



Sigma II Servo System

Yaskawa Expands its World with the Sigma II Servo System



- ✓ **FLEXIBLE, OPEN**
- ✓ **DIGITAL, NETWORKABLE**
- ✓ **COMPACT, SIMPLE**
- ✓ **HIGH PERFORMANCE**
- ✓ **RELIABLE, POWERFUL**

of Automation Solutions



World-Renowned
Yaskawa High
Quality and
Reliability,
MTBF Exceeds
400,000 Hours

Open Architecture
Makes Sigma II
Easy to Upgrade
for Future
Requirements

Easy Installation,
Reduced Machine
Setup Time Via
Built-in Auto-tuning

Faster Response in
Your Machine,
400Hz Speed
Response Bandwidth

Smoother
Mechanical Motion
in Your Machine

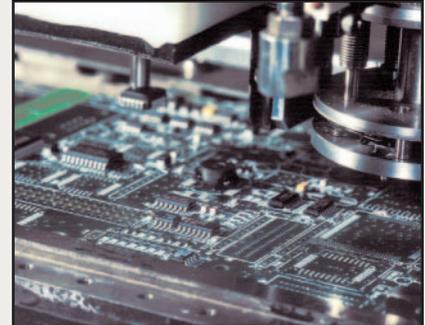
Maximized
Throughput,
Reduced
Operating Costs

Compact Size,
Less Floor
Space Required
for Machines

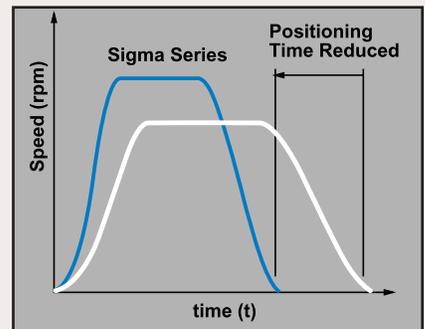


High Performance

Sigma II Servo System offers the highest resolution control even at high speeds, to ensure that your operations will be performed with uncompromising accuracy. The Sigma II system utilizes a high-resolution serial encoder (16,17 bits), with a peak speed of 5000rpm on its SGMAH, SGMPH, and SGMSH servomotor models. 20-bit (1,048,576 ppr) high resolution serial absolute encoders are standard with SGMCS Direct Drive Motors. Torque control accuracy (repeatability) has also been improved from -5% to -2%, through a new vector control system. To improve transient characteristics during motor acceleration and deceleration, the system can be switched between speed loop PI (proportional integral) and P (proportional) control, helping to prevent overshoot and undershoot.



The Sigma II Servo System allows faster positioning time through new upgraded control algorithms which prevent vibration. A mechanical system is modeled to compensate for system delay and suppress vibrations when a machine has a low characteristic frequency. This function reduces the settling time of rigid machinery.

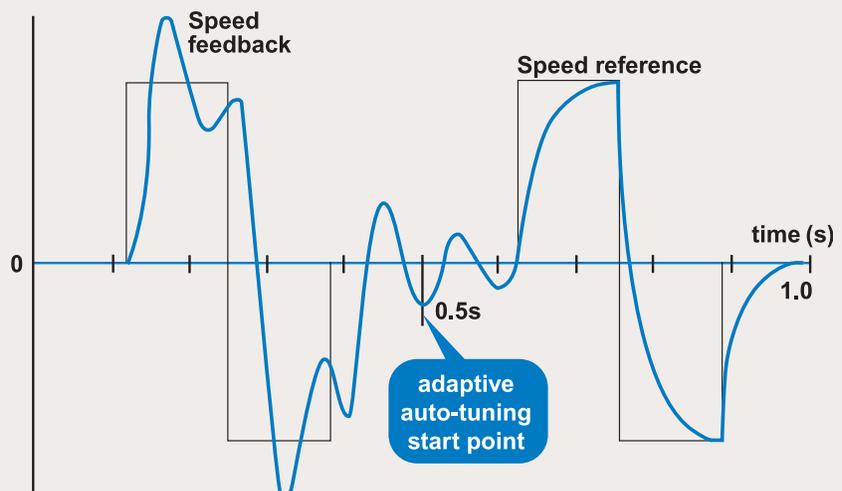


Use of a new speed observer provides smooth motion even at low speeds and shorter position settling time.

User-Friendly Installation

For easier setup, the Sigma II Servo System offers adaptive auto-tuning which eliminates troublesome adjustment. The number of wires needed for setup is reduced by 50%. This is possible by the adoption of a serial encoder. (Absolute encoder reduces 15 wires to 7 wires; incremental encoder reduces 9 wires to 5 wires.)

Thanks to a modular design, setup and operating procedures are identical for all Sigma II Servo models.

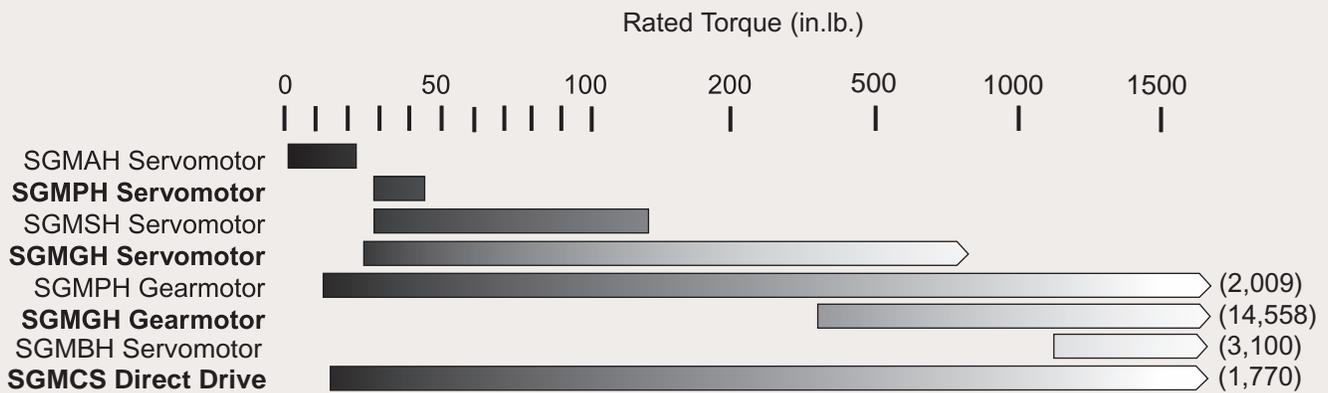


Global Quality Standards

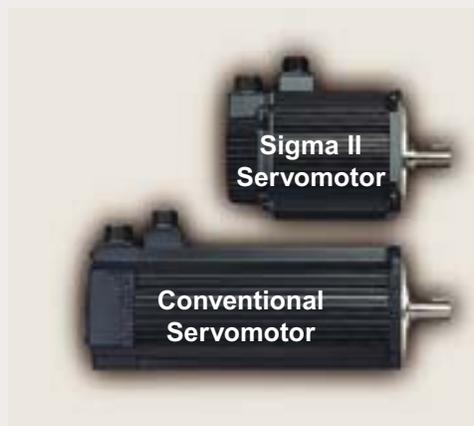
The Sigma II power supplies for the main and control circuits are isolated from each other to provide greater safety and easier maintenance. If an alarm occurs, only the main circuit needs to be shut down. Safety features embedded in Sigma II firmware simplify motion programming. Sigma II safety checks also prevent unsafe boundary conditions for system power components. Coordinated surge current protection for AC rectifiers, power IGBTs, and braking resistors are included with all amplifiers. All Sigma II Servo products are compliant with the following international safety requirements:



Servo Product Range



Sigma II Servo Systems are available in 35 sizes with peak torques of 13.5oz.in. to 14,558in.lb. Whether you require 110VAC single-phase, 230VAC three-phase, or 480VAC three-phase, incremental or absolute encoder feedback, holding brake options or units that fit into a tight mounting space requirement, there is a Sigma II Servo System to fit your needs.



comparison of a conventional servomotor and a Sigma II servomotor

A small package size, ruggedness and reliability are achieved through the use of surface-mount technology and minimal internal wiring in the amplifiers, as well as durable TENV construction in the servomotors. The Sigma II Servo system far exceeds the industry standard dollar per length and power per size class, allowing your factory to achieve maximum performance from a minimum floor space and cost.

Family of Products

Single-Phase SGDH Servo Amplifier

- Seven Sizes: 0.3kW, 0.05kW, 0.10kW, 0.20kW, 0.40kW, 0.8kW, 1.5kW
- Choice of 115VAC or 230VAC, 50/60Hz Single-Phase Input Power.
- Choice of Torque, Speed, or Pulse/Direction, or Network Control.
- Digital Control Loops.
- Surface-Mount Technology.
- Advanced/Digital Control Techniques Including Adaptive Tuning.
- 400Hz Velocity Loop Frequency Response.
- 5000:1 Speed Control Range.



SGMAH Servo Motor

- Six Frame Sizes: 13oz.in., 22oz.in., 45oz.in., 90oz.in., 181oz.in., and 338oz.in., RMS-Torque.
- 5000rpm Maximum.
- IP55 Standard (Excluding Shaft...Optional Shaft Seals Available).
- 13-bit Incremental Encoder (16-bit Absolute Encoder Optional).
- Application Emphasis: High Performance in a Compact Size.

SGMPH Servo Motor

- Five Frame Sizes: 45oz.in., 90oz.in., 181oz.in., 338oz.in., and 676oz.in. RMS-Torque.
- 5000rpm Maximum.
- IP67 Standard.
- 13-bit PPR Incremental Encoder Standard (16-bit Absolute Encoder Optional).
- Application Emphasis: Compact Size, Environmental, Rugged.
- Also available as gearmotor.



Linear Sigma Motor

- Zero cogging coreless linear motors from 140N to 660N force range.
- High force iron-core linear motors from 86N to 6000N force range.
- Unlimited travel length with modular magnet track design.
- Sigma Trac Linear Motor assembly provides easy plug-and-play setup with Sigma II and LEGEND Digital Torque Amplifier.

Three-Phase SGDH Servo Amplifier

- Fifteen Sizes: 0.5kW, 1.0kW, 1.5kW, 2.0kW, 3.0kW, 5.0kW, 6.0kW, 7.5kW, 11kW, 15kW, 22kW, 30kW, 37kW, 45kW, 55kW.
- 230VAC or 480VAC, 50/60Hz Three-Phase Input Power.
- Choice of Torque, Speed, or Pulse/Direction Command Inputs.
- Digital Control Loops.
- Surface-Mount Technology.
- Advanced/Digital Control Techniques Including Adaptive Tuning.
- 400Hz Velocity Loop Frequency Response
- 5000:1 Speed Control Range.



SGMGH Servo Motor

- Ten Frame Sizes: 79in.lb., 122in.lb., 207in.lb., 254in.lb., 404in.lb., 630in.lb., 775in.lb., 1050in.lb., 1550in.lb., and 1988in.lb. Peak Torque.
- 3000rpm Maximum.
- Environmental Rating: IP67 with Optional Shaft Seal.
- 17-bit Incremental Encoder Standard (Absolute Encoder Optional).
- Application Emphasis: General Purpose.
- Also available as gearmotor.

SGMSH Servo Motor

- Six Frame Sizes: 85in.lb., 130in.lb., 169in.lb., 260in.lb., 336in.lb., and 442in.lb. Peak Torque.
- 5000rpm Maximum.
- Environmental Rating: IP67 with Optional Shaft Seal.
- 17-bit Incremental Encoder Standard (Absolute Encoder Optional).
- Application Emphasis: Highest Speed and Cycles per Minute.

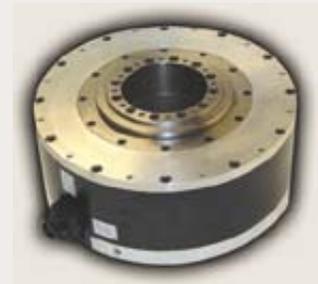


SGMBH Servo Motor

- Five Sizes: 2480in.lb., 2380in.lb., 4170in.lb., 5060in.lb., and 6120in.lb. Peak Torque.
- 2000rpm Maximum Speed.
- Environmental Rating: IP44 with Optional Shaft Seal.
- 17-bit Incremental Encoder Standard (Absolute Encoder Optional).

SGMCS Direct Drive Motors

- Seventeen Sizes Range from 15in.lb. to 5310in.lb. Peak Torque.
- Up to 500 rpm max.
- 20-bit (1,048,576 ppr) Absolute Encoder.
- Application Emphasis: Rotary Table, Automated Assembly, Inspection, Test.



System Flexibility, Product Expansion

The Sigma II Servo System is designed to be a power platform which is flexible enough to accommodate all your future control system requirements.

The modular Sigma II servo amplifier includes add-on application modules such as serial bus, and the new MotionSuite™ MP940 machine controller. This new platform allows add-on external registration and Yaskawa's Mechatrolink digital high-speed network communication.

Sigma II is fully compatible with PLCs, CNCs, indexers, and PC-based machine controllers. Sigma II amplifiers are shipped from the factory preset to speed mode; however torque, speed, position, and network control modes are all configurable to allow independent performance. This all-in-one design offers you unlimited options for controlling your machine.



Option Card for DeviceNet Network Communication (Profibus also available)



SGDH with Mechatrolink Serial Communication Card

For easy installation, all Sigma II application modules simply snap on to the side of the Sigma II servo amplifier of your choice. Application modules available include: Mechatrolink, external full-closed loop interface, MotionSuite™ MP940 Single Axis Machine Controller, DeviceNet and Profibus. Other field bus link technology cards will be available in the near future.

The Sigma II Servo System has a configurable host controller interface which allows configuration of position feedback resolution for precise performance. Adjustment range varies by the encoder used: (16 to 2048 or 16384PPR). New incremental encoder output can replace absolute encoder output for greater position control.

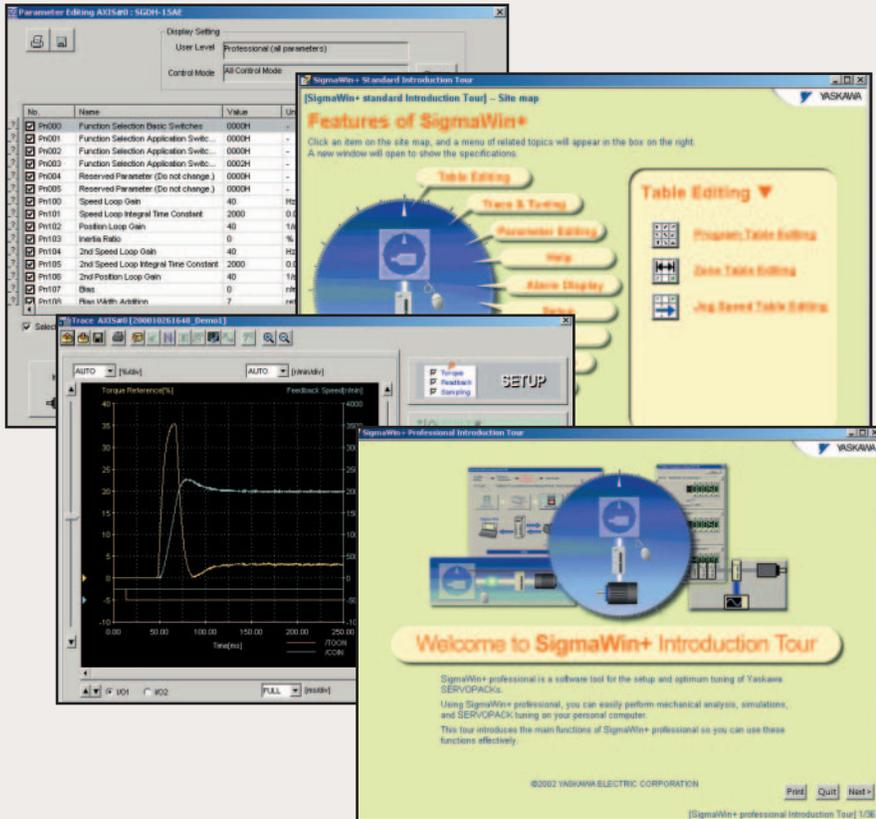
Scalable encoder outputs eliminate the need for external encoders in many applications, to lower your machine cost. Multiple amplifiers can be daisy-chained via serial interface, allowing up/downloading of parameter data as well as transfer of monitoring and diagnostic data to machine controllers.

Single, discrete alarm output or three discrete, coded alarm outputs are also available for easy machine controller interfacing.

Sigma II Servo System provides pulse train and direction inputs for easy integration with existing stepper motor controllers, as well as traditional standard -10V input for either torque or speed reference input.



MotionSuite™ MP940 Machine Controller attached to SGDH



“SigmaWin+” is a new software tool designed to help set up servo applications for the Sigma II Series amplifiers. SigmaWin+ provides a group of tools to simplify setup and operation of applications, for both experienced users of Sigma servo products and novices alike.

SigmaWin+ provides a user-friendly, graphical user interface for setup, control, monitoring, and testing of Sigma II servo systems. All user functions are easy to access and complete on-line help is available in a single keystroke.

- SigmaWin+ s auto-tuning function provides fast and easy optimization of the Sigma II Servo System.
- An on-board oscilloscope provides a graphic view of the system response.
- SigmaWin+ offers real-time monitoring of servo data (I/O, alarms, internal registers, etc).
- For the most complex application requirements, SigmaWin+ offers immediate access to an extensive, context-sensitive help database.

Holding brake logic and timing functions are built-in to the servo amplifier, further simplifying product integration for machines with overhanging loads.

Sigma II amplifiers incorporate electronic motor overload protection, eliminating the wiring of thermistors or external thermal relays.

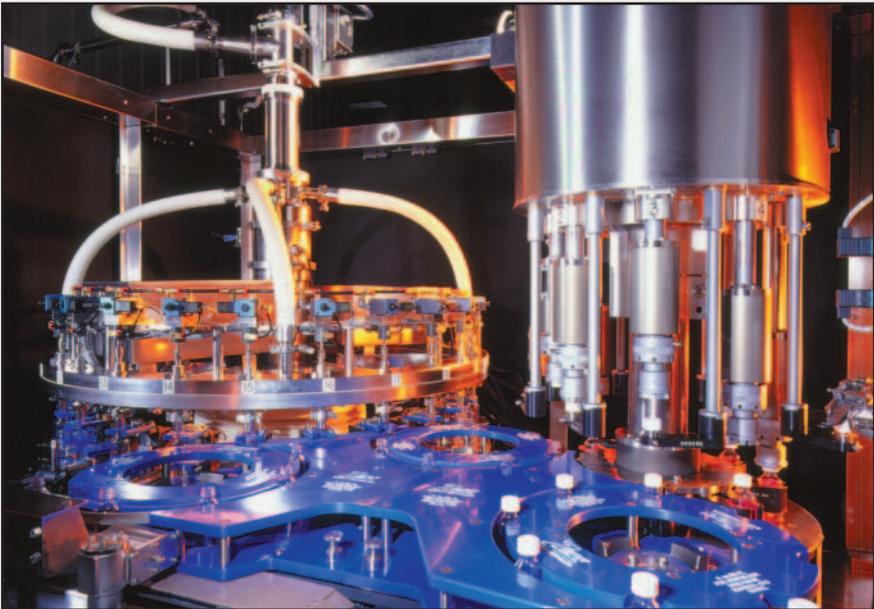
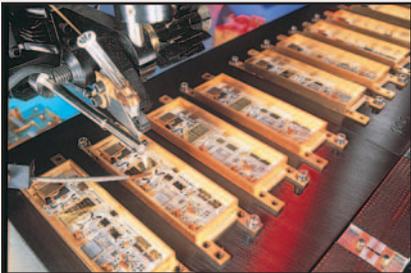
New monitoring functions for Sigma II include a new built-in digital operator interface. Motor type, size, encoder resolution, version number, built-in factory default settings, software versions, and alarm diagnostics are all accessible from the front panel.

A new adaptive auto-tuning function automatically measures machine characteristics (i.e. inertia, mechanical construction, etc.) for optimum tuning.

Analog test ports are available for scope and FFT spectrum analyzers.

An alarm history buffer stores the last ten alarms to simplify troubleshooting and improve system reliability.

Applications



Machine Tool: CNC Work Cells, Lathes, Milling Machines, Spindles, Lazer Cutting, Water-jet Cutting, Work Drive, Wheel Drives, Tapping, Tool Changers, Rotary Indexers, X-Y Tables, Loaders/Unloaders, Part Handlers, Drilling/Tapping, Back Gauging, Precision Grinding and Linear Stages Positioners, Actuators.

Material Handling: PCB Test, PCB Assembly, Coil Winding, Pipe Bending, Metering Pumps, Winder, Unwinder, Screw Feeders, AGV s Fillers, Cappers, Package Sortation,

Pharmaceutical: Test Machines, Fillers, Cappers, Centrifuge, Feeds.

Automotive: Fuel Injection Assembly, Transfer Lines, Robotics, Pick and Place, Index Tables, Slide Drivers, Lay-Down Conveyors, Tire Machines, Conveyors.

Semiconductor: Clean Room Wafer Handling, Rapid Thermal Processing, Wafer Cleaning/Drying, Ion Implanting, Vacuum Wafer Handling, Thin Film Deposition, Chemical Mechanical Planarization, Wire and Die Bonding, Chip Mounters, Crystal Growing, Testing and Assembly.

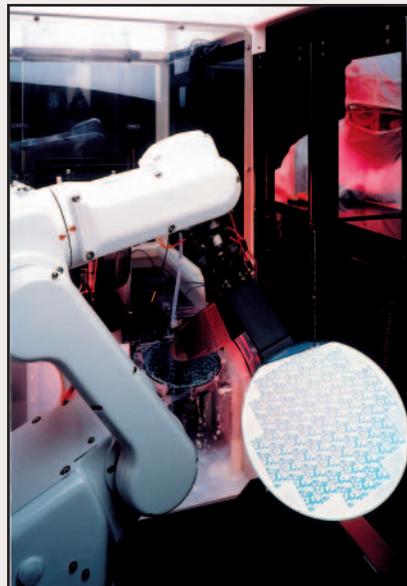
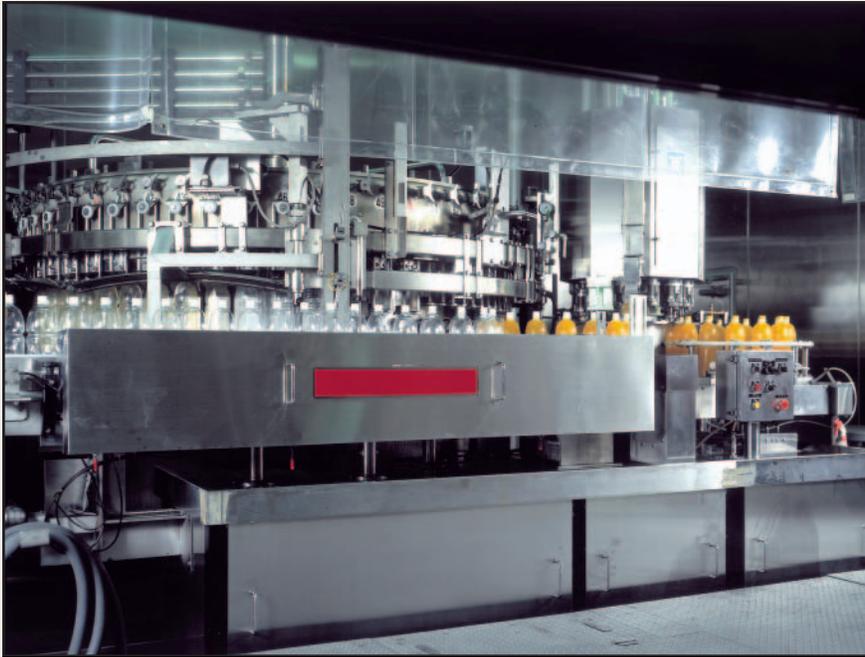
Packaging: Form-Fill-Seal, Wrapping Machines, Case Packers, Case/Tray Formers, Cut-To-Length, Labeling, Bottle Filling, Bag Making, Indexing Conveyors, Slitters, Winders, Sorting/Diverting, Accumulators, Automatic Splicers, Banding, Tray Packers, Box Making, Carton Closers, Thermoforming, Strapping, Laminators, Coupon Insertion, Pouch Forming, Printing Presses, Coating Machinery, Cup Making, Embossing, Extruding, Feeders, Folder Gluers, Cutters and Creasers.

Robotics: Parts Feeders, Contour Gauging, Pick and Place Systems, Synchronized Slave Drives, Articulated Manipulator Arms.

Medical: Diagnostic Test Equipment, Table Positioning, C-Arm Positioner, Bucky Control, Centrifuge, Lens Grinding.

Converting: Embossing, Winder, Unwinder, Indexer, Coating, Metering Pumps, Laminating, Slitters, Edge Guide Systems, Cappers.

Textile: Carpet Tufting, Stitching Machinery, Pattern Sewing, Fabric Cutting, Winders, Unwinders, Extruders, Transverses, Palletizing, Indexing Conveyors. Part Elevators



Specifications

Performance Features

- Speed control range over 5000:1
- Velocity loop frequency response 400Hz
- Continuous motor speeds up to 6,000rpm
- Separate, programmable acceleration and deceleration ramps (up to 10s)
- Overload capacity 300% to 400% for up to 3 seconds
- Integrated holding brake logic
- System efficiency: 95%
- Encoder resolution up to 20-bit (optional absolute)

Amplifier Features

- Analog speed or torque command input or pulse and direction input
- IGBT power circuits
- Sine-coded, pulse width modulated output
- Integrated power supply and bus shunt resistor
- 32-bit microprocessor logic, digital high speed current loop in ASIC
- Advanced adaptive tuning technology
- Convenient PC-based configuration, commissioning and monitoring tools
- Optically isolated 24VDC input/output
- 3 BCD-coded alarm outputs for customer use: 24VDC @ 20mA
- Built-in touch pad operator controls
- Analog speed and torque monitoring outputs
- NEMA 1 enclosure
- Surface-mount device technology
- Ambient operating temperature 0°C to 55°C

- Ambient storage temperature -20°C to 85°C
- Humidity non-condensing to 90%
- Input voltage 100 to 115VAC single-phase +10% to -15% up to 300W, 200 to 230VAC single-phase +10% to -15% up to 800W, 200 to 230VAC three-phase +10% to -15% up to 15kW, 380 to 480VAC three-phase +10% to -15% up to 55kW
- Input frequency 50/60Hz -5%

Amplifier Options & Application Modules

- Connector kits
- Interconnection cables
- MotionSuite™ MP940 snap-on single-axis machine controller
- Pocket-size, digital operator panel
- Sigma Win 100™ configuration and monitoring software
- Various communication cards

Motor Features

- High flux density (Neodymium Iron Boron permanent magnets)
- Coil space factor over 75%
- Resin encapsulated windings
- Motor generated vibration amplitude 15 m or less
- Totally enclosed non-ventilated, ratings from IP55 to IP67 (not including shaft opening)
- Ambient operating temperature 0°C to 40°C
- Ambient storage temperature -20°C to 85°C
- Humidity non-condensing to 90%
- Altitude to 3300 ft, higher by de-rating

Motor Options

- Shaft seals
- Absolute encoders
- 24VDC holding brake
- Gear box

Protective Functions

- CPU fault monitor
- Connection error checks, open input phase, motor phasing, encoder wiring
- Encoder diagnostics
- Erroneous parameter diagnostics
- Over-current alarm
- Electronic motor overload protection
- Overload versus time monitor (I²t)
- Regeneration error
- Over-speed detection (asserts at 20% above maximum speed)
- Runaway prevention
- Fault history up to 10 faults

Quality Assurance

- Amplifier MTBF exceeds 400,000 hours
- All printed circuit boards are burned in for 96 hours at 85°C
- Printed circuit boards are tested via computerized test equipment
- Equipment tested under full load prior to shipment
- Amplifiers and motors are UL, cUL, CE, and TUV compliant
- ISO 9000 manufacturing

Value-Added Components



AC Servo Gearmotors

For applications requiring higher torque capacity and reduced reflected inertia, a gearmotor may be selected instead of a standard servomotor for your Sigma II Servo System. Sigma II AC servo gearmotors provide the highest torque power with the shortest overall length, further maximizing your machine performance. Gearmotors are pre-engineered and pre-assembled to provide a high quality, convenient solution.

Sigma II gearmotors are available from 40.9 to 14,558in.lb. peak torque. Standard ratios are 5, 10, 25, 50 and 100. Gearmotors include a single, high resolution incremental encoder. An absolute encoder and holding brake are also available options for all gearmotor models. Easy to install plug-in connectors are standard. Pre-wired and feedback cables are available to facilitate setup.

Manuals & Reference

All Sigma II motors and amplifiers are shipped with easy-to-understand user's manuals available in the language of your choice. All technical documents are written by Yaskawa engineers and technical writers to ensure accuracy and clarity of product information. Catalogs and various supplemental brochures are available upon request in either hard copy or electronic file format.



Cables & Connectors

Yaskawa supplies all necessary cables and connectors for its Sigma II amplifiers and motors. Most pre-wired cables are available in five different lengths. If special applications require non-standard cable lengths, a Yaskawa cable kit may be selected, allowing you to create your own custom lengths. Yaskawa Technical Support engineers are also available for additional installation support. All pre-wired cables and cable kits meet UL, cUL, and CE requirements.

Technical Support & Service



Sigma II Training

Yaskawa offers a comprehensive Sigma II Servo System technical training program emphasizing "hands-on" learning. Class sizes are limited in order to provide personal attention to each student. Instructors are degreed engineers with a breadth of motion control experience. Classes are held monthly at training locations across the country and are priced well below the industry average. The class schedule can be obtained from our web site at www.yaskawa.com or by calling 1-800-YASKAWA.

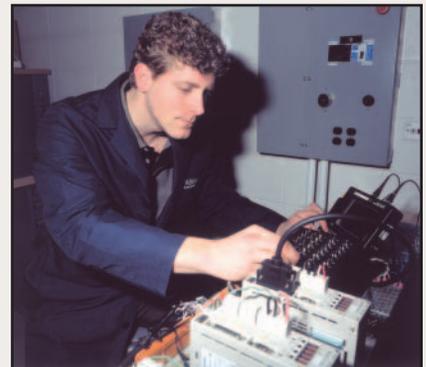
Product Availability

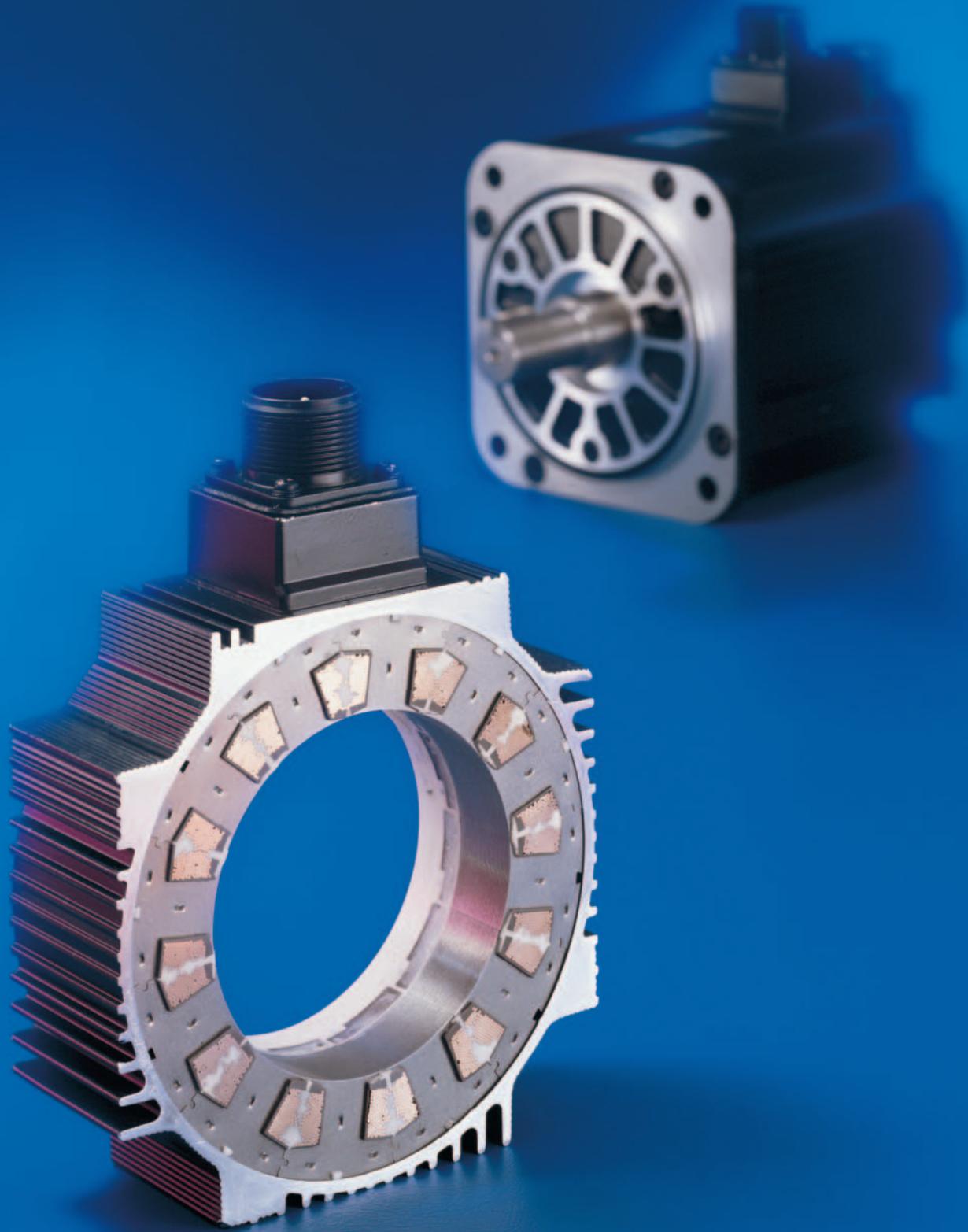
To ensure prompt product availability and support, Yaskawa has made a commitment to assemble and modify Sigma II products at its manufacturing facility in North America. An extensive inventory including peripheral devices is maintained. Thanks to the increased capability of the Sigma II amplifier, optimum inventory levels are easier than ever to achieve. A repair exchange program allows customers to trade in damaged parts for new repaired parts. The Yaskawa Asset Management program also gives customers the opportunity to store spare parts at their facilities, obligated only to purchase on an as-needed basis. These customer empowerment programs help maximize system up-time and factory productivity.



Local Application Support

Yaskawa's network of field engineers is available nationwide to assist with installation and troubleshooting of complex Sigma II applications. Our field engineers are certified motion control specialists with many years of experience. For immediate application assistance and technical questions, our **1-800-YASKAWA** call center offers friendly, knowledgeable service 24 hours a day, 7 days a week. Sigma II Servo System users are never more than a phone call away from reliable technical support.





Commitment to Quality

The Sigma II Series Servo System is a product of Yaskawa's rigorous quality assurance (QA) standards, combining leading edge technology, unsurpassed performance and user-friendly application with absolute reliability.

Yaskawa consistently applies quality control (QC) and reliability control (RC) methods across the company's operations, beginning with product planning and design and extending to order entry and after-sale service.



During the production process, Yaskawa assures product quality by utilizing the techniques of statistical quality control (SQC). Because of its outstanding achievements in quality assurance, Yaskawa is the first manufacturer specializing in industrial electronic equipment to win the prestigious **Deming Application Prize**.

Founded in 1915, Yaskawa is a global leader in the research, development and manufacturing of industrial and commercial products.

Today, this includes AC servos such as the Sigma II Servo System, machine controllers, AC inverters, CNC control systems, industrial robots, PLCs, process computers, and AC and DC motors.

Yaskawa is an **ISO 9000** certified company.

Yaskawa... A World of Automation Solutions



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