Sigma-5 Servo Family

50W to 15kW
1.6 kHz Bandwidth
Advanced Autotuning
Vibration Suppression
Sigma-5 SERVOPACKs

System Performance

With an industry best frequency response of 1.6kHz, Sigma-5 SERVOPACKS can slash settling time to under 4 ms.

Benefit of Reduced Settling Time

Pick and Place Example with 50 ms Settling Time

<table>
<thead>
<tr>
<th>Axis Length</th>
<th>Move</th>
<th>Settle</th>
<th>Move</th>
<th>Settle</th>
<th>Time Per Part</th>
<th>Parts Per Minute</th>
<th>Parts Per Hour</th>
<th>Price Per Part</th>
<th>Revenue Per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>X = 200 mm</td>
<td>0.5 s</td>
<td>0.05 s</td>
<td>0.5 s</td>
<td>0.05 s</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Z = 100 mm</td>
<td>0.2 s</td>
<td>0.05 s</td>
<td>0.2 s</td>
<td>0.05 s</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Total</td>
<td>0.7 s</td>
<td>0.1 s</td>
<td>0.7 s</td>
<td>0.1 s</td>
<td>1.6 s</td>
<td>37.5</td>
<td>2250</td>
<td>$0.1</td>
<td>$225.00</td>
</tr>
</tbody>
</table>

Pick and Place Example with 4 ms Settling Time

<table>
<thead>
<tr>
<th>Axis Length</th>
<th>Move</th>
<th>Settle</th>
<th>Move</th>
<th>Settle</th>
<th>Time Per Part</th>
<th>Parts Per Minute</th>
<th>Parts Per Hour</th>
<th>Price Per Part</th>
<th>Revenue Per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>X = 200 mm</td>
<td>0.5 s</td>
<td>0.004 s</td>
<td>0.5 s</td>
<td>0.004 s</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Z = 100 mm</td>
<td>0.2 s</td>
<td>0.004 s</td>
<td>0.2 s</td>
<td>0.004 s</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Total</td>
<td>0.7 s</td>
<td>0.008 s</td>
<td>0.7 s</td>
<td>0.008 s</td>
<td>1.416 s</td>
<td>42.37</td>
<td>2542</td>
<td>$0.1</td>
<td>$254.24</td>
</tr>
</tbody>
</table>

Revenue Per Hour $29.24
16 Hours $467.84
6 Days $2,807.04

Simple Tuning

How many times have you heard people say that servos need adjustment to work well? Sigma-5 SERVOPACKs feature a “tuningless” function that allows them to work as soon as they are installed. And if you want even more performance, “advanced autotuning” and “one-parameter” tuning functions allow you to accomplish it rapidly.

Get up and running quickly
New "Tuningless" Function

The new “tuningless” function automatically adjusts for changes in load to rotor inertia mismatches up to 20:1.

Setting time: 100 to 150 ms range

Minimize setting time with less vibration
New "Advanced Autotuning"

The advanced autotuning function automatically adjusts nearly 20 gain and filter parameters, including new feed-forward gain and friction compensation.

Setting time: 10 ms range

Fine-tuning is a must
New "One-Parameter" Tuning

Fine-tuning can tweak machine performance even further.

Setting time: 0 to 4 ms range
**Enhanced Vibration Suppression**

Existing functions to minimize vibration have been enhanced, and new ones added, improving tracking and further improving settling time. Vibration and noise during operation have also been reduced, along with vibration when stopping, resulting in very smooth edges of machined parts.

**Faster Setup: SigmaWin+ Setup Software**

**Setup Wizard**
Guides you through application-specific parameter configuration

**Wiring Check Function**
Verifies all input and output wiring on one screen

**Trace Function**
Provides high resolution graphical feedback of motion and I/O (as low as 125 μs sample time)
Sigma-5: Wide Variety of Servo Motors

**Rotary Servo Motors**

Sigma-5 rotary servo motors feature a wide range of outputs from 50W - 15kW. Both low and medium inertia models are available with 20-bit absolute encoders standard on all models.

**SGMJV Series**

- Medium Inertia
- Instantaneous Peak Torque (350% of rated torque)
- 20-Bit High Resolution Serial Encoder
- Maximum Speed: 6,000 RPM
- 50W-750W Capacity
- Enclosure: IP65 (excluding shaft)
- 200V

**SGMGV Series**

- Medium Inertia
- 20-Bit High Resolution Serial Encoder
- Maximum Speed: 3,000 RPM, (2000 RPM at 11 kW and 15 kW)
- 300W-15kW capacity
- Improved 5G Vibration Tolerance
- Enclosure: IP67 (excluding shaft)
- 200V and 400V

**SGMAV Series**

- Low Inertia
- Instantaneous Peak Torque (300% of rated torque)
- 20-Bit High Resolution Serial Encoder
- Maximum Speed: 6,000 RPM
- 50W-1.0kW Capacity
- Enclosure: IP65 (excluding shaft)
- 200V

**SGMSV Series**

- Low Inertia
- 20-Bit High Resolution Serial Encoder
- Maximum Speed: 5,000 RPM (6000 RPM at 1.0 kW)
- 1.0kW-7.0kW Capacity
- Enclosure: IP67 (excluding shaft)
- 200V and 400V
Linear Servo Motors

All Yaskawa linear servo motors feature plug-and-play connection with Sigma-5 SERVOPACKs through use of automatic motor recognition and serial encoder technology. Yaskawa’s linear servo motors are supplied as components or as integrated linear slides.

**SGLG Series: Coreless**

- 11 available models with speeds up to 5 m/s
- Direct-feed mechanism for high speed and high precision positioning
- Lack of magnetic attraction force helps extend the life of linear motion guides and minimizes noise
- Zero cogging for minimal force ripple

**SGLF Series: Iron Core**

- 8 available models with speeds up to 5 m/s
- Direct-feed mechanism for high speed and high precision positioning
- Magnetic attraction force between moving and stationary members can be used to increase rigidity by preloading the linear motion bearings
- Magnetic preloading can increase system response, improving deceleration and settling times

**SGLT Series: Balanced Iron Core**

- 14 available models with speeds up to 5 m/s
- Direct-feed mechanism for high speed and high precision positioning
- Balanced design negates the effects of magnetic linear attraction force between motor components
- Lack of magnetic attraction extends life of linear motion guides and minimizes noise

**Direct Drive Servo Motors**

- Directly Coupled to a Load Without a Mechanical Transmission Such as a Gear
- Small and Medium Capacity
- High Resolution Serial Encoder: 20 bit
- Powerful and Smooth Operation Throughout the Speed Range from Low to High
- Maximum Speed: 500rpm
- 6 to 600N-m Peak Torque
- Hollow core for wiring and piping
- Enclosure: IP42 (excluding shaft)
Network Communications

Sigma-5 SERVOPACKs are offered with three different communications options,
• Analog Voltage/Pulse Train Communications
• MECHATROLINK-II Communications
• EtherCAT (CoE) Communications

FEEDBACK OPTIONS

Each of the three types of SERVOPACK has the following feedback options.

► Primary
20-Bit Serial Absolute Encoder
• 20-bit serial absolute encoder that is standard on all Sigma-5 servo motors

► Secondary
Fully Closed Loop Option
• Allows the user to close the position loop around a secondary feedback device placed near the load
• Helps eliminate the effects of mechanical compliance and thermal variances
• Allows for more precise control and improved machine performance

Analog Voltage/Pulse Train Communications Reference
• +/- 10VDC Analog Torque or Velocity
• Pulse Train Reference
• Contact Speed
• 50 W to 15 kW Output
• Single Phase: 100/115V; 220/230V
Three Phase: 200/230V; 380/480V

MECHATROLINK-II Communications Reference
• High Speed Deterministic Digital Network
• Open Protocol (www.mechatrolink.org)
• Used with Yaskawa’s Full Line of IEC61131-3 Motion Controllers
• 50 W to 15 kW Output
• Single Phase: 100/115V; 220/230V
Three Phase: 200/230V; 380/480V

EtherCAT (CoE) Communications Reference
• High Speed Deterministic Digital Network
• Open Protocol (www.ethercat.org)
• Adheres to the CANopen device profile (CiA402)
• 50 W to 15 kW Output
• Single Phase: 100/115V; 220/230V
Three Phase: 200/230V; 380/480V
• Variety of different system architectures (cascade, line, star, ring)
• Distributed clock for synchronized operation. The transmission delay that is set to each slave as an offset is perfectly synchronized.
Expandability

Sigma-5 SERVOPACKs are also offered with a variety of other options to extend application capabilities.

**MP2600iec Single Axis Controller**

- **Communication Protocols**: Open standards EtherNet/IP and Modbus/TCP for connectivity to nearly every HMI and PLC on the market.
- **Standard Programming Languages**: IEC61131-3 means that programs are developed and executed with predictable behavior.
- **Programmable Amplifier Outputs**: The controller can operate local Sigma-5 outputs. This reduces panel cost and space requirements when just a couple of outputs are necessary.
- **Web Server**: A built-in web server offers standard controller diagnostic information eliminating the need for special software for maintenance personnel.

**Sigma-5 Indexer Module**

- Table editing (Program table, Zone signal output table, and JOG speed table) and parameter editing for ease of use.
- The use of program tables requires no special programming language knowledge.
- Up to 256 positioning points can be programmed.
- A wide range of functions such as external positioning, JOG speed, homing, and programmable signal outputs are available.
- 19 digital inputs and 16 digital outputs are standard.
- Easy ASCII commands via RS 422/485
- Realizes high-speed, high-accuracy positioning due to combination with Sigma-5 series.

**Sigma-5 Functional Safety Module**

- Sigma-5 servo functionality allows for a smooth integration of the mandatory legal safety standards.
- The STO (Safe Torque Off) function is implemented by default in all Sigma-5 series SERVOPACKS.
- The safety functions SS1 (Safe Stop 1), SS2 (Safe Stop 2), and SLS (Safely Limited Speed) are integrated by using the safety module.
Over 50 Years of Servo Technology Expertise

Minotaur Motor
First DC servomotor with low inertia Speed response: 100 times higher than DC-shunt-wound motor

Cup-Motor
First DC servo drive with large capacity

First Full Digital AC Servo Drive
With precise torque, speed, and position control

Σ-1 Series
High-resolution serial encoder Enhanced tuning functions International standards

Direct Drive Servo Motor
Eliminates backlash, Reduces mechanical components

Σ-V Option Command
EtherCAT, Full Closed Loop, Single Axis Controller (MP2600iec)

Print Motor
First DC disc motor Very flat design

First AC Servo Drive Range
For machine tool and robotic market

Σ-1 Series
Very compact amplifiers and motors

Σ-II Series
Further reduction in size Higher performance

Σ-V Series
Improved performance Advanced autotuning Vibration resistance Safety standards

Σ-V Option Command
Functional Safety Indexer

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