

# Sigma-5 Servo Family



# YASKAWA

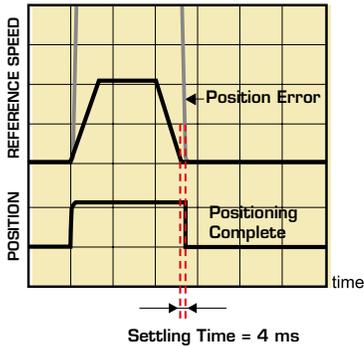
**50W to 15kW**  
**1.6 kHz Bandwidth**  
**Advanced Autotuning**  
**Vibration Suppression**

# 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.

Servo Adjustment Example



## Benefit of Reduced Settling Time

Pick and Place Example with 50 ms Settling Time

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

Pick and Place Example with 4 ms Settling Time

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

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

**Yearly Savings:**  
**\$140,353**

## 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**



Minimize setting time with less vibration  
**New "Advanced Autotuning"**



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

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**

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**

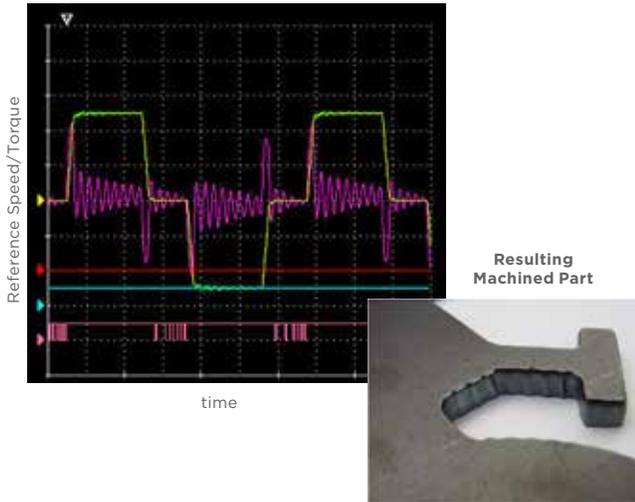
Fine-tuning can tweak machine performance even further.

**Setting time: 0 to 4 ms range**

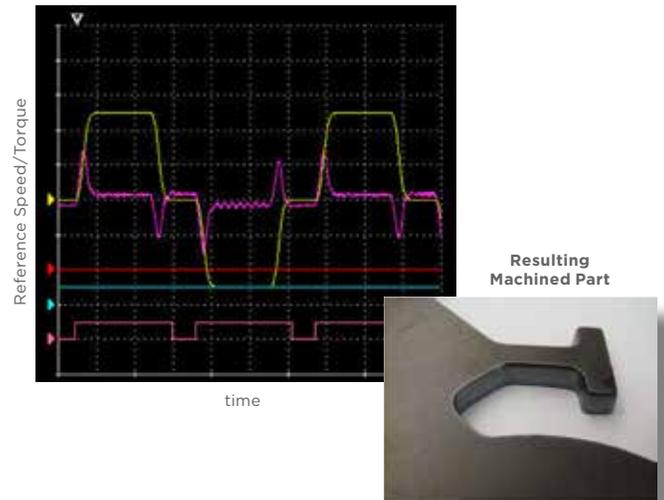
## Enhanced Vibration Suppression

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.

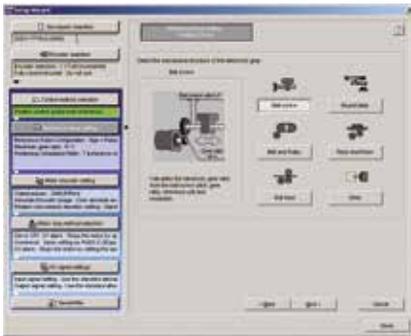
### Without Vibration Suppression



### With Vibration Suppression



## Faster Setup: SigmaWin+ Setup Software

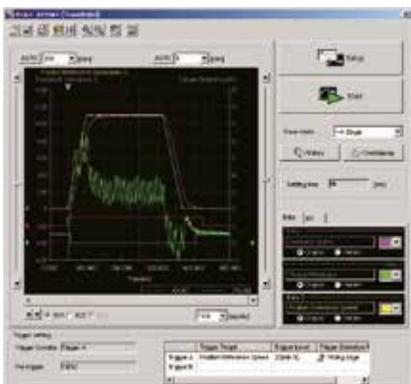
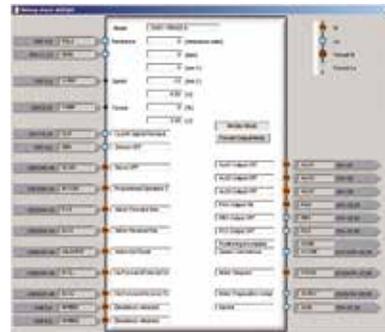


### Setup Wizard

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  $\mu$ s sample time)

# Sigma-5: Wide Variety of Servo Motors

## Rotary Servo Motors

Sigma-5 rotary servo motors feature a wide range of outputs from 3W - 55kW. Both low and medium inertia models are available with 20-bit absolute encoders standard on all models

Resolution 1,048,576  
pulses/revolution



### 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

Additionally, SGMMV Sigma-5 Mini servo motors range from 3 to 30W, while SGMVV large capacity servo motors range from 22 to 55kW. Please consult with your Yaskawa sales representative for more information about these models.

## Linear Servo Motors

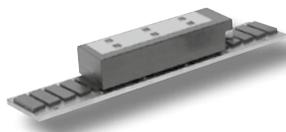
All Yaskawa linear servo motors feature plug-and-play connection with Sigma-5 SERVOPACKs through use of automatic motor recognition and serial encoder technology. Yaskawa's linear servo motors are supplied as components or as integrated linear slides.

### 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)

## SIGMA TRAC LINEAR SLIDES

- ▶ Factory assembled, fully integrated linear motor driven slide reduces design complexity and commissioning time
- ▶ Automatic motor recognition by the SERVOPACK automatically establishes motor coil parameters
- ▶ Large integrated cable carrier allows space for peripheral cables and hoses
- ▶ Renishaw or Heidenhain encoder (absolute or incremental)
- ▶ Multiple carriages available on a single base
- ▶ Covers and accessories available
- ▶ Quick ship program for certain models



# 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](http://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](http://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.



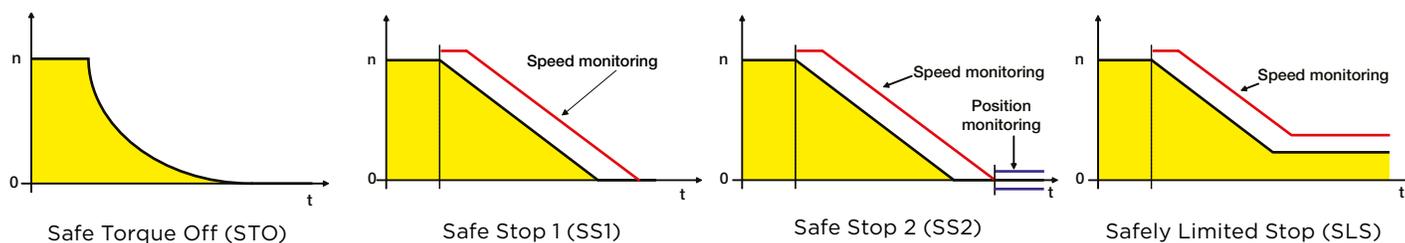
## Sigma-5 Indexer Module



- 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



**Minertia-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-II 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-I Series**  
Very compact amplifiers and motors



**Σ-III 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

1958      1961      1966      1983      1990      1992      1997      2002      2004      2007      2009      2011

# YASKAWA



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