ II servo and I/O communications. VersioBus II is Soft Servo Systems' proprietary, 5 Mbps fiber-optic digital servo communications technology. This system consists of software, a multi-function VersioBus II adapter board (ISA, PCI or PC104) that is easily inserted into your PC, and one or more universal interface modules and optional I/O modules (connected with VersioBus II fiber optics) for up to 16 axes of servo control and 416 points of general digital I/O.
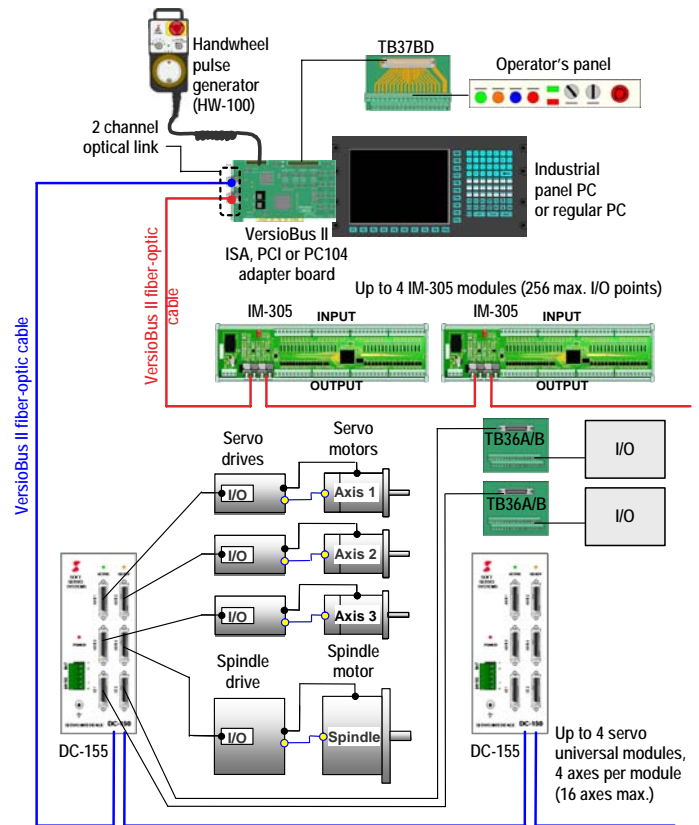
**Hardware Connections in the
VersioBus II Interface System**

MECHATROLINK II Interface System

The MECHATROLINK II interface system is based on Yaskawa's MECHATROLINK™ II [10 Mbps] technology for servo and I/O communications. This market-leading high-performance servo system has an all-digital, minimal-hardware control architecture that works with the Yaskawa family of Sigma II, Sigma III and Sigma V servo drives, inverters and I/O modules, as well as any MECHATROLINK II-compatible devices produced by other companies. This system consists of software and a MECHATROLINK II adapter board (PCI, ISA or PC104) that easily inserts into your PC, and requires no additional proprietary hardware components.
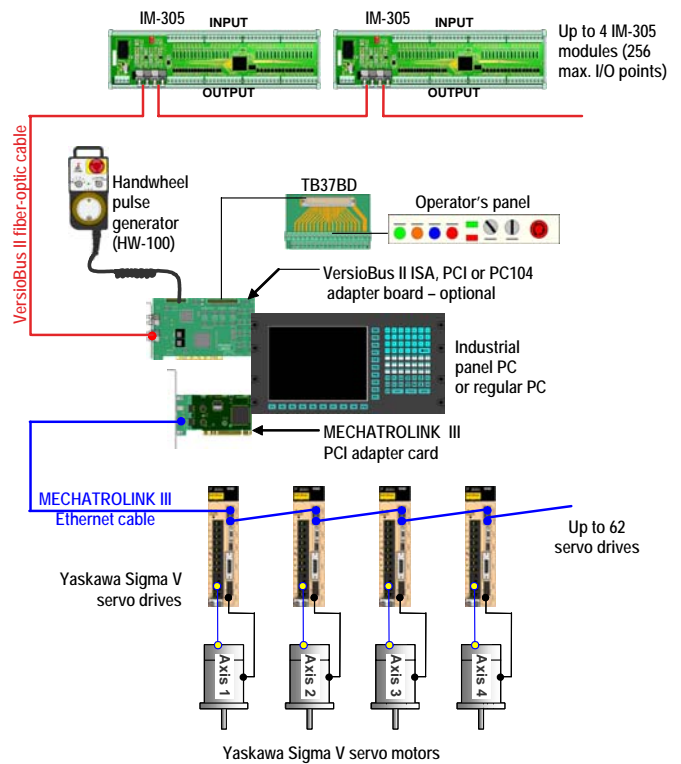
MECHATROLINK III Interface System

The MECHATROLINK III interface system is based on a new 100 Mbps Ethernet-based digital servo communications technology from YASKAWA Electric Corporation that integrates up to 62 stations in one network, using a single Ethernet interface cable and a MECHATROLINK III PC card.

This servo system works with the new Yaskawa family of Sigma V servo motors and amplifiers that represent a massive leap forward in technology from their predecessors, and have many impressive features, such as high performance, speed, accuracy, vibrationless motion, user-friendliness and fast setup times.

This system consists of software and a MECHATROLINK III PCI adapter board that easily inserts into your PC, and requires no additional proprietary hardware components.

**Hardware Connections in the
MECHATROLINK II Interface System**

**Hardware Connections in the
MECHATROLINK III Interface System**

The SSCNET Interface System

The SSCNET interface system is built for SSCNET™ (3.5 ms cycle time) and SSCNET™ II (0.88 ms cycle time) synchronous serial communications from Mitsubishi Electric Automation for 8- or 6-axis control (SSCNET and SSCNET II, respectively). This market-proven, high-performance servo network has an all-digital, minimal-hardware control architecture that works with the Mitsubishi family of MR-J2 Super AC servo drives. This system consists of software and an SSCNET PCI adapter board that easily inserts into your PC, and requires no additional proprietary hardware components.
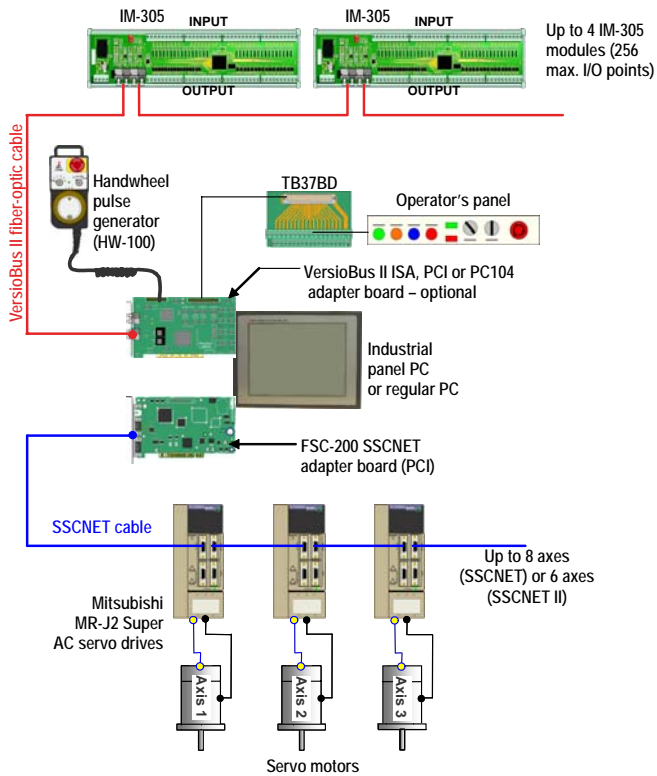
**Hardware Connections in the
SSCNET Interface System**