CODESYS STORE

Data Sheet CODESYS SoftMotion CNC+Robotics SL

CODESYS SoftMotion CNC+Robotics is an additional option for CODESYS compatible SoftPLC systems. CODESYS SoftMotion CNC+Robotics extends the functional scope of these systems from a purely logical controller to a CNC motion controller with 3D interpolation, as well as to a controller platform for robots with defined kinematic axis groups.

Product description

CODESYS SoftMotion CNC+Robotics enables the control of coordinated, spatial CNC and robotic motion on qualified CODESYS compatible SoftPLC systems.

Functional principle:

- Project engineering of motion using function library modules
- Configuration of actuated drives with fieldbus support integrated in the CODESYS Development System
- Parameterization of axis groups for predefined kinematics in a separate object
- Decoupling of application creation from the applied hardware by abstracting the drives with drive group names in the device tree
- 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 of CODESYS SoftMotion CNC+Robotics:

- As an additional option for powerful, CODESYS compatible control systems with strict real-time behavior (FPU recommended)
- Learned 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 CNC+Robotics extends the CODESYS Development System by the following elements:

- Extensive function library with blocks for handling and processing CNC paths, axis groups, as well as kinematic transformations for the most popular use cases
- Visualization templates for program blocks
- 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 and drive configuration inside the fieldbus configurators, as well as for stepper drives and encoders
- Axis group configurator for different kinematic systems (customizable for own kinematics)
- Convenient option for commissioning axes (“Online Configuration Mode”) without any special IEC 61131-3 application code

Scope of CNC function 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 modulation:
    - 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

- Transformation blocks (including inverser) 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 function library

- Axis group editor in the “Axis group” object 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
    - Fast and path invariant mode for PTP movements (MC_MoveDirect*): fast mode will perform the fastest possible movement in axis space, path invariant mode will perform a movement whose path does not change if the override changes.
    - Tracking: MC_TrackConveyorBelt, MC_TrackRotaryTable, MC_SetDynCoordTransform
    - Jog mode in any coordinate system: SMC_GroupJog
    - 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

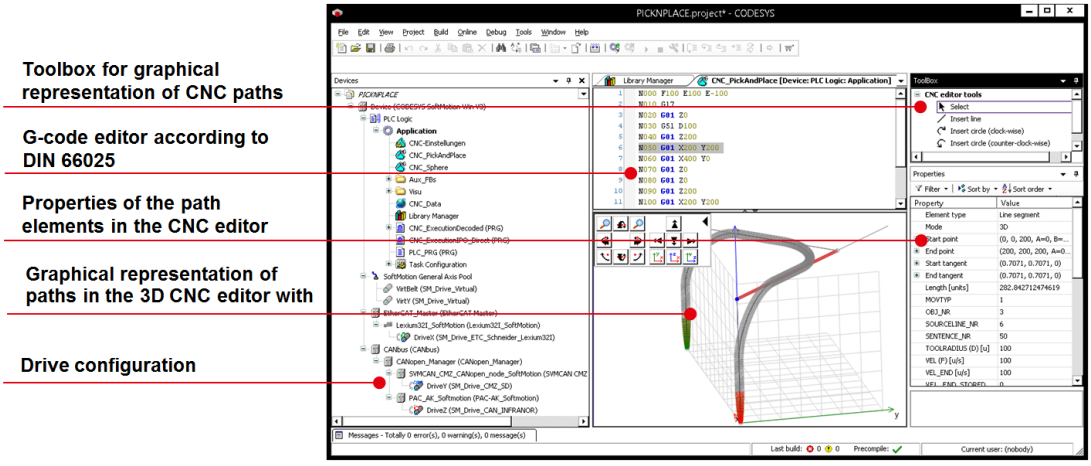
- Additional orientation kinematics, which can be combined with the other kinematics listed above, such as gantry and tripod kinematics.
- Tools with orientation and position offset (full 6D)

Scope of SoftMotion function library (contents of CODESYS SoftMotion)

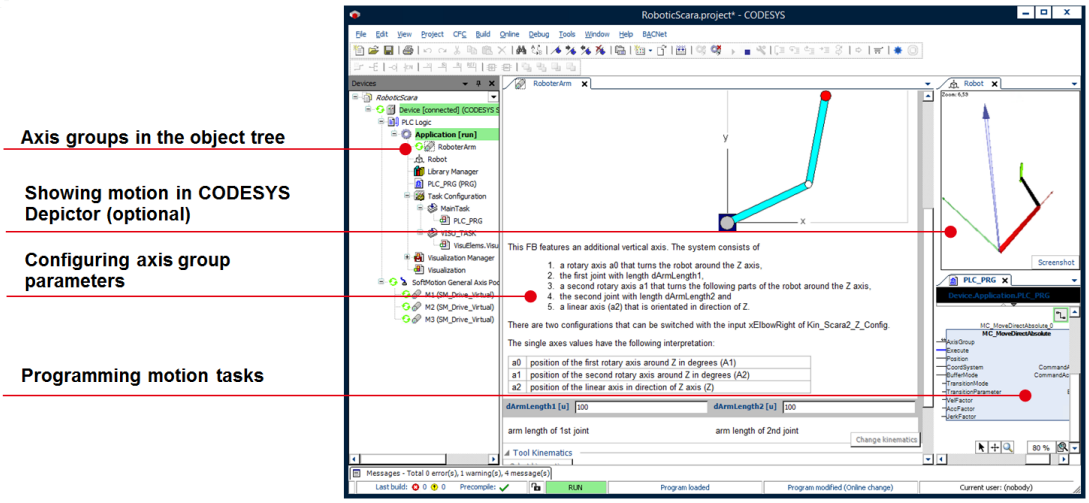
- Certified function blocks according to PLCopen MotionControl, Part 1 (V1.1):
  - Absolute and relative positioning (MC_MoveAbsolute, MC_MoveRelative)
  - Superimposed positioning (MC_MoveSuperimposed)
  - Movement at constant velocity (MC_MoveVelocity)
  - Consistent support of jerk-limited profiles (continuous acceleration for any kind of interruption of the current motion)
  - Drive-guided homing (MC_Home)
  - Blocking stop (MC_Stop)
  - Control release (MC_Power)
  - Read and write parameters (MC_Read/WriteParameter)
  - Read actual position (MC_ReadActualPosition)
  - Position, velocity, and acceleration profiles (MC_*Profile)

- Function blocks according to PLCopen MotionControl, Part 2 (V1.0):
  - Probe (MC_TouchProbe, MC_AbortTrigger)
  - Set and move position (MC_SetPosition)
  - Read actual velocity and actual torque (MC_ReadActualVelocity, MC_ReadActualTorque)
  - Cam switch (MC_DigitalCamSwitch)
  - Electronic gear with synchronization position (MC_GearInPos)
  - Full stop (MC_Halt)
  - Additional blocks
  - Control and query of the static deceleration
  - Monitoring of the drag error, a position window, or maximum values
  - Distance measurement (also of modulo axes)
  - External definition of position, velocity, and target value from the application
  - Management of errors in the function blocks
  - Controller-guided homing
  - Operation of cams and cam switches
  - Definition of the specified target torque
  - Drive commissioning
  - Absolute and relative positioning with transitional velocity (SMC_MoveContinuousAbsolute and SMC_MoveContinuousRelative)
  - Setting control mode to position, velocity, or torque

- Documentation of the library functions in the online help



Picture 1: Using the CNC editor to create a CNC application in the CODESYS Development System



Picture 2: Project engineering of a SCARA robot with an axis group and program block in CODESYS

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

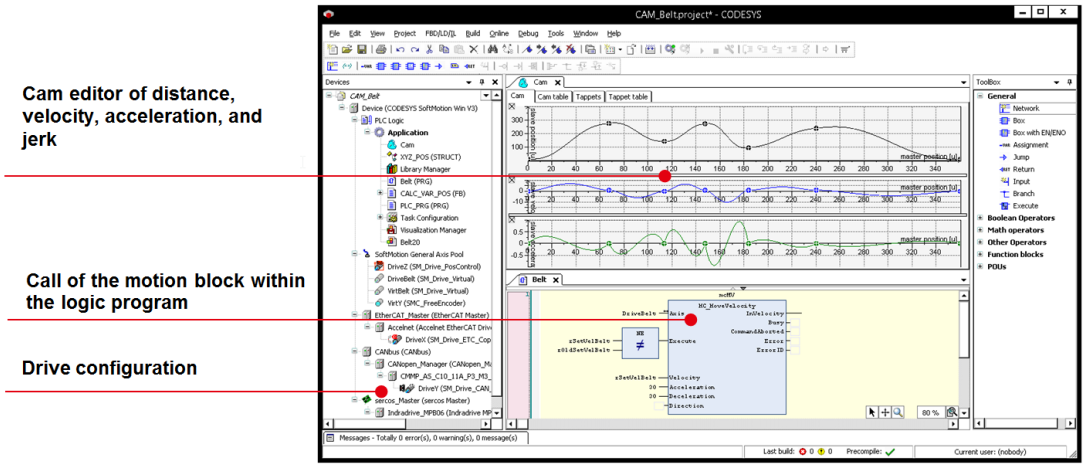
- Simultaneous graphical and textual editors
- Path preprocessing (offline preview of the effects, for example angle smoothing)
- Path pre-interpolation (offline preview of the resulting position, velocity, acceleration, and jerk curves of all supported axes)
- DXF import
- Read from and save to file
- 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)

Range of functions for the cam editor

- Graphical and numerical planning for the cam using any base in representation of the distance, velocity, acceleration, and jerk
- Linear or polynomial interpolation (5th order polynomial)
- Configuration of tappets and their switching behavior in the cam
- Configuration of the cam regarding dimension, period, and continuity requirements



Picture 3: Using cam planning to create a motion project in the CODESYS Development System

Supported fieldbus systems and drive connections

- EtherCAT
- CAN/CANopen
- Sercos
- Virtual drives (for virtual axes and tests)
- Position control in the PLC by using PTt control for velocity-controller axes with position feedback (for example, frequency converter with encoder feedback, hydraulic axes with proportional valve, and position feedback)
- Logical axes as copies of other axes with independent offset and on-demand dead-time compensation / actual value smoothing
- Configuration of encoder axes that form any analog signal (for example, as the master axis for cams)

Tested drivers for the following drives

- EtherCAT:
    - Beckhoff EL2521 / EL5101 / EL72x1 / EL7031
    - Bonfiglioli iBMD
    - CMZ BD / LBD
    - Control Techniques Digitax / Mentor / Unidrive
    - Copley Accelnet
    - Delta ASDA A2 / A3 / B3
    - Festo CMMP EtherCAT
    - Generic CiA 402 (also for multi-axis drives)
    - Generic SoE (also for multi-axis drives)
    - Hitachi ADV series
    - Infranor XtrapulsPac
    - JAT Ecovario
    - KEB F5 / H6
    - Kollmorgen AKD / AKD Servodrive
    - Metronix ARS 2000 series
    - Omron G5
    - Panasonic MINAS A5B / A6B
    - Parker compax3 / SBC / PSD
    - Sanyo Denki RS2
    - Schneider Electric Lexium32 / Lexium32i
    - Servotronix CDHD
    - Stäubli uniVAL
    - Stöber Posidrive, SD6, SI6/SC6
    - Yaskawa Sigma7 series

- CAN/CANopen
    - Bonfiglioli iBMD
    - CMZ BD /SD / LBD
    - Festo EMCA / CMMP

- Generic CiA 402 (also for multi-axis drives)
- Infranor cd1-k / XtrapulsPac
- KEB F5 / Stepless Technology
- Metronix ARS 2000 series
- Nanotec PD4C
- Schneider Electric Lexium05 / Lexium23 / Lexium28 / Lexium32 / Lexium32i / SD-3
- JAT Ecovario

- Sercos
  - Bosch Rexroth IndraDrive C/M/Cs/ML/Mi

General information

Manufacturer:

3S-Smart Software Solutions GmbH
Memminger Strasse 151
87439 Kempten
Germany

Support:

https://support.codesys.com

Item:
CODESYS SoftMotion CNC+Robotics SL
Item number:
2305000001
Sales:

CODESYS Store
https://store.codesys.com

Included in delivery:
- Extended device description for SoftSPS
- License key

System requirements and restrictions

Programming System	CODESYS Development System V3.5.9.50 or higher
Runtime System	CODESYS Control Version 3.5.5.0 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, or Sercos) Note: Use the project “Device Reader” to find out the supported features of your device. “Device Reader” is available for free in the CODESYS Store.
Additional Requirements	WIBU Codemeter Support **CODESYS SoftMotion CNC+Robotics requires CODESYS SoftMotion as a basis license.**
Restrictions	-
Licensing	License activation optional on CODESYS Key or Soft Key (Soft Key: free of charge component of CODESYS Controls)
Required Accessories	Optional: CODESYS Key

Note: Not all CODESYS features are available in all territories. For more information on geographic restrictions, please contact sales@codesys.com.
Note: Technical specifications are subject to change. Errors and omissions excepted. The content of the current online version of this document applies.