

Whitepaper

# CODESYS® SoftMotion

## Turn your PLC into a motion controller, CNC, or robot controller.

CODESYS SoftMotion is an add-on component for the CODESYS Development System and is seamlessly integrated in the IEC-61131-3 development interface.

With CODESYS SoftMotion, you use the available computing capacities of your PLC. Thanks to the integration and availability of logic and motion control in one device with a single engineering interface, you save costs for additional hardware and engineering tools. At the same time, the integration into the IEC 61131-3 interface reduces your engineering effort quite considerably. In addition, cabling and data exchange between logic and motion control are greatly simplified. The data from the logic controller allows for an immediate and flexible response to process changes. At the same time, the entire PLC infrastructure is at your disposal: User inputs via the machine or plant visualization can be used directly to adjust the movements. Positions or other motion information can be exchanged with other network participants via OPC UA, and motion controllers can be conveniently managed in a cloud-based Industry 4.0 interface.



The CODESYS Motion CNC Robotics tools can be licensed for various fields of application.

Three products are available:

- **CODESYS SoftMotion Light**  
for commanding single axes
- **CODESYS SoftMotion**  
for controlling single axes and synchronized movements, such as master/slave applications with cam plates or electronic gears
- **CODESYS SoftMotion CNC+Robotics**  
for coordinated multi-axis movements of CNC and robotics applications. This product is an extension and requires a license for CODESYS SoftMotion.

### Available products of the SoftMotion range: What are the differences?

Feature/Product	CODESYS SoftMotion Light	CODESYS SoftMotion	CODESYS SoftMotion CNC+Robotics
Commanding single axis movements	✓	✓	✓
Synchronized multi-axis movements	✗	✓	✓
Commanding servo drives or stepper motors	✓	✓	✓
Position control possible in motion controller	✗	✓ (optional)	✓ (optional)
Cam disks	✗	✓	✓
Electronic gears	✗	✓	✓
CNC applications	✗	✗	✓
Robotic applications	✗	✗	✓
Motion planning with special editors/configurators	✗	CAM editor	<ul style="list-style-type: none"> <li>▪ CNC editor</li> <li>▪ Configurator for axis groups</li> </ul>
Available kinematics for coordinated movements	✗	✗	Numerous available kinematics for typical CNC and robot tasks
IEC 61131-3 function blocks (FBs)	According to PLCopen Motion Control Part 1 (excluding master/slave function blocks)	According to PLCopen Motion Control Part 1	According to PLCopen Motion Control Part 1 and 4. Additional FBs for kinematic transformations
Portability of the application to different PLC systems	✓	✓	✓
Visualization templates for commissioning	✓	✓	✓

Feature/Product	CODESYS SoftMotion Light	CODESYS SoftMotion	CODESYS SoftMotionCNC Robotics
Integrability of the function in compatible PLC systems	✓ Support of license container required	✓ Support of license container required	✓ Support of license container required
Integrability of the function in CODESYS SoftPLC systems	✓	✓	✓
Required CPU resources	low	high	high/ very high
FPU required	no	recommended	recommended
Required bus bandwidth/speed	low	high	high
Supported fieldbus systems	CANopen/EtherCAT (CiA-402)	CANopen, EtherCAT, Sercos. Special drivers required, additional support of CiA-402 and SoE.	CANopen, EtherCAT, Sercos. Special drivers required, additional support of CiA-402 and SoE.
Required real-time capabilities (PLC and fieldbus)	low	high	high
Latency until new motion commands take effect	medium depending on configuration and fieldbus	very low; new command is started in the same PLC cycle	very low; new command is started in the same PLC cycle
Supported drives	Drives supporting CiA 402	Large and growing number of drives for specific drives, plus drives that support CiA402	Large and growing number of drives for specific drives, plus drives that support CiA402
Typical use cases	Commanding multiple, independent axes	<ul style="list-style-type: none"> <li>▪ Electronic gears</li> <li>▪ Cam applications</li> </ul>	<ul style="list-style-type: none"> <li>▪ CNC machines</li> <li>▪ Pick &amp; place applications</li> <li>▪ Placement machines with tripod robots</li> <li>▪ Gantry/SCARA robots in production</li> <li>▪ ...</li> </ul>
Typical PLC performance*	ARM/Cortex 400 MHz, 16 MB RAM/32 MB Flash	ARM/Cortex, 800 MHz, >32 MB RAM/Flash	Cortex A8 with < 1GHz, IPC with i5-CPU, 2 GHz, DualCore, 4 GB RAM
Number of axes for the above example	> 16 axes	> 8 to 16 axes	up to 2 robots (Cortex A8) (6 coordinated axes each) ≈ 16 single axes
Typical cycle times for the example above	20 ms	1 - 8 ms	1 - 8 ms

\* The specifications only provide a rough orientation. Especially for CODESYS SoftMotion and CODESYS SoftMotion CNC+Robotics, the required processor performance depends on the type of motion and the number of calculated axes.

## The "CNC" and "Robotics" functionalities: What are the differences?

Feature/Product	CNC	Robotics
Path accuracy	very important	PTP: not important CP: important
Limitation of speed, acceleration, and jerk	Dynamics of the axes results from tool dynamics	Direct limitation of the axis dynamics
Typical kinematics	Portals	Articulated arm robot, tripod, scara
Typical use cases	Laser cutting, milling, application of adhesives	Pick & Place
Programming movements	G-code (DIN 66025)	<ul style="list-style-type: none"> <li>▪ Programming the movements with function blocks</li> <li>▪ PTP: Start and target point with via points</li> <li>▪ CP: Straight line segments and circular arcs with overloops</li> </ul>
Dynamic path changes (collision avoidance)	Difficult to implement without stopping	Very easy to program

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