CODESYS SoftMotion Axis Groups/CNC Interpolators (6)

CODESYS SoftMotion Axis Groups/CNC Interpolators extends the functional range of CODESYS Control SL systems from pure logic to motion control with support for CNC and robotics.

This license is application-based and requires at least the application-based license CODESYS Control Standard S for the PLC.

With this product *6 axis groups or CNC interpolators* can be controlled.

The CODESYS SoftMotion package can be downloaded with the CODESYS Installer. The release notes are published on the CODESYS website.

Product description

CODESYS SoftMotion Axis Groups/CNC Interpolators enables the operation of axis groups or CNC interpolators.

The axes must be purchased additionally with the CODESYS SoftMotion Axes license. No axes are included in this license.

For example, if you want to use a PLC to control a 2D gantry and a SCARA robot with 4 axes, and also 2 drives for a conveyor belt and a rotary table, then you need a CODESYS SoftMotion Axes license for 8 axes and a SoftMotion Axis Groups/CNC Interpolators license with quantity 2.

Functional principle

- Parameterization of axis groups for predefined kinematics in a separate object
- Integrated motion planning:
  - with 3D CNC editor according to DIN 66025 (G code) and tabular editor
  - with coordinate values for robot positions in different coordinate systems
- Processing of CNC motion, robotic motion, or other motion tasks in the runtime system on the controller with the IEC 61131-3 logic application
- Online editing of CNC programs in CODESYS Visualization

Typical applications

- CNC motion with modifications by the end user (for example, in metal and woodworking machines)
- Robotic systems including SCARA, tripod, and palletizing robots such as in assembly and loading automation

CODESYS SoftMotion Axis Groups/CNC Interpolators extends the CODESYS Development System with the following elements:

- Extensive library with blocks for handling and processing CNC paths, axis groups, as well as kinematic transformations for the most popular use cases
- Visualization templates
- Examples and templates for creating specialized blocks in the CODESYS Development System for CNC, robotic, and motion handling in IEC 61131-3
- Integrated 3D CNC editor according to DIN 66025 (G-Code)
- Axis group configurator for different kinematic systems (customizable for own kinematics)

Scope of the CNC library

- Decoder for converting G-code for further processing
- Support for sub-programs and expressions in G-code
- Limiter for restricting the dynamic values of velocity and acceleration for one or more axes
- Block for testing velocities at transitions
- Interpolator for computing the path points based on the velocity profile (bidirectional interpolator for forward and reverse gear)
- Interpolator override
- Blocks for coordinate transformation (example: SMC_ScaleQueue3D and SMC_CoordinateTransformation3D)
- Help modules for path preprocessing and modification:
  - Tool-radius correction 2D
  - Angle rounding (with circular arc) and angle smoothing (with 3rd and 5th order splines)
  - Loop suppression
  - Limitation of dynamics
  - Range limit test
  - Path shifting and twisting
  - Velocity and acceleration definition for each axis
- Kinematic transformations (including inverse kinematics) for popular kinematic designs:
  - Portal systems 2D / 3D
  - Portal systems with axes of orientation and tool offset
  - Portal systems with belt drive (H-portals and T-portals)
  - Polar transformation
  - 2/3-arm SCARA
  - Bipod
  - Tripod with linear and joint axes
  - 5-axis kinematics for 3-axis portal with rotating and tilting tool
  - 4-axis kinematics for palletizing robots
  - 6-axis kinematics for articulated arm robots
- Blocks for reading and processing CNC paths from a file (for paths created and processed externally)
- Path velocity modes trapezoid / sigmoidal / quadratic (jerk-limited) / quadratic_smooth (jerk-limited with continuous jerk curve)

- Any definition of the lookahead buffer
- Odometer function
- Parameterizable 3D coordinate transformation (including inverse)
- Computation of a coordinate system from six scanning points
- Visualization templates for the most important function blocks for fast commissioning with the visualization integrated in the CODESYS Development System (for example, kinematic transformations)
- Visualization elements for 3D CNC operation and online editing for creating CNC machines by using CODESYS HMI or CODESYS TargetVisu

Scope of robotics library

- Axis group editor with mapping of axes to kinematics and their parameterization
- Certified function library with program blocks according to PLCopen Motion Part 4 (Coordinated Motion)
  - Administrative blocks: MC_GroupEnable/Disable/Reset/ReadError, etc.
  - Motion commands: MC_MoveDirectAbsolute, MC_MoveDirectRelative, MC_MoveLinear*, MC_MoveCircular*, MC_GroupHalt, MC_GroupStop
  - Tracking: MC_TrackConveyorBelt, MC_TrackRotaryTable, MC_SetDynCoordTransform
  - Jog mode in any coordinate system: SMC_GroupJog2
  - Support of different coordinate systems: world coordinates (WCS), machine coordinates (MCS), several product coordinates (PCS_1, PCS_2), tool coordinates (TCS), and axis coordinates (ACS)
- Support for waiting on the path with waiting time (SMC_GroupWait)
- Public documented interface for creating user-specific kinematics in the IEC 61131-3 languages
- Supported kinematics with convenient configuration:
  - 5-axis gantry robot
  - 2/3-axis gantry robot
  - 2/3-axis H gantry robot
  - 2-axis T gantry robot
  - Bipod robot
  - Tripod robot with linear /rotary axes
  - Polar kinematics
  - 2/3-arm SCARA robot with auxiliary axes
  - 4-axis kinematics for palletizing robots
  - 6-axis kinematics for articulated arm robots
- Additional orientation kinematics, which can be combined with the other kinematics listed above, such as gantry and tripod kinematics.
- Tools with orientation and position offset (full 6D)
- Support for user provided dynamic models that compute the torques and forces for each joint
- Support for torque/force limitation during planning
- Support for torque/force feed forward control
- Support for defining the workpiece and tool load

- Triggers

Memory requirements of the robotics library

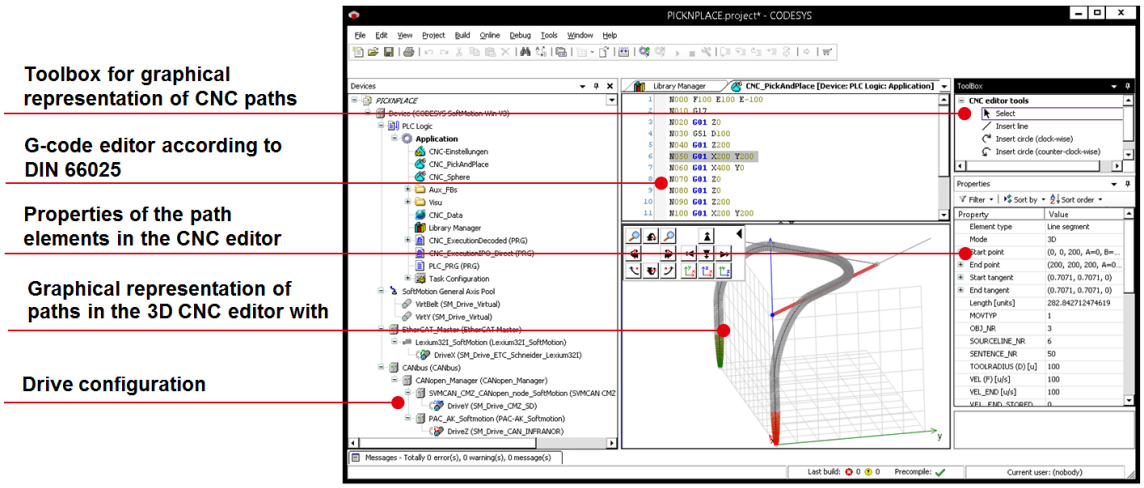
- An axis group object requires approximately 28 megabytes of memory.

Scope of functions for 3D CNC editor according to DIN 66025 (G-Code)

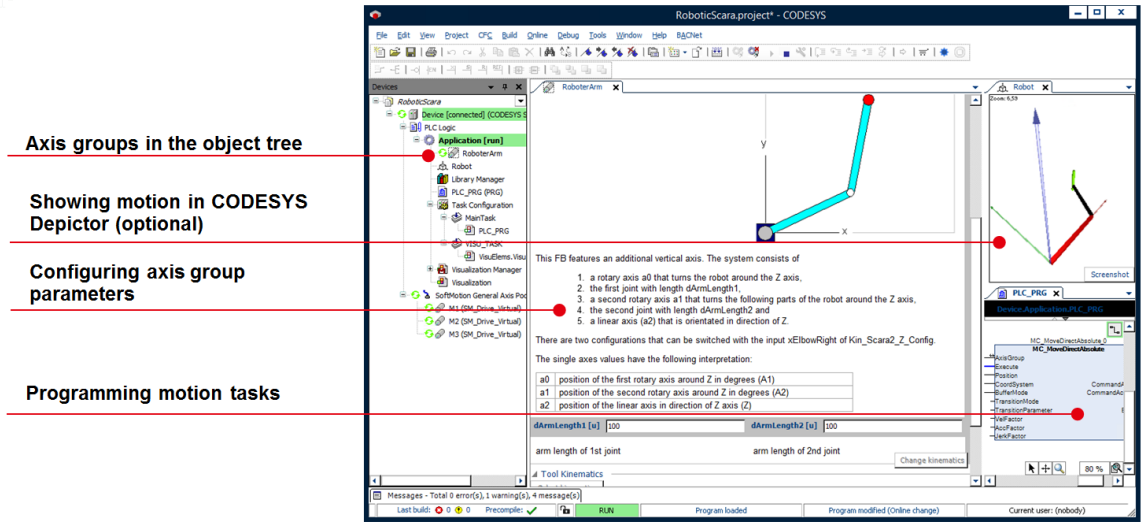
- Simultaneous graphical and textual editors
- Path preprocessing (offline preview of the effects, for example angle smoothing)
- Path pre-interpolation (offline preview of the resulting position, velocity, acceleration, and jerk curves of all supported axes)
- DXF import
- Read from and save to file
- Program transformations (rotate, shift, scale in G-code)
- Conversion to tables
- Program information (path length, path duration, number of objects, etc.)

G-code command set

- Linear interpolation (G1), Circular interpolation (G2/G3)
- Dwell (G4)
- Spline interpolation (G5, G10)
- Parabola interpolation (G6), Ellipsis interpolation (G8, G9)
- Interpolation plane selections for circular arcs (G16 to G19)
- Conditional jumps (G20)
- Variable write/increment (G36, G37)
- Tool radius compensation (G40 to G42)
- Angle rounding and smoothing (G50, G51, G52)
- Coordinate system shift (G53 to G56)
- Loop suppression (G60, G61)
- Timing synchronization with interpolator (G75)
- Absolute and relative coordinates (G90, G91)
- Position setting (G92)
- Absolute and relative coordinates (G98, G99)
- M-Functions (M), Path tappets (H)
- Velocity and acceleration definition (F, E)
- Use of IEC variables
- Supported dimensions: X, Y, Z (primary interpolation axes)
- A, B, C (orientation axes — splined)
- P, Q, U, V, W (additional axes — linear)



Picture 2: Using the CNC editor to create a CNC application in the CODESYS Development System



Picture 3: Project engineering of a SCARA robot with an axis group and program block in CODESYS

General information

Supplier:

CODESYS GmbH
Memminger Strasse 151
87439 Kempten
Germany

Support:

Technical support is not included with this product. To receive technical support, please purchase a CODESYS Support Ticket.

https://support.codesys.com

Item:

CODESYS SoftMotion Axis Groups/CNC Interpolators (6)

Item number:

2305000020

Sales/Source of supply:

CODESYS Store
https://store.codesys.com

Included in delivery:

- CODESYS package with SoftMotion functionality
- License key

System requirements and restrictions

Programming System	CODESYS Development System V3.5.19.10 or higher
Runtime System	CODESYS Control Version 3.5.19.0 or higher
Supported Platforms/ Devices	All supported by CODESYS: • Real-time capable operating system platforms • CPU platforms with available FPU (Floating Point Unit) • Devices with integrated fieldbus (EtherCAT, CAN/ CANopen)
Additional Requirements	WIBU Codemeter Support SoftMotion Light works with CiA 402 compatible drives with CANopen or EtherCAT. Compatibility can be checked with the test project *SML_CompatibilityCheck_DS402.project*
Restrictions	-

Licensing	 Single device license: The license can be used on the target device/PLC on which the CODESYS runtime system is installed. Licenses are activated on a software-based license container (soft container), which is permanently connected to the controller. Alternatively, the license can be stored on a CODESYS Key (USB dongle). By replugging the CODESYS Key, the license can be used on any other controller.
Required Accessories	Optional: CODESYS Key

Note: Technical specifications are subject to change. Errors and omissions excepted. The content of the current online version of this document applies.

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