SIMATIC S7-1500 - All about Motion Control

SIMATIC S7-1500

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1 General Programming / Standardization

1.1 S7-1200/S7-1500: Programming Guidelines and Programming Styleguide

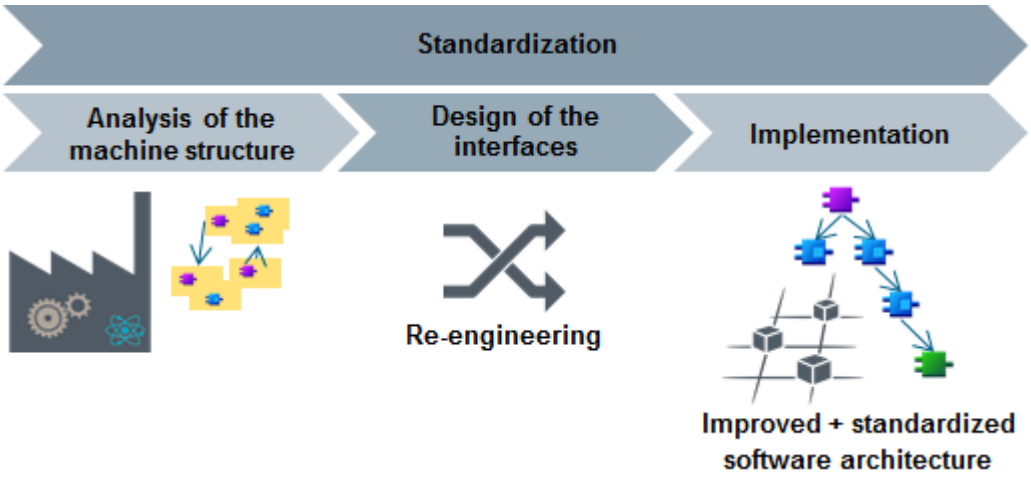
Two different manuals for optimal programming of S7-1200 and S7-1500 controllers are offered here:

- programming guideline (optimal programming with regards to technology)
- programming guideline safety (Recommendations for configuring F-CPUs and programming safety programs)
- programming styleguide (suggestion for a consistent program style)

Siemens Industry Online Support ID: 81318674

1.2 S7-1500: Guide to Standardization

The standardization guide shows you how you can modularize your machines and systems. It gives you recommendations and hints for structured and standardized programming of your automation solutions.



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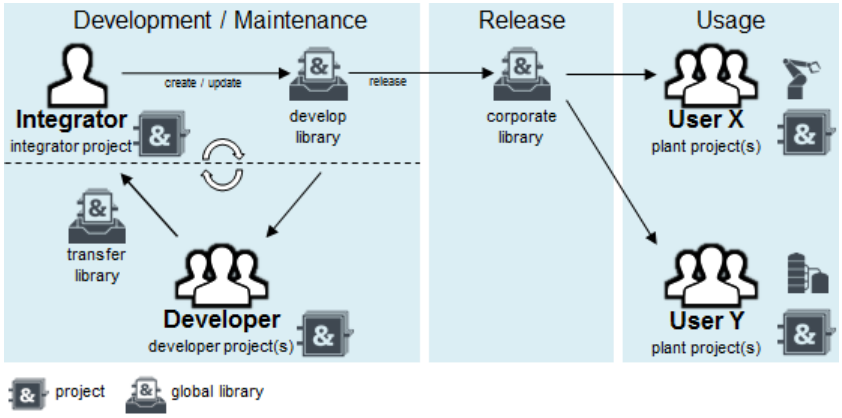
1.3 S7-1200/S7-1500 Guideline on Library Handling in TIA Portal

This guideline describes the creation of a corporate library using typified library elements in TIA Portal.



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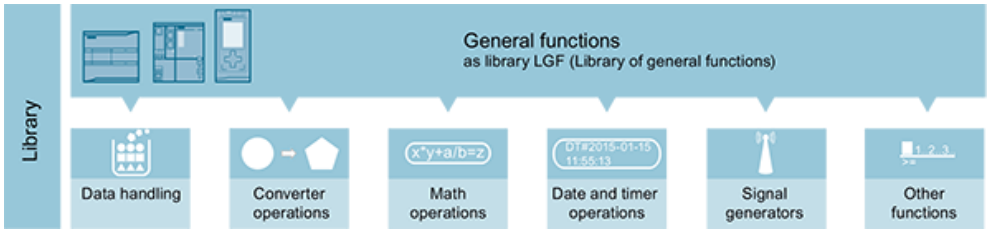
1.4 S7-1200/S7-1500: Library of general functions LGF

The library "LGF (Library of general functions)" contains additional functions for STEP 7 (TIA Portal).



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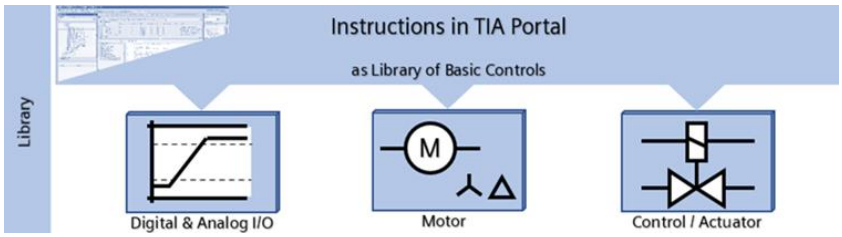
1.5 S7-1200/S7-1500 Library of Basic Controls (LBC)

The “Library of Basic Controls” (LBC) provides basic control modules that are programmed in a standardized concept according to the Siemens programming style guide and the “PLCopen” guideline.



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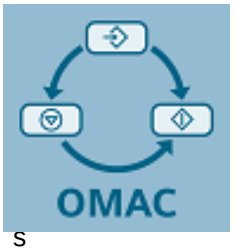
1.6 S7-1200/S7-1500 OMAC PackML V3 Machine and Unit States



The Intelligent Belt application (multi belt control) can be used to pick up sequentially arriving products and to provide them grouped at an unloading position. The most important feature is that loading and unloading are independently performed.

s

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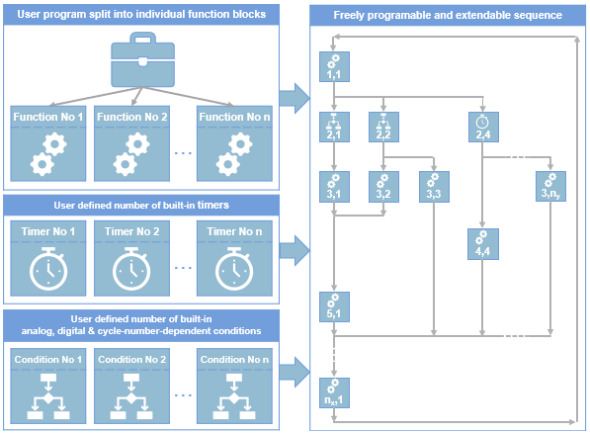
1.7 S7-1500 SIMATIC ACL

ACL makes this programming work easier for the user by allowing pre-defined actions, built-in timers and fully parameterizable digital and analog conditions to be combined into a sequence based on a modular principle in a simple user interface.

The following benefits are provided with this library:

- Flexible sequence configuration and controlling of cyclic processes
- Cycle and action time monitoring with various reaction options if the time limit is exceeded
- Action-dependent as well as -independent time delays
- Parameterizable analog, digital and cycle number dependent conditions with various reaction options
- Modes: Fully-Automatic, Semi-Automatic, Repositioning
- Error handling included
- Easily extendable matrix



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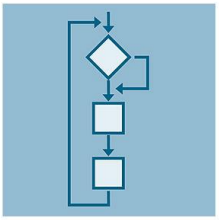
1.8 S7-1500 / S7-1500T SIMATIC Interpreter



The Interpreter application provides the commands for control structures, such as jumps, loops and transition conditions. Simple mathematical functions are also implemented. This enables easy parametrization of the machine sequences, without the need of further programming skills. The parameterization of the machine sequences can take place both during engineering phase and during normal machine operation, e.g. via an HMI. This allows a flexible response to different requirements

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2 Diagnostics and communication

Diagnostics reduces downtimes and thus contributes to increasing the productivity of the machine. Diagnostics supports over the entire lifecycle of a machine, from planning to operation and maintenance. Diagnostics essentially comprises the diagnosis of all system components, the monitoring of process sequences and the diagnosis of program errors.

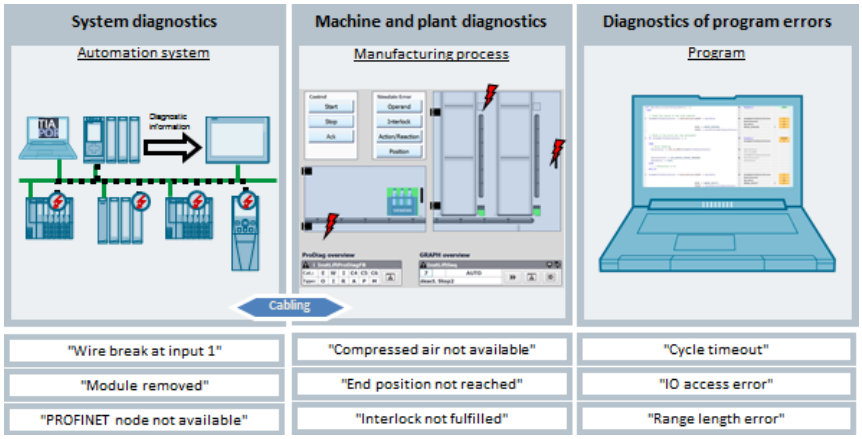
Provided Applications

Application - System Diagnostics with S7-1500 and TIA Portal

Application - Diagnostics in User Program with S7-1500

Application - Machine and Plant Diagnostics with ProDiag

Application - Overview: Diagnostic tools at SIMATIC and SCALANCE



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2.1 S7-1500 Overview acyclic communication standards to SINAMICS V90 via PROFINET

This example shows you the difference between different communication applications regarding communication to SINAMICS drive systems.

Basic application example for acyclic communication of a SIMATIC S7-1500 using different function block variations to a SINAMICS V90 via PROFINET

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2.2 S7-1200/S7-1500 Acyclic Data Exchange LAcycCom

The standard libraries LAcycCom for SIMATIC S7-1200/S7-1500 and LDPV1 for SIMOTION provide a collision-free coordination of communication resources in the CPU for acyclic data exchange via DPV1 services. Therefore the corresponding functions in these libraries have to be used in the application instead of the existing system functions for the communication with external devices.

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2.3 S7-1500 Alarm Handling for SINAMICS drives

With the Alarm Handling application the alarm, fault and safety messages of SINAMICS drives can be read and added to the alarm display of the SIMATIC S7-1500. The messages are added with the timestamp of the event in the drive and with the message texts of the SINAMICS drive. This provides enormous support for the first fault evaluation at the machine.

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2.4 S7-1200/S7-1500 Simple acyclic Function Blocks for controlling a SINAMICS drives in TIA Portal

This entry contains additional SIMATIC function blocks that support you in various functions of the SINAMICS drive system like absolute encoder adjustment.

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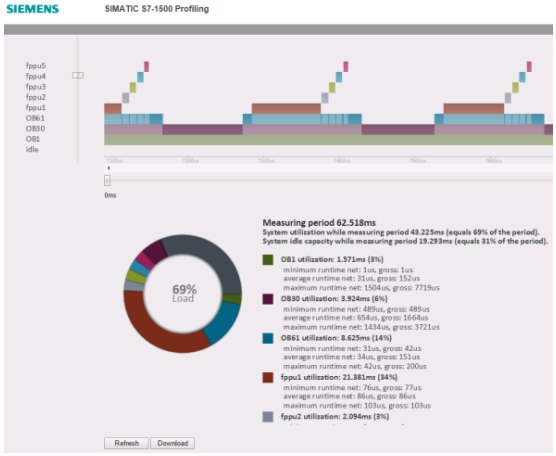
2.5 S7-1500 Profiling / CPU task trace

The runtime behavior of an application on a SIMATIC S7-1500 controller can be analyzed and evaluated in-depth using SIMATIC S7-1500 Profiling. All relevant information is displayed graphically via a web-based visualization (see figure). For further analysis purposes, you can output the recorded data as CSV file and evaluate it in a spreadsheet.



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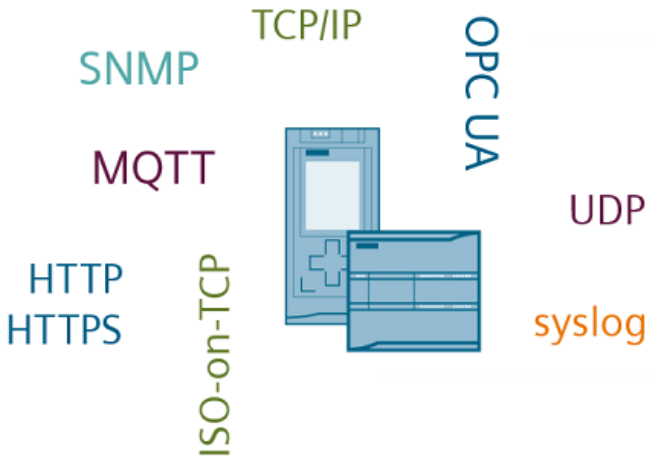
2.6 S7-1200/S7-1500 Libraries for Communication for SIMATIC Controllers

The Libraries for Communication are a collection of blocks for various communication tasks, functions, and protocols for SIMATIC Controllers.



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3 Safety

3.1 S7-1200F/S7-1500(T)F Programming Guideline Safety

This document provides you with many recommendations and notes for the optimal configuration and programming of S7-1200/1500 controllers. This helps you create standardized and optimal programming of your automation solutions.

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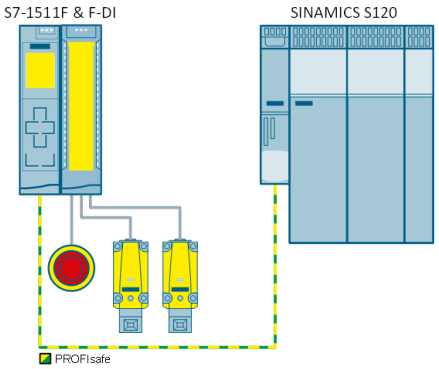
3.2 S7-1500(T)F Safety Integrated with SINAMICS S120 via PROFIsafe

This application example describes how to implement the following safety functions of the plant with the Safety Integrated Functions of the SINAMICS S120 and a SIMATIC S7-1500 F-CPU.



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3.3 S7-1200F/S7-1500(T)F SINAMICS Failsafe blocks LDrvSafe

The library includes fail-safe SIMATIC S7 blocks to implement various Safety applications in conjunction with a S7-1200F, S7-1500F, failsafe Open/Software Controller, SINUMERIK ONE and SINAMICS drives coupled through PROFIsafe.

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3.4 S7-1200F/S7-1500(T)F SIMATIC Micro-Drive Failsafe library LDrvSafe

The library contains fail-safe S7 blocks for implementing various safety applications in which an S7-1200F/1500F and a SIMATIC MICRO-DRIVE PDC-F interact via PROFIsafe.

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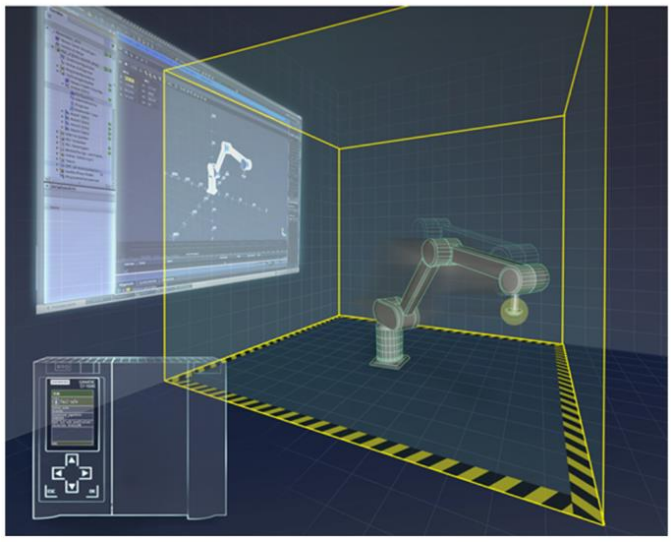
3.5 S7-1500(T)F SIMATIC Safe Kinematics – in a nutshell

With SIMATIC Safe Kinematics, movement in space of predefined kinematics with up to 12 interpolating axes can be monitored safely.

The following monitoring functions are available:

- Safe velocity monitoring
  With safe velocity monitoring you monitor the cartesian velocity of individual kinematics points, e.g. at the Tool Center Point or at joints.
- Safe zone monitoring
  With safe zone monitoring you monitor the position of the kinematics in the cartesian space, e.g. to limit the travel range of the kinematics or to monitor areas that can be entered by operating staff.
- Safe orientation monitoring
  With safe orientation monitoring you monitor the orientation of the flange at an user-defined kinematics, e.g. the operation on a workpiece may only be enabled if the tool is vertical to the floor.



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4 Motion Control

This topic page gives you an overview of the essential documents, entries and links on the topic of Motion Control. The topic Motion Control contains every control task to the operation of drives and capturing position values with the help of position sensors.

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4.1 General Motion Control

4.1.1 S7-1500/S7-1500T Standard application axis control (LAxisCtrl & LAxisBasics)

Function blocks for simple and central control of the basic motion control functions of axes (technology objects) of a SIMATIC S7-1500 or S7-1500T. The central view of each axis via this standard application enables easy programming, fast commissioning and direct testing of your application.

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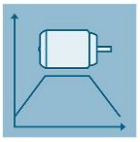
4.1.2 S7-1500 LCalcMC - Calculation of motion profile details



When moving axes in production machines, the following questions are of particular interest:

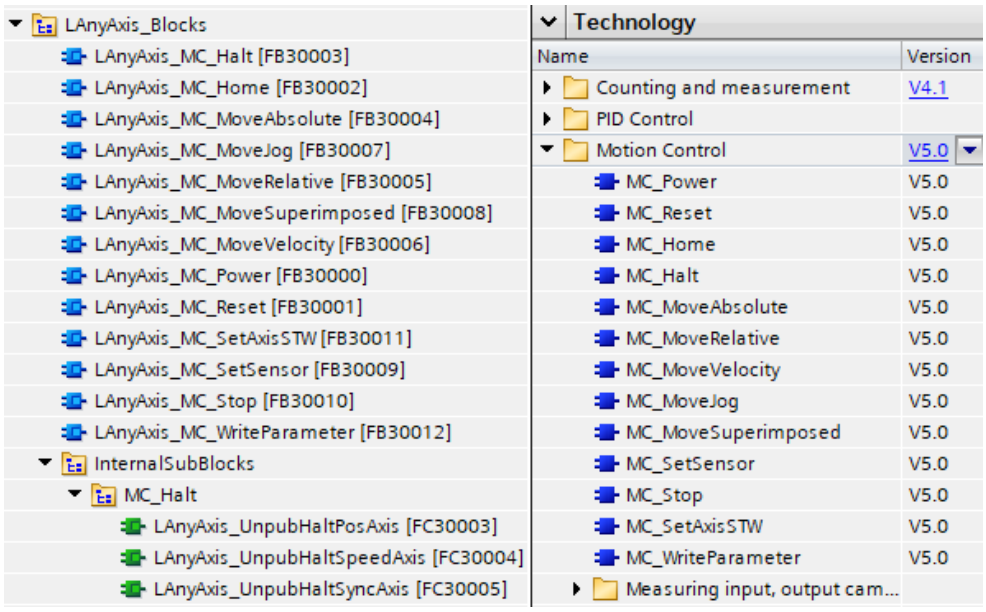
- How much time will a positioning take?
- How long does it take to reach the target velocity?
- How much distance is traveled when a velocity change is commanded?
- What acceleration is needed to complete a positioning in a certain time?
- When must a movement be stopped at the latest to avoid a crash (collision monitoring)?
- How can maximum required power be reduced?
- How can the jerk be limited to achieve minimal wear on the machine?
- …

The library LCalcMC for SIMATIC provides easy-to-use calculation functions that help the user to find solutions to the above questions. The function results can be used for programming the motion profiles with respect to the dynamics (velocity, acceleration, deceleration, jerk).

Siemens Industry Online Support ID: 109475569

4.1.3 S7-1500/ S7-1500T LAnyAxis - Motion Control Applications with DB_ANY

By means of the library it is possible to create own motion control applications for various axis types. This is used, for example, for software modules with flexible use of technology objects or when using axis arrays.



Siemens Industry Online Support ID: 109779533

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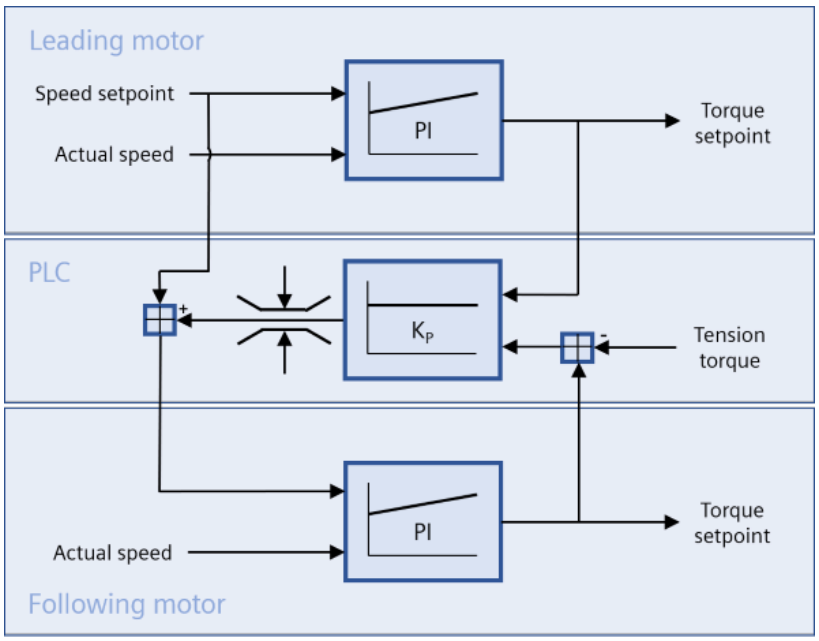
4.1.4 S7-1500 LPrintMark - Print Mark Acquisition with TO Measuring Input

The blocks of the present library support the user in acquiring print marks via the technology object measuring input in the automation system SIMATIC S7-1500 or SIMATIC S7-1500T.

Siemens Industry Online Support ID: 109475573

4.1.5 S7-1500 Load balancing (LLoadBal)

The "LLoadBal" library provides a load balancing functionality to be easily integrated into existing user projects in which several motors act on a common mechanical load and drive it together.



Siemens Industry Online Support ID: 109794291

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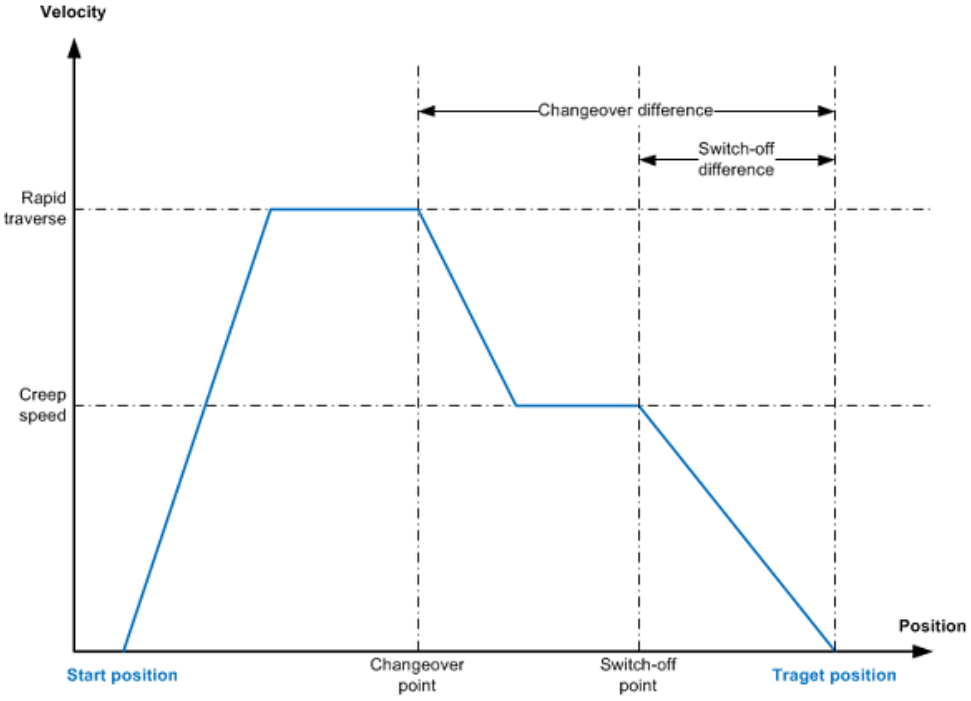
4.1.6 S7-1500 Rapid/Traverse/Creep Speed positioning

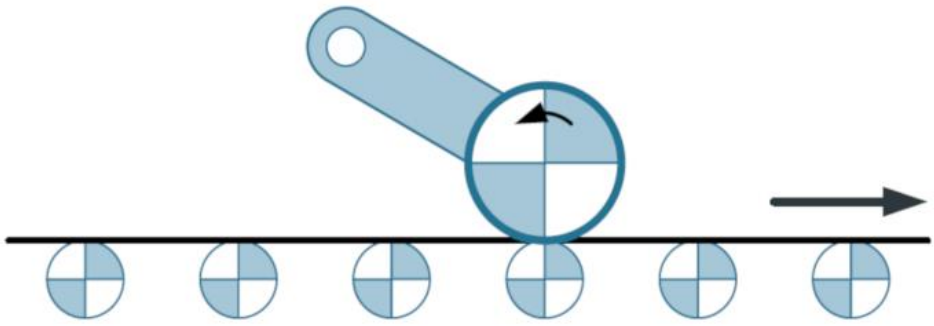
Rapid traverse/creep speed positioning moves an axis to a specified target position in a relatively simple way. The traversing motion is performed with the aid of two speed levels and suitable switchover points.



Siemens Industry Online Support ID: 109745386

4.1.7 S7-1500T Guidelines for filtering and extrapolation with actual value coupling

This FAQ response provides guidelines for parameterizing the actual value extrapolation on the "External encoder" technology object. The individual parameters are explained in detail and the effect of the actual value extrapolation is demonstrated with examples.



Siemens Industry Online Support ID: 109763337

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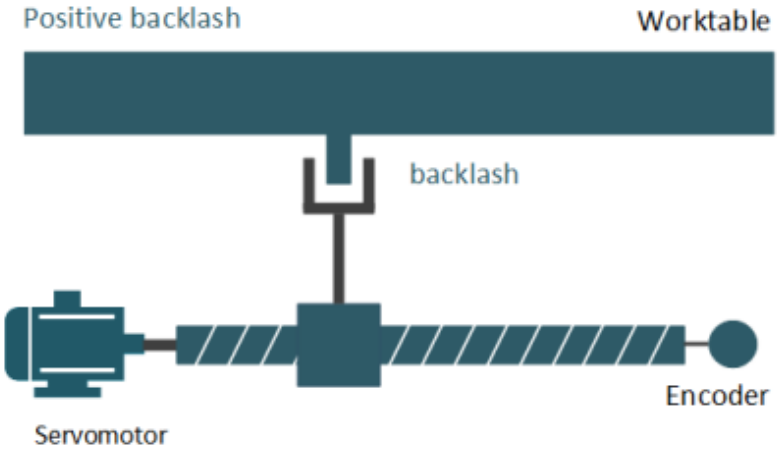
4.1.8 S7-1500 Backlash compensation

From Motion Control V6.0 (TIA Portal V17 – PLC FW V2.9) the backlash compensation is integrated in the system features of the technology objects.

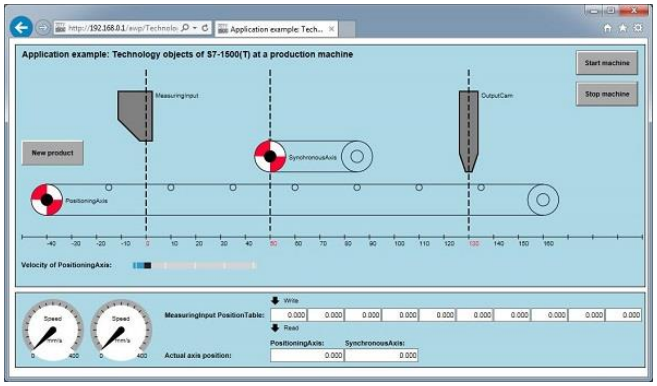
The FB "BacklashCompensation" on the S7-1500 CPU computationally compensates the mechanical play between a drive and a moving machine part or the play between an encoder and a moving machine part.



Siemens Industry Online Support ID: 109766673

4.1.9 S7-1500 Technology Objects of SIMATIC S7

The technology objects included in the SIMATIC CPUs simplify the programming of technological processes. This application example introduces the technology objects of the SIMATIC S7-1500(T) and shows their use in an example program.



Siemens Industry Online Support ID: 109743134

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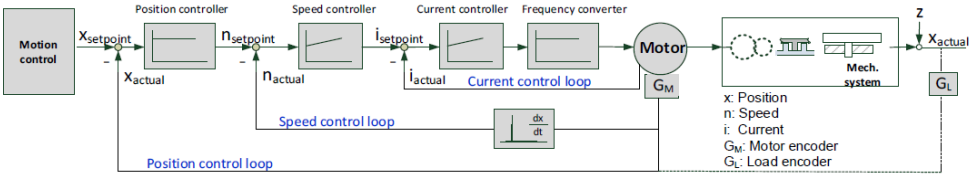
4.1.10 S7-1500 Basics of axis control with technology objects and approach to axis optimization

This guide to position controller optimization of a technology object (TO) describes the basic principle of axis control and the optimization of position control in TO.



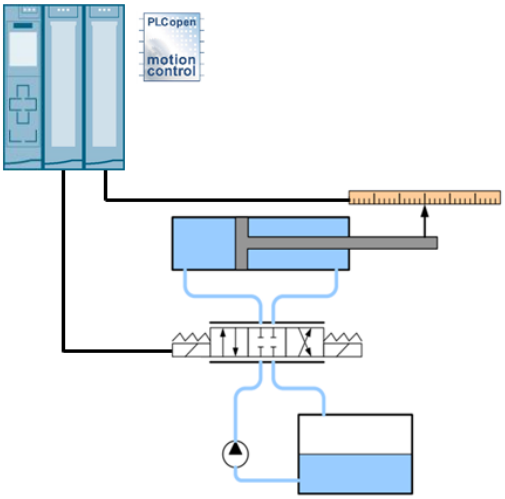
Siemens Industry Online Support ID: 109779884

4.1.11 S7-1500 Use of MC-PreServo and MC-PostServo

The MC-PreServo and MC-PostServo organization blocks are programmable and allow a program modification directly before or after the call of the MC-Servo organization block.

TIA Portal V14 and higher provides the possibility to access the interface between axis and drive or between axis and encoder via the user program.

In addition to PROFIdrive and analog coupling, the data connection of drive and encoder to the axis technology object can also be provided via a data block.



Siemens Industry Online Support ID: 109741575

4.1.12 S7-1500 Which requirements have to be fulfilled before a technology object can be enabled via "MC_Power"?

Before a technology object can be enabled without error via "MC_Power", all the necessary sensors (encoders) and actuators (drives) must be available for the technology object.

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4.1.13 S7-1500 SIMATIC Low Frequency Vibration Suppressed Positioning

With this application the load oscillation for positioning can be reduced significantly.

It is suitable for applications, where low frequency load vibrations occur.

The axis is positioned in a way, so that the load oscillation is exciteted as less as possible. This way the oscillation on the load side can be reduced significantly, without having a load encoder.

Siemens Industry Online Support ID: 109799539

4.1.14 S7-1500 What are the advantages of using the data type DB_ANY with Motion Control applications?

You can store all sorts of data blocks in an ARRAY of the data type DB_ANY. Hence also the technology data block of the technology object of a project. An ARRAY of the data type DB_ANY can show a list of axes, for example. In this way, technology objects can be integrated more flexibly in user program.

		Name	Data type	Start value
1		Static		
2		PositioningAxis	Array[1..3] of DB_ANY	
3		PositioningAxis[1]	DB_ANY	0
4		PositioningAxis[2]	DB_ANY	0
5		PositioningAxis[3]	DB_ANY	0
6		SpeedAxis	Array[1..2] of DB_ANY	
7		SpeedAxis[1]	DB_ANY	0
8		SpeedAxis[2]	DB_ANY	0
9		SynchronousAxis	Array[1..5] of DB_ANY	
10		SynchronousAxis[1]	DB_ANY	0
11		SynchronousAxis[2]	DB_ANY	0

Siemens Industry Online Support ID: 109750880

4.1.15 SINAMICS Which drives can you use with S7-1500 Motion Control

An overview of configuration options for SINAMICS drives with different versions of TIA Portal.

Siemens Industry Online Support ID: 109750431

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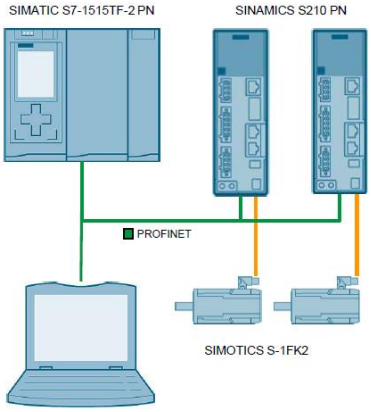
4.1.16 S7-1500 Technology Objects with Sinamics S210

SIMATIC S7-1500 CPUs support the connection of drives as speed axis, positioning axis or synchronous axis via PROFINET, PROFIBUS or via an analog drive connection. In TIA Portal it is possible to control a SINAMICS S210 drive in a TIA Portal program and to operate it using Motion Control instructions.



Siemens Industry Online Support ID: 109749795

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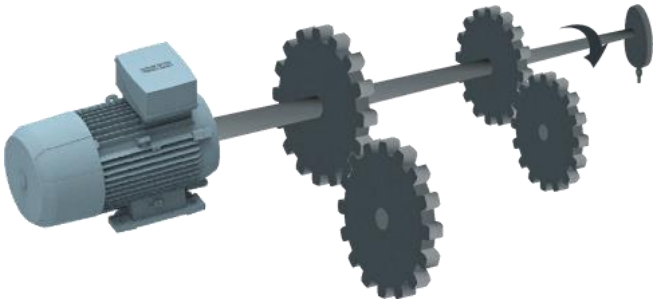
4.2 Synchronous Operation

4.2.1 S7-1500/ S7-1500T Compare of synchronization modes

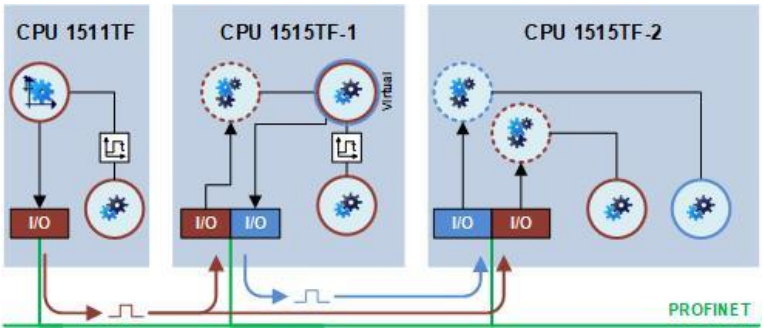
The synchronization modes of the SIMATIC S7-1500(T) are presented in this application example. The synchronous types of gear synchronism and cam synchronism are described in detail and illustrated by means of motion recordings.



Siemens Industry Online Support ID: 109764888

4.2.2 S7-1500T Cross PLC synchronous operation

Cross-PLC synchronous operation is available from firmware version V2.8 in all technology controllers and from firmware version V20.8 in the Open Controller of the SIMATIC S7-1500T controller family and can be used in SIMATIC for synchronous operation with gearing or camming across several controllers.



Siemens Industry Online Support ID: 109770938

4.2.3 S7-1500T Set synchronization in simulation - Retain a synchronized connection when locking the slave axis, for example

When you remove the axis enable or in the case of motion jobs on a slave axis, an active synchronized connection is disconnected. By setting the synchronization in simulation you can keep the synchronization active without disconnecting it.

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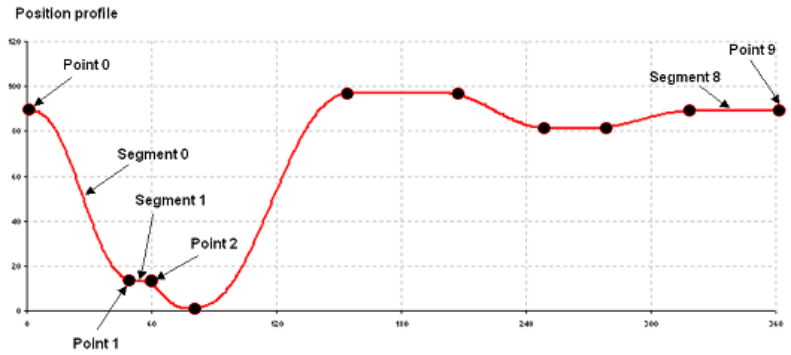
4.2.4 S7-1500T Creation of cam disks at runtime

The LCamHdl library for SIMATIC and SIMOTION provides function blocks that support the user in creating high-quality and jerk-free cam disks compliant to VDI guideline 2143. The necessary calculations of the segments of different profile types especially of polynomial coefficients and standardizations are done by the function blocks.



Siemens Industry Online Support ID: 105644659

4.2.5 S7-1500T Synchronize in Standstill CamInStandStill

This application example shows how to couple the leading axis and one or more following axes via setpoint positions in standstill with camming using the instruction "MC_CamIn".

At the motion control function "MC_CamIn", the parameter setting “SyncProfileReference" = 2 can be used to set a following axis synchronously with a leading axis via a cam disk coupling. The master and slave axes must be at the synchronous position before the function is called (for more information, see also 109758886).

The use of the function blocks described below allows you to move the leading axis or one or more following axis/axes directly to the synchronous position and then couple them.

Siemens Industry Online Support ID: 109745764

4.2.6 S7-1500T How does a slave axis of camming behave during "Direct synchronous setting" (SyncProfileReference = 2)?

When 'direct synchronous setting' is performed for a slave axis with the aid of the "MC_CamIn" motion control function in camming using the "SyncProfileReference" = 2 parameter setting, the cam is offset based on the current positions of the two axes and the two axes are synchronized immediately.

Siemens Industry Online Support ID: 109758886

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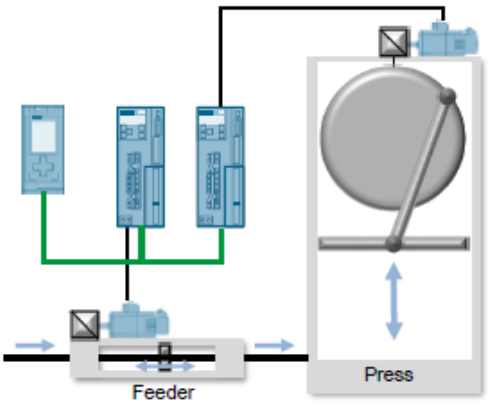
4.2.7 S7-1500T Switchover and generation of cams

A press is created using the components shown in figure. The material is pushed into the press through a feeder. The motion profile of the feeder is stored in two cams, which should be switched over during press operation. It should also be possible to change the values of the cams at any time.



Siemens Industry Online Support ID: 109749460

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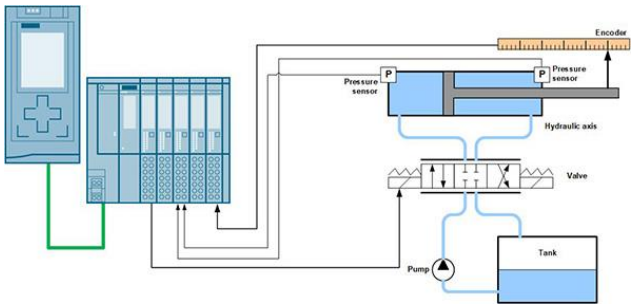
4.3 Hydraulic

4.3.1 S7-1500 LSimaHydTO for hydraulic applications

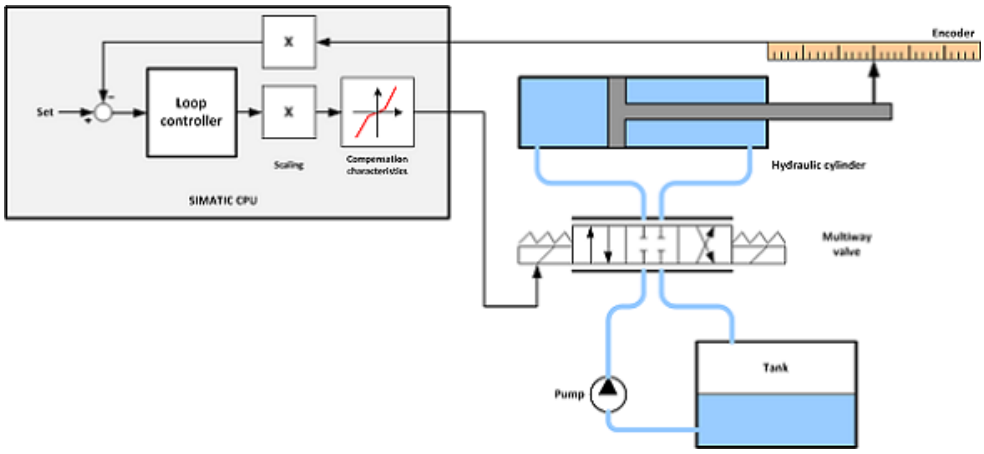
The "LSimaHydTO" block library enables closed-loop control of hydraulic axes with the SIMATIC S7-1500(T). With the help of modular function blocks, it is possible to realize not only valve-controlled hydraulic applications, but also those with variable-RPM pump drive (servo pump).



Siemens Industry Online Support ID: 109756217

4.3.2 S7-1500 Manual determination of a compensation characteristic for hydraulic valves and hydraulic axes

Description of the approach on how to determine a compensation characteristic for a hydraulic valve or axis for use with the “Axis” technology object (TO) of the S7-1500(T).



Siemens Industry Online Support ID: 109747516

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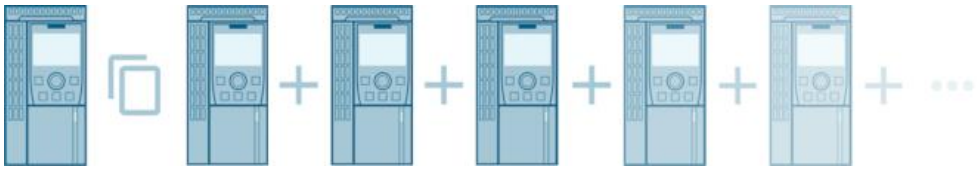
4.4 Motion Control & Drives

4.4.1 SINAMICS SDC: Serial Drive Commissioner

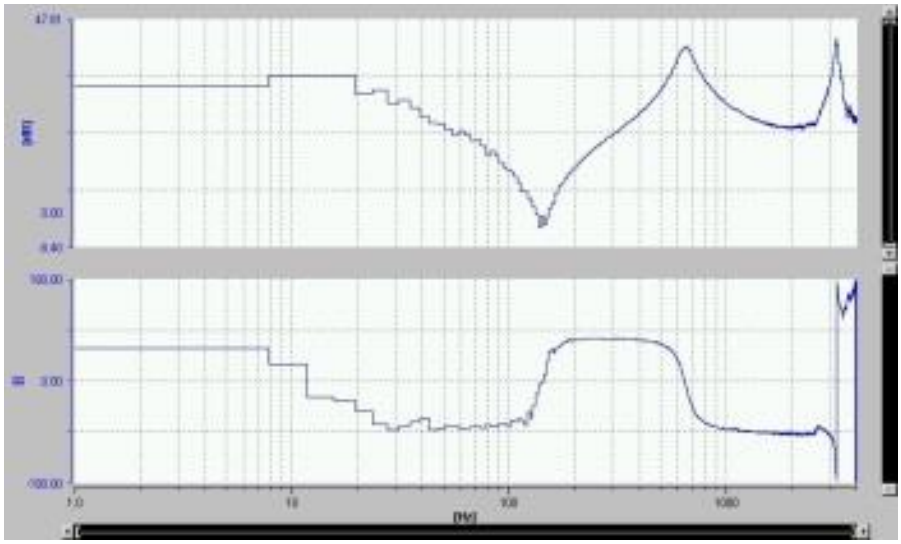
The openness application SINAMICS SDC (Serial Drive Commissioner) provides functionality to copy, update and download multiple drives. The PROFINET drives of the SINAMICS G product line and SINAMICS S210 included in SINAMICS Startdrive are supported.



Siemens Industry Online Support ID: 109774753

4.4.2 SINAMICS drive optimization guide

The Drive Optimization is an important part during commissioning of servo applications. Dynamic, stability and the limits of the mechanical system must be evaluated and optimized. The productivity of the machine axis can often be increased by optimization methods.



Siemens Industry Online Support ID: 60593549

4.4.3 S7-1200/S7-1500 Drive Lib control blocks for TIA Portal

Here you can find the DriveLib for reading and writing data from and to the SINAMICS S/G converter systems within SIMATIC S7-300/400/1200/1500 at TIA Portal. Note: As from Startdrive V16, the DriveLib library is no longer supplied with Startdrive. As from STEP7 V15.1, these blocks are also provided as instructions.

Siemens Industry Online Support ID: 109475044

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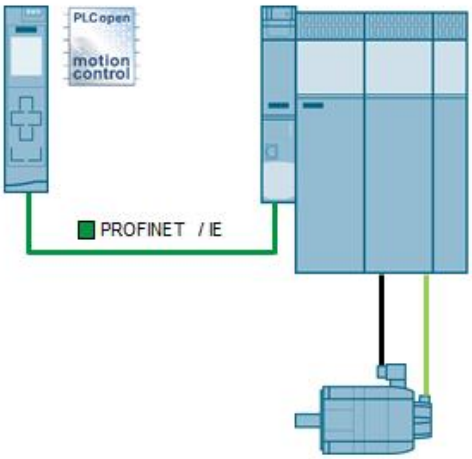
4.4.4 S7-1500 Configuring a SINAMICS S120 with Startdrive

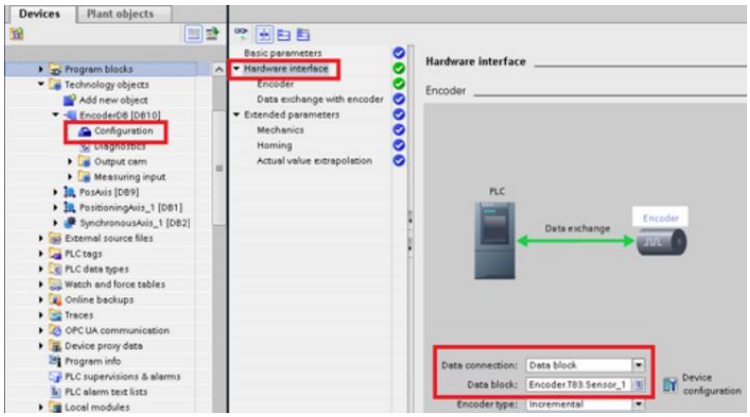
In this application example, a SINAMICS S120 drive is operated as position-controlled drive. This drive shall serve as master axis for a second drive configured with gear synchronization. The drives are configured using "SINAMICS Startdrive V15.1



Siemens Industry Online Support ID: 109743270

4.4.5 S7-1500T and SINAMICS S120: Connecting a 2nd encoder using Startdrive + Tel. 106

With Startdrive V15 and V16 you cannot configure machine or external encoders as encoder DO. You can configure a second encoder on the drive and send the encoder data to the S7-1500T via telegram 106, but the data cannot be evaluated in the axis TO. We show you how, you still can evaluate the encoder data with the aid of a DB and the TO External Encoder.



Siemens Industry Online Support ID: 109793754

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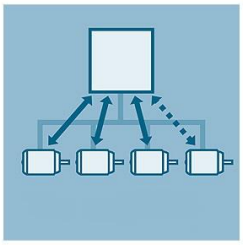
4.4.6 S7-1500 LSINATopo - SINAMICS Topology Modifications at Runtime



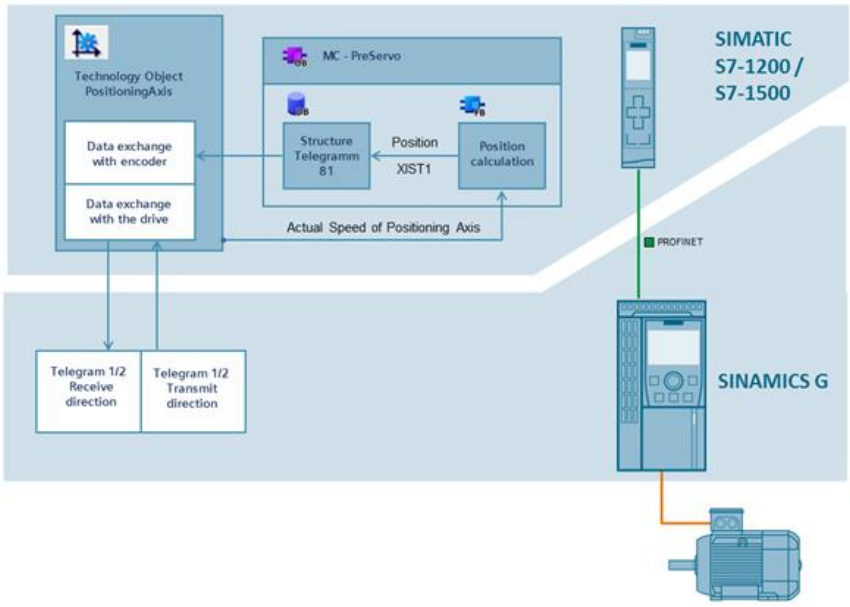
In addition to enabling and disabling SINAMICS components, the LSINATopo library offers the following functions for SINAMICS S120, among others:

- Replacing large motor/small motor
- Replacing double-axis module with two single-axis modules (and vice versa)
- Enable/disable motor brake
- Replacing Active Line Module
- Replacing when Safety is activated

Siemens Industry Online Support ID: 109770003

4.4.7 S7-1200/S7-1500 Encoderless positioning with SINAMICS G

In most applications, measuring systems are used to determine position actual values, for example a motor encoder. There are also many applications where encoders are not necessary and in fact, in some cases, an encoder is not required at all. The subsequent application example discusses the various options and secondary conditions relating to encoderless positioning.



Siemens Industry Online Support ID: 109767951

4.4.8 SIMATIC Micro-Drive PDC/PDC-F Operation of third-party motors

User information for connecting third-party motors to converters of SIMATIC MICRO-DRIVE PDC/PDC-F product family.

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4.4.9 Siemens Industry Online Support ID: 109780403S7-1500 SIMATIC Micro-Drive positioning axis

Application example for using a SIMATIC MICRO-DRIVE PDC/PDC-F as positioning axis with SIMATIC S7-1500 Technology Object via PROFINET.

Siemens Industry Online Support ID: 109770395

4.4.10 S7-1500 Getting Started: SIMATIC F-TM ServoDrive

This entry describes the configuration and optimization of the F-TM ServoDrive and its connection to the technology object (TO) Positioning axis.

Siemens Industry Online Support ID: 109780201

4.4.11 SIMATIC Micro-Drive Motor recommendation SIMATIC F-TM ServoDrive

When using the SIMATIC F-TM ServoDrive in positioning tasks in conjunction with a SIMATIC S7-1500 as well as S7-1200, the design of the mechatronic system for positioning accuracy is of particular importance.

With the information and the Excel tool provided in this article you have the possibility of calculating the positioning accuracy for your individual mechanical system (motor/gearbox combination). The tool also supports you in determining the position resolution of your Motion Control application.

Siemens Industry Online Support ID: 109778535

4.4.12 Projects for the "Universal demonstration and training case with SINAMICS S120" V3

You can here downloads projects that can run on "Universal demonstration and training case with SINAMICS S120, version 3"

Siemens Industry Online Support ID: 109782051

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4.5 Manuals

4.5.1 S7-1500 Motion Control Overview V6.0 as of STEP 7 V17

This documentation describes the Motion Control functions independent of and across technology objects.

Siemens Industry Online Support ID: 109781848

4.5.2 S7-1500 Axis functions V6.0 as of STEP 7 V17

This documentation describes the Motion Control functions for the following technology objects:

- Speed axis
- Positioning axis
- External encoder

Siemens Industry Online Support ID: 109781849

4.5.3 S7-1500 Motion Control alarms and error IDs V6.0 as of STEP 7 V17

This documentation describes the technology alarms of the technology objects and the error identifications of the motion control instructions.

Siemens Industry Online Support ID: 109781853

4.5.4 S7-1500 Measuring input and cam functions V6.0 as of STEP 7 V17

This documentation describes the Motion Control functions for the following technology objects:

- Measuring input
- Output cam
- Cam track

Siemens Industry Online Support ID: 109781852

4.5.5 S7-1500 Synchronization operation functions V6.0 as of STEP 7 V17

This documentation describes the Motion Control functions for the following technology objects:

- Synchronous axis
- Cam (S7-1500T)
- Leading axis proxy (S7-1500T)

Siemens Industry Online Support ID: 109781851

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4.5.6 S7-1500T Kinematics functions V6.0 as of STEP 7 V17

This documentation describes the Motion Control functions for the following technology objects:

- Kinematics (S7-1500T)

Siemens Industry Online Support ID: 109781850

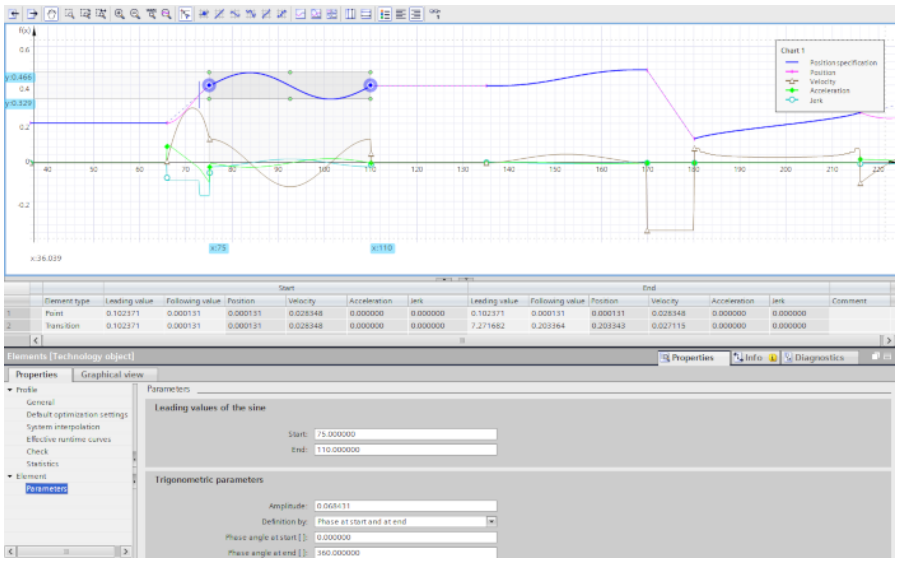
4.5.7 S7-1500 Control structure of a technology object "Axis"

This entry includes a detailed signal flow plan of the control structure of a technology object positioning or synchronous axis of the SIMATIC S7-1500 or SIMATIC S7-1500T.

Siemens Industry Online Support ID: 109770664

4.5.8 S7-1500T Working with the cam editor

The cam editor of the technology object Cam supports the user in creating and dimensioning complex curves in the TIA Portal. Cam elements can be added and parameterized in graphical and tabular form. The transitions between two cam elements are created automatically. The cam editor supports linear interpolation, interpolation with cubic and Bézier splines, and the definition of transitions in compliance with VDI guideline 2143. All changes of the cam are immediately made visible in the graphical area of the editor and can be validated by various methods of verification.



Siemens Industry Online Support ID: 109749820

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4.5.9 S7-1500/ET 200MP Manual Collection

As an alternative to the individual user manuals we are now offering a complete edition of all manuals for the systems S7-1500 / ET 200MP in one pdf file.

Siemens Industry Online Support ID: 86140384

4.5.10 ET 200SP Manual Collection

As an alternative to the individual user manuals we are now offering a complete edition of all manuals and Product Information bulletins for the scalable ET200SP I/O system in one pdf file.

Siemens Industry Online Support ID: 84133942

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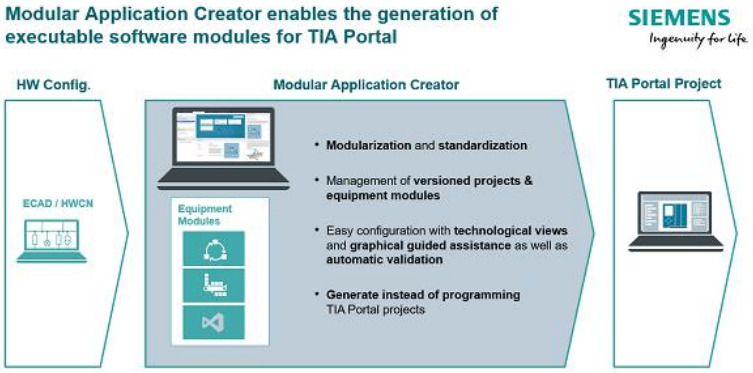
5 Integrated Engineering

5.1 SIMATIC Modular Application Creator (MAC)

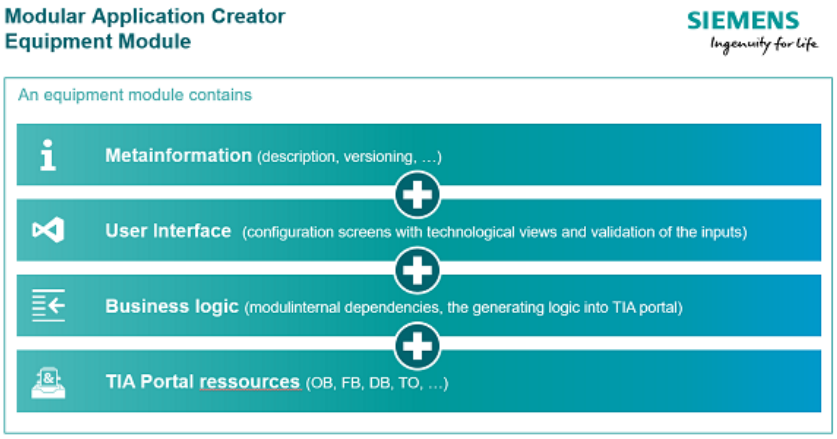
The Modular Application Creator enables the automatic generation of TIA Portal projects. Especially with complex machine configurations, such as multi-belt control or other multi-axis applications, this is very efficient compared to manually creating and assigning software blocks and parameters to the automation project directly in the TIA Portal.



Siemens Industry Online Support ID: 109762852

5.2 SIMATIC Modular Application Creator Equipment Modules

With equipment modules, a TIA Portal machine project can be generated using the Modular Application Creator. The parameterization of an equipment module is made in a technological view. The user is supported by a validation of the entries, which not only considers incorrect entries but also cross-dependencies. This procedure reduces the sources of errors and the time required for engineering.



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5.3 TIA Portal Openness: Overview

TIA Portal Openness is a programming interface (API) to automate engineering tasks in TIA Portal:

- Access to TIA Portal objects via API methods
- Import / export interface and data exchange

Possible workflows are project generation, project verification, maintenance and much more.

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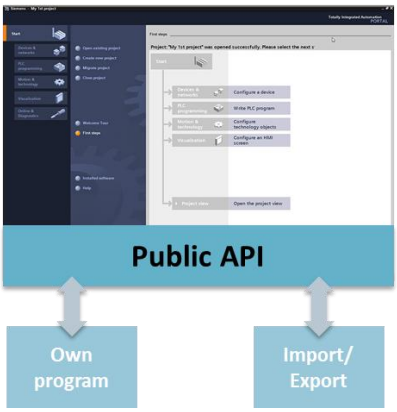
5.4 TIA Portal Openness Introduction and Demo Application

The present application describes the steps required for generating a TIA Portal Openness application. The "StartOpenness" application is to facilitate the first steps. The “DemoOpenness” is used for detailed programming help and a function overview of the programmable functions with TIA Portal Openness.



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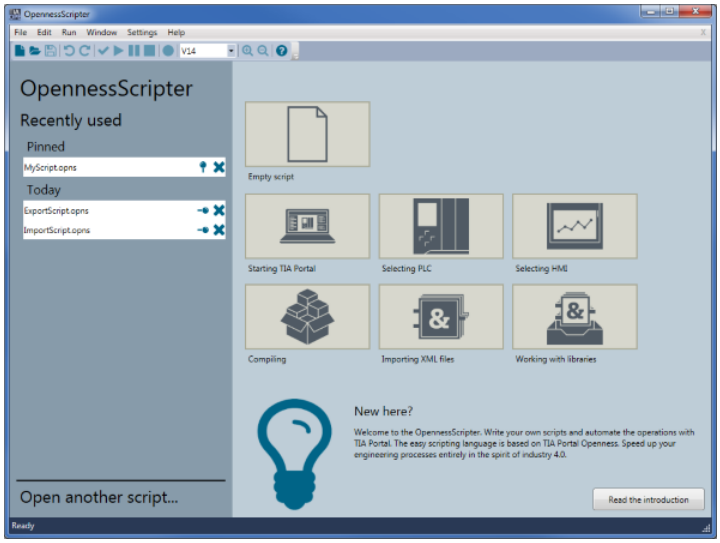
5.5 TIA Portal Openness Tool for easier use of the interface (Openness Scripter)

The TIA Portal OpennessScripter allows you to automate your tasks in TIA Portal projects without programming skills. Easy script commands allow you to avoid complex programming.



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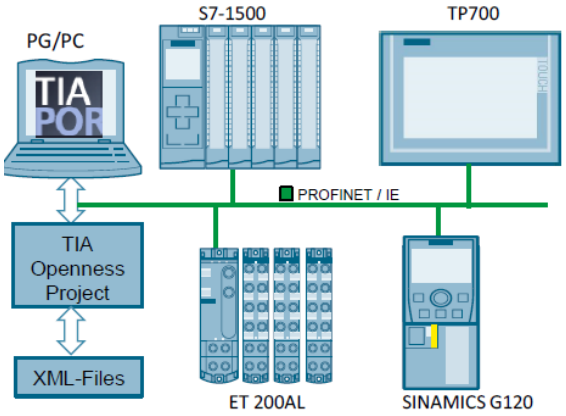
5.6 TIA Portal Openness Generating a Modular Machine with S7-1500

The aim of the application example is to start the TIA Portal via a remote control and to configure and generate a STEP 7 project for a modular machine. All variants of the system are automatized with the same STEP 7 project and without reconfiguration.



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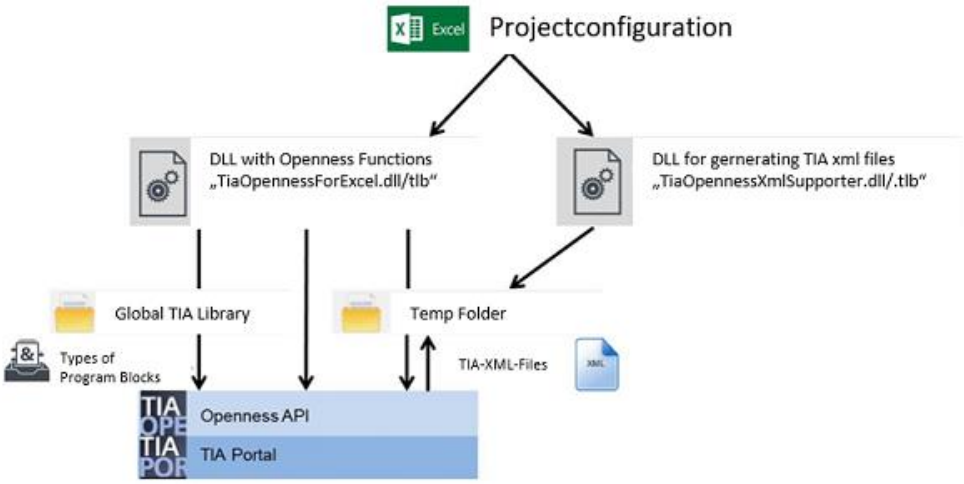
5.7 TIA Portal Openness Excel code generator

The code generator can be used to automatically generate STEP 7 projects that have been previously configured from Microsoft Excel.



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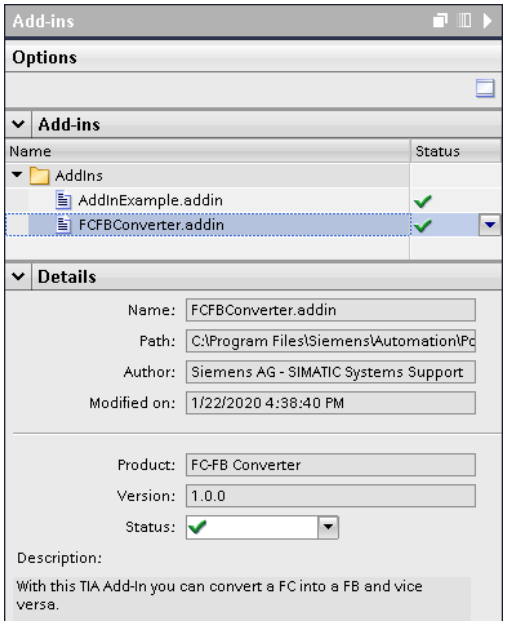
5.8 TIA Portal Add-Ins

Add-ins give you the opportunity to expand the functionality of the TIA Portal. With the installation of "TIA Portal Openness" you have the possibility to use add-ins.



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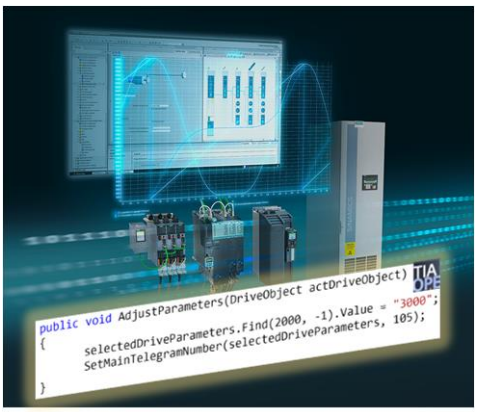
5.9 SINAMICS Startdrive TIA Add-Ins Getting Started

This description is intended to help you get started with programming TIA Add-Ins. A step-by-step guide will lead the user comfortably through the creation of a TIA Add-In. The necessary settings are explained using program examples. A template for changing SINAMICS drive parameters is also included in the description.



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5.10 Integration of planning data from TIA Selection Tool to TIA Portal

TIA Selection Tool (TST) offers the possibility to export planning data (device configuration, network configuration) as “AutomationML” files. These AML files can be imported into projects by TIA Portal.

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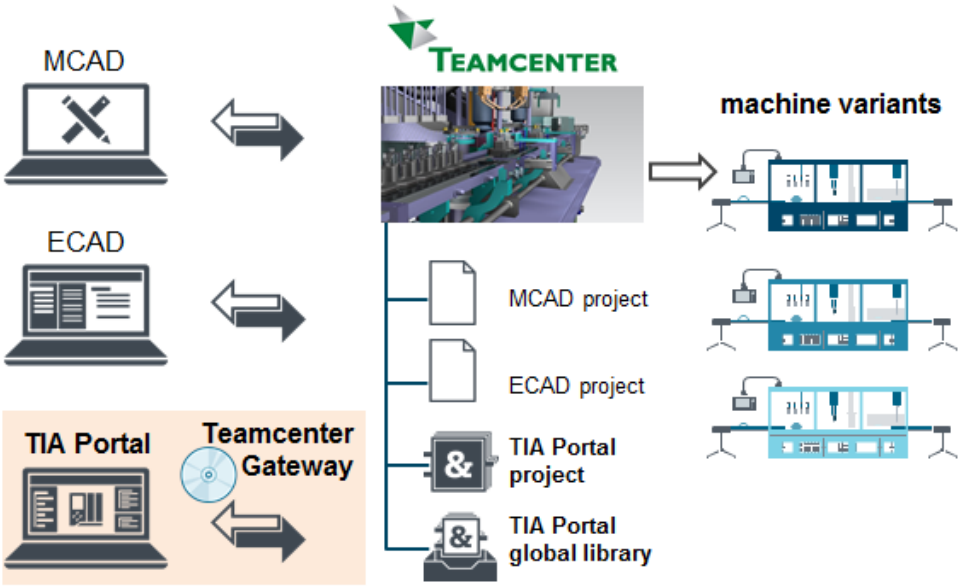
5.11 PLM integration of automation engineering

The TIA Portal uses Teamcenter Gateway to connect to the Teamcenter server. It is possible to revise, edit and save TIA Portal projects and global libraries and to link them to PLM processes using Teamcenter workflows. Moreover, with further project information, project versions can be linked to specific library states.



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6 Virtual Commissioning

6.1 SIMIT/MCD Virtual commissioning in machine building

In order to reduce risks and effort during the real commissioning, the virtual commissioning of a machine offers an efficient alternative. With the help of NX MCD, SIMIT and PLCSIM Advanced you can virtually commission your machine.

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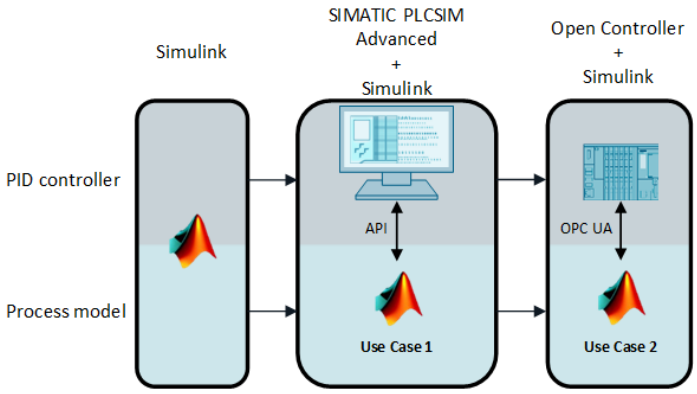
6.2 Virtual Commissioning with SIMATIC and Simulink

This application example describes how to build a simulation model with Simulink. It uses two digitization use cases to describe the possibilities and limitations of validating and simulating the simulation model virtually and based on hardware with SIMATIC products. The sample Simulink model consists of a process simulation and a PID controller.



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6.3 SIMIT Overview Page

Further technical information and solutions regarding the SIMIT simulation platform can be found on the SIMIT overview page. Here you will find for example information about:

- DRIVES Behavior Library for SIMIT
- RFID behavior library for SIMIT
- Creating a SIMIT component with CTE
- HWCN Exporter

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6.4 SIMIT Simulation Model Generator

The application example contains a TIA Portal Add-in, which enables the user to automatically create simulation models for SIMIT, based on the TIA Portal product configuration.

The drive simulation model is automatically created from the existing TIA Portal project information, saved, and can be imported into SIMIT via an automated import. The focus is on the simulation of drives and technology objects (TO).

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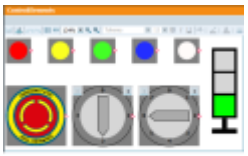
6.5 SIMIT Control Library



The SIMIT behavior library already contains some standard components, such as buttons, indicators, actuators and valves. With this library you receive an extension of the control and indicator elements library of SIMIT contained in the standard:

- Rotary Switch / Key Switch
- Indicator Tower / Indicator Lamps
- Emergency Stop / Light Buttons

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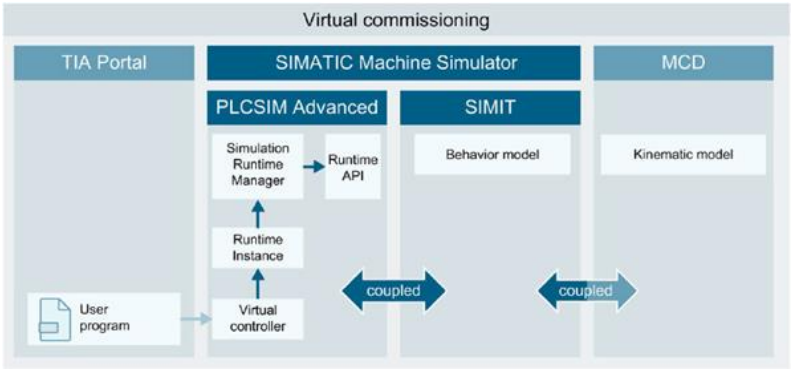
6.6 SIMATIC Machine Simulator Virtual commissioning of machines Getting Started

This Getting Started helps you to become familiar with essential steps for performing virtual commissioning with the SIMATIC Machine Simulator based on a specific application example.



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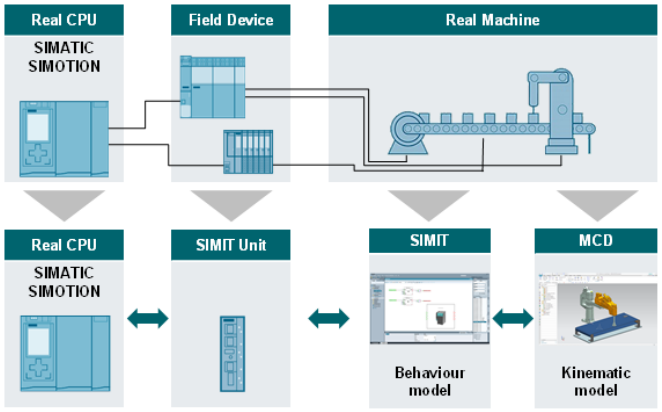
6.7 SIMATIC Virtual Commissioning with Hardware in the Loop

To lower risks and effort of the real commissioning of a machine, virtual commissioning is an efficient alternative. This application example describes how to build up a hardware in the loop scenario with a SIMOTION or SIMATIC controller. Using NX MCD, SIMIT and SIMIT Unit you can virtually commission your machine.



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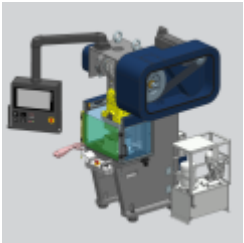
6.8 MCD/SIMIT model for Simapress + Press Safety Blocks



This application example allows you to simulate the SIMATIC Simapress application in combination with the SIMATIC S7-F/P Press Safety Blocks using PLCSIM Advanced, SIMIT and NX Mechatronics Concept Designer (MCD).

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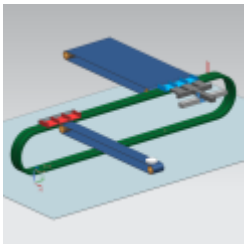
6.9 MCD/SIMIT model for Intelligent Belt - Multi Belt Control



In this application example you can simulate the SIMATIC Intelligent Belt application with PLCSIM Advanced, SIMIT and NX Mechatronics Concept Designer (MCD).

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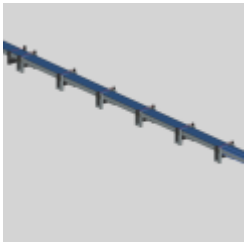
6.10 MCD/SIMIT model for Intelligent Belt - Multi Belt Control



This application example allows you to simulate SIMATIC Intelligent Infeed – Product Separation using SIMATIC PLCSIM Advanced, SIMIT and NX Mechatronics Concept Designer (MCD). Therefore, the MCD Model consists of 1 inlet belt, 5 infeed belts and 1 outlet belt. Furthermore, a SIMIT Model is provided to simulate the behavior model for this machine setup and SIMATIC PLCSIM Advanced is used to emulate a SIMATIC S7-1500 controller. The SIMATIC PLCSIM Advanced instance runs the corresponding example project. This allows a virtual commissioning with the digital twin.

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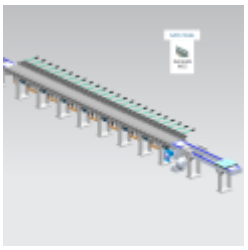
6.11 MCD/SIMIT model + toolkit for Multi-Carrier-System



This application example allows you to simulate the SIMATIC Multi-Carrier-System application using PLCSIM Advanced, SIMIT and NX Mechatronics Concept Designer (MCD). The MCD model therefore consists of a transport track, consisting of linear motors, which drive the individual carriers and simulates their kinematics. Furthermore, a SIMIT model is provided to simulate the behavior model of the transport track and PLCSIM Advanced is used to emulate a SIMATIC S7-1500T controller.

Furthermore a MCS Toolkit for NX MCD is provided. The MCS Toolkit enables a fast and easy virtual commissioning of a multi-carrier system by automated kinematization in MCD as well as the automatic generation of drive behaviour models in SIMIT.

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6.12 MCD/SIMIT model for SIMATIC Hairpin Application

The Hairpin TIA application allows the operator to simulate an example for a hairpin production machine using PLCSIM Advanced, SIMIT and NX Mechatronics Concept Designer (MCD).

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6.13 MCD/SIMIT model for cylinder positioning

This application example allows you to simulate SIMATIC Print Standard Add-On Cylinder Positioning using PLCSIM Advanced, SIMIT and NX Mechatronics Concept Designer (MCD).

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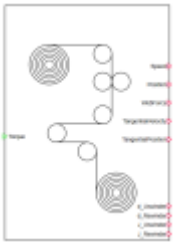
6.14 SIMIT model for continuous web simulation



The SIMATIC application Winder and Tension Control is part of the Converting Toolbox and was developed with the objective to provide common functions which are necessary for any kind of converting machine.

This application example allows you to simulate a continuous web process of your converting machine in order to virtually commission your PLC program using PLCSIM Advanced and SIMIT. Mechanical and process elements like winders, driven axes, guide rolls, dancers, and the web behavior can be modeled with the described simulation components. Among others this allows you to test and validate your winder and web tension control in the virtual environment.

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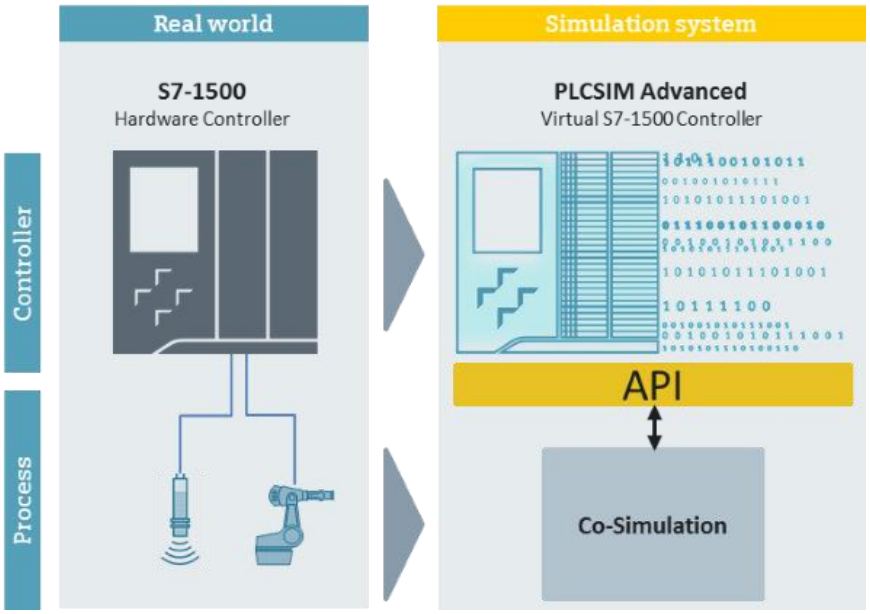
6.15 SIMATIC S7-PLCSIM Advanced: Co-Simulation via API

A STEP 7 program created in STEP 7 V14 controls a conveyor system. For a comprehensive function test, the STEP 7 program is loaded via S7-PLCSIM Advanced into a virtual S7-1500 controller. This controller interacts via the API with a co-simulation (plant simulation), in order to validate the STEP 7 program in the context of the plant.



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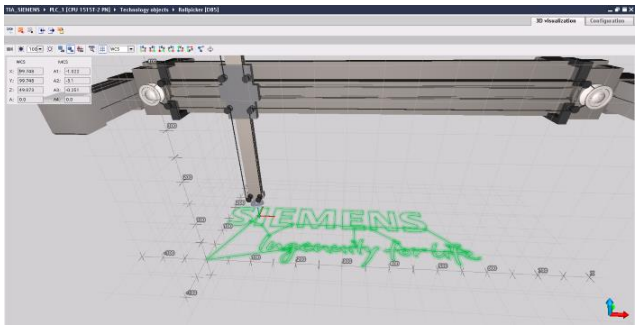
7 Handling Toolbox

In order to support the engineering of handling applications there is a collection of software blocks and libraries for SIMATIC S7-1500 T-CPUs, which simplify the creation of such applications. Besides an HMI faceplate to control and configure the kinematics via an HMI there is e.g. an application to easily program path motions.



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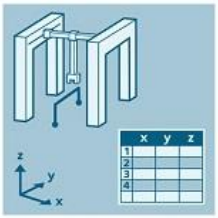
7.1 S7-1500T Kinematics Control



The library LKinCtrl provides functionalities for TO Kinematics to easily program and control granular path motions in a command list.

Following benefits are provided with this library:

- Comfortable path definition in a command list
- Single step / automatic mode for path execution
- Flags for actuator control depending on path status
- Function block to jog the kinematics
- Generation of a path definition by given G-Code

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7.2 S7-1500T Kinematics Language

The library LKinLang enables textual motion programming of kinematics. Besides the possibility to define user-specific textual languages, the motion program can also be defined in G-Code.

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7.3 S7-1500T Kinematics Manual Control

The library LKinMCtrl provides manual control functionalities for TO Kinematics with a predefined faceplate for an HMI. This reduces HMI engineering time as all mayor kinematics functions are encapsulated in a single HMI faceplate. Following benefits are provided with this library:

- Jog kinematics with different modes
- Jog / home single axes
- Clearly displayed error in HMI of the kinematics and axes
- Monitoring and configuration of zones
- Configuration of frames and dynamics for the kinematics
- Configuration of axis dynamics and position limits
- Teach kinematics positions in a point table

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7.4 S7-1500 Kinematics Operate

SIMATIC Kinematics Operate can control up to 6 axes with synchronous Point to Point (sPTP) movement. The plug & play solution offers a comfortable user interface for configuring, programming, operating and diagnosing the kinematics via the HMI.

- Following benefits are provided with this library:
- extensive configuration functionality via HMI
- programming functionality via HMI
  - synchronous point-to-point commands
  - single axis motion commands
  - program sequence control commands
  - variable access and value assignment commands

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7.5 S7-1500T Kinematics Computed Torque Control

The library Kinematics Computed Torque Control (LKinCTC) enables the user to easily realize a torque pre control for different types of kinematics in the drive.

Following benefits are provided with this library:

- Higher precision due to reduced following error
- Higher performance due to smaller positioning windows necessary
- Calculating torque curves in advance with virtual axes
- Automated parameterization

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7.6 S7-1200 Handling library for pick & place applications

Using the "LAxesGrpCtrl" block library for controllers in the SIMATIC S7-1200 family, it is possible to coordinate and traverse multiple axes of a Cartesian handling system on a predefined motion path as a synchronous point-to-point (sPTP) movement in space.

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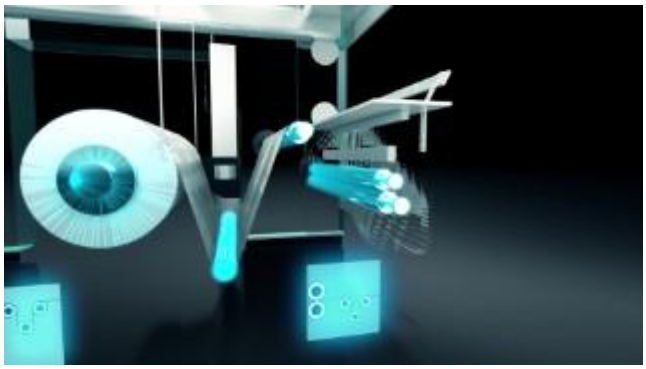
8 Converting Toolbox

Do you want to significantly reduce your engineering time based on fully functioning solutions and tested know-how? Our Converting Toolbox is the perfect solution to achieve this: The package, which has been specifically created for this purpose, includes a whole raft of preconfigured software functions and applications for production machines with continuous material webs.



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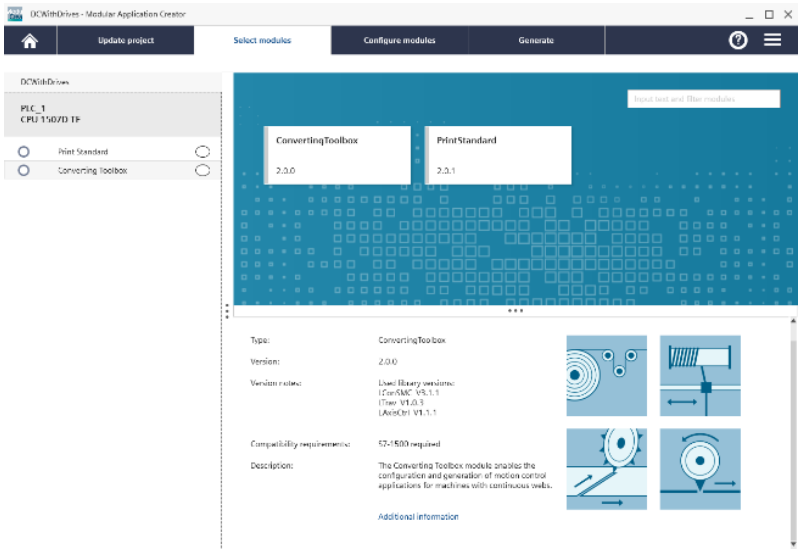
8.1 SIMATIC Modular Application Creator Module for Converting Toolbox

The SIMATIC Modular Application Creator module for Converting helps you to generate the technological motion control part of your Converting machine convenient and without engineering faults. All necessary parameters are configured wizard based. Afterwards, technology objects including its settings and interconnections, application libraries, function block calls and the required settings are generated automatically. Thus, a machine comprising line axis, winder axes, traversing drives and tension control axes are reliably and quickly generated.



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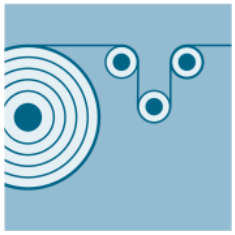
8.2 S7-1200/S7-1500 Winder



The Winder application is the technological basis for many converting and finishing processes. It provides comprehensive open-loop and closed-control functions for winder axes based on load cell, dancer roll or indirect tension control. Furthermore, it contains additional functions like diameter calculation, torque pre-control, web break detection and winding hardness characteristic.

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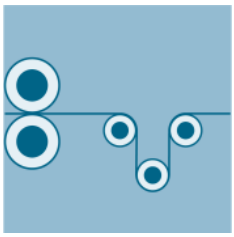
8.3 S7-1200/S7-1500 Tension Control



The Tension Control application provides the same function blocks to implement a higher-level closed-loop or open-loop tension control as the winding application.

Same as winding, tension control is the technological basis for many converting and finishing processes. The Line Tension Control application provides comprehensive open-loop and closed-control functions based on load cell, dancer roll or indirect tension control. Additional functions like torque pre-control or web break detection are integrated.

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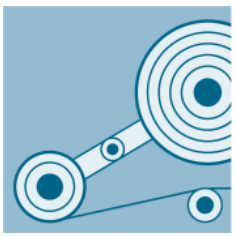
8.4 S7-1500 Splice



To achieve the highest productivity, axial winders are often equipped with an automatic roll change function (Splice Control). In this case, the expiring roll is changed while the machine is in full production. The web from the new role is sticked to the running web on the fly and the expiring web is cut off. The old, empty coil is then rotated to a change position to release the empty core and a new coil can be loaded. The application can also be used for a rewinder roll change.

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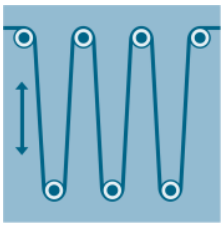
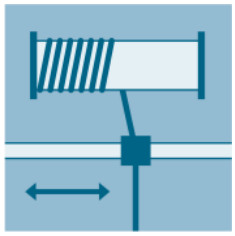
8.5 S7-1500T Web Accumulator



A Web Accumulator is used to buffer the material web after an unwinder or before a rewinder to perform a roll change (Splice) without having to interrupt the process. This increases the productivity of the machine. For this purpose, the winder is stopped while the process is continued from the web storage system. After changing the coil, the winder is started again, and the web storage can be refilled (unwinder web accu) respectively emptied (rewinder web accu).

Siemens Industry Online Support ID: 109794482

8.6 S7-1500T Traversing Drive



The standard application Traversing Drive is providing open application standards for winding and spooling of round- and flat-material, e.g. for wire, cable, paper or non-wovens, etc. The transversing drive follows the winder drive, either in the system via an electronic gear (the winder itself is then also controlled from the automation system) - or externally via a machine encoder. The traversing drive profile is emulated using a cam; this can also be influenced during operation via parameters.

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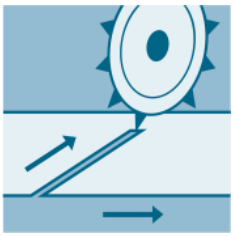
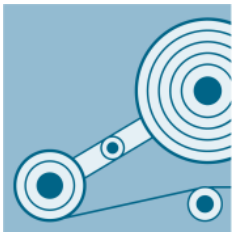
8.7 S7-1500T Flying Saw



The Flying Saw application is a solution to realize flying saws or flying shears easily and quickly. To perform a cut, the flying saw is synchronized to a precise position on the moving material. When speed synchronous, the material is getting processed. This can be cutting, perforating, or punching. After the cut has been made, the tool sledge is stopped and moved back to the starting position.

Siemens Industry Online Support ID: 109744840

8.8 S7-1500T Rotary Knife



The Rotary Knife application provides the basis for typical applications with rotary cutting processes, e.g. cross-cutters, punching and embossing machines. Typically, a rotary knife consists of at least one cylinder equipped with one or more knives. During the cut, the circumferential speed of the cylinder is adjusted to that of the material. The format is adjusted outside the cutting area.

Siemens Industry Online Support ID: 109757260

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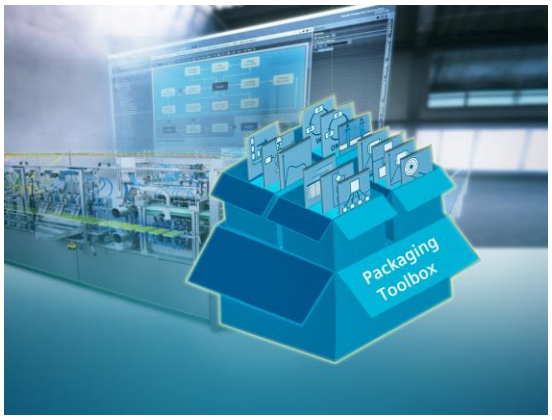
9 Packaging Toolbox

Why reinvent the wheel every time? With the Packaging Toolbox, Siemens offers packaging-specific technology libraries that can be integrated in existing or new machine applications along with own blocks, all with minimal effort. This increases the availability and flexibility of production and reduces substantially engineering and commissioning times.



Siemens Industry Online Support ID: 109770338

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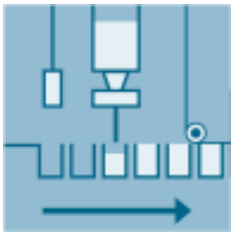
9.1 S7-1500 LFFS - Automation of form, fill and seal machines

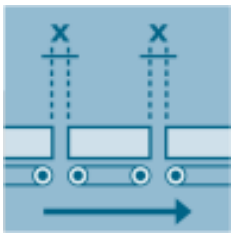


This library contains functionalities for the following technological tasks of horizontal and vertical form, fill and seal machines:

- Machine master
- Product supply and dosing
- Foil transport (incl. auxiliary functions like print mark correction, dancer control, ...)
- Sealing (cross and longitudinal sealing)

Siemens Industry Online Support ID: **On request;** see 109770338

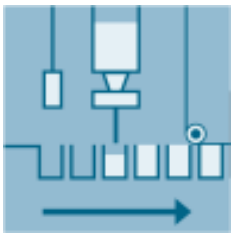
9.2 S7-1500 Intelligent Infeed – Product Separation



The Intelligent Infeed application can be used to create equal gaps between irregularly arriving products of same length. A typical use case is the synchronization of the products into a tappet chain. The application automatically calculates and regulates the appropriate accelerations and velocities of the products. Since the process is contact free, Intelligent Infeed is also suitable for especially sensitive products.

Siemens Industry Online Support ID: 109770903

9.3 S7-1500 Intelligent Belt - Multi Belt Control

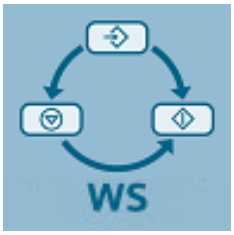


The Intelligent Belt application (multi belt control) can be used to pick up sequentially arriving products and to provide them grouped at an unloading position. The most important feature is that loading and unloading are independently performed.

Siemens Industry Online Support ID: 48812744

9.4 S7-1200/S7-1500 Weihenstephan Standards

This application supports in integrating the Weihenstephan Standards into SIMATIC controllers and the motion control system SIMOTION. The Weihenstephan Standards (WS) define a universal communication interface for connecting machines to higher level data acquisition systems or MES (Manufacturing Execution Systems). They also define the data which must be provided for acquisition.



Program and State Management according to Weihenstephan for SIMATIC S7-1200/S7-1500 controllers is also available.

Siemens Industry Online Support ID: 109475571

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10 Multi-Carrier-System Toolbox

The Multi-Carrier-System is a linear motor-based transport system for highly flexible and modular applications. In order to support the engineering of a Multi-Carrier-System there is a Toolbox for SIMATIC S7-1500T controllers, which simplify the creation of such applications. Besides the libraries, it also contains tools for project generation, visualization and virtual commissioning of the MCS.

Siemens Industry Online Support ID: 109784038

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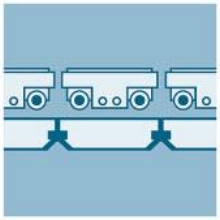
10.1 SIMATIC Multi-Carrier-System Module for Modular Application Creator

The LRailCtrl application for SIMATIC S7-1500T controllers can be configured quickly and user-friendly as an equipment module of the SIMATIC Modular Application Creator. This increases the efficiency of the project development and commissioning of your machine.

Siemens Industry Online Support ID: 109783900

10.2 S7-1500T Station Management LRailSMT for Multi-Carrier-System



The library "LRailSMT" allows a fast commissioning of a MCS based on processing stations. The application consists of at least one carrier to perform a product movement. Each carrier can be moved independently. This means that one carrier can be loaded in a station while the other carriers are in motion, being processed or unloaded.

Siemens Industry Online Support ID: **On request;** see 109784038

10.3 S7-1500T Control of a Multi-Carrier-System

The LRailCtrl application for SIMATIC S7-1500T controllers includes blocks for the control and simple configuration of the linear track and PLCopen commands for easy movement of carriers.

Siemens Industry Online Support ID: 109762340

10.4 SIMATIC S7-1500T: TS 2 Booster variants

The Multi-Carrier System (MCS®) is a transport system based on linear motors and has been jointly developed by Siemens and Festo. In the context of the introduction of the TS 2 Booster, the system has been integrated in the Rexroth transfer system TS 2plus.

n this entry the Siemens products required for the TS 2 Booster from Rexroth will be provided for the 12 possible variants as an Excel list for download.

Siemens Industry Online Support ID: 109776644

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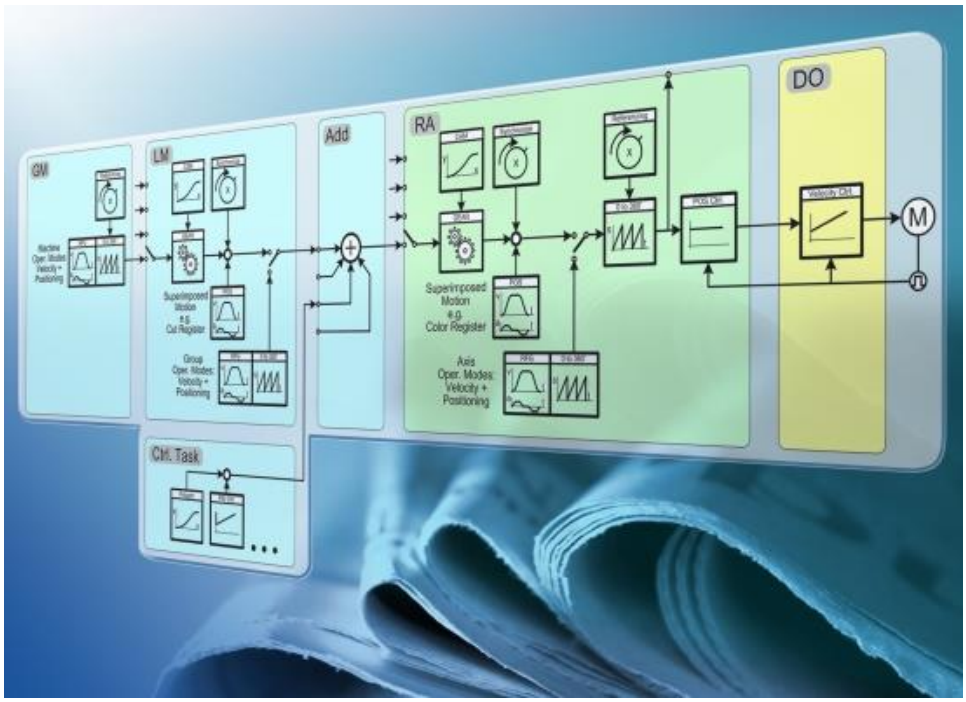
11 Print Standard

Printing presses are becoming increasingly flexible and modular. Many functions that used to be performed mechanically are now implemented with a separate drive. This leads to comprehensive multi-axis concepts with cross-control synchronous operation. In conjunction with ever shorter development and commissioning times, a standardized software solution for motion control with flexible modules for technology functions is becoming increasingly important. The Print Standard application with its Add-Ons provide these functionalities.



Siemens Industry Online Support ID: 109748022

11.1 SIMATIC Modular Application Creator Module for Print Standard

The SIMATIC Modular Application Creator module for Print Standard helps you to generate the technological motion control part of your Printing machine convenient and without engineering faults. All necessary parameters are configured wizard based. Afterwards, technology objects including its settings and interconnections, application libraries, function block calls and the required settings are generated automatically. Thus, a machine comprising the standard applications Print Standard, Winder, Tension Control, Cylinder positioning and Register Control are reliably and quickly generated.

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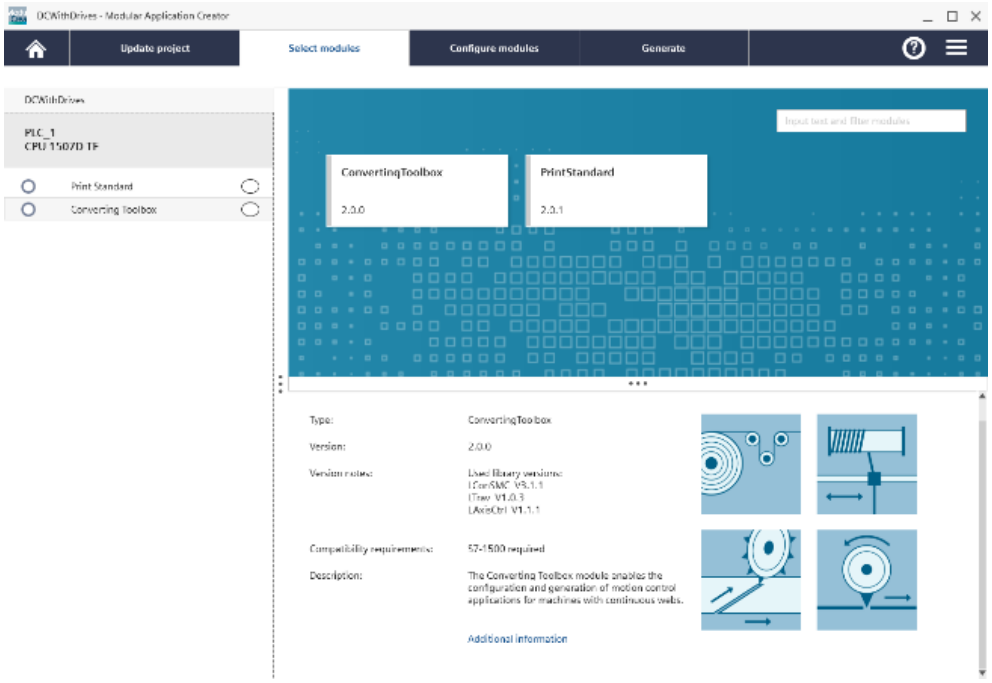
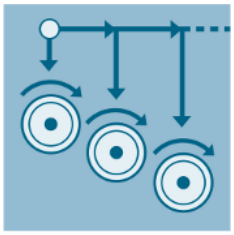


Siemens Industry Online Support ID: [109783007]

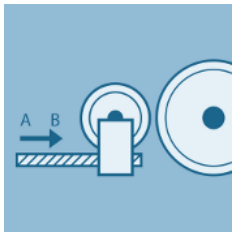
11.2 S7-1500 Print Standard Master



The Print Standard software package comprises motion control functions and concepts for printing and post press machines. The application is controlled via a standardized interface as well as a uniform operating mode management for all types of axes used in printing machines.

Siemens Industry Online Support ID: [109762435]

11.3 S7-1500T Add-On Cylinder Positioning



The standard application Cylinder Positioning was developed to offer a flexible positioning solution for Flexo printing machines. It realizes the positioning of the format cylinder to the impression cylinder as well as anilox cylinder to the format cylinder.

Siemens Industry Online Support ID: Coming soon!

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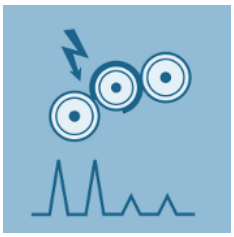
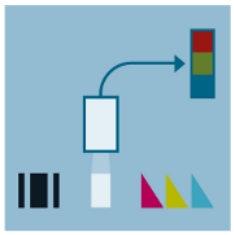
11.4 S7-1500T Add-On Drive Optimization



The library LDrvOpt contains functions for drive optimization during runtime. The functions are developed and designed for format variable machines with continuous web.

Siemens Industry Online Support ID: 109775495

11.5 S7-1500T Add-On Register Control



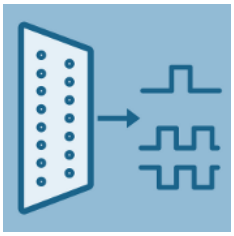
In modern printing presses, each print unit is individually driven by servo motors. The synchronism is achieved by an electronic line shaft. For perfect printing results a high precise mark detection and exact correction of the register deviation between the print units is necessary.

The application provides an example for integration of the RGB print mark sensor TRC3000 and the print mark camera TRC7000 into a project based on Print Standard.

The application provides the software parts for communication via PROFINET IRT, parameterization of the sensor, evaluation of point-, wedge- and block marks, control of the axis for correction of length and side register deviations, as well as a visualization example for TIA Portal WinCC Advanced.

Siemens Industry Online Support ID: Coming soon!

11.6 S7-1500T Add-On TM41



The output of axis position and speed for use by process systems such as an external register control, a web-video or for coupling with external machine modules can also be realized via an electronic pulse encoder emulation instead of a physical external encoder.

The Print Standard Add-On TM41 shows how the SINAMICS TM41 module can be integrated into an existing Print Standard project and contains detailed parameterization instructions for various applications as well as the necessary software modules.

Siemens Industry Online Support ID: 109791919

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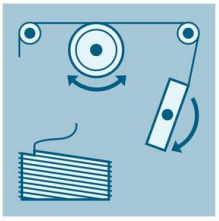
12 Wire Processing Toolbox

You want to significantly reduce your engineering time based on fully functional solutions and tested know-how? The WireProcessing Toolbox is the perfect solution to achieve this: The libraries created specifically for this purpose contain a whole range of preconfigured software functions and applications for wire bending and wire winding machines, as well as additional basic functions.

Siemens Industry Online Support ID: 109800769

12.1 S7-1500 SIMATIC Wire Brake



The SIMATIC application Wire Brake is a software package for automation of wire winding machines for non-circular coil formers with a dynamic servo wire brake

Siemens Industry Online Support ID: 109793325

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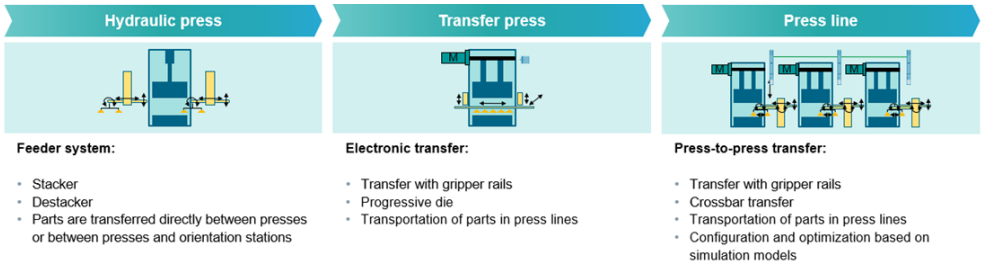
13 Metal Forming

13.1 S7-1500T SIMATIC PressAutomation

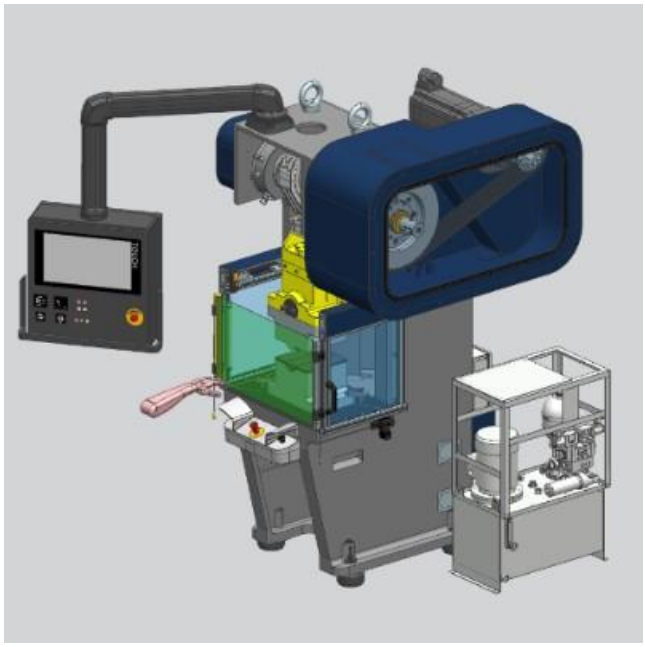
The Application SIMATIC PressAutomation offers a solution for a quick and easy automation of systems required for material transport in, through and out of press systems based in Simatic S7-1500T controllers.



Siemens Industry Online Support ID: 109779147

13.2 S7-1500 SIMATIC Simapress: Software package to automate a conventional flywheel press

This application example is intended for all engineers an users that wish to implement a mechanical excentric press based on SIMATIC S7-1500. It realizes all of the above mentioned functionalities based on following hardware: SIMATIC S7-1500, TM Timer, AI HS, SINAMICS S120.



Siemens Industry Online Support ID: 82605334

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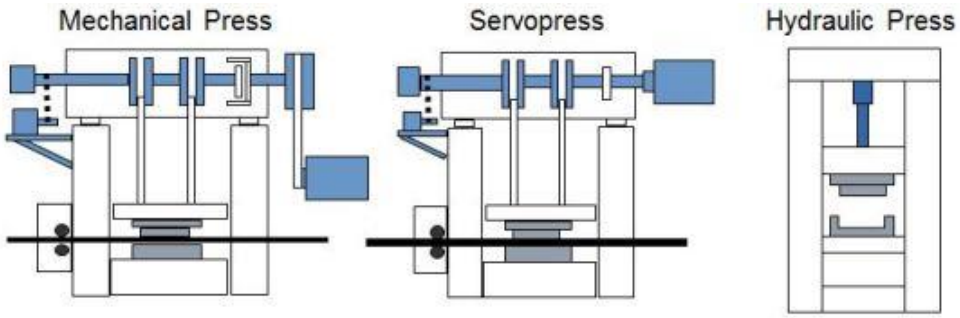
13.3 S7-1500F SIMATIC S7-F/P Press Safety Blocks

Press safety library for all SIMATIC S7-F-Controller. Functionality for mechanical-, hydraulic- and servopresses based on DIN EN ISO 16092. Available as of Distributed Safety V5.4 or TIA Portal V14. New as of SIMATIC S7 F/P V15.0.2 is the full scalability through all SIMATIC F-Controller Incl. S7-1200F and Software Controller of S7-1500F and as of 2021 a certification based on DIN EN ISO 16092.



Siemens Industry Online Support ID: 48299432

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14 Appendix

14.1 Service and support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

Product information, manuals, downloads, FAQs, application examples and videos – all information is accessible with just a few mouse clicks:

support.industry.siemens.com

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For more information on our offered trainings and courses, as well as their locations and dates, refer to our web page:

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Industry Online Support app

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support.industry.siemens.com/cs/ww/en/sc/2067

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14.2 Industry Mall

The Siemens Industry Mall is the platform on which the entire siemens Industry product portfolio is accessible. From the selection of products to the order and the delivery tracking, the Industry Mall enables the complete purchasing processing – directly and independently of time and location:
mall.industry.siemens.com

14.3 Change documentation

Table 14-1

Version	Date	Modifications
V1.0	10/2021	First release

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