



# AC SERVO DRIVES SIGMA-5 SERIES

EN

DE



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## Experience and Innovation

Since 1915 YASKAWA has manufactured and supplied products for machine building and industrial automation. Our standard products as well as tailor-made solutions are well known and have a high reputation for outstanding quality and reliability.

YASKAWA is the leading global manufacturer of inverter drives, servo drives, machine controllers, medium voltage inverters, and industrial robots.

We have always been a pioneer in motion control and drive technology, launching product innovations, which optimise the productivity and efficiency of both machines and systems.



Today YASKAWA produces more than 1.8 million inverters per year. Considering this, YASKAWA is probably the biggest inverter manufacturer in the world.



Furthermore, with a yearly production of more than 800,000 servo motors and 20,000 robots YASKAWA offers a wide range of products for drive automation processes in many different industries such as mining, steel, machine tools, automotive, packaging, woodworking, textiles and semiconductors. YASKAWA technology is used in all fields of machine building and industrial automation and has a high reputation for their outstanding performance and quality.

## Wherever You Are – Our Local Support is Near.



Employing more than 14,600 People Worldwide

More than 1,350 Employees in Worldwide Service Network

More than 1,250 Employees in Europe

## YASKAWA Servo Technology – a Success Story in Mechatronics

The history of mechatronics is closely related with the development of YASKAWA. The Japanese technology company has already proven its cutting edge technology with the Minertia DC servo motor more than half a century ago. This legendary motor with a response speed 100 times faster than conventional motors was based on the revolutionary idea of placing a conductor directly on the motor rotor.

With the development of the cup motor in 1966, the first DC servo drive with large capacity, YASKAWA once again pushed the market forward. This was the first time high precision drives were available in large quantities.

YASKAWA not only pushed forward new technology, but also introduced the term „mechatronics“ to the world. It enhances machinery performance by using electronics and information technology together with mechanics. Mechatronics is a registered trademark of YASKAWA's since 1972.

The Sigma-5 Servo Drive Series continues with this tradition of innovation. Today YASKAWA servo technology covers a broad power range and a multitude of industrial applications. Beginning with the Sigma-5 mini rated at 3.3 W up to the Sigma-5 Large Capacity motors and amplifiers with a rating of 55 kW.



YASKAWA Allershausen, Germany

## Sigma-5 Overview

### Precise, scalable and highly dynamic: YASKAWA Sigma-5 Servo Drive Series

The YASKAWA Sigma-5 Servo Drive series offers standard rotary motors as well as linear and rotary direct drives and linear sliders. This broad variety of drive systems covers all market demands with regard to compact size, high dynamics, high efficiency, low maintenance and outstanding reliability.

The most impressive feature of the Sigma-5 series is a positioning accuracy of up to 10 nm with standard products, while offering shortest positioning times. The well known YASKAWA auto-tuning functions enable a complete servo axis set-up in a high dynamic performance machine in less than two hours – compared to more than eight hours needed by other solutions currently available in the market.

In short, Sigma-5 offers precise positioning at high speed, smooth, vibration-free operation and easy start-up.

Result: Reduced cycle time – maximum throughput, improved product quality, enhanced machine wear resistance, shortened initial set-up time, lower life cycle cost.



Servo Motors

SERVOPACKS

Linear Motors

Linear Sliders

Out-of-the-Box Solutions

Programming Software

Motion Control Solutions

Flexible Connectivity

## Five Reasons for Sigma-5

The YASKAWA Sigma-5 Servo Drive series offers a wide range of well matched components with excellent performance and outstanding efficiency.

# 5

# 1

### Comprehensive Motor and Amplifier Power Range

#### Wide power range

- ▶ Very compact motors less than 30 W
- ▶ Low and medium inertia motors up to 15 kW
- ▶ Large capacity motors up to 55 kW
- ▶ Linear motors iron core and ironless with a force up to 7500 N

# 2

### Savings through Performance

#### Lower production costs

- ▶ Speed loop bandwidth of 1.6 kHz
- ▶ Shorter settling time, reduced positioning time, higher throughput

#### No additional cooling necessary

- ▶ Ambient temperature 0 - 55 °C without derating

#### Energy savings and higher productivity

- ▶ High peak torque, fast acceleration, no amplifier oversizing
- ▶ Lightweight mechanics

#### Higher performance

- ▶ Overload 350 % for 3 - 5 sec
- ▶ High peak torque, fast acceleration

# 3

### Safety Features

#### Smooth integration of mandatory legal safety standards

- ▶ The STO function is implemented by default in all Sigma-5 series servo amplifiers.
- ▶ The safety functions SS1, SS2 and SLS are integrated by using the SGDV-OSA01A safety module.

# 4

### Quality and Reliability in your Production

#### Excellent production quality

- ▶ Improved anti-vibration control
- ▶ High resolution Encoders with 1,048,576 pulses per revolution for highest positioning accuracy

#### More than 8,000,000 servo systems in the field

- ▶ Improved machine reliability, reduced service and maintenance costs, less downtime

# 5

### Fast and simple set-up

#### Advanced autotuning, one parameter tuning

- ▶ Faster commissioning – for 80 % of applications no tuning necessary

## Enhanced Product Range

Since 2012 YASKAWA covers an even wider range of servo drives. Starting with the ultra compact 3.3 W Sigma-5 mini up to the high power 55 kW Sigma-5 Large Capacity, YASKAWA provides an impressively wide power range.



3,3 W

Wide Power Range

55 kW

### Sigma-5 Mini



Capacity: 3.3 - 30 W  
For applications with high dynamics and precision in smallest dimensions.

### Sigma-5 Standard



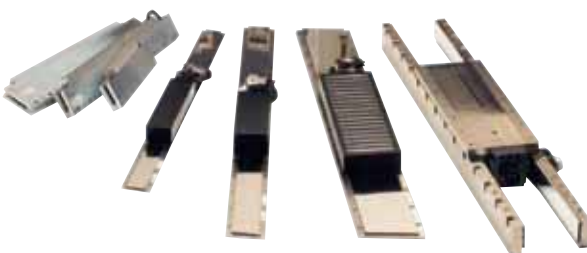
Capacity: 50 W - 15 kW  
For applications with high dynamics and accuracy, fast positioning and perfect multi-axes synchronization.

### Sigma-5 Large Capacity



The large-capacity AC servo drive is the consequent extension of the Sigma-5 Series up to 55 kW.

### Sigma-5 Linear Motors



Capacity: 12.5 to 2,250 N (7,500 N peak)  
Long durability, reliable and constant performance after years of use.

### Rotary Motors and Direct Drives



AC brushless servo motor lines with speeds to 6,000 rpm and torques to 700 Nm.  
Direct drives (0.02 - 3 kW), high inertia.

## Rotary Servomotors



**SGMMV**  
(Low Inertia,  
Very Small Capacity)  
max. 6,000 min<sup>-1</sup>  
3.3 - 30 W  
0.0105 - 0.0955 Nm (Rated Torque)  
0.0263 - 0.286 Nm (Peak Torque)



**SGMAV**  
(Low Inertia,  
Small Capacity)  
max. 6,000 min<sup>-1</sup>  
50 - 1,000 W  
0.159 - 3.18 Nm (Rated Torque)  
0.477 - 9.55 Nm (Peak Torque)



**SGMEV**  
(Low and Medium Inertia,  
Small Capacity, optional IP67)  
max. 5,000 min<sup>-1</sup>  
100 - 1,500 W  
0.318 - 4.77 Nm (Rated Torque)  
0.955 - 14.3 Nm (Peak Torque)



**SGMVV**  
(Small Inertia,  
High Capacity)  
max. 2,000 min<sup>-1</sup>  
22 kW - 55 kW  
140 - 537 Nm (Rated Torque)  
350 - 1182 Nm (Peak Torque)



**SGMJV**  
(Medium Inertia,  
Small Capacity)  
max. 6,000 min<sup>-1</sup>  
50 - 750 W  
0.159 - 2.39 Nm (Rated Torque)  
0.557 - 8.36 Nm (Peak Torque)



**SGMGV**  
(Medium Inertia,  
Medium Capacity)  
max. 3,000 min<sup>-1</sup>  
300 W - 15 kW  
1.96 - 95.4 Nm (Rated Torque)  
5.88 - 224 Nm (Peak Torque)



**SGMSV**  
(Low Inertia,  
Medium Capacity)  
max. 6,000 min<sup>-1</sup>  
1 kW - 5 kW  
3.18 - 15.8 Nm (Rated Torque)  
9.54 - 47.6 Nm (Peak Torque)

## Linear Servomotors



**SGLGW**  
(Coreless Type,  
With standard-force  
magnetic ways)  
12.5 - 750 N (Rated Force)  
40.0 - 3,000 N (Peak Force)  
4 - 5 m/s (Peak Speed)



**SGLGW**  
(Coreless Type,  
With high-force  
magnetic ways)  
57 - 255 N (Rated Force)  
230 - 1,080 N (Peak Force)  
4.2 m/s (Peak Speed)



**SGLFW**  
(With F-type Iron Core)  
25 - 2,250 N (Rated Force)  
86 - 5,400 N (Peak Force)  
2,3 - 5 m/s (Peak Speed)



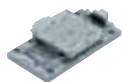
**SGLTW**  
(With T-type Iron Core)  
130 - 2,000 N (Rated Force)  
380 - 7,500 N (Peak Force)  
2,5 - 5 m/s (Peak Speed)



**SGLC**  
17 - 180 N (Rated Force)  
60 - 840 N (Peak Force)  
4.0 m/s (Peak Speed)

## Cylinder Type Servomotors (Sigma-Stick)

## Linear Slider (Sigma-Trac)



**SGTMM**  
(Sigma-Trac-μ)  
3.5 - 7 N (Rated Force)  
10 - 25 N (Peak Force)



**SGTMF**  
(Sigma-Trac-MAG)  
90 - 200 N (Rated Force)  
270 - 720 N (Peak Force)

## Linear Slider (SGT)



**SGT-Linear Slider**  
80 - 1,120 N (Rated Force)  
220 - 2,400 N (Peak Force)

## Direct Drive Servomotors



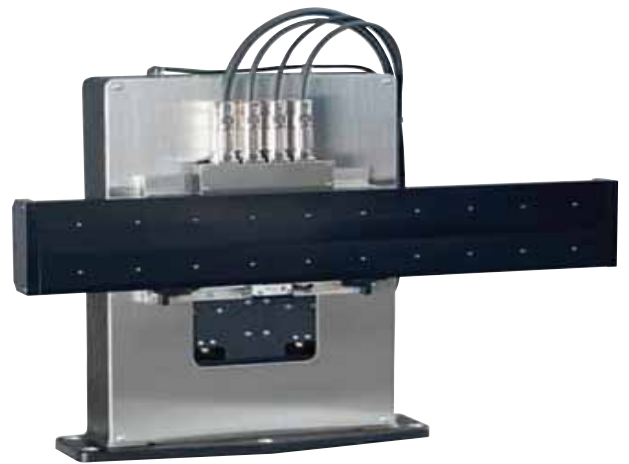
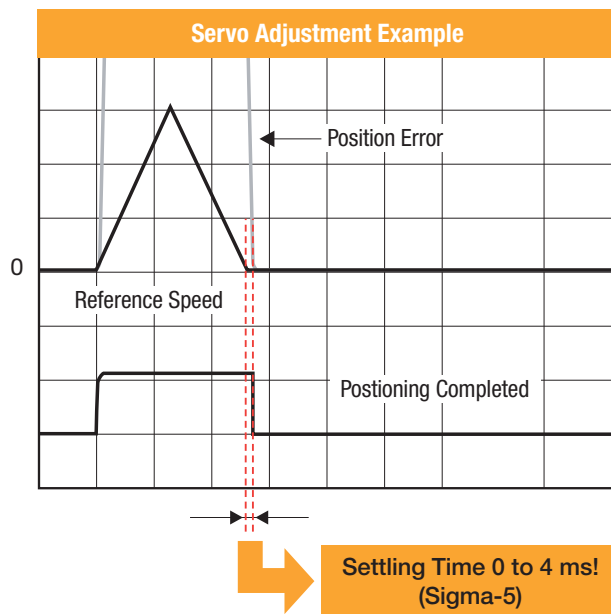
**SGMCS**  
(Small-capacity)  
5 - 15.8 Nm (Rated Torque)  
6 - 105 Nm (Peak Torque)  
150 - 200 rpm (Rated Speed)  
250 - 500 rpm (Max. Speed)



**SGMCS**  
(Medium-capacity)  
15.8 - 200 Nm (Rated Torque)  
135 - 600 Nm (Peak Torque)  
150 rpm (Rated Speed)  
300 rpm (Max. Speed)

## Savings through Performance

With a best in class frequency response of 1.6 kHz, Sigma-5 SERVOPACKS can reduce settling time to less than 4 ms. Compared to a standard system with for example 50 ms settling time, a Pick & Place unit based on Sigma-5 components can save a significant amount of money.



## Shorter Settling Time increases your Revenue

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	1.6 s	37.5	2250	€ 0.1	€ 225.00
X = 200 mm	0.2 s	0.05 s	0.2 s	0.05 s					
<b>Total</b>	<b>0.5 s</b>	<b>0.1 s</b>	<b>0.7 s</b>	<b>0.1 s</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	1.416 s	42.37	2542	€ 0.1	€ 254.24
X = 200 mm	0.2 s	0.004 s	0.2 s	0.004 s					
<b>Total</b>	<b>0.5 s</b>	<b>0.008 s</b>	<b>0.7 s</b>	<b>0.008 s</b>					

Revenue per Hour:  
**29.24 €**

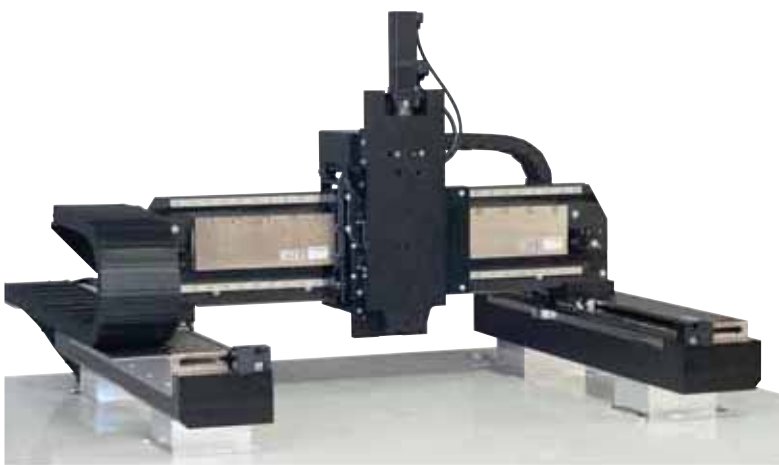
Revenue per 16 Hours:  
**467.84 €**

Revenue per 5 Days:  
**2,339.20 €**

Revenue per Year:  
**116,690.00 €**

### Open for Challenging Applications

YASKAWA provides equipment for a broad range of applications and offers support in all engineering tasks. This way YASKAWA will find the perfect solution for common tasks and complex automation challenges.

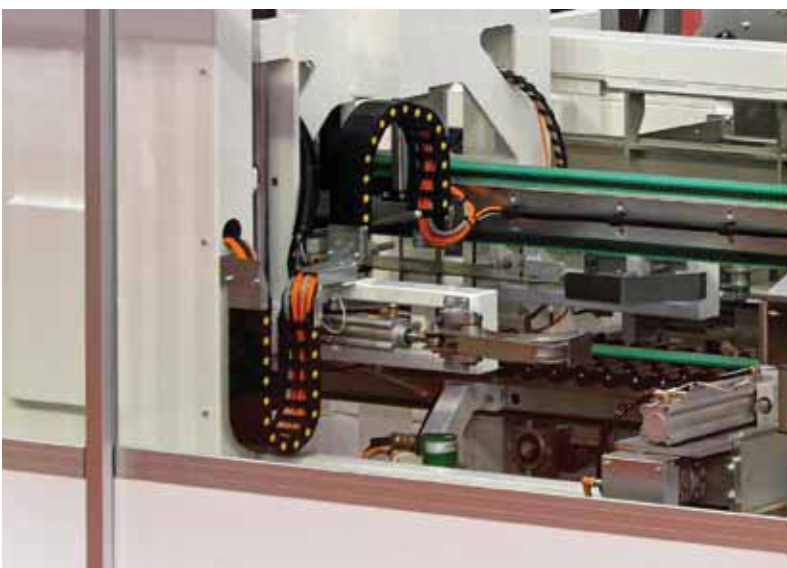


### Solutions for common tasks

Quick and easy set-up and no configuration effort - these are the benefits of the YASKAWA out-of-the-box solutions. And in case you want to upgrade a solution the whole Sigma-5 system can easily be used for any new task.

The following solutions are currently available:

- ▶ Gantry
- ▶ Pick & Place
- ▶ Beam



### Tailor-made solutions

For complex tailor-made automation solutions YASKAWA provides the whole Sigma-5 system and support in all life cycle phases. From small and compact design with ratings as low as 3.3 W to massive power of up to 55 kW - the Sigma-5 series offers the perfect equipment. And with a broad range of supported communication interfaces, it is easy to connect the Sigma-5 series to existing machines to benefit from the efficiency features of modern Sigma-5 components.

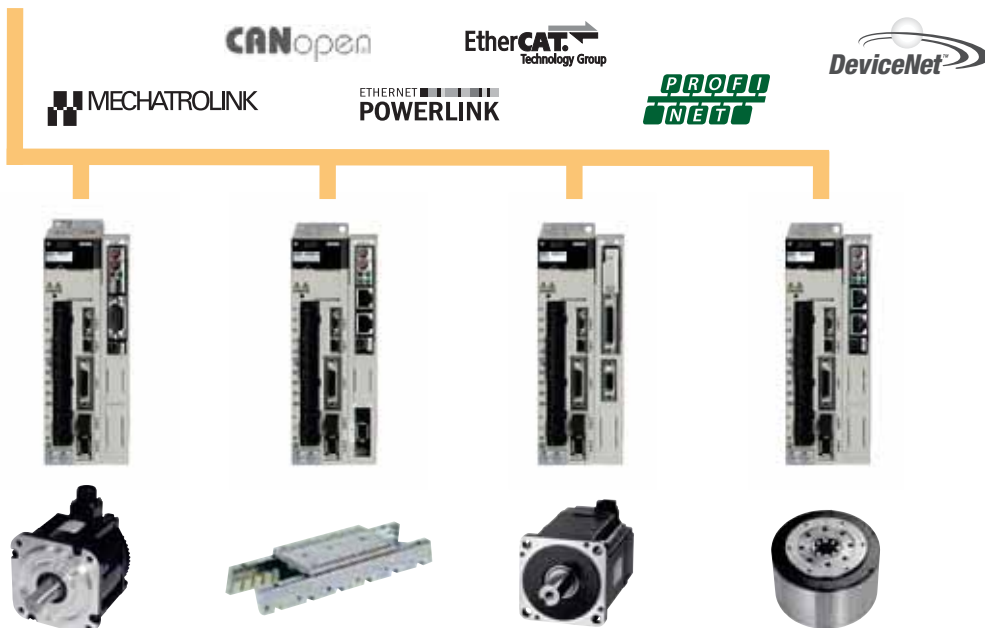
## We connect to your Solution

Sigma-5 amplifiers are open to almost every industrial communication standard. To enable a certain fieldbus communication, simply install and connect a “Communication Option Attachable Type” module.

The Sigma-5 series is designed to comply with common standards. It is as easy as plug and play to use the communication module together with servopacks and motors. Either in existing plants and machines or in newly designed ones. A broad support of communication standards provides even more flexibility.

Communication Type	Sigma-5 mini	Sigma-5	Sigma-5 Large Capacity
Mechatrolink II	•	•	•
Mechatrolink III	•	•	•
PROFINET		•	•
DeviceNet		•	•
EtherNet/IP *		•	•
Modbus TCP/IP *		•	•
Powerlink		•	•
EtherCAT		•	•
CANopen		•	•
Analogue voltage	•	•	•
Pulse train	•	•	•

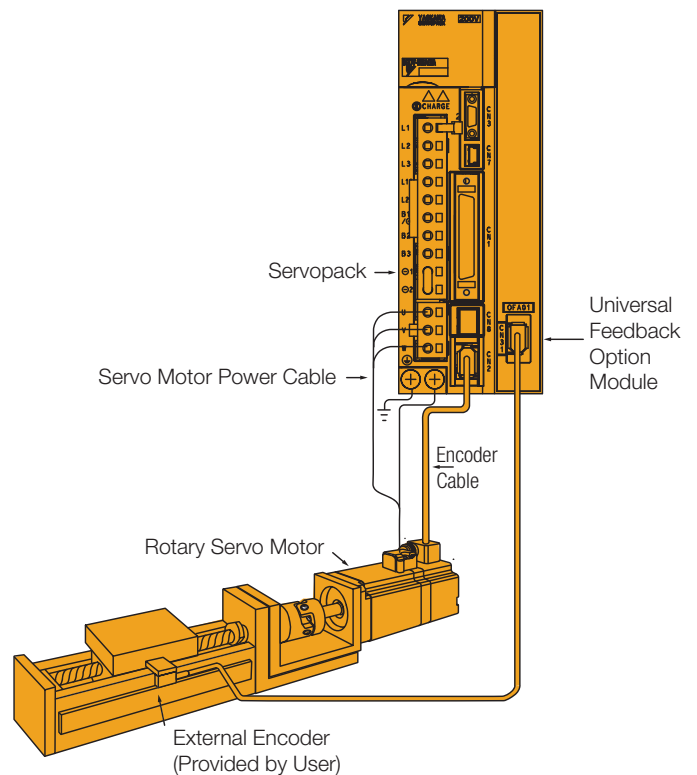
\* with MP Controller MP2600iec



## Control Automation with a Broad Range of External Encoder Types

The Universal Feedback Option Module for Sigma-5 servo amplifiers (SGDV-OFB01A) enables third-party vendor encoders to close the control loop.

The Universal Feedback Option Module supports encoders with SERIAL and SIN/COS interfaces. Moreover, it operates as additional feedback for the speed and position loops when information is required from the mechanical system i.e. the load (dual loop functionality).



System Configuration for the Universal Feedback Module

## Sigma 5 Feedback Option Cards

- ▶ SGDV-OFB01A  
Sin/Cos, Serial encoders  
(ENDAT, HIPERFACE)
- ▶ SGDV-OFB03A  
A quad B encoders
- ▶ SGDV-OFB04A  
Resolver

## Safety in Motion

Machine movements represent a major source of hazard for operators and personnel carrying out maintenance tasks. Typical situations requiring safe machine states occurring during commissioning, in setup mode, troubleshooting and when operating or maintenance personnel are required to

The safety module SGDV-OSA01A for the Sigma-5 series servo drives enables you to realise safe and cost-effective automated motion applications.

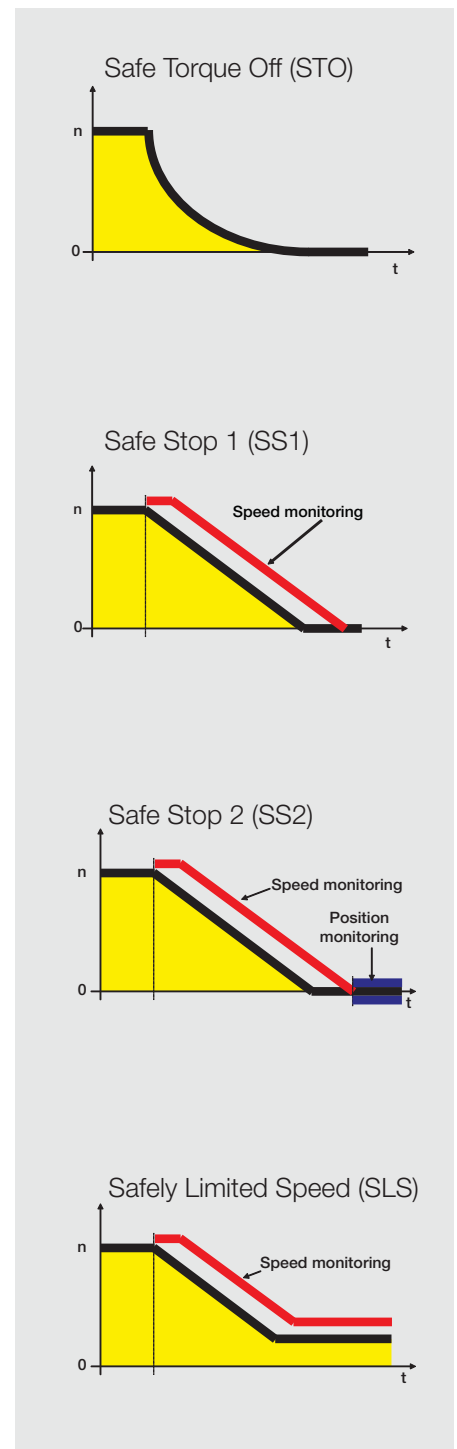
- ▶ Sigma-5 servo drive functionality allows a smooth integration of the mandatory legal safety standards.
- ▶ The STO function is implemented by default in all Sigma-5 series servo amplifiers. The safety functions SS1, SS2 and SLS are integrated by using the SGDV-OSA01A safety module.



With the coming into effect of the standard EN ISO 13489 1:2008 “Safety of machinery – Safety-related parts of control systems”, the construction of safe machines will now be assessed either according to the performance level (PL a – e) or according to the safety integrity level (SIL 1 – 4). The safety relevant functions for variable speed drives are defined in the standard IEC 61800-5-2.



Description	Standard	Performance
Safety Integrity Level	IEC 61508	SIL 2
	IEC 62061	SILCL2
Performance Level	EN ISO 13849-1	PL-d
Stop Functions	IEC 60204-1	Stop category 0/1/2
Functional Safety	IEC 61800-5-2	STO/SS1/SS2/SLS



## More than just another Amplifier... It's the Best in Class Machine Controller Module

The controller/servo combination provides standardized programming. The single axis MP2600iec allows applications to scale up from single to multi-axis control within a standard IEC61131-3 programming environment, MotionWorks IEC. Built-in Ethernet/IP and Modbus/TCP (master and slave) connect to most PLCs and expanded I/O.

### IEC on the Drive. MP2600iec Motion Controller Module

- ▶ One software platform, MotionWorks IEC, allows applications to scale up from single to multi-axis control within a standard IEC 61131-3 environment
- ▶ PLCopen function blocks in Motion Works IEC simplify programming
- ▶ Diagnostic web server reduces field maintenance time
- ▶ Optional OPC server provides HMI connectivity or data acquisition



**POINT-TO-POINT**

EASY INTUITIVE COMMANDS

HOMING, JOGGING, AND POINT-TO-POINT MOVES WITH STANDARD PLCOPEN FUNCTION BLOCKS

**BLENDED MOVES**

CHANGE PROFILE WHILE-IN-MOTION

EVENT

**GEAR**

MASTER SPEED

FOLLOWER PROFILE

FOLLOWER SYNCHRONIZED

**CAM**

CAM DISK

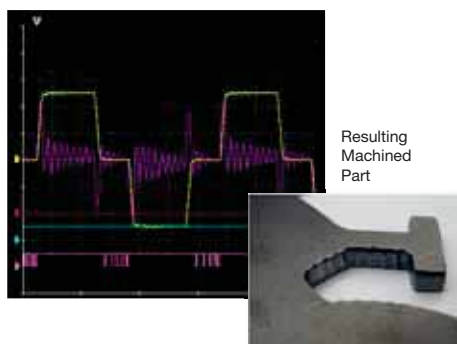
TABLE OF MOTION COORDINATES

MASTER ENCODER INPUT (STANDARD)

## Enhanced Vibration Suppression

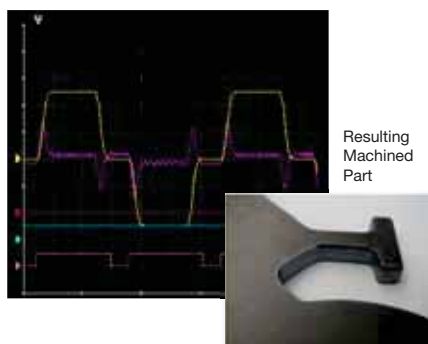
Existing functions to minimize vibration have been enhanced and new ones added, thus improving tracking and further improving settling time. Vibration and noise during operation have also been reduced, along with vibration when stopping, resulting in very smooth edges of machined parts.

Without Vibration Suppression



Resulting Machined Part

With Vibration Suppression



Resulting Machined Part

### Tuning-less function. “Get up and run” quickly after connecting the motor.

Even without servo adjustment and with load changes, an oscillation- and vibration-free drive is possible with up to 20 times the load moment of inertia.

- ▶ Settling time: 100 to 150 ms.

### Advanced autotuning Minimize settling time with less vibration.

The reference filter and feedback gain adjustment functions have a new automatic feed forward gain adjustment for optimal adjustment performance. The friction compensation function automatically cancels out the effect of friction on machine characteristics.

- ▶ Settling time: 10 ms.



### “One-parameter” tuning Fine tuning is a must.

Fine tuning can tweak machine performance to the max.

- ▶ Settling time: 0 to 4 ms.

## Simplify your Life with the Sigma-5 Series

The Sigma-5 Series provides an easy and quick adjustment for your servo solution. That saves time and money.



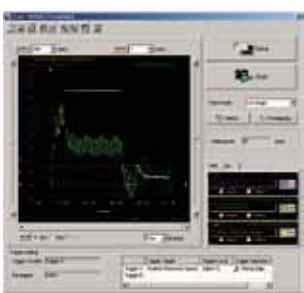
### Software Setup Wizard

Simple parameter setup with wizard guided input



### Wiring check function

The SigmaWin+ wiring check function checks your wiring in a single operation.



### Trace function

Real-time trace of adjustment state facilitates instantaneous monitoring.

### Full of handy functions for startup and more effective operation!

Optimal selection for your application with consideration of moment of inertia, dynamic braking resistance, etc.

### Maintenance

Faster troubleshooting with alarm diagnostic function – presumes possible causes of alarm and immediately displays suggested corrective actions.





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The Sigma-5 Series is CE-certified,  
cULus-listed and RoHS-conform.



Specifications are subject to change without notice  
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