At-A-Glance

- Designed to control high speed multi-axis production machinery.
- Ideal for web control, synchronized cut-off, form-fill-seal, cut and seal, punching and forming applications.
- For use in the manufacture of metal, plastic, paper, and film products.
- Control up to 32 servo axes using SERCOS III, a deterministic Ethernet device network with scan rates of 250 μsec minimum.
- SERCOS II automation network option is also available.
- Select from a wide power range of servomotors and inexpensive matching servo drives.
- Access and control up to 512 digital and analog I/O points.
- Industrial Ethernet TCP/IP Connectivity
- DeviceNet Connectivity
- Serial Communication Ports
- Inexpensive software tools for application development and system commissioning.

Select from a wide range of Servo Motors

Industrial Indexing Systems, Inc.
www.iis-servo.com
(585) 924-9181
Emerald Automation Controller

Overview
The Emerald Automation Controller is an open architecture high performance multi-axis motion controller designed for demanding applications that require close synchronization of up to 32 servo axes, I/O and auxiliary equipment. The Emerald Automation Controller is powerful enough to execute all of the control functions required in a production environment, thus eliminating the need for additional control devices such as a PLC.

Emerald motion control technologies include indexing, positioning, complex motion trajectories, high speed registration, electronic gearing, electronic cams and programmable limit-switch functions.

Emerald Motion Language™ (EML) developed specifically for high performance automation systems, along with the Emerald Development Environment™ (EDE) programming tools, provide all that is needed to produce quality application programs for today’s advanced systems.

Real-time Process Environment
Now designers can setup their own real-time configuration for their application using powerful “Event Interrupts.” The Emerald Automation Controller defines events as the real-time response to changes of a device state. During the controller configuration process, events are mapped to application software routines designed to perform an immediate action to satisfy the needs of the event. An event can be the result of any change in the state of any input or output device, servo drive status, timers and internal flags.

Motion Functions
- Positioning -- absolute and relative
- Indexing -- linear and rotary
- Synchronizing motion to a registration mark
- Homing or search for the home position mark
- Jogging in the CW or CCW direction
- Acceleration/deceleration profile shapes (trapezoidal, S-curve, or a custom profile)
- Electronic gear ratio between a master encoder and motor, or motor to a motor.
- Versatile slave to master locking methods that are analogous to a mechanical clutch, but are programmable.

Programmable Limit Switches (PLS)
Any digital output can be configured as a programmable limit switch. A programmable limit switch is defined as an output that will turn off and on at the required angle positions of a master rotating source such as a motor or encoder. Once configured and enabled by the application, the PLS function operates as an independent process in a real-time environment. Up to eight PLS engine-tasks can be operating simultaneously, each PLS engine controlling up to 16 outputs.

Master/Slave Lock and Unlock Functions
Multiple methods are available for locking a slave function to a master position vector. Slave functions include electronic cams, electronic gear ratio, and the PLS.

External Memory
For convenient machine configuration and setup, the Emerald Automation Controllers use SD and SDHC memory cards to hold backup files for the operating system firmware and application programs.
Ethernet Connectivity
Standard TCP/IP port for Ethernet communication with various industry protocols provide a high speed link to factory networks, PLCs, and HMI devices.

Master Encoder Input Connector
Digital input port provides line shaft encoder interface for synchronizing the entire automation system.
- Two quadrature A and B channel inputs, with a Z-index input, will interface to industry standard encoder devices.
- An additional high speed input, to access the position trap circuit for sensing a registration mark position, is standard.

DeviceNet
Universal connectivity network for interfacing to auxiliary devices ranging from simple temperature sensors and controls to sophisticated robotic systems. DeviceNet slave interface is standard, master is optional.

Rs232 Comm Port
Serial interface port available to the application program to access external text displays and color touchscreens.

USB 2.0 Port
Executive Serial Port for software development and firmware updates from a PC.

Specifications
- Size and weight: 150 x 40 x 100 mm, 1.2 kg
- Power requirements: 24 Vdc, 500 milliamps
- Operating environment:
  - -10º to 55º C Ambient
  - 10% to 90% RH Non-Condensing
- Storage environment:
  - -10º to 65º C
- Processor and memory:
  - Processor: 756 Mips, 32 bit bus
  - External memory: SD card slot up to 4G bytes
  - Internal memory: 8 Mbytes of DRAM w/NOR flash
- Interfaces:
  - SERCOS III: 100 Mhz, 32 devices
  - SERCOS II: 16 Mhz, 32 devices
  - Ethernet: 100 Mhz, TCP/IP
  - USB / Rs232: 115,000 / 38,400 Baud
  - DeviceNet slave: 500 kbaud, 64 devices
  - DeviceNet master*:
    - 4 Mhz input, quadrature
- Indicators:
  - Visual: Built-in 7 segment display, Network status indicators
  - History view: 31 Diagnostic states with alarm storage history

I/O capacity
- Digital points: 256 Inputs, 256 Outputs
- Analog points: 32 Inputs, 16 Outputs

Ordering Guide
- SERCOS III controller: EMC-2100S3
- SERCOS III controller/DeviceNet master: EMC-2100S3S
- SERCOS III network cable: ECC-ENA101
- SERCOS II controller: EMC-2100S2
- SERCOS II controller/DeviceNet master: EMC-2100S2S
- SERCOS II network cable: C-753001.5
- Ethernet Cat5 cable (1 meter): ECC-ENA101
- USB A/B cable (1 meter): ECC-USB101
- Rs232 comm cable: C-987010
- PC comm 9-pin adapter: C-822000
- Master Encoder (2048 ppr)**: THA-2-2048
- Master Encoder (4096 ppr): THA-2-4096
- Encoder Cable (YYY is length): C-300YYY
- Interface Adapter: INT-810
- Memory Card: EMM-SD2G
- Development Software: EDE v3.06 or later

* DeviceNet master is optional, ** Other line counts are available

Status Indicator
Seven segment display provides a quick visual indication of real-time operating status.

SERCOS Master Interface
Two SERCOS interface options are available for the Emerald Automation Controller.
- **SERCOS III Automation Network** -- High speed Ethernet based deterministic network with a four-fold improvement in update rates over the SERCOS II network. SERCOS III gives an increased response to the real-time servo drive functionality and associated I/O devices.
- **SERCOS II Automation Network** -- A fiber optic cable network option is available for compatibility with our Emerald Drive series of servo products. Users of a SERCOS II network will see an increase in processing power over the legacy EMC-2005 controller model.
Emerald Motion Technology Overview

The heart of a multi-axis automation system is the ability to synchronize the motion of multiple motors to a designated “master” source device. Depending on the machine application, a source device may be an encoder device measuring web travel, position feedback from another motor that is driving a feed roll, or an Emerald Virtual (software) Motor. A Virtual Motor provides a software-configured internal master source with control over its virtual distance, speed and acceleration.

Synchronization between the source device and a servomotor is achieved using the Emerald electronic gear ratio or electronic cam motion functions. The process starts by locking the master source device to the slave servomotor. How the source device gets locked to the servomotor is critical especially when the source is running. The Emerald Automation Controller provides eight lock methods for smooth and accurate transition regardless of the speed of the source. The source device and the lock method are specified first. Then, the lock control is enabled to start the synchronization process.

Digital outputs are synchronized to a master source using the programmable limit switch (PLS) function. Up to eight independent PLS engines can be enabled with each engine controlling the action of sixteen outputs. Digital outputs can be located on the servo drive or on the SERCOS network using 3rd party I/O interface blocks.
Sealing and Perforating
The Emerald Automation Controller coordinates the feed rolls on a system built to synchronize a web of the printed bags under a servo actuated knife. The knife will seal and perforate each bag before rewinding the web onto a takeout roll. A registration sensor reads the imprint on the web and uses the feed axis to adjust the position of the image under the knife to assure the bag will only seal in-between the images.

Rotary Knife Cutting
Feed rolls move a ribbon of sheet metal with printed labels under a rotary knife to be cut into individual sheets with the labels centered. A double cut action is performed using switched cam functions available in the Emerald Automation Controller. The registration sensor connected to the high speed trap input measures the label position relative to the knife edge. An electronic cam table is adjusted accordingly, either to advance or retard the knife’s position for the first cut. The cam table is switched for the second knife cut that determines the exact length of the sheet.

The Emerald Automation Controller provides all the necessary functionality to perform contoured cutting or marking with a G-Code conversion utility using DXF file information to produce electronic cam tables for the X and the Y axis.

Using a Virtual Motor as a master source to synchronize cam tables for the X and Y axis, patterns are produced on the x-y plane of a Cartesian assembly. The Z axis is used to control the instrument for marking, cutting, perforating, or sewing a variety of materials.

The operator interface is a PC with CAD programming software for pattern development teamed up with a Visual Basic program using the DLL provided by IIS to connect to the Emerald Automation Controller.
Emerald SERCOS III Drive Overview

X-Series Servo Drives with SERCOS III
IIS offers a full range of servo drives employing the newly introduced Velconic hi-speed digital hardware by Toshiba Machine providing precise control of velocity and torque. Now with the SERCOS III interface option available from IIS, the X-Series drive can be used in the high performance multi-axis automation systems using the new Emerald Automation Controller. A full complement of servo motors are available ranging from 30 watts to 55K watts.

With the SERCOS III option installed, the following on-board I/O points are mapped into the SERCOS network update process making the I/O available to the Emerald Automation Controller every SERCOS III network scan time.

- Digital inputs (8), 1 dedicated, 7 general purpose
- Digital outputs (5), all general purpose (24v 50ma)
- Analog inputs (2), 12 bit +/- 10 volts, all purpose
- Analog outputs (2), 12 bit +/- 10 volts, all purpose
- Auxiliary encoder interface (A-B channel)

A separate control power input, allows the X-Series drives to communicate on the SERCOS III network when main power is removed thus keeping access to vital status information available to the Emerald Automation Controller.

Three feedback interface options are available:

- Enhanced Resolver (24,000 ppr)
- 17 bit Absolute Encoder (131,765 ppr)
- Multi-turn Absolute Resolver (24,000 ppr)

Four modes are available for tuning the servo motor to the mechanical load using the PC based tools:

- Real-time continuous tuning
- Semi-auto tuning mode
- Standard tuning mode
- Manual input tuning mode

Servo motor features include:

- Low inertia high torque motors for quick response and frequent repetitive motion (Type A)
- Medium inertia motors for applications that require stable velocity and rigid shaft control (Type B)
- Compact motors with small weight and quick response (Type C)
- Large capacity motors with maximum torques up to 526 Nm at 2200 rpm (Type D)
## Toshiba Servo Motor Overview

For motor feedback selections, in-line holding brakes, connector/cable options and mechanical dimensions for these servo motors and X-series drives please refer to the Toshiba catalogs available on our web site or by requesting them from our office.

### Metric to English conversion key:
- $8.85 \text{Nm} = \text{in-lbs}$
- $0.03937 \text{y mm} = \text{inches}$

### Toshiba Servo Motor Specifications

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Emerald SERCOS II Drive Overview

The Emerald Series servo drives and motors use the latest servo technology to bring cost effective solutions to the automation market. The wide range of sizes and feature rich functions make the Emerald servo drive the most versatile servo system in today's automation market. State of the art software minimizes hardware cost while maximizing features and performance.

The Emerald servo drive is a certified SERCOS II drive designed to integrate with any industry standard SERCOS II controller. The SERCOS II standard forms a fiber optic isolated network and when interfaced to the IIS Emerald Automation Controller, this drive is part of a network of up to 32 servo drives or I/O devices with a minimum 500 micro-second scan rate.

The Emerald Servo Drive is available in 7 size ranges: 5, 10, 20, 40 and 60 amp @ 220 VAC and 25 and 50 amp @ 440 VAC. Emerald servo motors are available from 400W to 21kW, 1500 to 3400 RPM rated speeds with low and medium rotor inertia versions.

Emerald Drive features:
- Analog I/O, one +/- 10 volt input and one PWM style output
- Auxiliary encoder, ABZ RS422 interface with an optional resolver interface also available.
- Two high-speed position “trap” inputs for storing encoder position relative to a sensor to provide web or product registration functions.
- The Extended I/O bus will interface up to two Emerald 16 position I/O racks (ESD-I016) providing an additional 32 I/O points per drive. Two rack types are available to meet AC, DC, low voltage, and high voltage requirements. All drive I/O become instantly available to and controlled by the automation controller on the SERCOS II Network.

- Seven segment status display.
- Watchdog timer with safety loop contact for external shut-down control.
- High-speed DSP microprocessor for position, velocity and torque loop control.
- Selectable current loop switching frequency; Choose the 16 KHz frequency when maximum performance and minimum audible noise is required or choose either 4 or 8 KHz for maximum power.
- USB port for easy interfacing to laptop PC for drive diagnostic and setup procedures.
- Designed to operate at temperatures of up to 55°C at full rated power.
### IIS Servo Motor Overview

<table>
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<tr>
<th>Type</th>
<th>Frame Size</th>
<th>Shaft Dia.</th>
<th>Pilot Dia.</th>
<th>Power</th>
<th>Speed Rated</th>
<th>Torque Rated</th>
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<th>Torque Max</th>
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</table>

**Type A**  Low inertia, high torque motors for quick response and frequent repetitive motion.

**Type B**  Medium inertia motors for applications that require stable velocity and rigid shaft control.

**Type C**  Compact motors with small weight and quick response.

**Type D**  Heavy-duty motors with maximum torques of 298 Nm up to 2400 rpm.

**NOTE:** Additional motors sizes and styles are available but are not listed in the table above. Please call or e-mail us if you have other requirements like wash-down, explosion-proof, and stainless servo motors. Servo rated gear-boxes are available for any servomotor we offer. Free motor sizing software is available.

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Metric to English conversion key: 8.85[Nm] = in-lbs  0.03937[mm] = inches
Various I/O blocks are available for a full complement of digital and analog inputs and outputs for both the SERCOS III and SERCOS II Networks.

DINT-300 Breakout terminal strip for input and output connections on the Toshiba SERCOS III drives.

Encoders, cables and breakout assemblies are available for the Master Encoder interface port on the Emerald Automation Controller. The THA-2-4096 encoder with cable and the INT-810 terminal breakout are shown. Various encoder line counts are in stock.

The IPS-24 is a 24 volt dc power supply for I/O and controllers are available in various capacities.

Our pre-sales support team will help specify servo-rated gearboxes for light duty or heavy-duty applications that will match the servo motor for the best system performance, guaranteed.

Made-to-order and stock servo motors are provided for standard and severe duty, stainless wash-down, and explosion proof applications.

The ESD-ACE and the ESD-ACR modules are used to provide position loop control for analog interface drives on the SERCOS II network. Mainly used to replace position loop functionality of the legacy MSC-250 and MSC-850 controllers, the DIN-rail mountable ESD-ACR modules are used in new designs where a resolver is used as a master source device or where an interface to an adjustable speed drive is required on the network. For encoder feedback position loops, use the ESD-ACE module.

The ESD-ACE and the ESD-ACR modules also include the hi-speed position trap input, a holding register for registration applications, and a general purpose 12 bit analog output.
Servo Motor Sizing
Servo motor selection starts with a complete description of the mechanical system entered to the Servo Mechanical Analysis (SMA) software.

The resulting analysis shows all performance data for the motor and drive package selected from our database. Free pre-sales support is always available to assist you in the selection of the motor and drive.

Menus for the basic types of systems are provided for analyzing ballscrew, conveyor, chain, and feedroll systems.

Application Development
The Emerald Development Environment (EDE) provides project management utilizing a system component configuration window to manage all the drives, I/O devices and files used in an automation system.

The EDE provides a debugging window for program development support. Watch data values, trace the program flow and view network device status in real-time.

Commissioning Support
Two software tools are available for setup and tuning the motor-drive system. ShanX for the SERCOS III Toshiba drives and eDrive for the SERCOS II Emerald series drives.

Real-time scope functions display the motor velocity and torque responses to assure the required motor response is achieved.

Once the motor and the drive are installed you can fine tune the motor’s response by adjusting the servo loop parameters for maximum performance.

The EDE program code editor is content sensitive and easy to use. The Emerald Motion Language (EML) is a straightforward language that uses a standard structure with mature functions tailored to the real-time aspects of motion control.

Menus from the configuration window allow you to select and configure all the devices in your system for fast and easy setup.
Team IIS

Our objective is to bring state-of-the-art servo system products to practical use on the factory floor. Whether it is a complete turnkey system or servo components, IIS’ commitment to quality products and personalized support is unsurpassed. Our business philosophy is pretty simple. We take responsibility for everything we sell. By doing that we make a long-term commitment to our customer’s success.

Headquarters in Victor NY

To accommodate the steady growth we’ve enjoyed over the years, our facility has been expanded several times to its present 17,000 square foot capacity. This location houses all critical departments - Sales, Marketing, Applications Engineering, R&D, Production, Warehouse, Panel Shop, Quality Control and Customer Support. Having everything under one roof speeds communications and provides better service to our customers.

Sales Representatives for Industrial Indexing Systems

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(585) 924-9181

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