SIEMENS

SINUMERIK

SINUMERIK ONE /828D Create MyVirtual Machine System Manual

System Manual

Valid for:
MACHINUM
Create MyVirtual Machine V1.4.1
SINUMERIK Virtual CNC software V5.24
SINUMERIK Virtual CNC software V6.24

07/2024
A5E47496012B AL

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens Aktiengesellschaft. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens Aktiengesellschaft
Digital Industries
Postfach 48 48
90026 NÜRNBERG
GERMANY

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Introduction

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1.1 About SINUMERIK

From simple, standardized CNC machines to premium modular machine designs – the SINUMERIK CNCs offer the right solution for all machine concepts. Whether for individual parts or mass production, simple or complex workpieces – SINUMERIK is the highly dynamic automation solution, integrated for all areas of production. From prototype construction and tool design to mold making, all the way to large-scale series production.

Visit our website for more information SINUMERIK (https://www.siemens.com/sinumerik).

1.2 About this documentation

Target group

This documentation is intended for the following target groups:

- CNC configuration and commissioning personnel
- CNC programming personnel for job planning

Purpose

This documentation describes the virtual SINUMERIK system "Create MyVirtual Machine". It is intended to give you an overview of the functions and operation in a virtual environment and to guide you quickly to initial work results.

Controllers of the virtual SINUMERIK system:

- SINUMERIK ONE and CNC software V6.x
- SINUMERIK 828D and CNC software V5.x

Note

The documentation describes the operation (actions, screenshots) on the basis of SINUMERIK ONE with CNC software V6.x. Operation for machine projects with SINUMERIK 828D with CNC software V5.x is identical. Controller-specific features are noted in the text and marked with SINUMERIK 828D or SINUMERIK ONE.

Benefits

This documentation enables the target group to implement Create MyVirtual Machine projects while taking account of the existing function scope.

Standard scope

This documentation only describes the functionality of the standard version. This may differ from the scope of the functionality of the system that is actually supplied. Please refer to the ordering documentation only for the functionality of the supplied drive system.

It may be possible to execute other functions in the system which are not described in this documentation. This does not, however, represent an obligation to supply such functions with a new control or when servicing.

For reasons of clarity, this documentation cannot include all of the detailed information on all product types. Further, this documentation cannot take into consideration every conceivable type of installation, operation and service/maintenance.

The machine manufacturer must document any additions or modifications they make to the product themselves.

Websites of third-party companies

This document may contain hyperlinks to third-party websites. Siemens is not responsible for and shall not be liable for these websites and their content. Siemens has no control over the information which appears on these websites and is not responsible for the content and information provided there. The user bears the risk for their use.

1.3 Documentation on the internet

1.3.1 Documentation overview SINUMERIK ONE

Comprehensive documentation about the functions provided in SINUMERIK ONE Version 6.13 and higher is provided in the Documentation overview SINUMERIK ONE (https://support.industry.siemens.com/cs/ww/en/view/109768483).

You can display documents or download them in PDF and HTML5 format.

The documentation is divided into the following categories:

- User: Operating
- User: Programming
- Manufacturer/Service: Functions
- Manufacturer/Service: Hardware
- Manufacturer/Service: Configuring/Commissioning
- Manufacturer/Service: Safety Integrated
- Information and training
- Manufacturer/Service: SINAMICS

1.3.2 Documentation overview SINUMERIK 828D

Comprehensive documentation about the functions provided in SINUMERIK 828D Version 4.8 SP4 and higher is provided in the 828D documentation overview (https://support.industry.siemens.com/cs/document/109766724).

You can display documents or download them in PDF and HTML5 format.

The documentation is divided into the following categories:

- User: Operating
- User: Programming
- Manufacturer/Service: Configuring
- Manufacturer/Service: Commissioning
- Manufacturer/Service: Functions
- Manufacturer/Service: Safety Integrated
- SINUMERIK Integrate/MindApp
- Info & Training

1.3.3 Documentation overview SINUMERIK operator components

Comprehensive documentation about the SINUMERIK operator components is provided in the Documentation overview SINUMERIK operator components (https://support.industry.siemens.com/cs/document/109783841/technische-dokumentation-zu-sinumerik-bedienkomponenten?dti=0&lc=en-WW).

You can display documents or download them in PDF and HTML5 format.

The documentation is divided into the following categories:

- Operator Panels
- Machine control panels
- Machine Pushbutton Panel
- Handheld Unit/Mini handheld devices
- Further operator components

An overview of the most important documents, entries and links to SINUMERIK is provided at SINUMERIK Overview - Topic Page (https://support.industry.siemens.com/cs/document/109766201/sinumerik-an-overview-of-the-most-important-documents-and-links?dti=0&lc=en-WW).

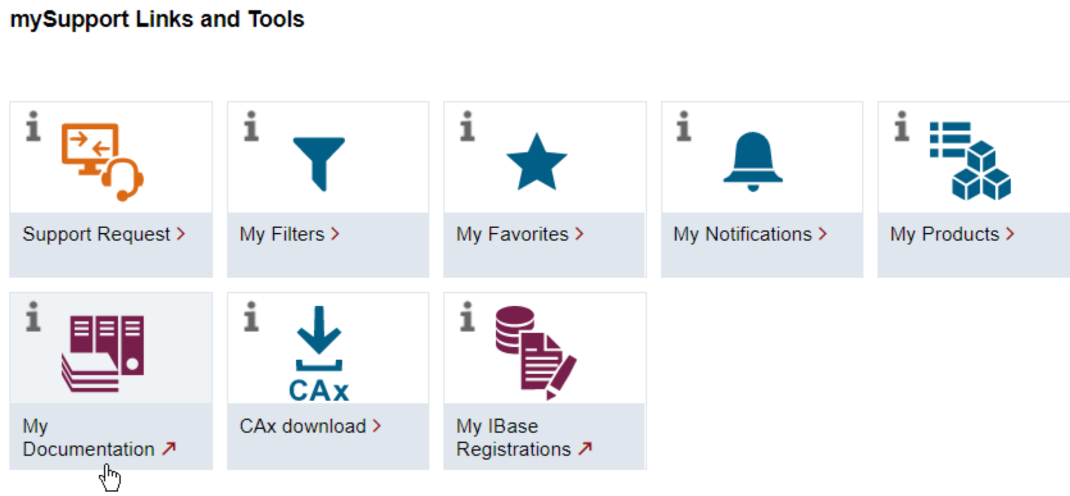
1.4 Feedback on the technical documentation

If you have any questions, suggestions, or corrections regarding the technical documentation published in the Siemens Industry Online Support, use the "Provide feedback" link which appears at the end of the entry.

1.5 mySupport documentation

With the "mySupport documentation" web-based system you can compile your own individual documentation based on Siemens content, and adapt it for your own machine documentation.

To start the application, click on the "My Documentation" tile on the "mySupport links and tools" (https://support.industry.siemens.com/cs/ww/en/my) portal page:



The configured manual can be exported in RTF, PDF or XML format.

Note

Siemens content that supports the mySupport documentation application can be identified by the presence of the "Configure" link.

1.6 Service and Support

Product support

You can find more information about products on the internet:

Product support (https://support.industry.siemens.com/cs/ww/en/)

The following is provided at this address:

- Up-to-date product information (product announcements)
- FAQs (frequently asked questions)
- Manuals
- Downloads
- Newsletters with the latest information about your products
- Global forum for information and best practice sharing between users and specialists
- Local contact persons via our Contacts at Siemens database (→ "Contact")
- Information about field services, repairs, spare parts, and much more (→ "Field Service")

Technical support

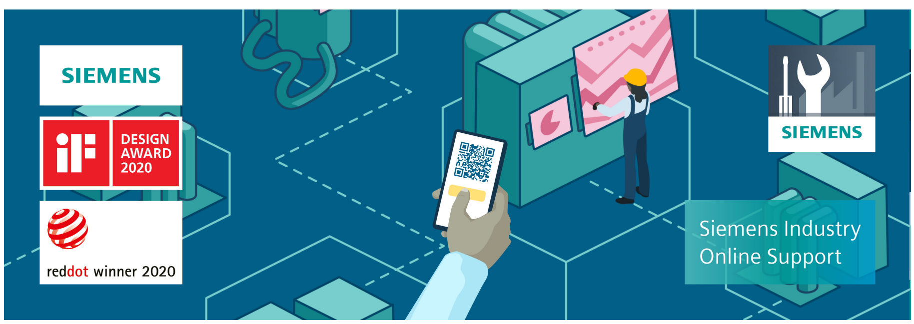
Country-specific telephone numbers for technical support are provided on the internet at address (https://support.industry.siemens.com/cs/ww/en/sc/4868) in the "Contact" area.

If you have any technical questions, please use the online form in the "Support Request" area.

Training

You can find information on SITRAIN at the following address (https://www.siemens.com/sitrain).
SITRAIN offers training courses for automation and drives products, systems and solutions from Siemens.

Siemens support on the go



With the award-winning "Industry Online Support" app, you can access more than 300,000 documents for Siemens Industry products – any time and from anywhere. The app can support you in areas including:

- Resolving problems when implementing a project
- Troubleshooting when faults develop
- Expanding a system or planning a new system

Furthermore, you have access to the Technical Forum and other articles from our experts:

- FAQs
- Application examples
- Manuals
- Certificates
- Product announcements and much more

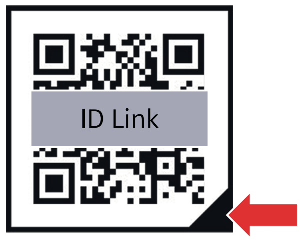
The "Industry Online Support" app is available for Apple iOS and Android.

Digital product information as QR code

The ID link according to IEC 61406 provides you with digital information about your product.

The ID link is a globally unique identifier and appears as a QR code on the product.

You can recognize the ID link by the frame with a black corner at the bottom right.



In addition to the digital nameplate you will find the following product information:

- Technical specifications
- FAQs
- Manuals
- Certificates
- Product announcements
- Application examples

1.7 Using OpenSSL

This product can contain the following software:

- Software developed by the OpenSSL project for use in the OpenSSL toolkit
- Cryptographic software created by Eric Young.
- Software developed by Eric Young

You can find more information on the internet:

- OpenSSL (https://www.openssl.org)
- Cryptsoft (https://www.cryptsoft.com)

1.8 Compliance with the General Data Protection Regulation

Overview

Siemens observes standard data protection principles, in particular the data minimization rules (privacy by design).

For the SINUMERIK Operate, this means:

The product processes/saves the following personal data:

- FullName (optional): Only if user management is activated
- User name + password: Only if user management is activated
- UserID: Only if user management is activated
- IP address

- Security events
- Time stamp

It does not involve data from the personal or private sphere.

The above data is required for the user log-in function. The storage of data is appropriate and limited to what is necessary, as it is essential for the identification of the authorized operator. (Mandatory here are: user name + password; the FullName is optional.)

The above-mentioned data cannot be stored anonymously or – with the exception of the user name – pseudonymously, as otherwise the purpose of identifying the operating personnel cannot be achieved.

Our products do not automatically delete the data mentioned above. The data and logs can be deleted manually by authorized personnel.

The above data is secured against loss of integrity and confidentiality by Industry State-of-the-Art Product Security mechanisms.

For the product Create & Run MyVirtual Machine, this means:

The product processes or stores the following personal data in log files.

- Name of the Windows user account in the specification of the user path (User-Path)
- Time stamp log functions for events that occurred

It does not involve data from the personal or private sphere. The above data is required for the SINUMERIK Trace diagnostic function. The data saved is limited to the absolute minimum as this is absolutely necessary for diagnostics purposes.

Fundamental safety instructions 2

2.1 General safety instructions

⚠ WARNING
Danger to life if the safety instructions and residual risks are not observed
If the safety instructions and residual risks in the associated hardware documentation are not observed, accidents involving severe injuries or death can occur. • Observe the safety instructions given in the hardware documentation. • Consider the residual risks for the risk evaluation.

⚠ WARNING
Malfunctions of the machine as a result of incorrect or changed parameter settings
As a result of incorrect or changed parameterization, machines can malfunction, which in turn can lead to injuries or death. • Protect the parameterization against unauthorized access. • Handle possible malfunctions by taking suitable measures, e.g. emergency stop or emergency off.

2.2 Warranty and liability for application examples

Application examples are not binding and do not claim to be complete regarding configuration, equipment, or any eventuality which may arise. Application examples do not represent customer-specific solutions, but merely serve to provide assistance with typical tasks.

As the user you yourself are responsible for ensuring that the products described are operated correctly. Application examples do not relieve you of your responsibility for safe handling when using, installing, operating and maintaining the equipment.

2.3 Cybersecurity information

Siemens provides products and solutions with industrial cybersecurity functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial cybersecurity concept. Siemens’ products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial cybersecurity measures that may be implemented, please visit
https://www.siemens.com/cybersecurity-industry.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed under
https://new.siemens.com/cert.

Further information is provided on the Internet:

Industrial Security Configuration Manual (https://support.industry.siemens.com/cs/ww/en/view/108862708)

⚠ WARNING

Unsafe operating states resulting from software manipulation

Software manipulations, e.g. viruses, Trojans, or worms, can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.

- Keep the software up to date.
- Incorporate the automation and drive components into a state-of-the-art, integrated industrial cybersecurity concept for the installation or machine.
- Make sure that you include all installed products in the integrated industrial cybersecurity concept.
- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.
- Carefully check all cybersecurity-related settings once commissioning has been completed.

Overview 3

3.1 Deployed software

Software requirements

The installation of Create & Run MyVirtual Machine and other essential software components is described in the *Create & Run MyVirtual Machine Installation Manual*. The Installation Manual can be found on the installation medium in the folder ..\Documents\Readme\[language]\.

3.2 General information

Create MyVirtual Machine

Create MyVirtual Machine is a virtual CNC system that simulates a SINUMERIK controller on your PC. The hardware components of the control are modeled as software components, and represent a complete or partial image of a real CNC.

SINUMERIK ONE

With Create MyVirtual Machine, you can develop and test the next SINUMERIK ONE controller generation in the development phase of a CNC machine, or NCK, PLC and HMI software without requiring any hardware. Parts of the machine commissioning are preconfigured on the virtual model. You can significantly shorten the commissioning time of the real machine by configuring the system using the virtual model. Furthermore, the created machine projects can be made available by Create MyVirtual Machine for processing in Run MyVirtual Machine for work preparation.

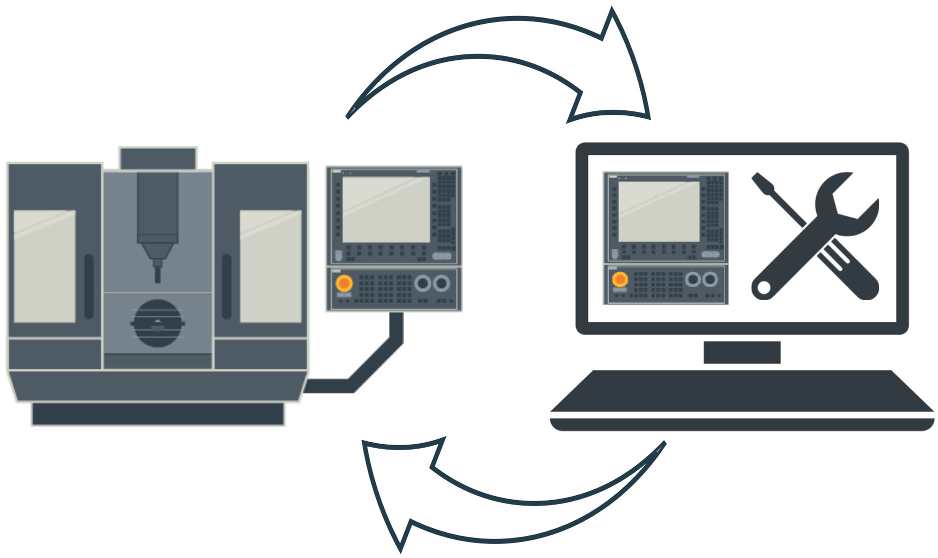


Figure 3-1 Create MyVirtual Machine, virtual commissioning (example SINUMERIK ONE)

SINUMERIK 828D

With Create MyVirtual Machine, you can create a machine project in Create MyVirtual Machine from a real machine with SINUMERIK 828D. The machine project can be made available for the process in Run MyVirtual Machine for work preparation.

Components of overall system Create MyVirtual Machine

Create MyVirtual Machine (incl. SINUMERIK Virtual CNC software) consists of the following components:

- simNCK: Simulation of the NCK
- PLC
  - SINUMERIK ONE: SIMATIC S7-PLCSIM Advanced, PLC simulation based on S7-1500
  - SINUMERIK 828D: SIMATIC S7-200
- HMI: SINUMERIK Operate
- MCP: Virtual machine control panel
- Drive simulation
  - For SINUMERIK ONE: simDrive, substitute drive component SINAMICS S120
  - For SINUMERIK 828D: no drive simulation
- Integrated I/O simulation
- Open interface for integration of external simulation tools (option)
- 3D Simulation (option)

Create MyVirtual Machine and license

Create MyVirtual Machine can only be used with a valid license. Without a license, you can only start the application, without any further functionality. License-free operation in demo mode with limited functionality is only possible for Run MyVirtual Machine.

More information can be found in Section Licensing Create MyVirtual Machine.

Product description (SINUMERIK ONE V6.x) 4

4.1 Overview

Create MyVirtual Machine simulates various functions of a real SINUMERIK ONE on your PC system.

With Create MyVirtual Machine and SINUMERIK ONE STEP 7 Toolbox, you can engineer and configure NCU, subcomponents and modules, and develop and test your PLC and NC programs during the development phase of a CNC machine without having real physical hardware. You can significantly shorten the commissioning time of the real machine by configuring the system using the virtual model.

Create MyVirtual Machine supports functions of a real SINUMERIK ONE by simulating the individual subcomponents and relevant functions:

- PLC simulation (Page 28) based on S7 PLCSIM Advanced (SIMATIC S7-1500F) including F-capability and communication mechanisms (Page 34)
- NCK simulation simNCK (Page 30)
- HMI user interface SINUMERIK Operate with machine control panel (Page 30)
- simDRIVE substitute drive component (Page 31) to simulate various safety functions
- Peripheral simulation (Page 32)

4.2 Properties

4.2.1 Create MyVirtual Machine

Description

Create MyVirtual Machine includes the well-proven SINUMERIK Operate commissioning and operating software, and supplements this to include a virtual machine control panel and simulation control. Unlike the real control system, not all known functions are implemented.

The main applications of Create MyVirtual Machine are the testing and verification of the following projects:

- PLC projects based on S7-1500
- Migrated PLC projects for SINUMERIK 840D sl
- Projects with drive-based Safety Integrated

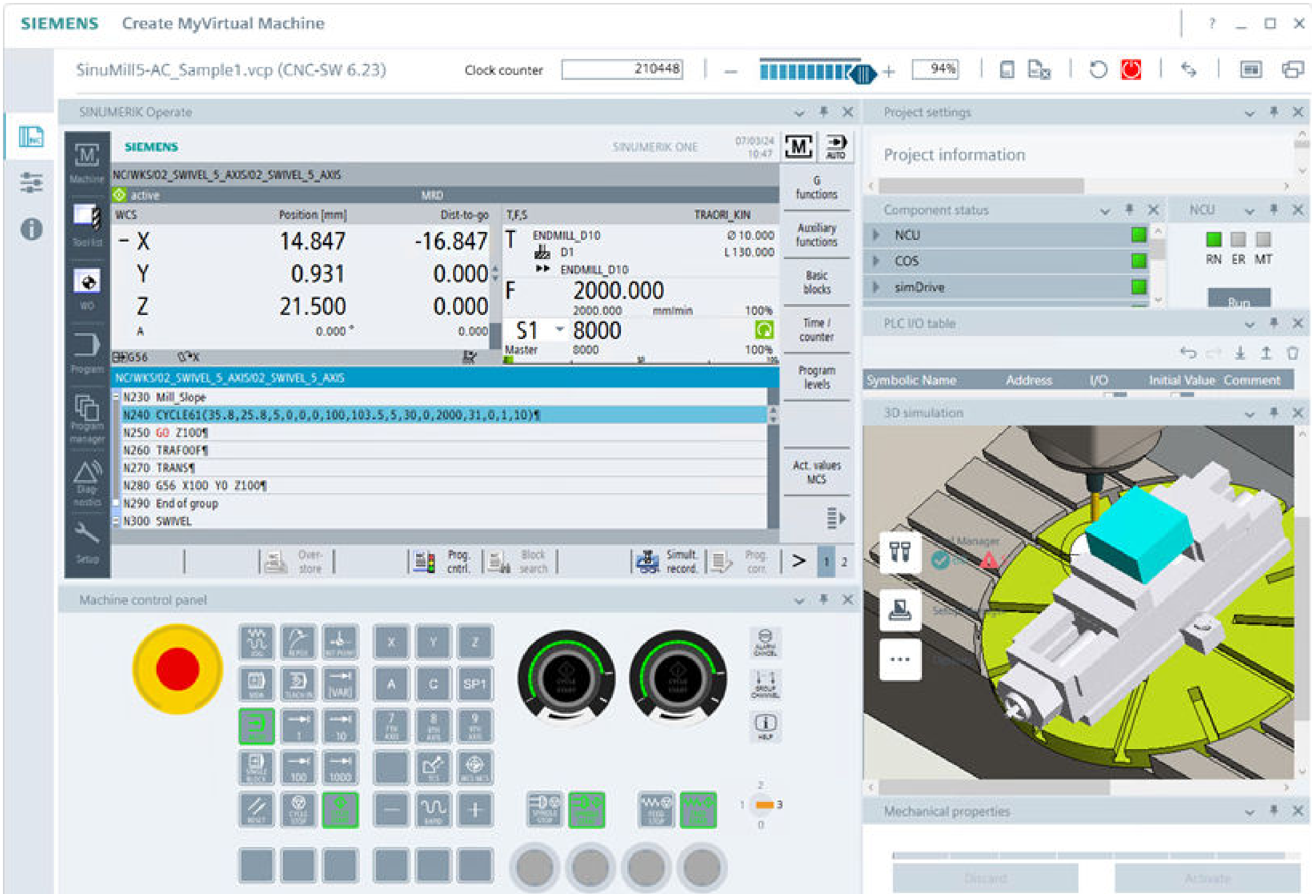


Figure 4-1 Create MyVirtual Machine with a machine project that has started

Functional scope

- Possibility for the use of different machine setups, e.g. turning machine (with/without Safety Integrated), milling machine (with/without Safety Integrated).
- Manage machine setups in machine projects (e.g. create, configure, save).
- Machine projects are only compatible if you use the identical version of the Virtual CNC software, e.g. V6.23.
- Exchange machine projects (vcp files) between computers.
- Open Interface for connecting external simulation applications (option: Create MyVirtual Machine /Open)
- Parallel installation to other SinuTrain simulation products for SINUMERIK Operate or Run MyVNCK, or SINUMERIK Operate for PC
- Display of the component status and trace capability
- Adaptation of the simulation speed and pause mode
- Faster processing of the part program than on the real system can be simulated (> 100%)
- Modern design and intuitive operation

- Virtual machine control panel (operating mode switch-over, traversal in JOG, etc.)
- Operational Emergency Stop on the machine control panel
- Simultaneous recording in automatic mode and simulation in the program editor
- 3D machine space simulation with stock removal and collision detection (option: Create MyVirtual Machine /3D)
- Online help available

Engineering in the TIA Portal

You configure the SINUMERIK ONE and the SINUMERIK PLC basic program in the TIA Portal. Many of the tools known from the SINUMERIK STEP 7 Toolbox are integrated in the TIA Portal user interface.

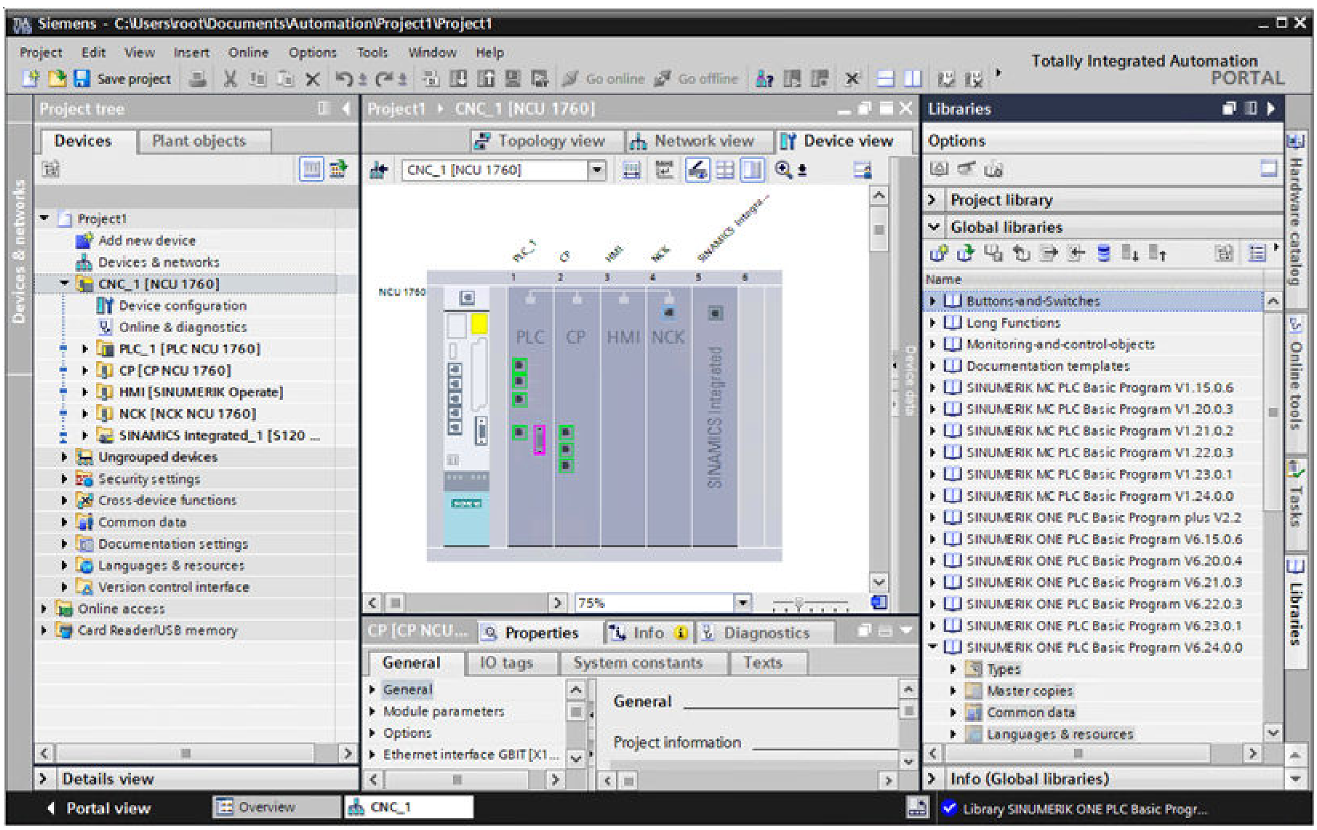


Figure 4-2 Engineering in the TIA Portal

4.2.2 SINUMERIK STEP 7 Toolbox

The SINUMERIK ONE software component is part of the SINUMERIK STEP 7 Toolbox V19 SP1 and includes the following tools and functions:

- Supplement to the hardware catalog with the following SINUMERIK ONE modules V6.24:
  - NCU 1740
  - NCU 1750
  - NCU 1760
  - PPU 1740
- The NX15.3 or NX10.3 modules that match the NCU 1740, NCU 1750, NCU 1760 and PPU 1740 are the same as for SINUMERIK 840D sl and can be found in the "Hardware catalog" in the folder "Controllers > SINUMERIK 840D sl > NX".
  The firmware version of the NX module must match the firmware version of SINAMICS Integrated - and must be compatible with the firmware version of the NCU. An overview of the version compatibility is listed in the following table.

NCU firmware (SINUMERIK ONE)	SINAMICS Integrated/NX firmware
V6.24	V5.2 SP3 HF

- SINUMERIK ONE basic PLC program V6.24
- Creation of SINUMERIK PLC commissioning archives in DSF format
- Use of NC variables
- Import of SINUMERIK user alarm texts (alarm number range 500,000 ... 999,999)
- Export all alarms (e.g. system diagnostics) and text lists for SINUMERIK Operate
- Support of SINUMERIK Safety Integrated (F-PLC) for SINUMERIK ONE

Note

Industrial security

Activating potentially insecure services or functions (e.g. web server, OPC UA server, PUT/GET communication) lowers the protection level against unauthorized internal or external access to functions and data of this controller.

Carefully ensure that you prevent any unauthorized access to your plants, systems, machines and networks by applying the appropriate measures.

4.2.3 PLC simulation

The integrated PLC of Create MyVirtual Machine is a functionally expanded SIMATIC S7-PLCSIM Advanced V6.0 Update 1 (PLC V3.1).

This means that you can configure your PLC and all the associated modules with the SINUMERIK ONE STEP 7 Toolbox, program your user logic, and then load the hardware setup and the PLC program to the virtual controller. From there, you can execute your program logic step by step, monitor the responses/effects of the simulated inputs and outputs and adapt your program logic.

Note

Validity of the information about the PLC simulation in this manual

The information relating to the simulation of the PLC and on SIMATIC S7-PLCSIM Advanced in this manual is only intended as entry-level information and describes the special features of SINUMERIK.

Supplementary to the information provided in this manual, information about SIMATIC S7-1500 CPUs or about SIMATIC S7-1500F is provided in the manual for SIMATIC S7-PLCSIM Advanced V6.0 Update 1.

SIMATIC S7-PLCSIM Advanced Function Manual (https://support.industry.siemens.com/cs/products?search=SIMATIC%20S7-PLCSIM%20Advanced&dtp=Manual&pnid=14667)

Features of a PLC simulation

A virtual PLC cannot fully simulate a real PLC. There can be differences in the behavior of a virtual PLC compared with a real PLC.

It can also be difficult to simulate testing for programs that are highly time-control dependent, because the time control in the simulation is nowhere as deterministic as the time control of a real PLC.

Functional scope of the PLC simulation

S7-PLCSIM Advanced supports the following functions:

- **Instructions**
  S7-PLCSIM Advanced supports almost all operations (system functions and system function blocks) for the S7-1500F as for a real CPU. S7-PLCSIM Advanced treats blocks that are not supported as not being ready to run.
  Some operations are partially supported. For these operations, S7-PLCSIM Advanced checks the input parameters for validity and returns outputs; although they are valid, it is however possible that they do not necessarily correspond to those of a real CPU with physical I/O.
  A list of all supported operations can be found in the SIMATIC S7-PLCSIM Advanced Function Manual.
- **Modules/technology modules**
  S7-PLCSIM Advanced simulates technology modules with some restrictions.
- **Technology objects**
  S7-PLCSIM Advanced simulates technology objects with some restrictions.
- **I/O devices**
- **Web server**
  S7-PLCSIM Advanced simulates the web server functionality with some restrictions.

- **OPC UA**
  S7-PLCSIM Advanced simulates OPC UA with some restrictions.
- **Diagnostics**
  S7-PLCSIM Advanced cannot simulate the complete scope of all possible diagnostic buffer entries. For instance, it does not simulate any messages regarding weak batteries in the CPU or EPROM errors. However, most I/O and program errors are simulated.

See also

Guidelines for migrating from SIMATIC S7-300/400 to SIMATIC S7-1500 and the TIA Portal (https://support.industry.siemens.com/cs/document/109478811/)

SIMATIC NET "7-1500 Industrial Ethernet CP 1543-1 Manual (https://support.industry.siemens.com/cs/document/76476576/)

CPU-CPU Communication with SIMATIC Controllers Compendium (https://support.industry.siemens.com/cs/document/78028908/)

4.2.4 NCK simulation

The NCK integrated in SINUMERIK ONE is simulated for the virtual SINUMERIK with the simNCK component. The simNCK component simulates all of the relevant functions, and uses machine data specifically adapted for the simulation mode.

4.2.5 HMI

Create MyVirtual Machine contains the SINUMERIK Operate commissioning and operating software with the standard functions relevant to Create MyVirtual Machine.

Additional functions

- Safety diagnostic functions
- HMI PRO support (version and release dependency on SINUMERIK Operate)
- Display of PLC alarms (incl. DB2 alarms) in SINUMERIK Operate
  To display PLC alarms, you can export the alarm text from the TIA Portal and copy to the machine project.
  Export the PLC messages and text lists manually from the TIA Portal and store them in the user directory at "%LOCALAPPDATA%\Siemens\Automation\SINUMERIK ONE\ncu\card\oem\sinumerik\hmi\lng\".

4.2.6 Substitute drive components

Create MyVirtual Machine includes the simDrive substitute drive component to simulate selected safety functions. simDrive only simulates those functions that are required for commissioning Safety Integrated. To do this, the following SINAMICS functions are simulated in a simplified form:

PROFIBUS communication and telegram configuration

The substitute drive component operates with predefined bus clock cycle times of Tdp=2.0 ms, To=1.0 ms, Ti=0.5 ms.

The following PROFIdrive and PROFIsafe telegrams are simulated:

- SIEMENS telegram 903
- SIEMENS telegram 902
- SIEMENS telegram 136
- SIEMENS telegram 701
- SIEMENS telegram 391
- SIEMENS telegram 390
- SIEMENS telegram 370

See also: Standard telegram configuration of a SINUMERIK ONE.

From Create MyVirtual Machine with CNC-SW V6.20

From version CNC-SW V6.20, additional PROFIdrive telegrams are available. As a consequence, planned telegrams for the real machine can be configured for virtual commissioning in the TIA Portal and can be loaded to Create MyVirtual Machine.

The following PROFIdrive and PROFIsafe telegrams are emulated:

- SIEMENS telegram 138
- SIEMENS telegram 139
- SIEMENS telegram 146
- SIEMENS telegram 148
- SIEMENS telegram 149

Note

Restricted functional scope

The full functional scope of the new telegrams is not emulated in Create MyVirtual Machine. Only PZD values from SIEMENS telegram 136 are supported.

More information: Restrictions regarding substitute drive components

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Drive objects

The simulation includes a maximum of seven CUs. For each configured CU_I / CU_NX, one CU and one INFEED drive object are automatically created. The number of SERVO drive objects created corresponds to the number of configured axis telegrams 136.

Telegram 370 can be used to release INFEED drive objects. The release status of the INFEED drive object is evaluated in all SERVO drive objects of the same CU_I / CU_NX. The control unit for the INFEED drive object does not support EP terminals, parameterized wait times and feedback signals.

Measuring systems/encoders

Two encoders, which may be incremental or absolute, are supported per Motor Module.

- Encoder 1 is always a motor encoder. These are used for closed loop control.
- Encoder 2 is the load encoder and is configured in the simulation via the "Mechanical properties" viewlet.

Note

With two encoders, the addresses in MD30110 $MA_CRTLOUT_MODULE_NR and MD30220 $MA_ENC_MODULE_NR can refer to different Motor Modules. Note that the encoder setups of the addressed encoders in the NCK and the drive match, in particular the encoder type and number of pulses.

Speed and current control loop

A speed controller with default settings is simulated. The controller settings are selected to match the mass modeled in the mechanical system, and therefore cannot be changed.

Mechanical system of the machine

You configure the properties of the mechanical model via the "Mechanical properties" viewlet.

Drive functions

- Travel to fixed stop
  Is only supported if the appropriate measured signals are transferred via the Open interface.

4.2.7 I/O simulation

Description

The virtual SINUMERIK provides several ways of performing an I/O simulation.

- Open Interface for external applications/simulators in Create MyVirtual Machine
- Internal I/O simulation in Create MyVirtual Machine

Note

I/O simulation influences operation of the machine control panel

Create MyVirtual Machine simulates the I/Os through direct reading/writing in the PLC I/O image. Parts of the PLC I/O image is also used for internal communications.

The machine control panel integrated in Create MyVirtual Machine uses the first 8 bytes in the input range of the PLC I/O image. If this input range is written with its own values via the simulation API (Open interface and internal I/O simulation), the integrated machine control panel is no longer operable as expected.

If you operate the machine control panel and the Open interface or internal I/O simulation at the same time, the following may happen: Operator actions at the machine control panel do not function or data which was written with the Open interface or internal I/O simulation are overwritten when the machine control panel is subsequently used. The reason for this is the equality of data sources in Create MyVirtual Machine. This means that the last executed write access to a data area is exclusively effective.

Avoid writing to the I/O area of the machine control panel via the Open interface or the internal I/O simulation.

Open Interface for external applications

The Open Interface (option: Create MyVirtual Machine /Open) of Create MyVirtual Machine allows external applications to control the Create MyVirtual Machine system and to communicate at runtime. The possible applications are described below. The Create MyVirtual Machine application is started, operated and stopped by another application. The external simulation project is also integrated in the cyclical operation of Create MyVirtual Machine.

Functional scope of the Open Interface

- Start/exit Create MyVirtual Machine
- Create/open/save/close a machine project
- Start/stop control simulation
- Register for cyclical events of the virtual SINUMERIK (OB1 clock cycle of the PLC and/or IPO clock cycle of the NC)
- Read NC data in the IPO clock cycle
- Read PLC outputs in the OB1 clock cycle
- Write PLC inputs in the OB1 clock cycle
- Read PLC outputs via symbols
- Write PLC inputs via symbols
- Start/stop external I/O simulation synchronously with the Create MyVirtual Machine simulation
- Read/write channel/axis/tool data
- Read probe signals

- Manage folders, files, NC programs on the NC and virtual memory card
- Select files (e.g. NC programs)

Internal I/O simulation in Create MyVirtual Machine

Via the internal I/O simulation, you can read and write I/O inputs/outputs in Create MyVirtual Machine. With the aid of a watch table, you assign switches to inputs and LED displays to outputs. This means that you can write to virtual input addresses and read output addresses – and therefore check basic PLC functions.

4.2.8 Communication interfaces

Interfaces of a SINUMERIK ONE

SINUMERIK ONE uses PLC, CP and CM communication mechanisms based on the S7-1500 product family, and therefore has different interfaces than a SINUMERIK 840D sl.

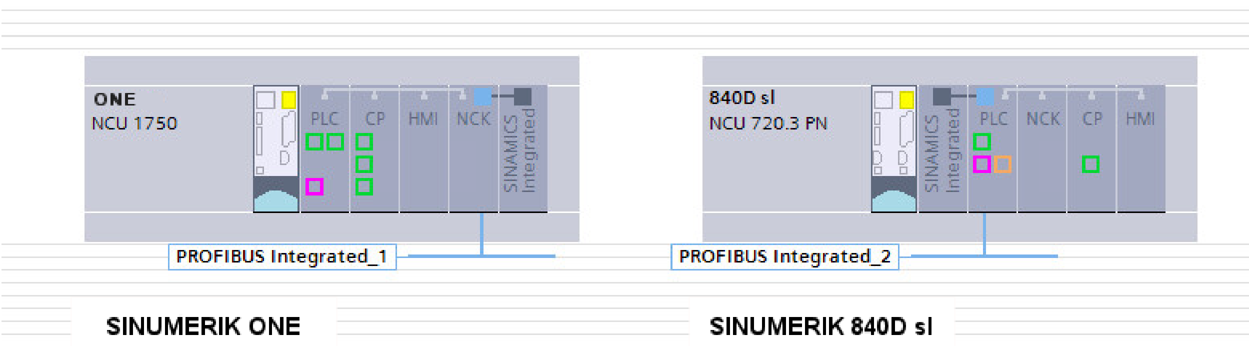


Figure 4-3 Comparison of the configuration (network view): SINUMERIK ONE and SINUMERIK 840D sl

	Interface	Type	ONE	840D sl
	Internal	PROFIBUS DP Integrated	x	x
	X120/X130, X127	Ethernet, PN-IE interfaces	x (individually configurable)	x (not configurable)
	X126	PROFIBUS DP	x	x
	X136	MPI/DP	-	x
	X150	PROFINET IO	x	x
	X160	PROFINET IO	x	-

Interfaces of a virtual SINUMERIK

A virtual SINUMERIK ONE has configurable communication interfaces like the real SINUMERIK ONE. The interfaces X120, X130 and X127 are provided in the current version.

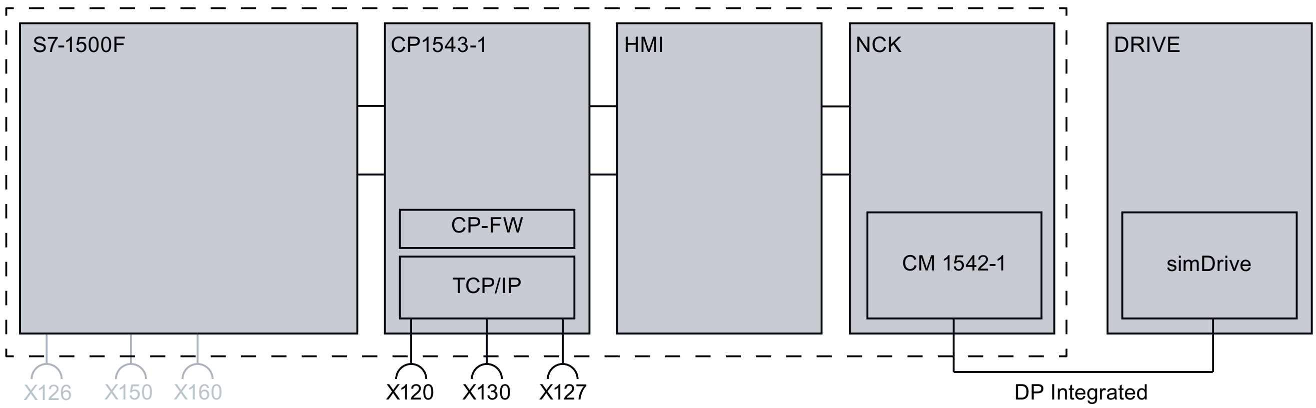


Figure 4-4 Interface overview - the interfaces shown grayed out are not available with the virtual SINUMERIK

Special aspects

The interfaces of the virtual SINUMERIK ONE are treated in the simulation as a single interface, because the various interfaces can be accessed only via the same IP address as the computer.

The interfaces X126, X150 and X160 are not available to the PLC I/O. An existing PLC I/O is simulated in the virtual context by direct reading/writing in the PLC I/O image via the Open Interface of Create MyVirtual Machine.

The current version of the virtual SINUMERIK supports the following communication mechanisms:

- Loading a TIA Portal project into the PLC via the CP
- Communication between PLC and TIA Portal or HMI (e.g. to read/write variables)
- S7 communication between the HMI and NCK
- DCP protocol is supported
- IPv4 protocol is supported

4.2.9 Safety Integrated and acceptance test

Safety Integrated

SINUMERIK ONE supports the following scope of the new Safety Integrated safety solution:

Supports F-PLC, F-I/O and safety program

- F-I/O are connected via the F-capable PLC of the SINUMERIK ONE
- Programming of F-blocks with F-logic via the editors for F-FBD or F-LAD

- Handling of configurations and the F-library in the same way as for SIMATIC F-CPUs
- Configuration via the Safety Administration Editor

Scope of the drive-integrated safety functions

You can use the following drive-integrated safety functions (as Extended Safety Functions):

- STO/SS1 (Safe Torque Off / Safe Stop 1)
- SS2/SS2e/SOS (Safe Stop 2 / Safe Operating Stop)
- SS2ESR
- SLS (Safely-Limited Speed)
- SSM (Safe Speed Monitor)
- SCA (Safe Cam)
- SAM/SBR
- SDI
- SLP/SP
- SBT

Commissioning the F-PLC and programming the safety program

The F-PLC (SIMATIC S7-1500) is configured and programmed in the TIA Portal - taking into account the restrictions and constraints listed in this manual as well as those in the manuals for SINUMERIK ONE Safety Integrated, SIMATIC Safety Advanced and SIMATIC S7-1500.

Commissioning and controlling safety functions integrated in the drive

You can control the safety functions integrated in the drive via PROFIsafe/PROFIdrive. The safety functions integrated in the drive are commissioned in SINUMERIK Operate via function-specific screens or by configuring the appropriate SINAMICS parameters.

Diagnostics, safety functions integrated in the drive

SINUMERIK ONE supports the following safety diagnostic functions of SINUMERIK Operate:

Status safe drives	Displays the configured safety-relevant status and diagnostics information of the selected drive.
PROFIsafe telegrams	Displaying receive and send information about PROFIsafe telegrams of the particular drive.
SIC/SCC telegrams	Displaying receive and send information about SIC/SCC telegrams of the particular drive.
SI Safe Cams	Display the status of the function and enabled cams.

Acceptance test (from V6.20)

With SINUMERIK ONE Create MyVirtual Machine, you have the option of preparing for an acceptance test, evaluating an acceptance test that has already been completed or carrying out parts of the acceptance test and transferring the test results to the real machine.

Note

You can only perform a complete acceptance test at a real machine.

From version Create MyVirtual Machine V1.3 with CNC-SW 6.20 and higher, the following acceptance test types are available for virtual commissioning:

- Functional relationships
- Safety Activation Test

More information: *SINUMERIK ONE SINUMERIK Operate acceptance test*, keyword "Safety acceptance test in SINUMERIK ONE Create MyVirtual Machine".

Additional references

More information can be found in the following documentation:

- *SINUMERIK ONE Safety Integrated* Commissioning Manual.
- *SINUMERIK ONE SINUMERIK Operate acceptance test* Function Manual

Functions and restrictions overview table

Only those safety functions listed in the following overview table are supported.

Function group / function		Short designation	Actual Sinumerik	Virtual SINUMERIK
Safety Integrated motion control features				
	Safe Torque Off	STO	X	X
	Safe Stop 1	SS1	X	X
	Safe Stop 2	SS2	X	X
	Safe Stop 2E	SS2E	X	X
	Safe Stop 2 ESR	SS2ESR	X	X
	Safe Operating Stop	SOS	X	X
	Safely-Limited Speed	SLS	X	X
	SLS Override (Specification of the correction factor in the F-program via PROFI-safe)	SLS Override	X	X
	Safe Acceleration Monitoring	SAM	X	--
	Safe Brake Ramp	SBR	X	--
	Safe Speed Monitoring	SSM	X	X
	Safe Direction	SDI	X	X
	Safe Limit Positions	SLP	X	X

Function group / function		Short designation	Actual Sinumerik	Virtual SINUMERIK
	Safe Brake Test (only telegram 701 SIC/SCC)	SBT	X	X
	Safe Cams (can be used only with PROFIsafe telegram 903, not together with the SP function)	SCA	X	X
	Transfer of safe position values (only with PROFIsafe telegram 901/902, cannot be used together with the SCA function)	SP	X	X[1)]
	Safely-Limited Acceleration (SLA)	SLA	X	X
	Internal SOS/SLS deselection		X	X
	Switchover speed to SOS (Cancel stop transition times at SOS for SOS, SS2, SS2E, SLS selection)		X	X
	SafeUserData	SUD	X	X
	Safety Integrated change of view to dbSI mode		X	X
NC				
	Dynamic Stop D		X	X
	SIC/SCC		X	X
	Referencing via SIC/SCC		X	X
SINUMERIK Operate diagnostic support				
	Diagnostics overview		X	X
	SI drives		X	X
	SI telegrams		X	X
	Integrated F-CPU		X	X
	SI checksums - global checksum		X	--
	SI checksums - F-signature		X	X
	SI checksums - drive checksum		X	--
	SI alarms		X	X
	SI peripherals		X	X
	SCA		X	X
SINUMERIK Operate commissioning support (Safety Integrated)				
	Overview (PROFIsafe is activated only in one channel)		X	X
	Overview SI password		X	--
	Setting options		X	X
	Settings - configuration		X	X
	Settings - telegram configuration (PROFIsafe enable and input of the PROFIsafe module number is not relevant for the Create MyVirtual Machine)		X	X
	Proposed values for encoder parameterization Automatic presetting of the encoder parameterization by means of the "Default" softkey		X	--

Function group / function		Short designation	Actual Sinumerik	Virtual SINUMERIK
	STO/SS1 (Basic)		X	X[2]
	STO Extended		X	X
	SBC		X	--
	SS1 Extended		X	X
	SS2/SOS/SS2E		X	X
	SAM/SBR		X	--
	SLS		X	X
	SSM		X	X
	SDI		X	X
	SLP/SP		X	X
	SBT		X	X
	SCA		X	X
	SS2ESR		X	X
	SI Ref		X	X
Acceptance test				
	SINUMERIK Safety Integrated features		X	--
	F-PLC		X	X[3]
F-PLC				
	F-programming		X	X
	F-I/O		X	X

1) Only PROFIsafe telegram 902

2) Via PROFIsafe

3) Parts of the F-PLC acceptance test can be performed using CMVM

4.3 Differences compared to the real system

4.3.1 System-related properties

Overview

The SINUMERIK ONE control system is available as a real control SINUMERIK ONE and as a digital twin Create MyVirtual Machine. Due to the modeling of the hardware, the virtual system has system-related properties and limitations that are different from those in a real system. You will find the properties documented by topic in the following chapter.

4.3.2 Create MyVirtual Machine restrictions

The following functional restrictions are in place for the virtual SINUMERIK.

- After ramp-up, axes always have the "Homed" status.
- Machine projects (vcp files) cannot be used between versions.
- Limited function scope of the virtual operator panel compared with the real operator panel.
- Numerical control cold restart is not supported (ramp-up with standard machine data).
- No parallel use with other SinuTrain simulation products for SINUMERIK Operate or Run MyVNCK or SINUMERIK Operate for PC because multiple HMI instances cannot run in parallel.
- Only limited diagnostics possible.
- Upgrade requires uninstallation/reinstallation.
- Performance measurements, e.g. block change times, and processor capacities do not provide representative values and differ from the first version of the product. A declaration of performance is therefore only possible to a limited extent.

4.3.3 Restrictions in the TIA Portal

General restrictions for the virtual SINUMERIK regarding planning and configuration in the TIA Portal are listed as follows.

- TIA Portal functions that are not supported
  - "Firmware update"
  - "Reset to factory settings"
  - Backup/restore
  - PLC MRES does not function reliably
- The device cannot be loaded as new station/control in the project (hardware and software)
- **Support for Motion Control technology objects (external drives)**
  Motion control technology objects cannot be used with integrated NCU drives (SINAMICS Integrated or NX module).
  Instead, use either the corresponding NC functionality for integrated drives (LBP_CtrlAxisSpindle [FC18]) or external drives with Motion Control technology objects

4.3.4 Restrictions with the communication interfaces

Restrictions

The following CP communication functionality is not currently supported:

- S7 communication between different NCUs via the S7 services Put/Get, Fetch/Write, Send/Receive is not supported.
- External S7 communication to the drive simulation (read/write variables/files) is not supported.
- Port 80/8080 forwarding is not supported.
- OPC-UA forwarding is not supported.
- FTP client and FTP server are not supported.
- SMTP and SMS are not supported.
- IPsec secured communication is not supported.
- IP address, MAC address and port interconnection (IRTE) port configuration is not supported.
- Routing tables are not supported.
- SNMP is not supported.
- DHCP client/server and DHCP configuration via TIA Portal are not supported.
- LLDP is not supported.
- IPv6 usage for T-blocks is not supported.
- NTP is not supported.
- PING and ICMP configurable via Firewall are not supported.
- Secure NTP is not supported.
- SNMPv3 is not supported.
- IP firewall, MAC firewall, bandwidth limitation and global firewall rules are not supported.
- Communication between multiple instances of Create MyVirtual Machine (via X120) is not supported.
- List of the accessible nodes is not supported when TIA Portal and Create MyVirtual Machine are installed on the same computer.
- The following applies for RFC1006 (ISOonTCP):
  ISOonTCP can only be used at one interface in Windows. The set interface is assigned to the "SINUERMIK_CP1543" access point (see also "Configuring communication settings").

4.3.5 PLC simulation restrictions

The following functions are not currently permitted for the virtual SINUMERIK or are not available for hardware reasons.

Note

The information listed here describes specific restrictions for simulation of a PLC in the SINUMERIK environment. In addition to the restrictions listed here, all information for SIMATIC S7-1500 CPUs or SIMATIC S7-1500F CPUs in the manual for SIMATIC S7-PLCSIM Advanced V6.0 Update 1 (PLC V3.1) applies.

SIMATIC S7-PLCSIM Advanced Function Manual (https://support.industry.siemens.com/cs/products?search=SIMATIC%20S7-PLCSIM%20Advanced&dtp=Manual&pnid=14667)

- **Web server**
  Access to the PLC web server via the interfaces X120/X130/X127 is not possible with the HTTPS protocol. Only HTTP is supported.
  Use the interfaces X150/X160 when using HTTPS.
- **Access via web browser**
  In order to be able to access the PLC with a web browser using X120, X130, X127, the interfaces which may be used for access must be defined when configuring the web server in the TIA Portal.
  For this purpose, choose: "Detailed view > General tab > Web server > Overview of interfaces" and activate the checkbox "Enable web server access" for the corresponding interfaces.

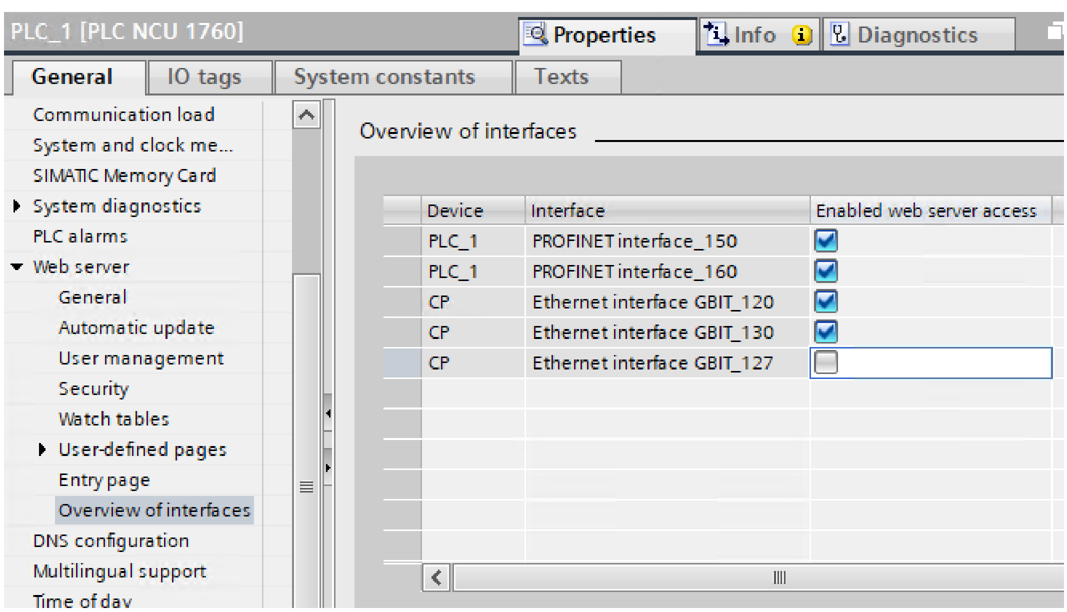


Figure 4-5 Interfaces X120 and X130 activated for web server access

- **Online diagnostics functions of the PLC**
  The "Let LED flash" function is not available.
- **Support for Motion Control technology objects (external drives)**
  SIMATIC S7-PLCSIM Advanced supports the simulation of SIMATIC S7-1500 Motion Control. However, to allow these programs to execute successfully, the cycle time for the motion control must be increased because the sampling times for the simulation are longer.

- **Simulation restriction compared with the physical hardware**
  The PLC simulation is performed on a PC with the Windows operating system. Consequently, the scan cycle time and the exact time for actions are not the same as when these actions were performed on physical hardware. This is because several programs share the processing resources on the PC.
- **TIA Portal functions not supported**
  "Assign IP address"
- **PLC data compatibility**
  PLC data can be stored persistent in machine projects ("*.vcp file"). Machine projects which were created with older Create MyVirtual Machine versions are not compatible.
- **Troubleshooting in the PLC program**
  OB1 time violations cannot be diagnosed.

4.3.6 NCK simulation restrictions

Restrictions

The simulated NCK (simNCK) differs from a real NCK with the following machine data. This machine data is configured appropriately for the simulation operation and some of which cannot be changed (write-protected).

Table 4-1 Differently set machine data

MD	Name	Initial value (remark)	Configurability	Machine data type
MD10162	$MN_COM_TIMING	0 (Response time of the communication)	Configurable	General machine data
MD13060	$MN_DRIVE_TELEGRAM_TYPE	136 (PROFIdrive communication via SIEMENS telegrams 136, 138, 139, 146, 148, 149)	Configurable	
MD18965	$MN_SIM_ENVIRONMENT	1 (simNCK simulation environment)	Permanently assigned	
MD20700	$MC_REFP_NC_START_LOCK	0 (NC start is possible without homed axes)	Permanently assigned	Channel machine data

MD	Name	Initial value (remark)	Configurability	Machine data type
MD31050	$MA_DRIVE_AX_RATIO_DENOM	1 (Gearboxes are configured in the simulation via the "Mechanical properties". See: Substitute drive component restrictions (Page 47))	Configurable	Axis machine data
MD31060	$MA_DRIVE_AX_RATIO_NUMERA			
MD31064	$MA_DRIVE_AX_RATIO2_DENOM			
MD31066	$MA_DRIVE_AX_RATIO2_NUMERA			
MD31070	$MA_DRIVE_ENC_RATIO_DENOM			
MD31080	$MA_DRIVE_ENC_RATIO_NUMERA			
MD32100	$MA_AX_MOTION_DIR			
MD34090	$MA_REFP_MOVE_DIST_CORR	0 (Home offset / absolute offset is not supported. See: Substitute drive component restrictions (Page 47))	Permanently assigned	
MD34200	$MA_ENC_REFP_MODE	0 (Homing mode absolute encoder)	Configurable	
MD34210	$MA_ENC_REFP_STATE	2 (Absolute encoder is adjusted)	Configurable	

More information

Information about the system variables supported by SINUMERIK ONE can be found in the *SINUMERIK ONE List Manual*.

4.3.7 HMI restrictions

Restrictions

The following functions and any associated operating screens are not supported by SINUMERIK Operate for Create MyVirtual Machine:

- Identifier of PLC blocks and variables in optimized DBs that contain a level separator (".") cannot be addressed via the HMI. Example of unsupported addressing: "my.DB"."my.Signal" Address PLC variables in one of the following ways:
  - Absolute addressing as known from STEP 7 V5.5 SP4: <block address>.<offset>, e.g. DB19.DBB6
  - Type-safe accesses to DB of the form <block name>.<variable name>

  Mixed forms are not permissible, e.g. <block address>.<variable name>
- SINUMERIK Ctrl-Energy (as well as the associated parameter and commissioning operating screens) is not supported.
- Remote diagnostic functionality is not supported.
  (MENU > Diagnostics > Remote diagnostics)
- Drive system diagnosis is not supported.
  (MENU > Diagnostics > Drive system)

- PB/PN diagnosis is not supported.
  (MENU > Diagnostics > PB/PN diagnostics)
- TCP/IP diagnosis is not supported.
  (MENU > Diagnostics > TCP/IP diagnostics)
- Drive system commissioning is not supported.
  (MENU > Commissioning > Drive system)
- Operator panel commissioning is not supported.
  (MENU > Commissioning > OPs)
- Only the "Circularity test" is supported by the commissioning functions for "Optimization/test".
  (MENU > Commissioning > Optimization/test)
- Only the settings for OPC UA are supported by the functions for the network configuration/network settings.
  (MENU > Commissioning > Network)
- Set date and time
  The configuration of the time zone and time have no effect on the system time. The system time of PLCSIM Advanced and simNCK obtain their system time from the simulation PC. This time sequence is interrupted by the scheduler of Create MyVirtual Machine (date and time of NCU/PU are stopped).
  (MENU > Commissioning > HMI > Date Time)
- Security commissioning
  In HMI SINUMERIK Operate in Create MyVirtual Machine, the softkey "Commissioning > **>** > Security" is not available during commissioning and security commissioning cannot be performed. You can only commission security on a real SINUMERIK controller.
  (MENU > Commissioning > **>** > Security)
- Security component in archive
  No archive with security component can be created in HMI SINUMERIK Operate. The "Security" check box is not active.
  (MENU > Commissioning > Commissioning archives)
- The following files are not transferred to Create MyVirtual Machine when an archive is imported:
  - mmc.ini
  - systemconfiguration.ini
  - Backup of the network settings

Also observe the restrictions concerning the supported safety commissioning and diagnostics screens, the various configured machine data as well as information about the DSF archive data in the *Create MyVirtual Machine* System Manual.

4.3.8 Safety Integrated restrictions

The following functions are currently not permitted or are not available in SINUMERIK ONE Create MyVirtual Machine for hardware-related reasons.

Commissioning the F-PLC and programming the safety program

You configure and program the F-PLC in the TIA Portal just like a real PLC S7-1500 - taking into account the restrictions and constraints listed in this manual as well as in the manuals for SINUMERIK Safety Integrated, SIMATIC Safety Advanced and SIMATIC S7-PLCSIM Advanced.

- **Controlling safety functions integrated in the drive**
  Control via terminals is not supported. Use the control via PROFIsafe/PROFIdrive. Only PROFIsafe/PROFIdrive telegrams 902/903 are supported.
- **Monitoring channels**
  - The 2nd monitoring channel (p93xx) is not functionally supported.
  - However, the parameters for the 2nd channel are used to calculate the current load-side actual values of the second monitoring channel and the difference between the two monitoring channels.
  - A data comparison with the output of a safety message is output only for the parameters p9326 and p9526.
- **SI drive alarms**
  Alarms and messages are only output in one channel.
- **Safety Integrated commissioning**
  In the real system, the Safety Integrated commissioning must be activated to change Safety Integrated-relevant data. In SINUMERIK ONE Create MyVirtual Machine, the Safety Integrated data can be changed without Safety Integrated commissioning mode (p0010=95)
- **Evaluating the PROFIsafe address**
  The evaluation of the F-address (device configuration) specified in the TIA Portal and the PROFIsafe address configured in SINUMERIK ONE Create MyVirtual Machine is not supported.
- **Forced dormant error detection (test stop pulse cancellation)**
  Forced dormant error detection can only be configured using SIC/SCC.
- **Encoder preassignment**
  An encoder preassignment created in SINUMERIK ONE Create MyVirtual Machine may differ from the encoder preassignment on a real machine.
  In SINUMERIK ONE Create MyVirtual Machine, for example, a direction reversal or the fine resolution X_IST2 cannot be determined.
- **Scope of the usable safety functions and stop responses**
  - Only the safety functions listed in the SINUMERIK ONE Safety Integrated Commissioning Manual in the "Overview table of functions and restrictions" are supported.
  - SAM cannot be activated by triggering a stop response by SS1 or SS2.
- **Safe gearbox stage switchover**
  Safe gearbox stage switchover is only supported in the real SINUMERIK ONE.
- **Safety Info Channel (SIC)/Safety Control Channel (SCC)**
  - A prerequisite for the function of the Safety Info Channel (SIC)/Safety Control Channel (SCC) is that the option SINUMERIK ONE Safety Integrated - F-PLC is set.
  - With SINUMERIK ONE Create MyVirtual Machine, alarm 27813 "Option F logic not set" is not output if the option is not set.

4.3.9 Substitute drive component restrictions

Restrictions

The following functions are not permitted, restricted or not available for hardware reasons.

- **Restricted handling and scope of the SINAMICS parameters**
  - Only a subset of the SINAMICS parameters is supported for the simulation of the drive component.
    The read/write rights (and thus the assignment to R or P parameters) differ in some cases from the parameters in a SINAMICS.
    A listing and description of all supported SINAMICS parameters can be found in the SINUMERIK ONE List Manual.
  - Read/write drive parameters via NC/PLC variable access (FB2/FB3) is not possible.
  - Only a small selection of interface signals are available via "LBP_Axis* [DB31]... - Axis/spindle signals".

    The following bits of the message word are permanently preassigned 1:

Message word	Description	Signal
MELDW.6	1 = No motor overtemperature alarm	LBP_Axis*.E_MTempWarn
MELDW.7	1 = No alarm power unit thermal overload	LBP_Axis*.E_HTempWarn

    Only the following message word bits are supported:

Message word	Description	Signal
MELDW.11	1 = Controller enable signal	LBP_Axis*.A_ContrEnable
MELDW.12	1 = Drive ready	LBP_Axis*.E_MotOK
MELDW.13	1 = Pulses enabled	LBP_Axis*.E_PulseEnable

  - Import or save drive parameters via SINUMERIK archives is not supported.
- **Restricted support for the following drive functions**

– Restricted support for star-delta switchover (FC17/SINU_CtrlStarDelta)

Note

Only the part of the sequence control for the star-delta changeover that influences the enabling of the drive is supported.

The interface signals are also supplied:

- The pulse enable of the drive (MELDW.Bit13) is removed if a motor data set changeover is detected via STW2 (Bit0,1,2,9,10).
- The selected data set is reported back in ZSW2 (Bit0,1,2,9,10). The pulse enable (MELDW.Bit13) is set again with edge 0->1 in STW2.Bit11 ("Motor switchover feedback").
- Ensure that p1082[0] "Maximum speed/maximum velocity" is parameterized correctly.
- The value in p1082[0] and p1135 "OFF3 ramp-down time" determines the time it takes for the drive to come to a standstill following an OFF3 command. The value in p1135 may need to be adjusted depending on p1082[0].

- **No support for the following drive functions:**
  - Drive data set switchover
  - Motor data set switchover
  - Flying measurement
  - Drive-autonomous extended stop and retract
  - Weight counterbalance
  - Torque feedforward control
  - Operating mechanism options
  - Drive OA
  - Function modules
  - Brake control
  - Sensors
  - Terminals
  - Topology
  - Drive trace is not supported
  - Encoder parking (MD31046 ENC_PASSIV_PARKING)
- **Limited support in SINUMERIK Operate**
  - Display of status information in the HMI at "Diagnostics > Axis diagnostics" is only partially supported
  - Read/write drive parameters via HMI at "Diagnostics > NC/PLC variables" is not supported
- **Restricted support of drive objects**
  Only the drive objects listed in Section Substitute drive components (Page 31) are supported

- **Restricted support of telegram types**
  Only the telegram types listed in Section Substitute drive components (Page 31) are supported
  The following restrictions apply to the subsequent PROFIdrive telegrams (available from CNC-SW V6.20):
  Telegram 138/148 contains the encoder values for the 2nd and 3rd encoders
  - The encoder value is taken from the integrated mechanical system simulation (load encoder), and is impressed on the two encoder values (2nd/3rd encoders).
  - The encoder parameters for the 3rd encoder cannot be edited. The parameters of the 2nd encoder are copied to the 3rd encoder.
  - Parameter r979 is correspondingly adapted as information parameter. Indices 11-15 are mirrored to 21-25.

  Telegrams 139/149 include the encoder values for the 1st encoder and telegram logic for spindle states
  - The encoder values are taken from the integrated mechanical system model (motor encoder).
  - The spindle states and status change are not emulated (including the necessary parameter)
  - The spindle states cannot be used in CNC-SW ≥ V6.20.

  Telegrams 146/148/149 include additional telegram logic for ILC (intelligent load control)
  - The encoder values are taken from the integrated mechanical system model (motor encoder, load encoder), the same as for telegrams 13x.
  - The ILC states and the status change are not emulated (including the necessary parameter).
  - The ILC states cannot be used in CNC-SW ≥ V6.20.

  Note

  Incorrect configuring

  For an incorrect/inconsistent configuring of PROFIdrive telegrams, Alarm 26015 is output.

- **Referencing and absolute encoder**
  For an absolute encoder, the starting position of the axes corresponds to the reference position if the machine was referenced immediately after being switched on. The starting position is not defined if referencing was performed after an axis was already traversed. This is the reason that referencing should always be performed immediately after switching on.
  The starting position when switching on can be configured via the machine data setting. See section "Tips for commissioning > Starting position axes (encoder) (Page 170)".

- **Restrictions of mechanical model**
  The behavior of virtual mechanical system does not correspond to the behavior of a real mechanical system in all cases. A simplified model is used.
  For example, the friction torque does not increase as the speed increases, as it does in a real mechanical system.
- **Archive of SINUMERIK 840D sl with drive data**
  When importing an archive of a SINUMERIK 840D sl into the virtual SINUMERIK, no drive parts are transferred. The encoder setup in particular is set manually in SINUMERIK Operate in the corresponding drive parameters.

Layout and operation 5

5.1 Introduction

Description

In Create MyVirtual Machine you work with machine projects for a wide range of different types of CNC machines with SINUMERIK controls. Within the respective machine project, the virtual SINUMERIK with CNC user interface, CNC core functions, and optionally a 3D simulation of the machine room are available. The functional scope of a SINUMERIK control system is covered.

5.2 User interface

5.2.1 Managing machine projects

Introduction

The machine projects (*.vcp; **V**irtual **C**ommissioning **P**roject) are managed in the Create MyVirtual Machine project overview. In this view, you create, open and delete projects.

A machine project manages all required data for the machine operation. The machine project file contains NC, HMI, PLC and drive data stating the version of the CNC software used.

Machine project and CNC software version

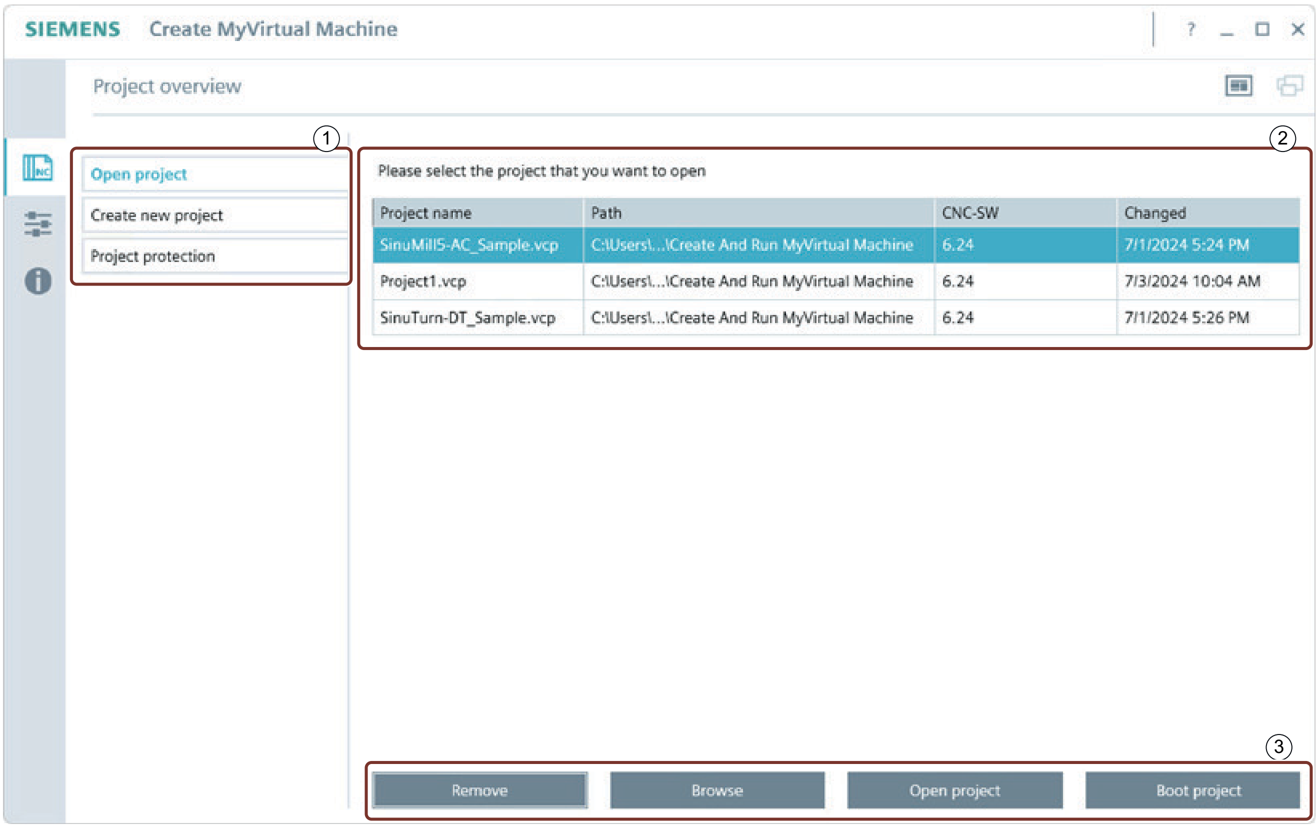
To edit a machine project, the matching version of the CNC software must always be installed on the computer. A machine project can neither be created nor opened without the CNC software being installed. If the version of the CNC software used in the project is not installed, an error message stating the missing CNC software is displayed. In this case, first install the stated version and then edit the machine project.

Several CNC software versions can be installed on a single computer. The CNC software version used in the machine project is displayed in the project overview in the "CNC version" column and in the title bar of the open machine project.

Managing projects

1. On the desktop, double-click the "Create MyVirtual Machine" icon, or select "Start > Siemens Automation > Create MyVirtual Machine". The Create MyVirtual Machine project overview appears.

Create MyVirtual Machine project overview



① **Open project**
Open existing projects from the overview
Create new project
Create new project or project from existing template project
Project protection
Setting up project protection for a machine project.

② Overview of the last opened machine projects with storage path, CNC SW version used, and date

③ **Remove**
Removes projects from the project overview. The machine project is only deleted from the overview, and remains on the data storage medium.
Browse
Searches the data storage medium for projects and enters them into the overview.
Open project
Opens a selected machine project in the overview.
Start the project
Open a selected machine project in the overview and then start the machine.

Figure 5-1 Create MyVirtual Machine project overview

See also

Working with machine projects (Page 109)

5.2.2 Overview of project settings

Project settings

After opening the project, the "Project settings" are first displayed. Here, you can configure specific project settings, save and start the project.

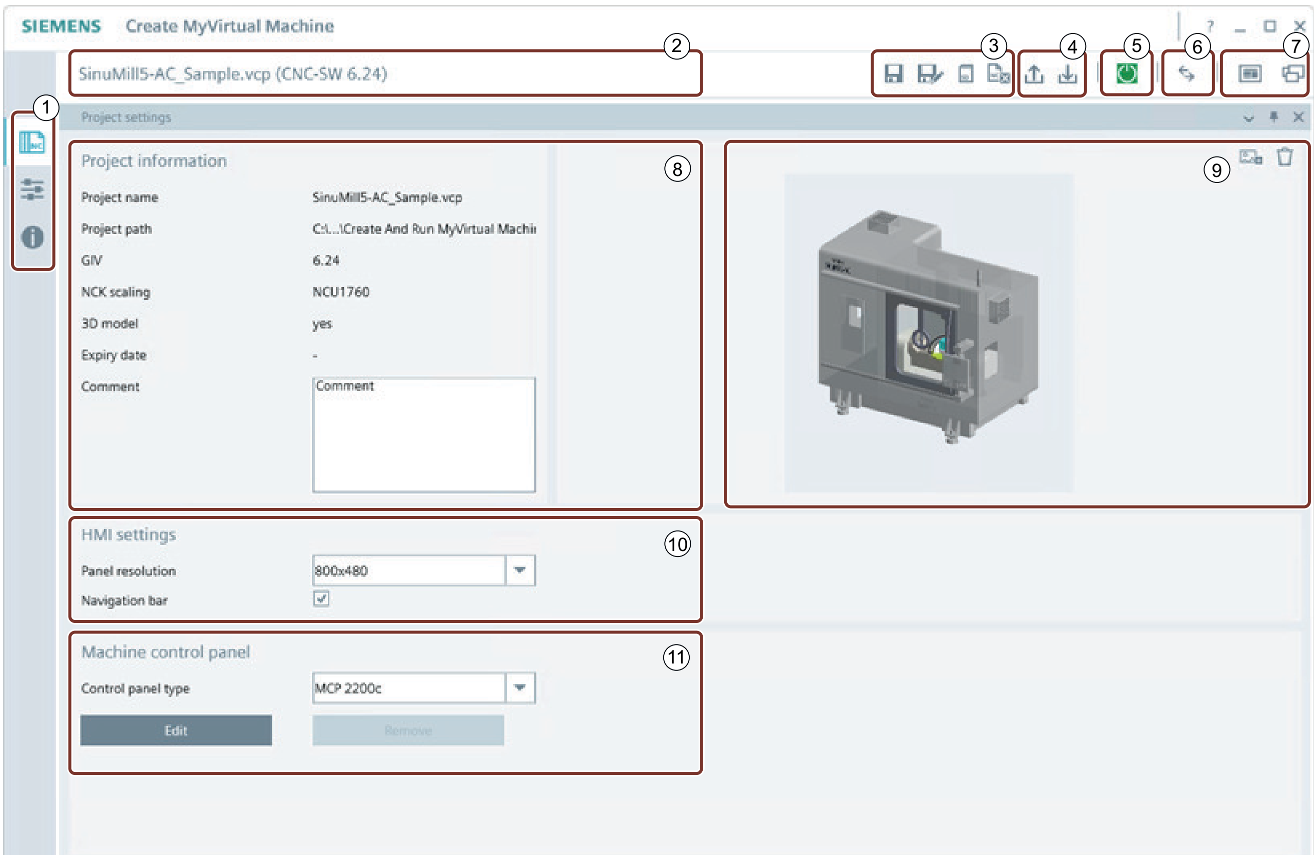


Figure 5-2 Project settings using a milling machine as example

① Basic functions

Click on the buttons to use the basic functions of Create MyVirtual Machine.

 Displays of the project overview

 Settings
Setting the user interface language and the communication connections

 Information
Display of the version and license information

② Title bar

Display of the project name and version of the CNC software.

③ Managing the opened machine project

- Save
  Saves the open machine project.
  Machine projects can be saved only if the machine simulation has been previously exited.
- Save as
  Saves the open machine project under a new name or in another folder.
  Machine projects can be saved only if the machine simulation has previously been exited.
- Memory card
  Opens Windows Explorer with the storage location of the virtual memory card.
- Close project
  Closes an open machine project. If there are unsaved changes, a note is displayed, and you can save the project before closing.

④ Exporting/importing project settings

Use the export/import function to save or exchange project settings.

 Export of project settings of the opened machine project

 Import of project settings from other machine projects in an open machine project

⑤ Start simulation

 Start simulation of the machine.
The simulation control cannot be operated during the ramp-up phase.

⑥ Switch between Create/Run MyVirtual Machine

 Click on the button to switch between the Create MyVirtual Machine and Run MyVirtual applications. The button becomes only active when a project is opened or started.

If the project is open, a switchover is performed directly. In case of a started project, a reset of the started machine project is performed. The source application is changed to the predefined layout and functionality of the target application. A change only takes place if the previously assigned licenses of the source application are also available for the target application.

⑦ Manage window arrangement and windows

 Click on the button to create or select a window arrangement. You can save the arrangement of the individual windows as user-defined arrangement. You can create, save and delete user-defined window arrangements.

 Click on the button to display/hide the window areas. Check/uncheck the checkbox in front of the respective window name in the displayed list.

You can undock the individual windows using the  buttons, and dock them at any other position in Create MyVirtual Machine. For example, you can display HMI SINUMERIK Operate in a separate window.

⑧ Project information

The following project information is displayed here. You define the project information when creating the project.

- Project name and project path
- CNC software version
- NCK scaling (specification of the NCU/PPU)
- Displays whether the machine project includes a 3D model (yes/no)
- Expiry date (the project can no longer be opened after the expiry date)
- You can optionally enter a comment.

⑨ Machine diagram

You can optionally assign a unique machine diagram to the project.

 Click on the button to integrate a graphic file as machine diagram. You can only select valid graphic formats.

 Click on the button to delete the machine diagram that was inserted.

⑩ HMI settings

You can only change the project settings if the simulation of the machine has not been started.

- Panel resolution
  Select the resolution of the HMI of SINUMERIK Operate or the Panel. The HMI will be displayed in the selected resolution at the next startup.
- Navigation bar
  Activate the checkbox if you want the lateral navigation bar to be displayed in the HMI. Using the navigation bar, you can quickly access machine areas of the HMI, e.g. program or tool list.
  The "Navigation bar" checkbox is grayed out from panel resolutions "1366x768- HD Ready".
  The navigation bar is automatically activated and is displayed in the HMI.

⑪ Machine control panel

- Control panel type
  Select which machine control panel is to be used in the machine project. Machine control panels are available, e.g. for milling (e.g. MCP 483 Milling), turning (e.g. MCP 483 Turning), SINUMERIK ONE, and a "User MCP".
- Using the "Edit" button you can edit the machine control panel; for example, to label buttons or to configure the start address of the machine control panel. You can delete the "User MCP" by pressing "Remove".

Note

The start addresses of the MCP and EMERGENCY STOP (Page 72) must be identical to the configured addresses in the PLC user program (TIA Portal project or PLC project).

When the machine is started, the selected machine control panel will be used.

See also

Project settings (Page 67)

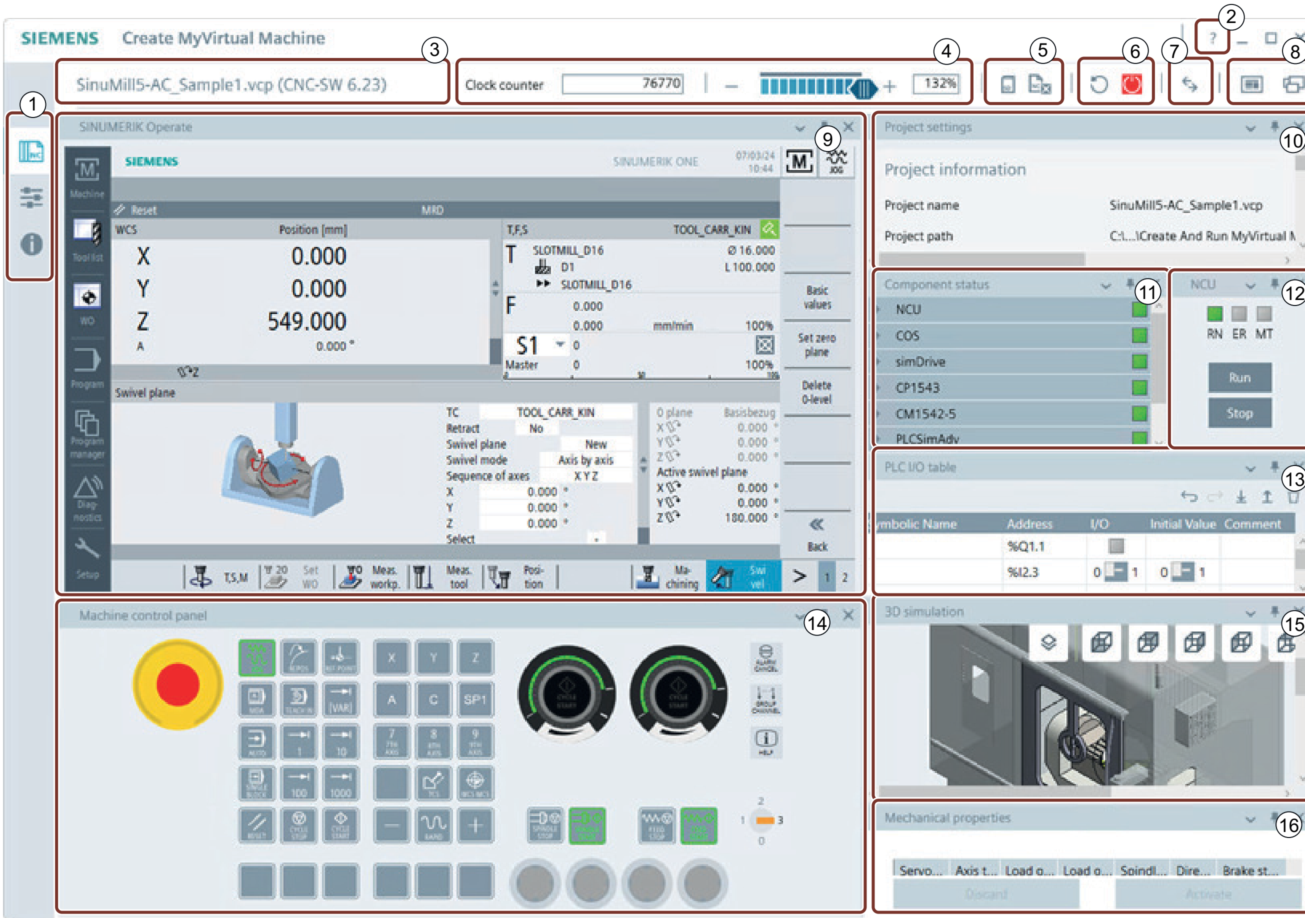
5.2.3 User interface (machine simulation)

Create MyVirtual Machine user interface

The operation of a Create MyVirtual Machine corresponds to that of a real control equipped with a SINUMERIK Operate user interface and machine control panel. The machine basic screen is displayed after the control ramp-up.

Note

Depending on the SINUMERIK controller (SINUMERIK ONE, SINUMERIK 828D), certain functions (windows) may not be available.



① Basic functions

Click on the buttons to use the basic functions of Create MyVirtual Machine.

Opens the project management/project overview

Settings

Opens the settings to switch between languages and reset the window layout

Information

Displays of the version information

② Help and window functions

? Open/close Help. The Help is displayed in a separate viewlet. You can extract the viewlet and display it as a separate window.

_ □ × Minimizing or maximizing the application window or closing the entire application.

Open/close Help. The Help is displayed in a separate viewlet. You can extract the viewlet and display it as a separate window.

③ Title bar

Display of the project name and version of the CNC software.

④ Simulation control

Clock cycle counter (optional)

Displaying previous servo clock cycles.

In "Settings", you can configure whether the clock cycle counter is displayed. As default, it is hidden.

Change simulation speed from standstill (pause – system stopped) up to the maximum speed.

Using the simulation control, you configure how much CPU performance should be used for Create MyVirtual Machine when in the simulation mode. For normal operation, keep the slider at the maximum position (+).

- In the left-hand position (-) 0 %, the simulation is in the pause status. In this state, the "frozen" machining process can be observed. Changes to values and operating actions are not possible or lead to inconsistent states in the machine project.

  Note

  Changes in pause mode 0%

  Do not make any changes to the machine project in pause mode. Changes can be lost and lead to inconsistencies.

- In the center position 100 %, the simulation speed approximates the speed/clock cycle of a real machine and runs approximately in real-time.
- In the right (+) position, the simulation runs with maximum speed. The percentage display specifies how much faster the system operates compared with real-time. For example, the value 800% corresponds to approximately the 8-fold real-time speed. The maximum simulation speed is limited by several factors, including the computer power.

Note

Program runtimes and simulation control

The simulation control does not influence determining the program runtimes of NC programs. Independent of the position of the slider, after running through the simulation or after executing NC programs, identical runtimes are obtained. Just like at the real machine, only changes to the override influence the determined program runtime.

⑤ Managing the machine project

- Memory card
  Opens Windows Explorer with the storage location of the virtual memory card.
- Close project
  Closes an open machine project. If there are unsaved changes, a note is displayed, and you can save the project before closing.

⑥ Stop/reset simulation

Exit simulation of the machine.

Reset
Initiate NCK/PLC warm restart

⑦ Switch between Create/Run MyVirtual Machine

Click on the button to switch between the Create MyVirtual Machine and Run MyVirtual applications. The button becomes only active when a project is opened or started.

If the project is open, a switchover is performed directly. In case of a started project, a reset of the started machine project is performed. The source application is changed to the predefined layout and functionality of the target application. A change only takes place if the previously assigned licenses of the source application are also available for the target application.

⑧ Manage window arrangement and windows

Click on the button to create or select a window arrangement. You can save the arrangement of the individual windows as user-defined arrangement. You can create, save and delete user-defined window arrangements.

Click on the button to display/hide the window areas. All windows and optionally usable plugins are displayed in the list. Check/uncheck the checkbox in front of the respective window name in the displayed list.

You can detach, dock or close an individual window using the buttons.

To release the window so that it can be moved and shown as an autonomous window, click on the **"v"** button.

- Anchor a window at another position in the basic window
  Drag the window to the required window icon using the mouse. The window is then automatically docked.
- Window on a second monitor, e.g. 3D Simulation
  Drag the window to the required monitor using the mouse.

Using a docking operation, the separated windows are embedded at the original location in the basic window. Save the new window arrangement as user-defined window arrangement.

⑨ HMI SINUMERIK Operate

The HMI SINUMERIK Operate viewlet permits CNC operation and programming in exactly the same way as at the SINUMERIK ONE controller of the CNC machine.

⑩ Project settings

Displays the project settings. You can only change the settings if the simulation of the machine is stopped.

⑪ Display of the component status with time measurement, clock cycle counter, and cycle time

This display provides only information whether the individual component runs correctly.

The time measurement is displayed in the component status display. For non-clocked components, the booting time and the shutdown time are shown. The shutdown time is still zero after the first ramp-up.

The cycle counters and cycle times of the clocked components are also shown in the component status display. The minimum, the maximum and the average cycle time are shown from top to bottom.

The status of the individual components is indicated using a colored rectangle:

Already started component (green)
Component starting at that instant in time (gray/green)
Component shutting down at that instant in time (green/gray)
Not started component (gray)
Faulty component (red)

Note

The components are monitored during the ramp-up phase and the cyclical operation of the machine. If no communication can be established between the components (e.g. faulty components are no longer available or incorrectly configured), the attempt to establish communication is terminated after a configured interval (timeout). Faulty components remain in the status red (not available).

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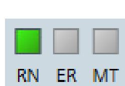
⑫ NCU (only SINUMERIK ONE)

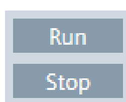
The displays provide information on the current status of the PLC.

PLC status LED



- **RN** Run/Stop LED
  - Gray: PLC switched off
  - Green: PLC status Run
  - Yellow: PLC status Stop
  - Two-color flashing: PLC status transition
- **ER** Error LED
  - Gray: No diagnostic result or PLC switched off
  - Flashing red: Diagnostic event pending
- **MT** Maintenance LED
  - Gray: No maintenance request pending or PLC switched off
  - Yellow: Maintenance request pending
  - Yellow flashing: Maintenance demand pending

PLC mode selector switch



The PLC mode selection area is a simulation-specific extension for setting the operating mode of a running or switched-off PLC. The functionality is comparable with the operating mode selection of the PLC module in the TIA Portal.

- **RUN**
  PLC operating mode RUN is requested. The PLC program is being executed.
- **STOP**
  PLC operating mode STOP is requested. Processing the PLC user program is stopped and all PLC outputs are set to substitute values.
  Note:
  When after setting STOP operating mode, a switch is made again to RUN mode, you must trigger a warm start (Reset) so that the components (NCK and PLC) are resynchronized.

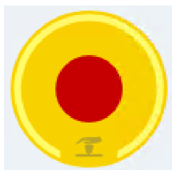
⑬ PLC I/O table

You read and write the PLC inputs and outputs with the integrated I/O simulation. Outputs with status LEDs and inputs with toggle switches are configured in the table rows of the expandable PLC I/O table.

⑭ Virtual machine control panel

Machine control panel for milling or turning.

- EMERGENCY STOP (yellow ring)
  The status of the EMERGENCY STOP (pressed) is indicated by a pictogram below the red button. The EMERGENCY STOP is functional only with the appropriate PLC basic program.



- Powerride, feedrate and spindle override
- Alarm, Channel, Help keys
- User-assignable function keys
- Keyswitch (0-3)

⑮ 3D Simulation (option)

During execution of an NC program in AUTOMATIC mode, 3D Simulation with collision detection enables you to check the machining process so that any program errors can be detected.

⑯ Mechanical properties (only SINUMERIK ONE)

In the "Mechanical properties" viewlet, you configure the physical structure (mechanics) of the NC machine and define the brake states for a "Safe Brake Test".

Optional plugins

In addition to the standard windows, you can also display optional plugins.

- Toolpath Connector
- Behavior Model (status/behavior model)
  In Run MyVirtual Machine with limited functionality.
- Acceptance test - signals
  Not available in Run MyVirtual Machine.

5.3 Protecting machine projects

5.3.1 Project protection

You protect machine projects against unauthorized disclosure to third parties or manipulation using the project protection function. Project protection is implemented as follows:

- Tying the machine project to the unique FlexLM vendor strings of the license server/license for the customer's MyVirtual Machine product (from V1.4)
- Optionally or as the only protection, the machine project is assigned an expiry date (from V1.4.1)

Before opening the protected project, a check is carried out to see whether the FlexLM vendor string in the protected machine project matches the string of the active license server or whether the expiry date has not yet been reached. After successful verification, the customer can open the project.

Project protection options

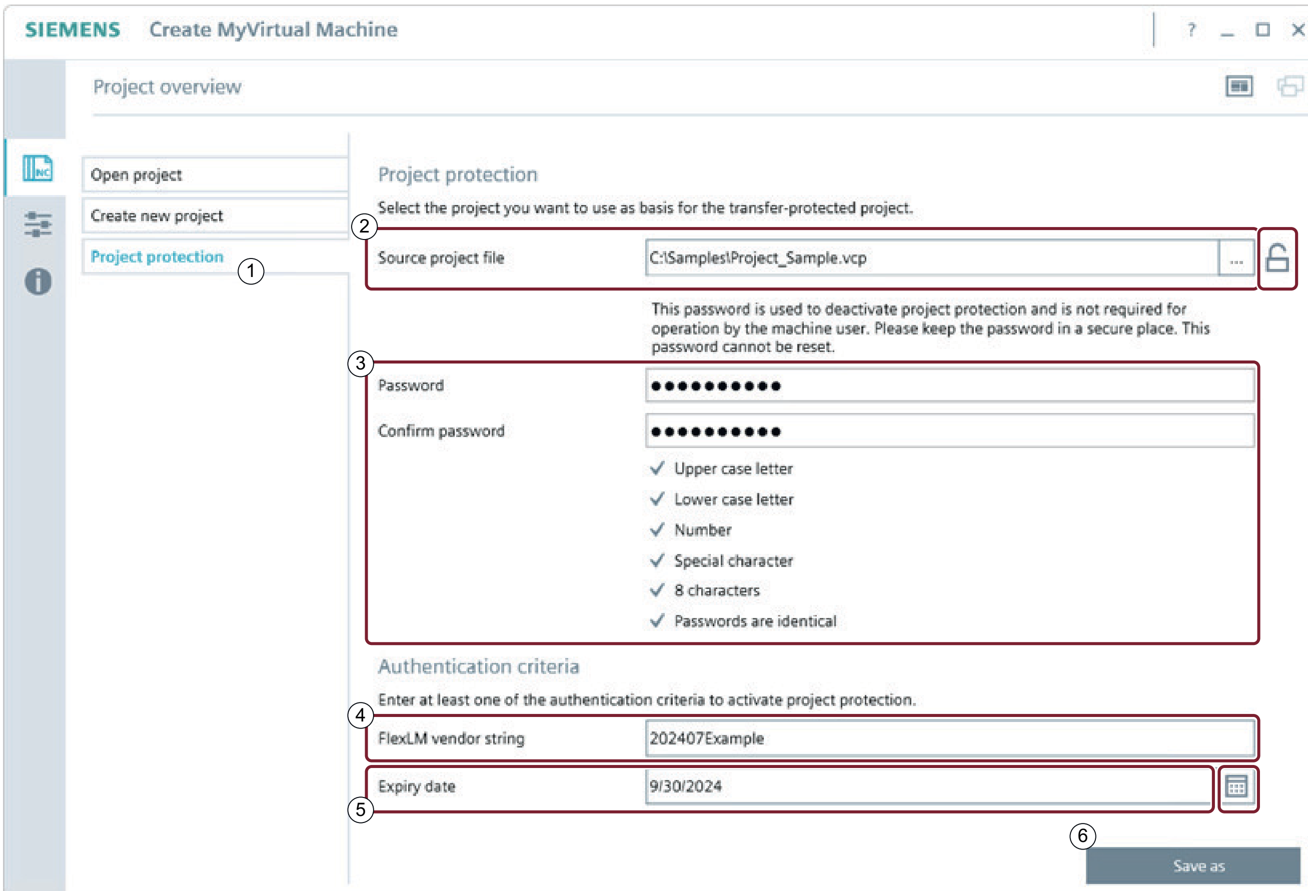
- **Protection via FlexLM vendor string**
  You created a machine project in Create MyVirtual Machine for a customer and want only that customer to be able to open the machine project. In this case, you link the FlexLM vendor string of the license server for the MyVirtual Machine products at the customer with this machine project.
  ⇒ Only the customer with the license server with the unique FlexLM vendor string can open the protected machine project.
- **Protection through an expiry date**
  You only want the machine project to be used for a defined period of time, e.g. as a test project. In this case, you only protect the machine project by specifying the expiry date.
  ⇒ The machine project can be opened by any customer with a licensed Create & Run MyVirtual Machine until the expiry date.
- **Protection via FlexLM vendor string and expiry date**
  You only want the machine project to be opened for one customer and only for a defined period of time. Protect the project by using the unique FlexLM vendor string **and** entering an expiry date.
  ⇒ Only the customer with the license server with the unique FlexLM vendor string can open the protected machine project if the expiry date has not yet been reached.

Note

Access level and version of Create & Run MyVirtual Machine

- For machine projects with project protection, the maximum access level is limited to "User" with password protection. A higher access level cannot be unlocked for protected machine projects.
- A protected machine project can only be opened if the correct version of Create & Run MyVirtual Machine is used. Older versions are not supported.
  - Project protection via FlexLM vendor string ≥ V1.4
  - Expiry date ≥ V1.4.1

Project protection parameters



① **Project protection tab**

Set up project protection for a machine project or, in the case of protected machine projects, remove the project protection by entering the password and saving.

② **Source project file**

Select the source project file to be protected. Click the button "..." to select the machine project. This file is the basis for project protection and is not itself modified unless the same file name is selected for saving. Otherwise, a new file will be created with project protection.

The lock icon indicates whether the selected machine project is protected or unprotected .

③ Assign a password with which the project protection can be removed again.

Note

As the protected machine project can only be opened by the owner of the license server with the FlexLM vendor string or before the expiry date is reached, it is essential that the password is assigned. Only with the password can the project protection of the machine project be removed again on another computer with a different FlexLM vendor string. After selecting the protected project, unlock the project with the password and save it as an unprotected project.

If you use project protection, you must ensure the process for managing and handling the password throughout the life cycle of the product so that you have access to the password at any time if needed.

Password

Password to be able to remove the project protection of the machine project without the valid FlexLM vendor string. The password must comply with the password policy for valid password assignment.

At the same time as the password is entered, the fulfilled policies for the password are checked and marked with a tick.

Password policy:

- Uppercase letters (at least 1)
- Lowercase letters (at least 1)
- Numbers (at least 1)
- Special characters (at least 1)
- 8 characters (or more)

Confirm password

Enter password again for confirmation.

- Passwords are the same

④ **FlexLM vendor string (V1.4 or higher)**

Unique FlexLM vendor string of the license server or license of the customer that is to open the protected machine project. Before you set up project protection for a machine project, you must know the FlexLM vendor string of the license server used to license the MyVirtual Machine product. Have your customer provide you with the FlexLM vendor string. The customer reads out the FlexLM vendor string of the license server via the licensing application (License Tool) on his computer.

⑤ **Expiry date (V1.4.1 or higher)**

Optional specification of the expiry date.

Once the date has expired (current date > expiry date), the machine project can no longer be opened, even if the FlexLM vendor string matches.

Click on the "Calendar" button to select a date from the calendar.

Alternatively, enter the expiry date directly in the language-dependent format. The valid date format is based on the user interface language set for Create & Run MyVirtual Machine. The date is only adopted if it corresponds to the valid date format.

Examples: German "dd.mm.yyyy"; English: "mm/dd/yyyy"

The expiry date is displayed in the project settings for a protected project.

⑥ **Save as**

Save the machine project with set up project protection under a new project name. "Save as" only becomes active when the entered data is valid, e.g. the password complies with the policy.

Note

Save the protected machine project as copy under a new name. This allows you to open and edit the originally unprotected machine project without a password.

Figure 5-3 Overview of project protection for machine projects

See also

Setting up project protection for projects (Page 66)

Removing project protection from projects (Page 66)

5.3.2 Setting up project protection for projects

Requirement

Get the FlexLM vendor string of the license server from your customer under which the machine project should be opened. The customer reads out the FlexLM vendor string via the licensing application on his computer.

How to set up project protection

1. In Create MyVirtual Machine, select the "Project protection" tab.
2. Select the machine project to be protected in the "Source project file" field.
3. Enter a valid "password" and confirm the password in the "Confirm password" field. You can use the password to remove the project protection from the protected machine project.
4. Enter the FlexLM vendor string of the license server on which the machine project is to be opened.
5. Optionally enter an expiry date or protect the machine project using the expiry date only.
6. Click "Save as" and save the protected machine project under a new name. If the password is invalid or if data in the window is missing, you will not be able to save the machine project.

The project protection for the saved machine project is set. It can only be opened if the FlexLM vendor string of the license matches the FlexLM vendor string entered and/or the expiry date has not yet been reached.

See also

Project protection (Page 63)

5.3.3 Removing project protection from projects

You can remove the project protection for a project after entering the password

Requirement

The password for the protected project is known.

How to remove the project protection

1. In Create MyVirtual Machine, select the "Project protection" tab.
2. Select the protected machine project in the "Source project file" field.
If project protection is active for the selected project, the lock icon is displayed next to the "Source project file" selection box. In addition, only the "Password" input field is displayed.
3. Enter the valid "password" for the protected machine project.
4. Click "Save as" and save the machine project under a new name or overwrite the existing one.
If the password is invalid or if data in the window is missing, you will not be able to save the machine project without project protection.

The project protection for the saved project has been removed.

See also

Project protection (Page 63)

5.4 Project settings

5.4.1 Adapting the HMI resolution

The screen resolution of the CNC user interface (HMI SINUMERIK Operate) in the machine project can be set. This gives you the possibility to adjust the representation of the machine project as best as possible to the respective screen resolution of your simulation PC.

Requirement

You can only change the HMI resolution in the "Project settings" when the project is open. The machine simulation is in the stop state.

How to adapt the HMI resolution

1. In the opened "Project settings" viewlet, select the respective resolution from the list.

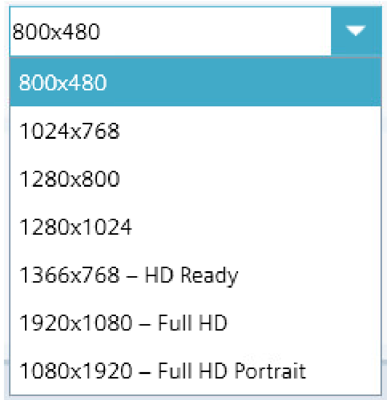


Figure 5-4 Selecting the HMI resolution

2. Start the machine project by pressing button "Start machine".
   The machine project is started with the selected resolution of the HMI.

Note

The available HMI resolutions depend on the respective version of the virtual CNC software.

5.4.2 User control panel (user MCP)

5.4.2.1 Overview of editable user MCPs

For the existing control panel types, you can customize the images and labels of the MCP buttons and save them as "User MCP" in the machine project.

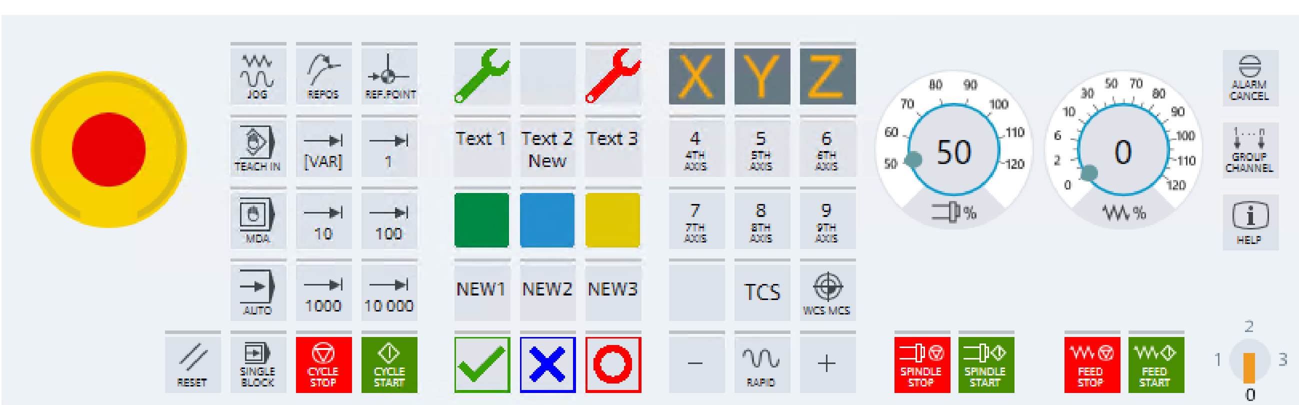


Figure 5-5 "User MCP" customer control panel

Functions

- Editing the existing control panel types and the "User MCP" in the MCP editor
- Change label/text of buttons
- Change images of buttons. The images are automatically scaled to the button size.
  – Supported image formats: "*.jpg", "*.jpeg", "*.jpe", "*.gif", "*.bmp", "*.png"
  – Maximum size of the image file ≤ 1 MB
- Changing pushbutton colors (SINUMERIK MPP, SINUMERIK MCP 1500/1900/2200C/2400C)
- Configuring MCP start addresses
  MCP input/output and EMERGENCY STOP input/output
- Saving as "User MCP"
- Deleting the "User MCP"
- The "User MCP" is only finally saved when the machine project is saved.

Constraints

- MCP editable only when project is open and simulation is stopped
- Only one "User MCP" per machine project possible
- Only one predefined font and size
- For a button, either the image or the text and the button color can be changed
- The following buttons cannot be edited
  – EMERGENCY STOP
  – Feedrate, spindle override
  – ALARM CANCEL
  – GROUP CHANNEL
  – HELP
  – Keyswitches
- "User MCPs" cannot be exchanged between machine projects

"User MCP" in Run MyVirtual Machine

The machine project with the "User MCP" can also be opened in Run MyVirtual Machine. The adapted "User MCP" is displayed, which cannot be edited.

See also

Editing a user MCP (Page 70)

Deleting a user MCP (Page 73)

Tips & Tricks (Page 73)

5.4.2.2 Editing a user MCP

You can edit the buttons of the standard control panel types and the "User MCP".

Requirement

- The machine project is open, still not started and the project settings are displayed.
- The new image files for the buttons are stored on a drive

How to edit an existing control panel

1. In the "Project settings" viewlet, select the "Control panel type" e.g. "MCP 483 Milling" and click on "Edit".
   The "MCP Editor" is displayed with the selected control panel.
2. Click the button whose image and/or text or color you want to change.
   The button is selected and the fields for "Image file", "Text" and "Button color" are active.
3. Click on "Image file" if you want to insert a new image for the button. The field is active and you can select an image.
   – Click the "..." button and navigate to the image file location in the explorer that is displayed. Only the image files of the supported graphic formats are shown.
   – Click on the image file and confirm with "Open".
   The image is inserted as a button and scaled to the button size.

   Note

   Image files > 1 MB and invalid image files will not be accepted. The "Image file" field will be framed in red.

4. Click on "Text" if you want to change the label of the button. The field is active and you can enter text.
   – Enter the text. The new text is displayed simultaneously on the button.

   Note

   If the text is too long, the "Text" field will be framed in red and the text will not be accepted.

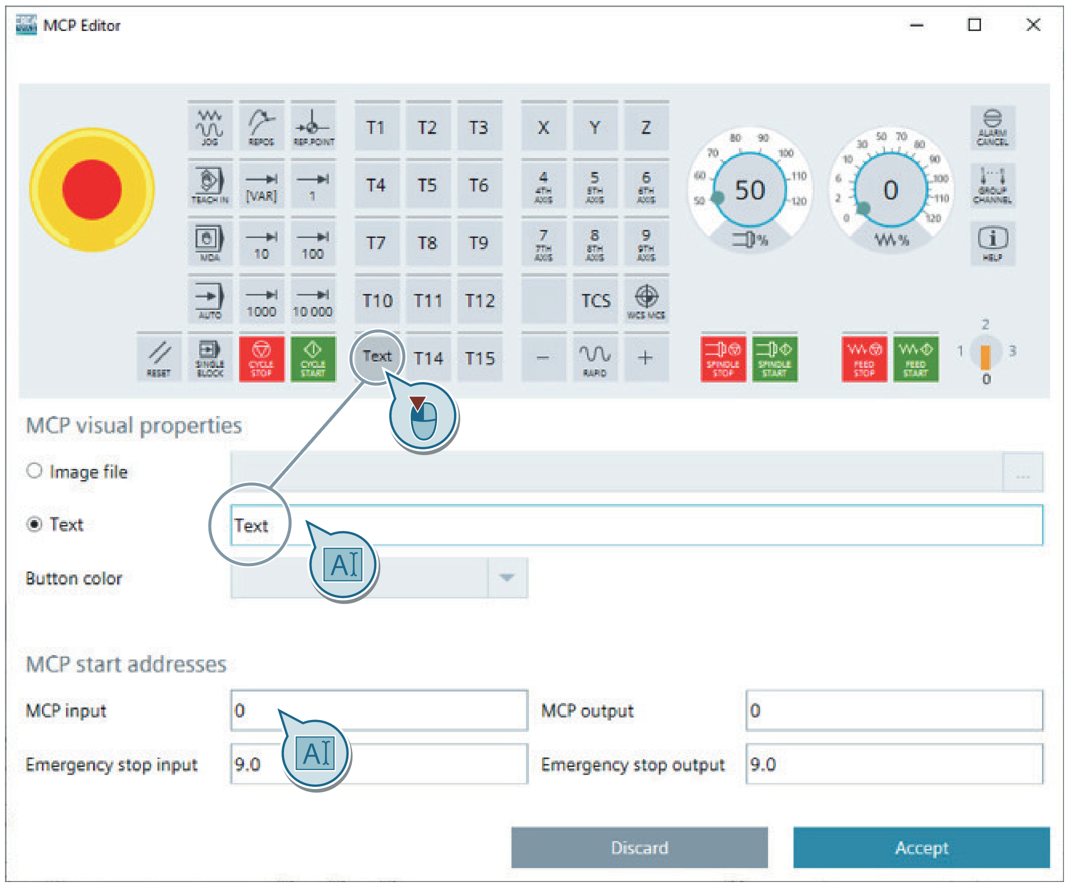


Figure 5-6 Editing text of the "User MCP"

5. **Only SINUMERIK MPP with pushbuttons:**
   Click on "Button Color" to select a color for the selected pushbutton from the list.
6. Repeat steps 2 to 5 if you wish to edit more buttons.
7. Optionally, you can configure dedicated start addresses for the machine control panel and the EMERGENCY STOP.
   More information is provided under Configuring user MCP start address (Page 72).
8. Click on "Apply" and confirm the dialog that appears with "Yes".
   All changes are applied and the "MCP Editor" is closed.
9. If you do not want to accept any changes, click on "Discard" and confirm the dialog that appears with "Yes".
   All changes since the last "Apply" process are discarded and the "MCP Editor" is closed.
10. Save the machine project.

Note

Saving "User MCP" in the machine project

The "User MCP" is only finally saved when you save the machine project. If the machine project is not saved after changing the "User MCP" before closing, all changes since the last time the machine project was saved will be lost.

Result

The modified control panel is displayed as "User MCP" under "Control panel type" and can be selected.

5.4.2.3 Configuring the user MCP start address

You can configure the start addresses of the MCP and the EMERGENCY STOP to suit your specific PLC project.

These addresses are used by default:

- MCP SINUMERIK ONE freely configurable
- MCP/MPP 483 %I0.0, %Q0.0.
- MCP SINUMERIK 828D %I112.0, %Q112.0

Note

The start addresses of the MCP and EMERGENCY STOP must be identical to the configured addresses in the PLC user program (TIA Portal project or PLC project).

Requirement

- The machine project is open, not started and the project settings are displayed.
- The MCP editor is open

This is how you edit the start addresses

1. Enter the absolute start address (<byte address>) in field "MCP input" or "MCP output", e.g. 100. Values between 0-32767 are permissible. The field is framed in red for inadmissible values.

   Note

   When specifying the start address, ensure that the length of the entire MCP address range lies within the permissible range.

   ---

2. Enter the absolute start addresses (<byte address>.<bit number>) for the EMERGENCY STOP input or output, e.g. %I9.0 and %Q19.0. The field is framed in red for inadmissible values.

5.4.2.4 Deleting a user MCP

You can delete an existing "User MCP" from the machine project.

How to delete the "User MCP"

1. In the "Project settings" viewlet, select the "Control panel type" "User MCP".
2. Click "Remove".
3. Click "Yes" to confirm the displayed dialog.
   The "User MCP" control panel is deleted from the machine project.
4. Save the machine project. The "User MCP" is only finally deleted after saving the machine project.

5.4.2.5 Tips & Tricks

Using a user control panel in multiple machine projects

Individual user control panels cannot be exchanged between machine projects. You have two options if you want to use a user control panel in several machine projects:

- Create a machine project with the user control panel that serves as template for other projects
- Exporting/importing project settings

Machine project with user control panel as template

1. Create an empty machine project.
2. Adapt an existing control panel as required.
3. Save the machine project with the user control panel.
4. You use the machine project with the user control panel as a template for other machine projects with the identical user MCP.

Exporting/importing project settings

1. Export project settings with the user control panel that should be used in another project.
2. Import the project settings into the other project.

Note

Observe the scope of the exported and imported project settings. All project settings are always exported/imported. A selective export/import is not supported.

See also

Exporting project settings (Page 74)

Importing project settings (Page 74)

5.4.3 Exporting project settings

You can export project settings of the opened machine project. For example, this means you back up the current settings or import the exported settings into a new machine project.

Requirement

- The machine project is open, still not started and the project settings are displayed.
- Machine project with the relevant project settings is saved

Exported project settings

The following project settings are exported as "*.vcs" file (Virtual Commissioning Settings):

- Comment
- Machine image
- Control panel type
- User MCP
- HMI settings
- Setting up mechanical properties
- Contents of the PLC I/O table

All project settings are always exported.

This is how you export project settings

1. Click the button.
2. In the dialog that opens, select the storage location and the file names.
3. Confirm with "Save".

The project settings are exported and saved as "*.vcs" file.

5.4.4 Importing project settings

You can import saved project settings of the machine project, for example, to apply settings from another project, for example in an upgraded project.

Requirement

- The machine project is open, still not started and the project settings are displayed.

Imported project settings

All project settings from the "*.vcs" file are imported. The following rules apply:

- Only the project settings contained in the imported "*.vcs" file are overwritten in the machine project.
- Project settings that are not overwritten at import are kept.

Example:

If the "*.vcs" file only contains for example the control panel type, the HMI settings and the content of a PLC I/O table, then only these are imported into the opened machine project. Any other project settings that possibly exist are kept.

This is how you import project settings

1. Click the button.
2. In the dialog that opens, select the previously exported "*.vcs" -file that is to be imported.
3. Confirm with "Open".
4. Confirm the confirmation prompt that is displayed with "Yes" if the project settings of the current machine project are to be overwritten.

The project settings are overwritten with the imported project settings.

5.5 Application settings

5.5.1 Switching over the program language user interface

You can switch the program language of the user interface (Create & Run MyVirtual Machine) to all installed languages.

Note

Languages and HMI SINUMERIK Operate

Switching over the language in Create & Run MyVirtual Machine does not change the language set in HMI SINUMERIK Operate. You change the language in SINUMERIK Operate in exactly the same way as at the real machine in area "commissioning" -or switch between installed languages using key combination "STRG+L".

This is how you switch between program languages

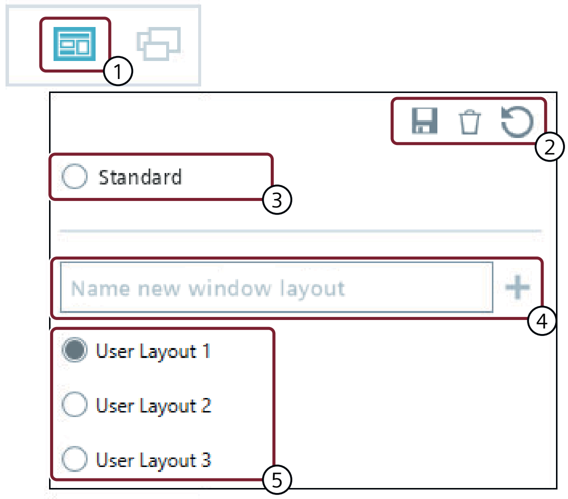
1. Click the "Settings" button .
2. In the window that is displayed, select tab "General settings".
3. Select the new program language.
4. Click "Apply".
   The language is only switched over after Create/Run MyVirtual Machine is restarted.

5.5.2 Window arrangement - standard, user-defined

5.5.2.1 User-defined window arrangement

You define the arrangement of the windows and which windows are displayed via the standard window arrangement or via the user-defined window arrangements. The standard view is specified and changes cannot be saved. User-defined window arrangements can be freely configured.

Managing window arrangements



① Click on the button to display or close the menu of the window arrangements.

② Save or delete an active user-defined window arrangement or reset it to the last arrangement that was saved

③ Standard window arrangement
Changes to the standard view cannot be saved. The standard view cannot be deleted.
If you wish to display the application in the standard view, then activate "Standard".

④ Create a new user-defined window arrangement
Enter a name and click on the plus symbol "+". A new window arrangement is created, based on the current arrangement.

⑤ List of available user-defined window arrangements
In the example "User Layout 1" is active

Figure 5-7 Managing window arrangements

See also

Creating a new window arrangement (Page 77)

Reset of the window arrangement to the standard (Page 78)

5.5.2.2 Creating a new window arrangement

Using user-defined window arrangements, adapt the view of Create or run MyVirtual Machine in order to create the optimum window arrangement for the particular task. For example, if you work with 3D simulation, undock the window and shift it to a second monitor. Once you have set the window arrangement, save it as user-defined view and toggle between the different views. You can create as many user-defined window arrangements as required.

This is how you create a user-defined window arrangement

1. In the navigation bar, click on the "Define or edit window arrangement" button.
2. In the window that opens, enter a new name in the "Name of new window arrangement" field.
   The name is marked red if characters or special characters, which are not permissible, are used in the name. Only letters, numbers and spaces are permitted in the name.
3. Click on the plus symbol "+". A new user-defined window arrangement is created with the name that was entered.
4. Use the buttons in the title bar of each window to undock individual windows or to shift a window to another position. You can minimize or close windows that are not required. Appropriately adjust the window arrangement.
5. In the menu of the window arrangement, click on "Reset window arrangement", if you wish to reset changes that have not been saved.
6. After completing the operation, click on "Save". The current view is saved in the user-defined window arrangement.
7. You can toggle between the individual views by clicking on the window arrangements that have been created.

See also

User-defined window arrangement (Page 76)

5.5.2.3 Reset of the window arrangement to the standard

You can set a modified window arrangement back to the original view by clicking on the "Reset window arrangement" button. Selecting "Standard" corresponds to the specified view.

This is how you reset a modified window arrangement back to "Standard"

You have changed the window arrangement in the "Standard" window arrangement, and you want to reset this to the original state.

1. In the navigation bar, click on the "Define or edit window arrangement" button.
2. Check whether the "Standard" window arrangement is active.
3. In the menu of the window arrangement, click on "Reset window arrangement".
   The view is reset to "Standard".

This is how you switch from a user-defined window arrangement to "Standard"

You want to switch from a user-defined window arrangement to the "Standard" view.

1. In the navigation bar, click on the "Define or edit window arrangement" button.
2. Activate the "Standard" window arrangement.
   The view is set to "Standard".

5.5.3 Switch between Create/Run MyVirtual Machine

As of version V1.3.2, you can switch between the Run MyVirtual Machine and Create MyVirtual Machine products during operation. Depending on the active license and which application is selected, the range of functions is thus extended or restricted.

Switching between applications is only possible for machine projects from the following CNC software versions:

- V6.15: CNC software V6.15 SP4 or higher
- V6.x: CNC software V6.22 or higher
- V5.x: CNC software V5.24 or higher

Switching over during operation with lower CNC software versions is not possible.

Switching between the applications is helpful, for example, if you have completed a machine project in Create MyVirtual Machine and want to test the machine project in Run MyVirtual Machine (e.g. machine project for customer).

NOTICE

Restrictions when switching from Run MyVirtual Machine to Create MyVirtual Machine

If Run MyVirtual Machine is active on the computer and you switch to Create MyVirtual Machine, an export/import of SINAMICS drive data is only possible after you have stopped and restarted the machine project. A reset of the machine project, as performed when changing the application, is not sufficient.

Requirement

- Create & Run MyVirtual Machine is installed on the computer.
- The same licenses (basic and optional license) are available for the active (source application) and on the application to be switched to (target application).

Licenses before the switchover	Required licenses for a successful switchover
Basic license: Create MyVirtual Machine Operate	Basic license: Run MyVirtual Machine Operate
Optional license: 3D	Optional license: 3D

Example of switching from Create MyVirtual Machine to Run MyVirtual Machine

- A machine project is opened or started

Note

You can check which licenses are currently assigned via " > License info".

How to change the application

1. Click the "Switch to the application ..." button .
   Before switching, a check is made to ensure that the same licenses exist for the source and target applications. If no corresponding licenses are found, the switchover is not performed. If the check is successful, the licenses for the source application are released and the licenses for the target application are assigned.
2. Confirm the displayed messages with "Yes".
   A reset is performed for a started machine project. With an open project, the switchover is executed immediately.

After the switchover, the user interface and the range of functions are changed to the target application.

5.5.4 Communication settings

5.5.4.1 Communication settings tab (SINUMERIK ONE)

In the "Settings" tab in Create & Run MyVirtual Machine, you configure the communication settings (PG/PC interface), e.g. for communication between HMI and PLC. The communication settings are automatically configured and displayed. Further settings are usually not necessary.

Checking the communication settings

The communication settings are checked when starting a machine project. If a valid setup is not available, and communication is not taking place an error message is displayed and the NCU remains in the stop state.

In this case you must check the current communication settings.

Requirement

- Create & Run MyVirtual Machine and SINUMERIK Virtual CNC software are installed on the computer and licensed
- Create or Run MyVirtual Machine is open

How to configure/check the communication settings

1. Click the "Settings" button .
2. Select tab "General settings" in the window that opens.
3. In selection list "Access point 1 - S7Online / CP1543", select the interface name of the hardware that is used (first network adapter). The access points for S7Online and CP1543 are configured at the same time.
   The selection of possible interfaces is logically prefiltered.

   Note

   You can display information about a specific function using the button.

   ---

4. Optional, if you are using a second access point:
   In selection list "Access point 2 - CP1543_2", select the interface name of the hardware that is used (second network adapter).
   The selection of possible interfaces is logically prefiltered. If you do not use the second access point, the selection remains empty or select the "empty" entry.

   Note

   Only different interfaces can be selected for access point 1 and access point 2.

5. Activate "Support TIA device search".
   Default setting, should not be changed.
6. Click "Apply".
   The "Apply" button is only active if the communication settings have been correctly configured.
7. If a project was open, restart the machine project after configuring the communication settings. The new communication settings are active.

Result

The communication settings have been configured. Create & Run MyVirtual Machine can be used.

More information

If you want to make further settings or work with the "Siemens communication settings" application, refer to the "Expert settings (Page 81)" section. All settings and special cases are described in detail in this section.

5.5.4.2 Expert settings (SINUMERIK ONE)

Configuring communication settings (PG/PC interface)

Description

You must configure the communication settings (PG/PC interface) for communications between the TIA Portal or HMI and PLC.

If you select an interface parameter assignment, then assign this to the access point. This means that you establish the connection between the access point, the interface parameter assignment and the interface itself.

Note

Establishing communication with SIMATIC STEP 7 Professional on a second computer

The network adapter configured at the **SINUMERIK CP1543** access point is relevant to the communication between SIMATIC STEP 7 Professional and the MyVirtual Machine products. If communication takes place across computer boundaries (e.g. SIMATIC STEP 7 Professional on another computer in the network), the network adapter with which the computer is connected to the network must be configured at the **SINUMERIK CP1543** access point. The same network adapter must be configured for **SINUMERIK CP1543** and **S7ONLINE (STEP 7)**.

Options for configuring communications

You have two options when configuring the PG/PC interface

- Configuring in Create/Run My Virtual Machine under "Settings" in tab "Communication settings (Page 82)"
  → For the compact and simple setup of the PG/PC interface
- Configuring using application "Siemens communication settings (Page 84)"
  → More complex operation with access to additional communication parameters

Both variants configure the same communication parameters and visualize identical settings.

Checking the communication settings

The communication settings are checked when starting a machine project. If a valid setup is not available, and communication is not taking place an error message is displayed and the NCU remains in the stop state.

Restart the machine project after configuring the communication settings. The new communication settings are active.

Configuring access points at the CP and S7Online in MyVirtual Machine

Configure the communication settings for the access points in tab "Settings" in Create/Run MyVirtual Machine.

Requirement

- Create & Run MyVirtual Machine and SINUMERIK Virtual CNC software are installed on the computer
- Create or Run MyVirtual Machine is open

This is how you configure communication settings

1. Click the "Settings" button .
2. Select tab "General settings" in the window that opens.
3. In selection list "Access point 1 - S7Online / CP1543", select the interface name of the hardware that is used (first network adapter). The access points for S7Online and CP1543 are configured at the same time.
   The selection of possible interfaces is logically prefiltered.

   Note

   You can display information about a specific function using the button.

   (Corresponds to communication setting "Configuring access points at the CP and S7Online (Page 84)")
4. Optional, if you are using a second access point:
   In selection list "Access point 2 - CP1543_2", select the interface name of the hardware that is used (second network adapter).
   The selection of possible interfaces is logically prefiltered. If you do not use the second access point, the selection remains empty or select the "empty" entry.
   (Corresponds to communication setting "Configuring the second access point at the CP (optional) (Page 86)")

   Note

   Only different interfaces can be selected for access point 1 and access point 2.
5. Activate "Support TIA device search".
   When the switch is activated, the device search for a locally installed TIA Portal is supported. For the network adapter set in access point 1, function "DCP" in S7Online is deactivated. DCP queries are responded to via the CP1543.
   (Corresponds to communication setting deactivate DCP in Section "Configuring access points at the CP and S7Online (Page 84)")
6. Click "Apply".
   The "Apply" button is only active if the communication settings have been correctly configured.
7. If a project was open, restart the machine project after configuring the communication settings. The new communication settings are active.

Result

You have now configured the access points for the application. Create/Run MyVirtual Machine can be used.

More information

If SIMATIC STEP7 Professional and Create/Run MyVirtual Machine are installed on different computers / virtual machines, you must still make settings for cross-computer TCP communication. Observe the Preparing cross-computer communication via Ethernet (Page 89) section.

Configuring access points in den "Siemens communications Settings"

Configuring access points at the CP and S7Online

You configure the PG/PC settings using the "Siemens communication settings" application.

Requirement

Create/Run MyVirtual Machine and SINUMERIK Virtual CNC software are installed on the computer.

This is how you configure communication settings

1. Enter "Control Panel" in the search field of the Windows taskbar and open the displayed application.
2. Select "All control elements".
3. Click "Communication settings". The "Siemens communication settings" window opens.
4. Click "Access points" in the navigation. The available access points are displayed in the right-hand area.

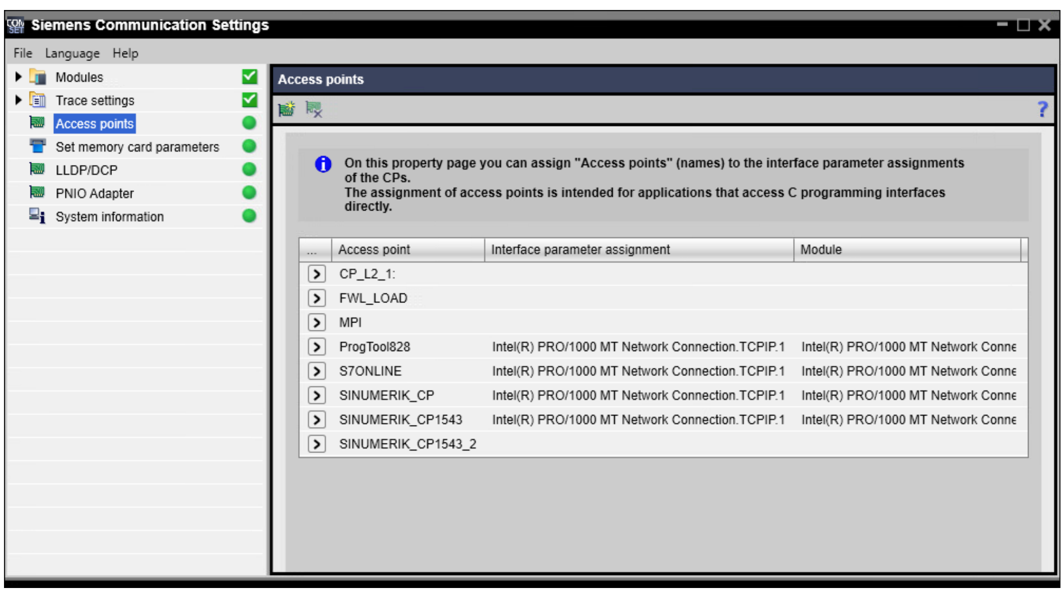


Figure 5-8 Access points in the communication settings

5. Click the arrow in front of "S7ONLINE" to display the settings.

6. In the "Used interface parameter assignment" field, select the entry "<network adapter>.TCPIP.1". <network adapter> is a placeholder for the interface name of your deployed hardware.

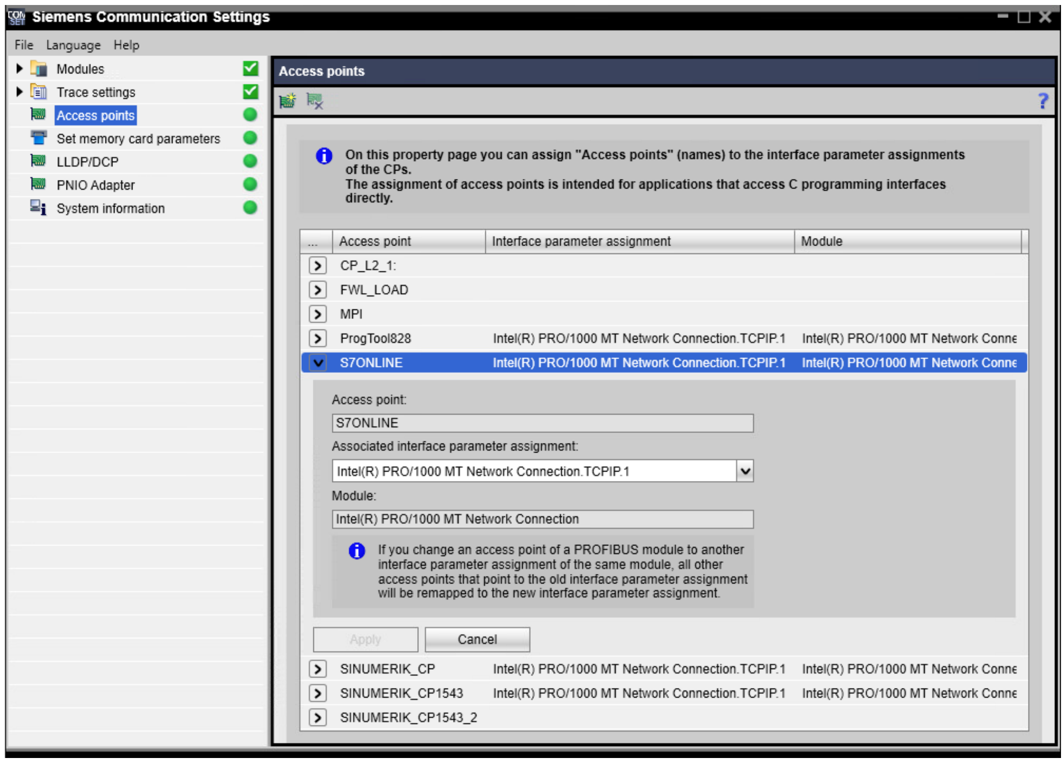


Figure 5-9 Setting the access point S7Online

7. Click "Apply".
8. Click the arrow in front of "SINUMERIK_CP1543" to display the settings.
9. In the "Assigned interface parameter assignment" field, select the entry "<network adapter>.TCPIP.1". <network adapter> is a placeholder for the interface name as used previously.
10. Click "Apply".
11. Click on "LLDP/DCP" in the navigation. The available protocols are displayed in the area on the right.

Note

To ensure communication mechanisms/device search between Create/Run MyVirtual Machine and TIA Portal, you need to deactivate the DCP function on the computer with Create/Run MyVirtual Machine (S7DOS). If the DCP function is disabled, then the "Livesearch" function is also functional when searching for the target system for Create/Run MyVirtual Machine. For the network adapter set in access point 1, function "DCP" in S7Online is deactivated. DCP queries are responded to via the CP1543.

If DCP is not deactivated, the connection to an incompatible device may be detected and reported in TIA Portal.

12. Uncheck the DCP box for the network adapter "<network adapter>" (same adapter as in the section above under point 9).

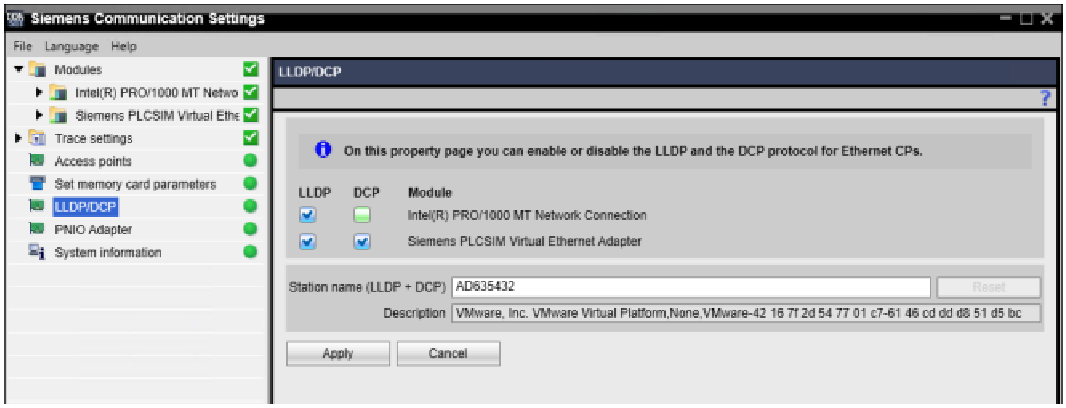


Figure 5-10 Disabling the DCP function

13. Click "Apply".
14. Select "File > Exit" in the menu to close the window.
15. Restart the computer to apply the changes.

Result

You have now configured the access points for the application. Create/Run MyVirtual Machine can be used.

More information

If SIMATIC STEP7 Professional and Create/Run MyVirtual Machine are installed on different computers / virtual machines, you must still configure the settings for cross-computer TCP communication. Observe the Preparing cross-computer communication via Ethernet (Page 89) section.

Configuring a second access point at the CP (optional)

The CP1543 can optionally communicate via a second network. For this purpose, you can assign another network adapter to the SINUMERIK CP1543_2 access point provided for this purpose. This can make sense if communications should be established to an external component via the second network adapter.

Without assignment, the system behaves as before and uses only the two previously known access points S7ONLINE and SINUMERIK CP1543.

Only when the second access point is assigned to SINUMERIK CP1543_2 will two interfaces actually be processed by the CP.

Precondition

- Create/Run MyVirtual Machine and SINUMERIK Virtual CNC software are installed on the computer.
- The "Siemens communication settings" are open (See, Configuring the first access point at the CP (Page 84)).

This is how you configure the second access point in the communication settings

1. Click "Access points" in the navigation. The available access points are displayed in the right-hand area.
2. Click the arrow in front of "SINUMERIK_CP1543_2" to display the settings.
3. In the "Used interface parameter assignment" field, select the entry "<network adapter>.TCPIP.1". <network adapter> is the placeholder for the interface name of the second network adapter.

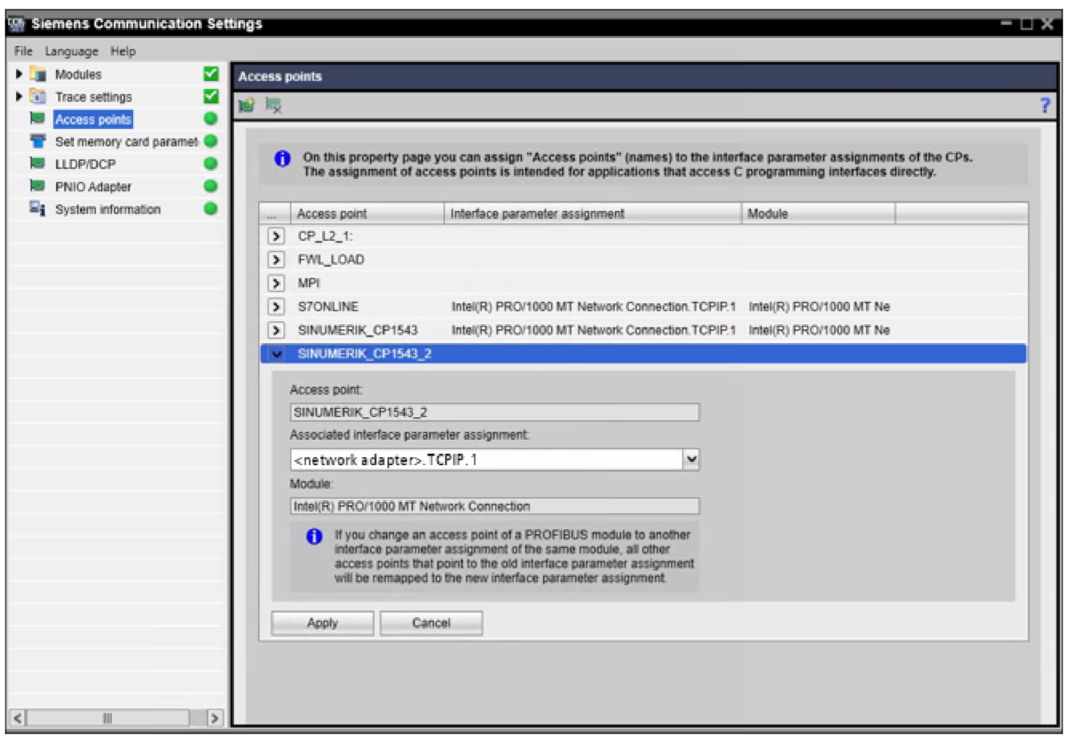


Figure 5-11 Setting the second access point CP1543_2

4. Click "Apply".
5. When using "Livesearch", deactivate the DCP functions on the second network adapter (See Configuring the first access point at the CP (Page 84)).
6. Select "File > Exit" in the menu to close the window.

Communication HMI via alternative network adapter

If the HMI is to communicate with SINUMERIK Operate not via the primary network adapter (localhost) but via the second assigned network adapter, the IP address assigned at the second network adapter must be entered in the mmc.ini configuration file of HMI Operate.

Requirement

- The Create/Run MyVirtual Machine project is open to modify mmc.ini on the virtual memory card.
- The second access point CP1543_2 (Page 86) is configured

How to enter the IP address of the second network adapter

1. In Create/Run MyVirtual Machine, click . The Windows Explorer opens with the storage location of the virtual memory card in the directory ...\card\. (%LOCALAPPDATA%\Siemens\Automation\SINUMERIK ONE\ncu\card).
2. Navigate to the directory "..\addon\sinumerik\hmi\840evo_vc\cfg" and open the file "mmc.ini" in the editor.
3. Navigate to the line with the IP address ADDRESS1=**127.0.0.1**.
   ```
   [840EVOVC}
   ...
   ADDRESS1=127.0.0.1,Line=20,NAME=/PLC,MAX_BUB_CYCLICS=1000
   ```
4. Enter the IP address of the second network adapter instead of the IP address **127.0.0.1** of the localhost.
5. Save the file.

The HMI communicates via the alternative network adapter after starting the machine project.

Constraints

- The IP address is only stored in the changed machine project. If the HMI is to generally communicate via the second interface, you must change the IP address in each machine project.
- If the IP address of the network adapter changes, you must also add it in mmc.ini. This may be the case, for example, with dynamic IP address assignments via DHCP.
- If the changed machine project is used on another computer, the IP address must also be adjusted.
- If you want to switch between network adapters (e.g. between WLAN and LAN), then the configuration of the access points and mmc.ini may have to be adjusted.

Preparing cross-computer communication via Ethernet

Cross-computer TCP communication

If the TCP communication between MyVirtual Machine products and, for example, SIMATIC STEP 7 (TIA Portal) is established across computers and diverse subnets, the inbound connection for the network areas of local port 102 must be enabled in the active firewall on the computer on which the MyVirtual Machine product is installed. This is the case, for example, when the applications are installed on different computers or virtual machines in the network, and you want to go online with, for example, SIMATIC STEP 7 Professional on the computer with MyVirtual Machine products. The procedure for the Windows Firewall is explained briefly as an example. The basic settings are also applicable for other firewalls.

Requirement

You are logged in on the computer with installed MyVirtual Machine product and have administrator rights.

Windows Firewall rules for inbound connections, protocols and ports

In the Windows Firewall, you can define the connection security rules for protocols and ports. For the connection rule, you must enable TCP communication via port 102 for the S7DOS (s7oiehsx64.exe) program.

1. Enter "Windows Defender Firewall with Advanced Security" in the search field of the Windows taskbar and open the displayed application.
2. Acknowledge the dialog with "Yes".
3. Click on "Inbound Rule" in the navigation area of the displayed window and select "New Rule" in the shortcut menu. The wizard opens.
4. In the wizard, first make the settings for which program the rules should apply and click "Next".
   - **Rule type**: Program
   - **Program path**: %ProgramFiles%\Common Files\Siemens\Automation\Simatic OAM\bin\s7oiehsx64.exe
   - **Action**: Allow connection
   - **Profile**: Select the appropriate profiles (e.g. domains when a domain controller is used)
   - **Name**: Enter a name for the rule, e.g. S7DOS_Service
5. Click "Finish". The new rule is displayed under "Inbound Rules".
6. Click the newly created rule, and select "Properties" from the shortcut menu.

7. Select the following settings on the "Protocols and Ports" tab in the displayed dialog.
   – **Protocol type**: TCP
   – **Local port**: Specific ports, 102

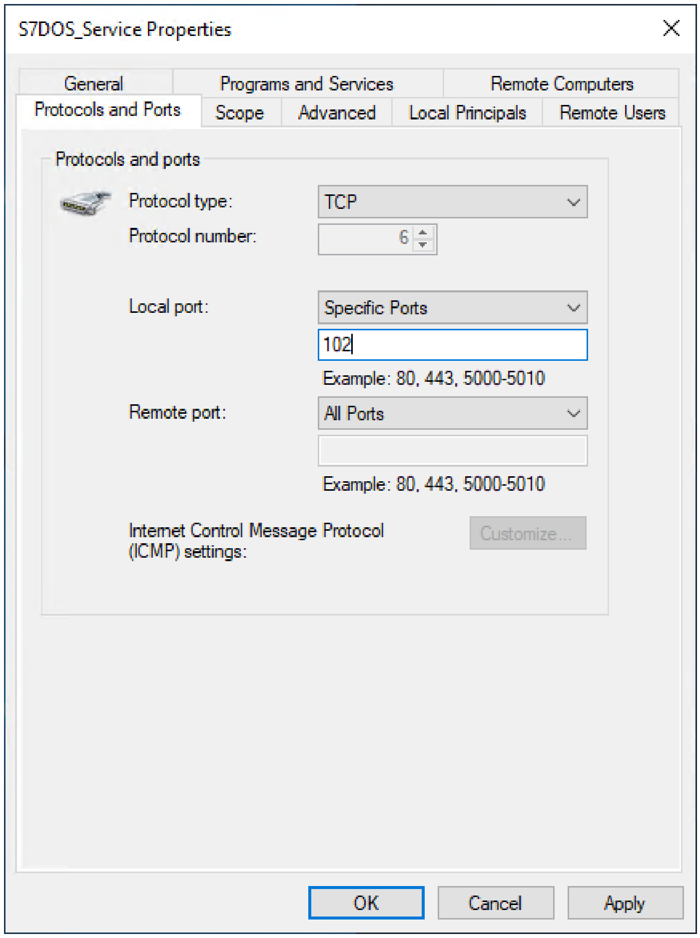


Figure 5-12 Windows Firewall rule: Protocols and ports

8. Check the settings on the "Programs and services" tab.

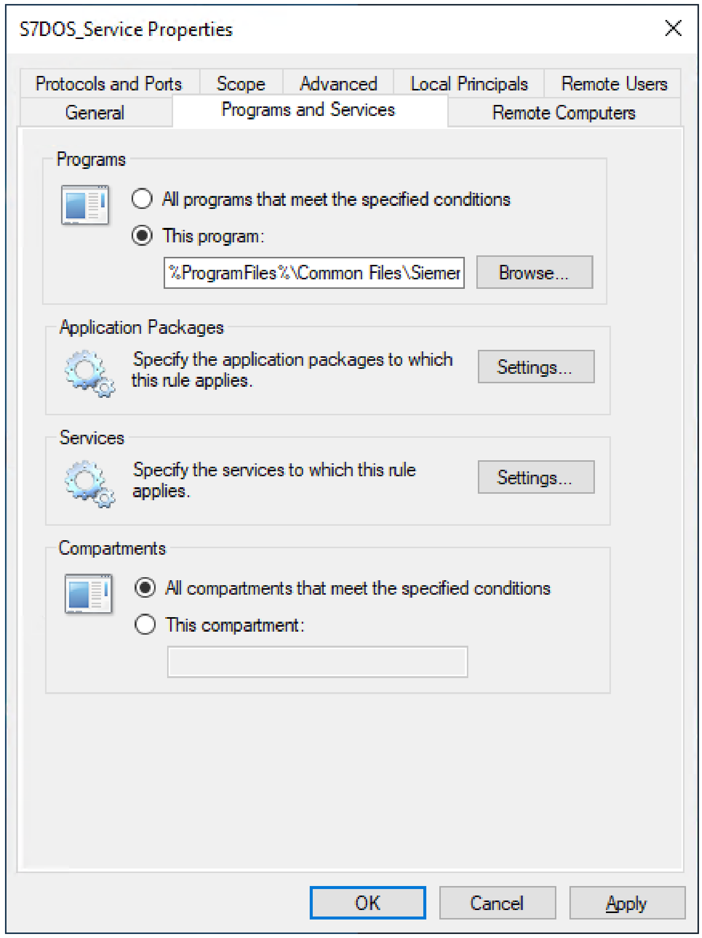


Figure 5-13 Windows Firewall rule: Programs and Services

9. Confirm with "OK".
   This completes the definition of the rules.

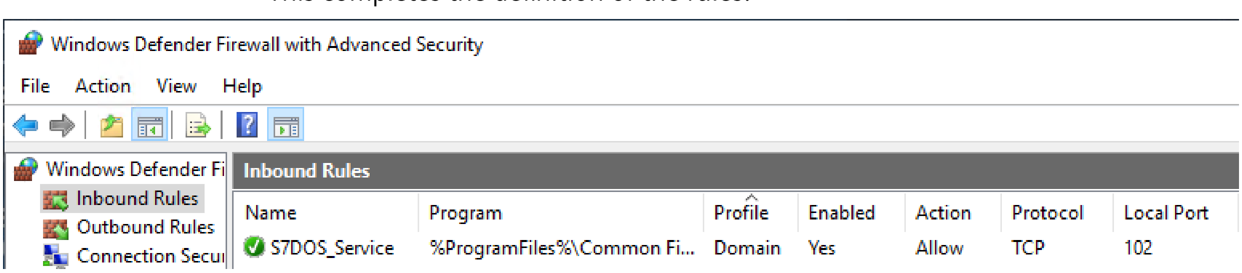


Figure 5-14 Windows Firewall: Inbound rules

5.5.4.3 Communication settings (SINUMERIK 828D)

Configuring communication settings (PG/PC interface)

Description

You must configure the communication settings (PG/PC interface) for communication between the PLC Programming Tool or HMI and the PLC.

If you select an interface parameter assignment, then assign this to the access point. This means that you establish the connection between the access point, the interface parameter assignment and the interface itself.

Note

Establishing communication with the PLC Programming Tool on a second computer

The network adapter configured at the **SINUMERIK CP** access point is relevant for communication between the PLC Programming Tool and the MyVirtual Machine products. If communication takes place across computer boundaries (e.g. PLC programming on another computer in the network), the network adapter with which the computer is connected to the network must be configured at the **SINUMERIK CP** access point. The same network adapter must be configured for **SINUMERIK CP**, **S7ONLINE and ProgTool828** (only for commissioning).

Options for configuring communications

To configure the PG/PC interface, you can use the Siemens communication settings, for example.

- Configuration of the SINUMERIK CP and S7Online access points (Page 92)
- Optional: Configuration of the ProgTool828 access point (Page 95)
  (only when using the PLC Programming Tool during PLC commissioning)

Checking the communication settings

The communication settings are checked when starting a machine project. If a valid setup is not available, and communication is not taking place an error message is displayed and the NCU remains in the stop state.

Restart the machine project after configuring the communication settings. The new communication settings are active.

Configuring access points at the CP and S7Online

You configure the PG/PC settings using the "Siemens communication settings" application.

Requirement

Create/Run MyVirtual Machine and SINUMERIK Virtual CNC software 5.xx are installed on the computer.

This is how you configure communication settings

1. Enter "Control Panel" in the search field of the Windows taskbar and open the displayed application.
2. Select "All control elements".
3. Click "Communication settings". The "Siemens communication settings" window opens.
4. Click "Access points" in the navigation. The available access points are displayed in the right-hand area.

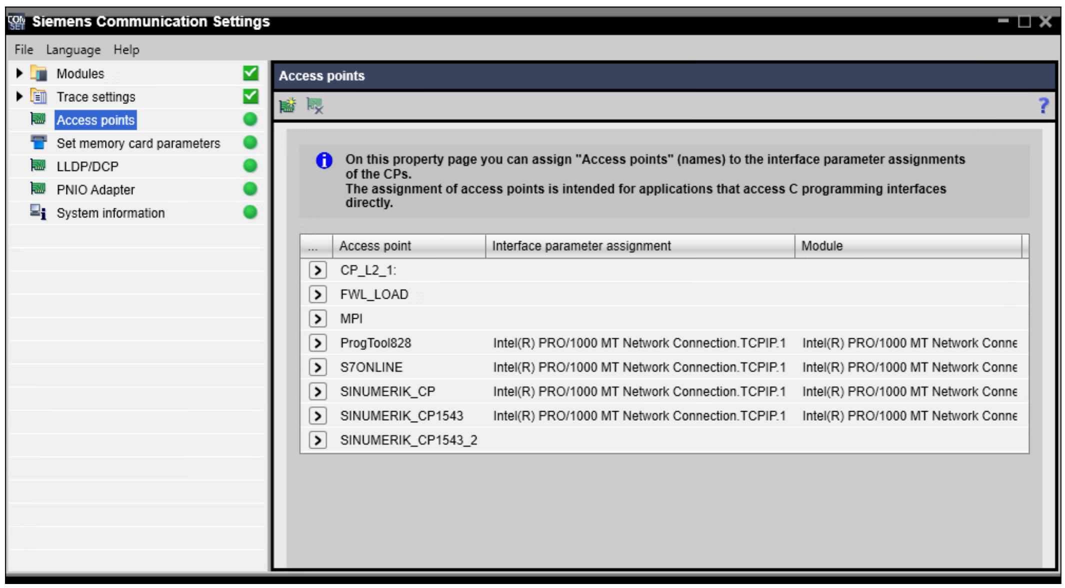


Figure 5-15 Access points in the communication settings

5. Click the arrow in front of "S7ONLINE" to display the settings.

6. In the "Used interface parameter assignment" field, select the entry "<network adapter>.TCPIP.1". <network adapter> is a placeholder for the interface name of your deployed hardware.

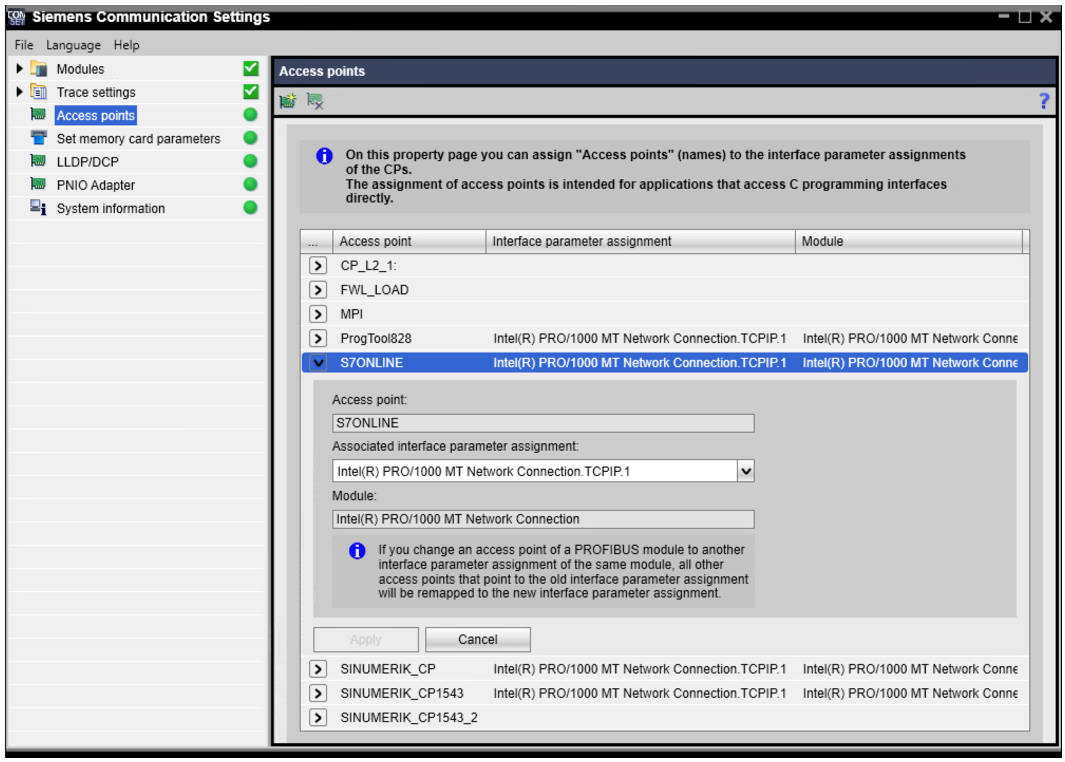


Figure 5-16 Setting the access point S7Online

7. Click "Apply".
8. Click the arrow in front of "SINUMERIK_CP" to display the settings.
9. In the "Assigned interface parameter assignment" field, select the entry "<network adapter>.TCPIP.1". <network adapter> is a placeholder for the interface name as used previously.
10. Click "Apply".
11. Select "File > Exit" in the menu to close the window.
12. Restart the computer to apply the changes.

Result

You have now configured the access points for the application. Create/Run MyVirtual Machine can be used with the CNC software 5.xx.

More information

If the PLC Programming Tool and Create/Run MyVirtual Machine are installed on different computers/virtual machines, you must still configure the settings for cross-computer TCP communication. Observe the Preparing cross-computer communication via Ethernet section.

See also

Preparing cross-computer communication via Ethernet (Page 89)

Access point PLC Programming Tool (only CMVM)

For commissioning in Create MyVirtual Machine, set the access point of the PLC Programming Tool to the SINUMERIK 828D.

Requirement

- Create & Run MyVirtual Machine and SINUMERIK Virtual CNC software 5.xx are installed on the computer.
- PLC Programming Tool is installed

This is how you configure communication settings

1. Enter "Control Panel" in the search field of the Windows taskbar and open the displayed application.
2. Select "All control elements".
3. Click "Communication settings". The "Siemens communication settings" window opens.
4. Click "Access points" in the navigation. The available access points are displayed in the right-hand area.
5. Click the arrow in front of "ProgTool828" to display the settings.
6. In the "Used interface parameter assignment" field, select the entry "<network adapter>.TCPIP.1". <network adapter> is a placeholder for the interface name of your deployed hardware.
7. Click "Apply".
8. Select "File > Exit" in the menu to close the window.
9. Restart the computer to apply the changes.

Result

The access points for the application is configured. The PLC Programming Tool can access the virtual SINUMERIK 828D in Create MyVirtual Machine.

5.6 Information application

5.6.1 Version information

You can display version information about the installed application by pressing the Info button.

This is how you display the version information

1. Click on the button ⓘ and switch to the "Version info" tab.
2. The following information is displayed in the window that opens:
   – Version of the installed software, e.g. Create or Run MyVirtual Machine Vx.x.

5.6.2 License info

You can display license information about the installed application by pressing the Info button.

Requirement

A machine project must be open for the license information for assigned (active) licenses to be displayed.

How to display the license information

1. Click on the button ⓘ and switch to the "License info" tab.
2. The following information is displayed in the window that opens:
   – Basic licenses
   List of the available basic licenses. The currently assigned license is displayed with a checkmark.
   – Optional licenses
   List of optional licenses. The currently assigned licenses are displayed with a checkmark.
3. Click the "Start license app" button if you want to use the "License Tool" to add or delete licenses.

See also

Licensing (Page 96)

5.7 Licensing

5.7.1 Licensing Create/Run MyVirtual Machine

Description

A license is required for operation of the Create or Run MyVirtual Machine and can be obtained in a license file (*.lic). A license file can include one or more licenses.

The license is managed using a licensing application (License Tool). The application is installed automatically when setting up Create & Run MyVirtual Machine.

Licenses for Create MyVirtual Machine and options

The installation of Create MyVirtual Machine also includes the Open Interface and the 3D Simulation. Additional licenses are required to be able to use the functions of these options.

The following licenses are required to run Create MyVirtual Machine:

- Create MyVirtual Machine /Operate (basic license to use the framework application Create MyVirtual Machine)

The following licenses can optionally be used:

- Create MyVirtual Machine /Open (license for using the Open interface to connect own applications)
- Create MyVirtual Machine /3D (license for using 3D Simulation in Create MyVirtual Machine)

Licenses for Run MyVirtual Machine and options

Installation of Run MyVirtual Machine also includes the open interface and 3D Simulation. Additional licenses are required to be able to use the functions of these options.

The following licenses are required to operate Run MyVirtual Machine:

- Run MyVirtual Machine /Operate (basic license to use the framework application Run MyVirtual Machine)

The following licenses can optionally be used:

- Run MyVirtual Machine /Open (license for using the Open interface to connect own applications)
- Run MyVirtual Machine /3D (license for using 3D Simulation in Run MyVirtual Machine)

Types of licenses

The license is transferred by way of a license file as follows:

- Local license (node-locked configuration) (Page 99)
  Configuration of the license file following installation on the local client or on a connected storage medium with the licensing application.
- License server (server configuration) (Page 100)
  Use of a license server which is managed by the licensing application. The license file with one or more licenses is located on the license server. The licenses can be used by all workstations (computers) in the network with an installed and configured licensing application. Simultaneous use of a license is only ever possible by one open Create/Run MyVirtual Machine.
  The license server can also be installed locally on a work station computer, i.e. the license server and Create/Run MyVirtual Machine are installed on the same computer.

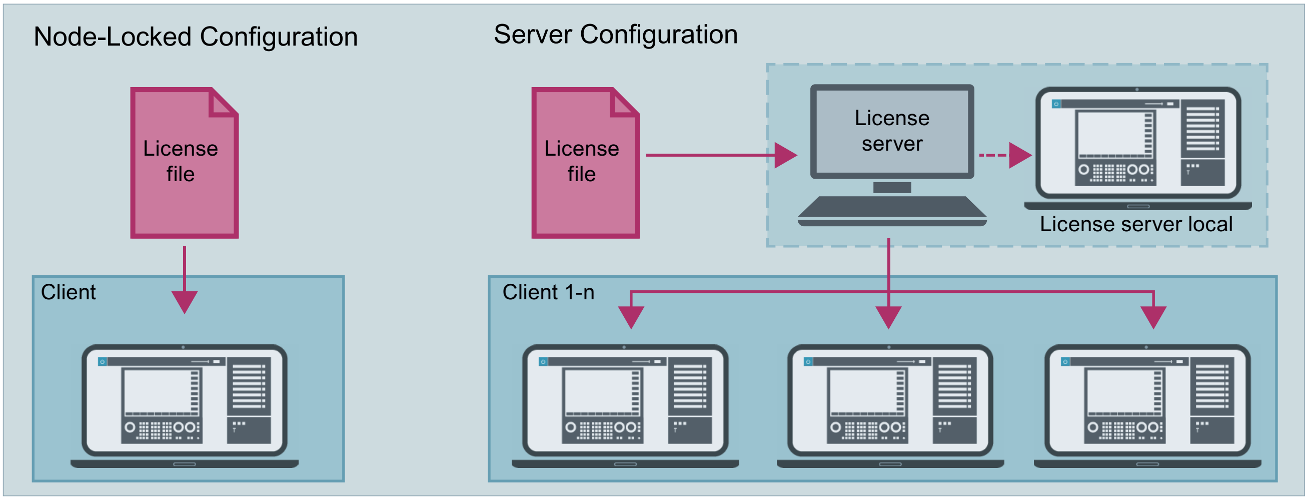


Figure 5-17 License file for local computer or server license

License file source of supply

The license file is generated according to your specifications and infrastructure (license requirement, server, MAC address and computer name of the client) during the order process and is then made available by email.

Example of the information required for a license:

- Hostname (server or client)
- COMPOSITE Host ID
- Sold-To (customer)

Note

After purchasing Create & Run MyVirtual Machine, you can request a license according to your task profile by email. During the license ordering process, you will be provided with the necessary tools to, for example, determine the Hostname or the COMPOSITE Host ID according to your infrastructure.

Managing licenses

- Managing licenses via the user interface (Page 103)
- Managing licenses via the command line (Page 106)

License check

The license is only checked when opening the machine project. If a valid license is not found, a message is displayed and you can directly start the licensing application.

Depending on the license, the functionality of Create/Run MyVirtual Machine is limited.

- No license
  → Run MyVirtual Machine in demo mode with reduced functionality. Only demo machine projects can be opened.
  → No functional scope of Create MyVirtual Machine can be used
- License for Run MyVirtual Machine
  → Full functionality of Run MyVirtual Machine license is available
- Create MyVirtual Machine license
  → Full functionality of Create MyVirtual Machine license is available
- Licenses for Create and Run MyVirtual Machine
  → You can switch between Create MyVirtual Machine and Run MyVirtual Machine in the open application

More information

Detailed documentation for the installation of the license server (Microsoft Windows and Linux) and the installation file for setting up the licenses can be found on the installation medium in the directory "Create and Run MyVirtual Machine\Support\".

5.7.2 Local license

NOTICE
Special case local license
The use of a local license is a special licensing case. As a rule, a local license server with a server license is also used for a single-user station license. Observe the section "License server (Page 100)".

Description (node-locked configuration)

The license file is copied to the local client or is installed on a computer connected in the network, e.g. "C:\LicenseFiles\license-myvirtual-machine-node-locked.lic". The license file is only used by one client. The path for storage of the license file is configured with the licensing application. The client references directly to the license file. The licenses in the license file are assigned to one client (computer name, MAC address) and are not available for any other client.

Note

Permitted characters in the path name

Do not use umlauts or special characters in the path name.

Characteristics of stand-alone configuration of a local license file (node-locked configuration):

- No server and no server configuration required
- Suitable for a small number of installations

5.7.3 License server

Description

A license server is used for management of the licenses. This is the standard use case for license management.

One or more license files used by the clients (floating) are located on the server. A floating license means that each client in the network can use the number of licenses specified in the license file.

The license server is set up and configured in advance. The license server can be installed locally or on a server. The reference to the server with the licensing application is configured on the clients.

The following license configurations are supported:

- Single server configuration
  A server manages the license file.
- Redundant server configuration
  Redundant servers manage the license file with a corresponding copy of the master license file.
- Configuration of several servers
  Each server has a stand-alone license file with its own licenses. The client places a license request at Server 1. If there is no free or available license, the request is forwarded to server n.

Requirement

The license server is configured according to the documentation "Siemens Digital Industries Software License Server Installation Instructions" and "Siemens Digital Industries Software Licensing Manual".

- License server installed and configured.
- License server stored on server and adapted to infrastructure.
- Port for TCP communication for license request is enabled on the server (Windows firewall).
- Name of the "License server" and "Port" are defined and are provided when configuring the licensing application.

See also

Installing the license server under Microsoft Windows (Page 101)

5.7.4 Installing the license server under Microsoft Windows

The following section describes how to install a license server on a computer with Microsoft Windows. Depending on the type of license, the license server can be used for several clients in the network or as a local license server.

With the local license server, Create & Run MyVirtual Machine is installed on the same computer and uses the license of the locally installed license server. This is the standard use case for using a server license for a single-user station, e.g. Run MyVirtual Machine work station for work preparation.

Requirement

- You have administrator rights on the computer.
- A suitable server license file ("*.lic") is available on the computer
- Setup file of the license server is available
  Installation medium:
  "Create&Run_MyVirtual_Machine\Support\SiemensLicenseServer_<version>_Win64_x86-64.exe"

How to install a license server

1. Double-click on the setup file "SiemensLicenseServer_<version>_Win64_x86-64.exe" of the license server.
   The setup is started.
2. Select the language of the installation wizard in the dialog that appears and confirm with "OK".
   The installation wizard is started in the selected language.

3. Follow the instructions of the installation wizard. The following information is requested during the installation process:
   – Server license file
     Specify the storage location of the license and import it.
   – License server port
     The license server can be reached via this port. The port must be enabled. Port 29000 is used by default. If you do not change port's default settings, you do not have to make any further settings. If you change the port, you must make a note of the port entered and configure the port activation if necessary.
   – Storage location of the installation
   – WebKey (Siemens account)
     Administrative tasks can be carried out more easily via this Siemens account (email address). The function is optional.
   – Confirm installation (firewall access)
     Activate "Allow license server access through local firewall" so that clients in the network can access the computer with the license server.

   Note

   License on local license server

   If the license server and Create & Run MyVirtual Machine are on the same computer and there is no access to the license server from other clients in the network, you can also deactivate "License server access through local firewall".

4. After installing and configuring the license server, click "Finished" to close the wizard.
   If you want to import additional licenses, click on "Licensing".

The license server is configured and can now be used. The next step is to configure the port number and the host name of the license server in the licensing application on the clients or on the local computer.

Note

Replacing or adding a license

Start the license server setup again if you want to replace the current license or add more licenses. Select the "Add/replace license file" option.

Repairing or uninstalling the license server

- Repairing the license server
  Start the license server setup and select the option "Repair license server software"
- Uninstalling the license server
  Start the license server setup and select the "Remove software" option
  Uninstall the software via the Windows Control Panel

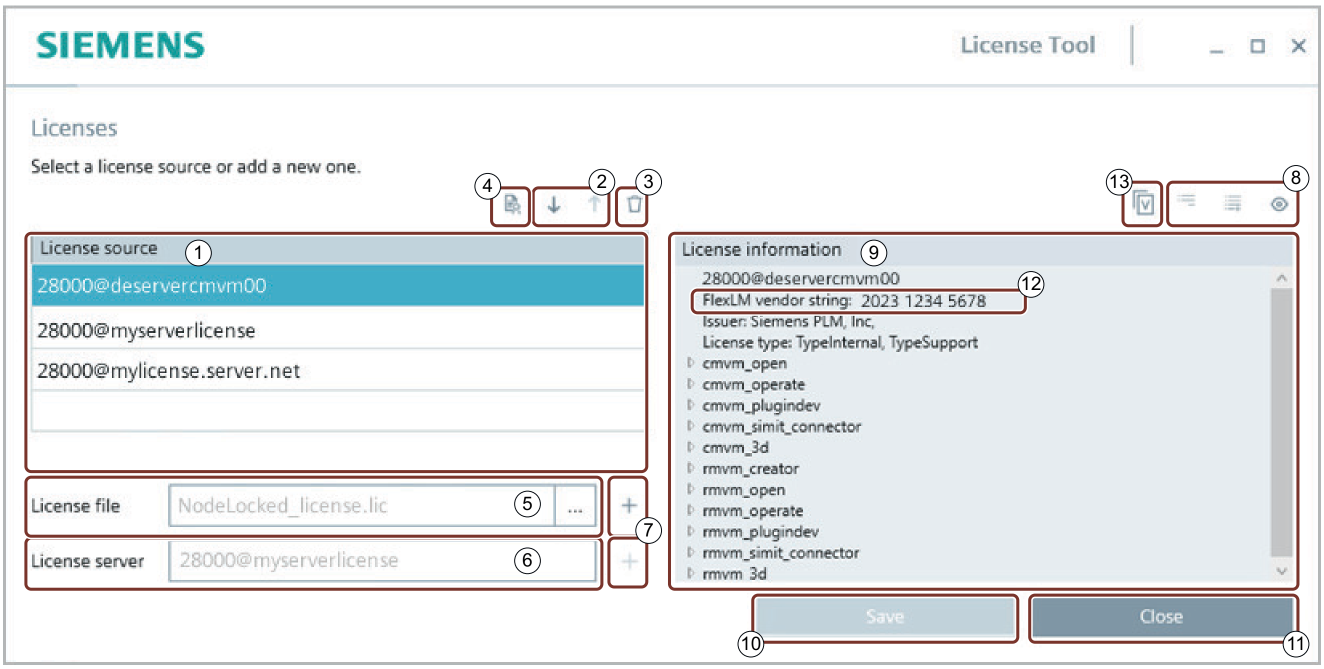
See also

Using the license server (Page 106)

5.7.5 User interface of the licensing application

Licensing application (License Tool)

The user interface of the licensing application allows you to manage the licenses for Create/Run MyVirtual Machine products. The application is installed on the computer with the Create/Run MyVirtual Machine products.



① List of added license servers or license files. When opening the machine project, a search is made for a valid license in the license files on the license servers. The search sequence goes from the top to the bottom. The first valid license found is used.

② The selected license file or the selected license server is shifted either up or down using the arrow keys. This allows you to change the search sequence for the license check.

③ Clicking on the button removes the selected license file or the selected license server from the list of license sources.

④ Clicking on the button displays the selection option for a local license file (node locked). By default, the "License file" selection box is not displayed, because usually only licenses for license servers are in use.

⑤ Selection of the local "license file" (<path and file name>). The selection box is not displayed until you click the button (see ④).
Select the local license file by clicking on "...".

⑥ Specification and display of the port number and name of the "License server" (<port number>@<Servername/Host-name> or <port number>@<IP address>)
The use of the license server is the default use case.

⑦ Clicking on the "+" button adds the license file or the license server to the list of license sources.

⑧ Clicking on the button displays the license information for the selected license in the "License source" section.

Clicking on the button expands all further information about the listed licenses.

Clicking on the button hides all further information about the listed licenses.

⑨ Display of the license information.

Header

- Server/license name
- FlexLM vendor string
- Issuer
- Type of license
- List of licenses found
  Click the button ▷ in front of the license to display more information.

Licenses (for server license)

- License name: Name of the application or information
- Expiry date: Date until when the license is valid
- Version: Software version for which the license is valid
- All users/PC: List of all users currently occupying a license (only visible if at least one license is occupied)
- In use: Indicates if the license from this client is in use (only if a project is open in C/RMVM)
- Number of licenses: Indicates how many licenses for this product are stored on the server
- Licenses in use: Number of currently used licenses

Licenses (for license file)

- License name: Name of the Application
- Expiry date: Date until when the license is valid
- Version: Software version for which the license is valid

⑩ Saving the license sources

If the list does not contain any license, an empty license entry is saved. As a consequence, the Create/Run MyVirtual Machine product has no reference to a valid license and the machine project is not opened.

⑪ Closes the licensing application without saving.

⑫ The unique FlexLM vendor string is used to implement the project protection of machine projects. Thus the machine project is linked to the value of the FlexLM vendor string and can only be opened if the linked FlexLM vendor string of the machine project is identical to the FlexLM vendor string of the license. Only users with this unique license can open the protected machine project.

⑬ Clicking on the button copies the FlexLM vendor string of the license to the clipboard. You must receive the copied value of the FlexLM vendor string from an end user, for example, so that you can deliver a machine project with project protection.

Figure 5-18 Managing licenses with the licensing application (using port 28000)

Requirement

Administrator rights are required for configuration of the licenses via the licensing application.

This is how you work with the user interface of the licensing application

1. In the Windows start menu, select "Start > Siemens Automation > License settings for Create and Run MyVirtual Machine".
2. Acknowledge the confirmation prompt.
   The "Licensing" application opens.

3. Select a new license source.
   – Using local licenses (Page 105)
   – Using the license server (Page 106)
4. Click on "+" to add the new license source to the list.
5. Click on the arrow keys to change the search sequence for multiple license sources.
   You use the sequence to specify which license source should be searched first for a valid license.
6. Click on the button if you want to remove added license sources from the list.
7. Click "Save" to save the list of license sources. In the window header line, a star "*" is displayed next to "License Tool" if the changes have still **not** been saved.
8. Click "Close" to close the application.

When opening the machine project, a search is made for a valid license in the license sources that have been entered. The machine project is opened in Create/Run MyVirtual Machine if a valid license is found.

5.7.6 Using local licenses

NOTICE
Special case local license
The use of a local license is a special licensing case. As a rule, a local license server with a server license is also used for a single-user station license. Observe the section "License server (Page 100)".

This is how you configure a local license file

1. Copy the license file *.lic locally to a directory on the client, e.g. "C:\LicenseFiles\license-myvirtual-machine-node-locked.lic".
2. Open the operator interface of the licensing application.
3. Show the "License file" option by clicking the button.
4. Under "License file", select the path for storage of the local license file.
5. Click on "+" to add the new license source to the list.
6. Confirm with "Save".
7. Close the app with "Close".

See also

User interface of the licensing application (Page 103)

5.7.7 Using the license server

This is how you configure access to a license server

1. Open the licensing application.
2. Enter the port number and the name of the host in the "License server" field. The default port is 29000.
   – Syntax: <port>@<host name> or <port>@<IP address>
   – Example: 29000@mylicenseserver
   – Example for local license server: 29000@127.0.0.1 or 29000@localhost
3. For multiple servers, enter all names, separated by semicolons.
   – Example: 29000@mylicenseserver1;29000@mylicenseserver2;29000@mylicenseserver3
4. Click on "+" to add the new servers to the list.
5. Confirm with "Save".
6. Then close the app with "Close".

See also

User interface of the licensing application (Page 103)

5.7.8 Command line of the licensing application

Licensing application "VMxLicenseTool.exe" can be controlled via the command line and is then executed without user interface. The functional scope is identical to that of the user interface, and allows licenses to be managed, e.g. for automated licensing procedures.

License Tool storage location

After installing the MyVirtual Machine product you can find the licensing application at the following storage location:

- `"C:\Program Files (x86)\Common Files\Siemens\VMx Middleware\VMxLicenseTool.exe"`

Functions

The command VMxLicenseTool.exe is extended by the following parameters (options and arguments). The parameters are attached to the command using a space followed by a separator. The different separators and the short and/or long form of the parameter can be used alternatively.

Separator	Short parameter	Long parameter	Arguments	Significance/example
/ - --	m	menu	-	Starts the user interface and closes the application in the command prompt. VMxLicenseTool.exe /m
/ - --	l	list	-	Lists the registered licenses line-by-line (line number 0-n). The sequence in the license list corresponds to the search sequence when checking the license. VMxLicenseTool.exe /l Example of a license list: Id Type Path 0 File c:\License\mylicense.lic 1 Server 29000@myserver 2 Server 29000@licenseserver 3 Server 29000@backupserver
/ - --	as	addServer	<port@servername> Server port and server name	Inserts a license server at the end of the list. VMxLicenseTool.exe /as 29000@myserver
/ - --	af	addFile	<path to file\filename> Path and file name	Inserts a local license (license file) at the end of the list. VMxLicenseTool.exe /af c:\License\mylicense.lic **Note:** Do not use umlauts or special characters in the path name.
/ - --	r	remove	<Line> Specifies the line ID (line number)	Deletes the specified line with the entered license (ID of the line). VMxLicenseTool.exe /r 2
/ - --	s	swap	<src Line> <dst Line> Specifies the line ID (line number) of the source and the destination.	Exchanges the license of the source line <src Line> with the destination line <dst Line>. The modified license list is displayed after the exchange. VMxLicenseTool.exe /s 1 3
/ - --	i	licenseInfo	-	Lists the license information for the licenses, e.g. license name, expiration date. VMxLicenseTool.exe /i
/ - --	rr	removeAll	-	Deletes all registered licenses from the list. The licenses are deleted after the prompt by entering DELETE and pressing the ENTER key. VMxLicenseTool.exe /rr
/ - --	h	help	-	Displays the help for the command. VMxLicenseTool.exe /h

See also

Using the command line of the licensing application (Page 108)

5.7.9 Using the command line of the licensing application

You can manage licenses via the command line directly via the Windows command prompt or via batch files.

This is how you use the command line to manage licenses

1. In Windows, open the command prompt.
2. Enter the path to the licensing application in the command prompt.
   `"C:\Program Files (x86)\Common Files\Siemens\VMx Middleware\"`
3. Check the current license status using `VMxLicenseTool.exe -l`.
   A list of registered licenses is displayed.
4. Register the local licenses or the license server, for example. At least one license must have been registered.
5. Manage the licenses with the other parameters of the licensing application.
6. Close the command prompt.

See also

Command line of the licensing application (Page 106)

Working with machine projects 6

6.1 Creating a machine project

Description

Create machine projects in the project management.

This is how you create a new machine project

Create MyVirtual Machine must be opened in the project overview before you can create a new machine project.

1. Click on the "Create new project" tab.
2. Under "Create new project with", select the "Empty project" option.
3. Enter a project name.
4. Select the storage path.
5. Select the "CNC software version". This CNC software version is used in the project, and corresponds to the version of the SINUMERIK components used in the virtual machine. All installed versions of the CNC software are displayed in the drop down list box.
6. Select the "NCK scaling" (type of SINUMERIK ONE NCU/PPU or SINUMERIK 828D PPU).

7. Confirm with "Create project". The project opens.

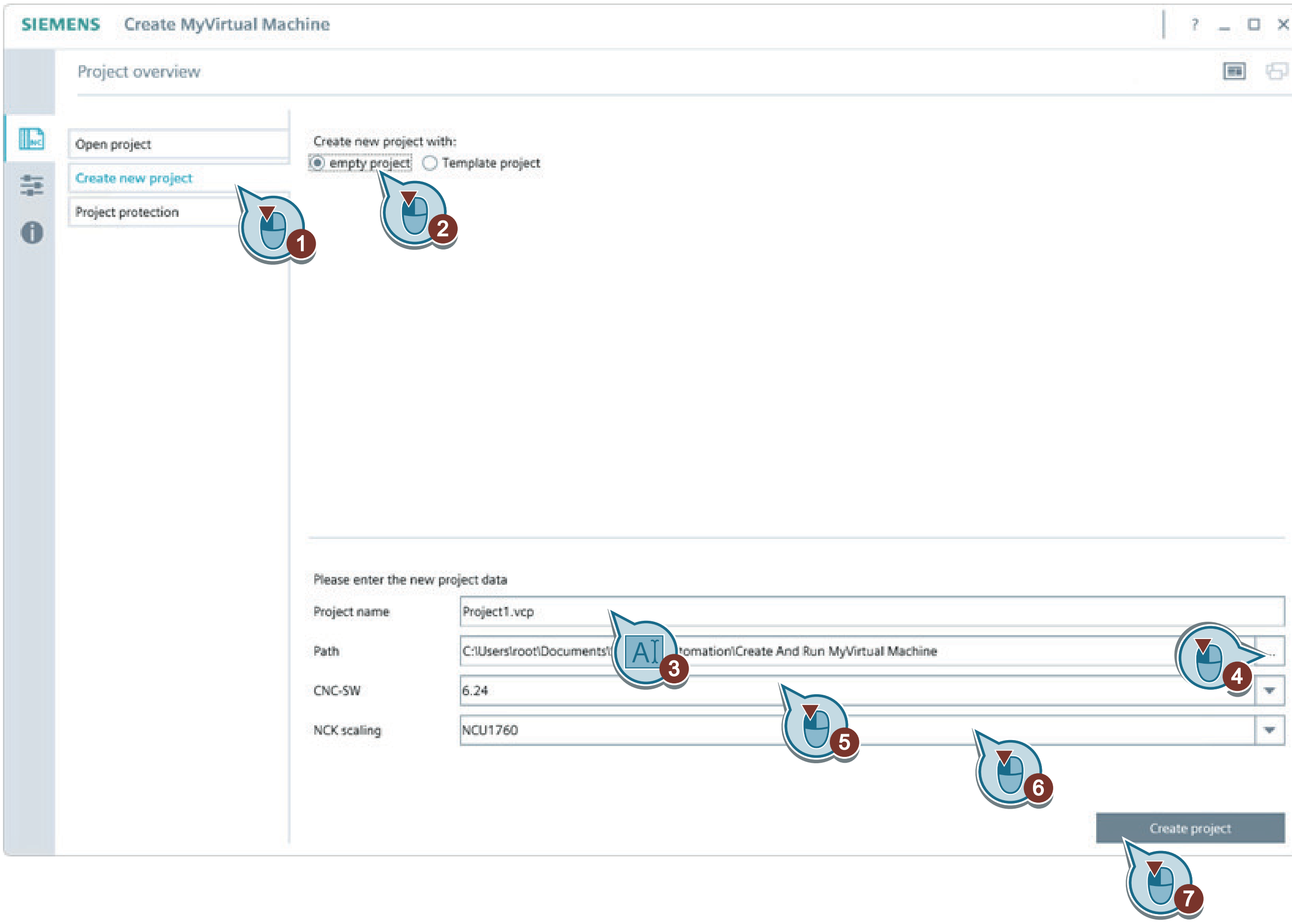


Figure 6-1 Creating a new machine project

8. The Create MyVirtual Machine project view is displayed with "Project settings" and default values.

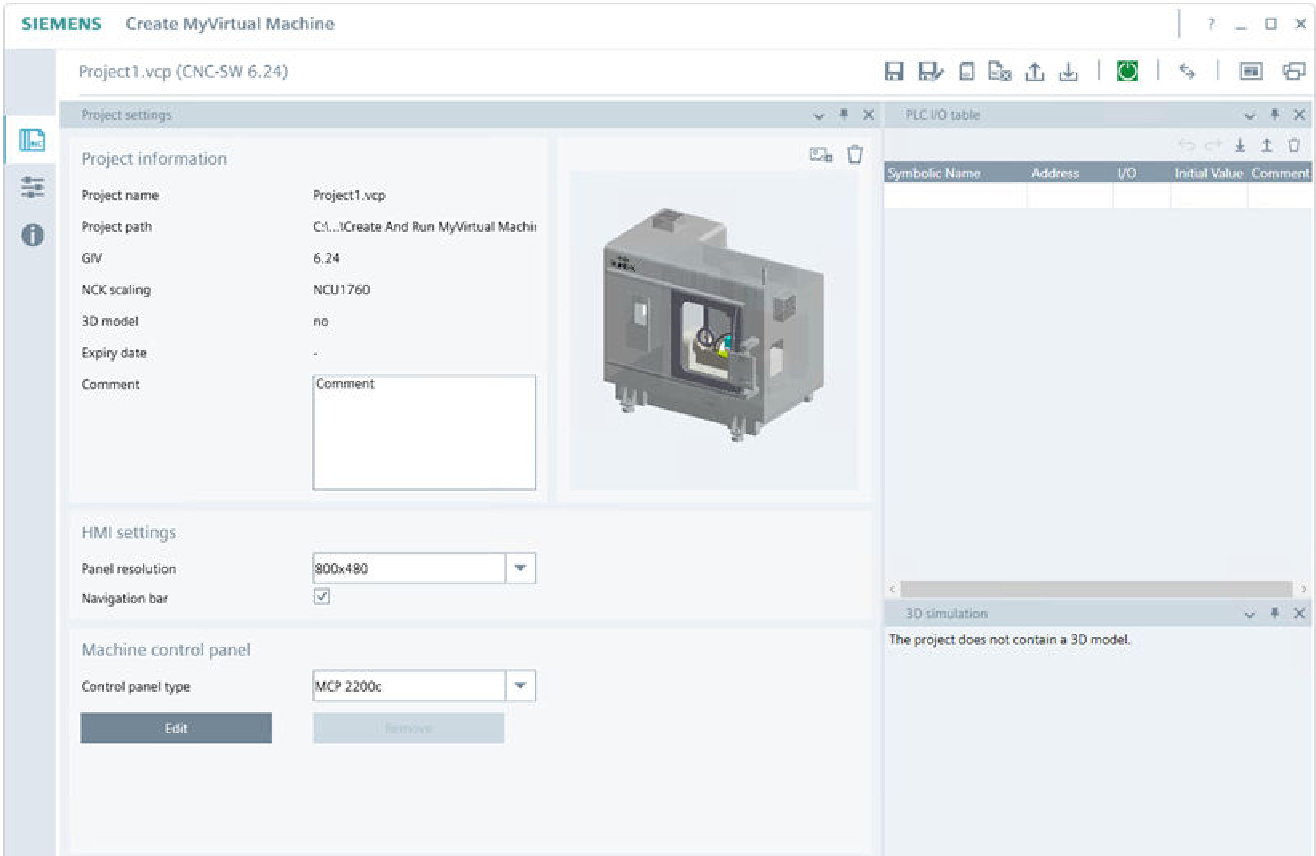


Figure 6-2 Create MyVirtual Machine with an open machine project

9. Configure the project in Section "Project settings".
   – Optionally, enter a comment and load a typical machine diagram for the project.
   – Select "HMI resolution" and display of the "Navigation bar" in the HMI.
   – Select the "Control panel type" according to the technology Turning or Milling or which type of control panel (e.g. SINUMERIK ONE MCP). Using the "Edit" button you can adapt the start addresses, images and labeling of MCP buttons to create a customized control panel (Page 68).

   Then start the machine in the next step. This places the machine in simulation mode. The starting corresponds to the switch-on and run-up of a real machine.
10. Click the "Start machine" button in the control area. The button can be clicked only when it is no longer faded.
    The machine is started and the HMI with machine control panel opens. The machine cannot be operated during starting.
    The machine start is completed when all components have green status. Because an empty machine project was started without PLC program, a PLC error message is displayed.

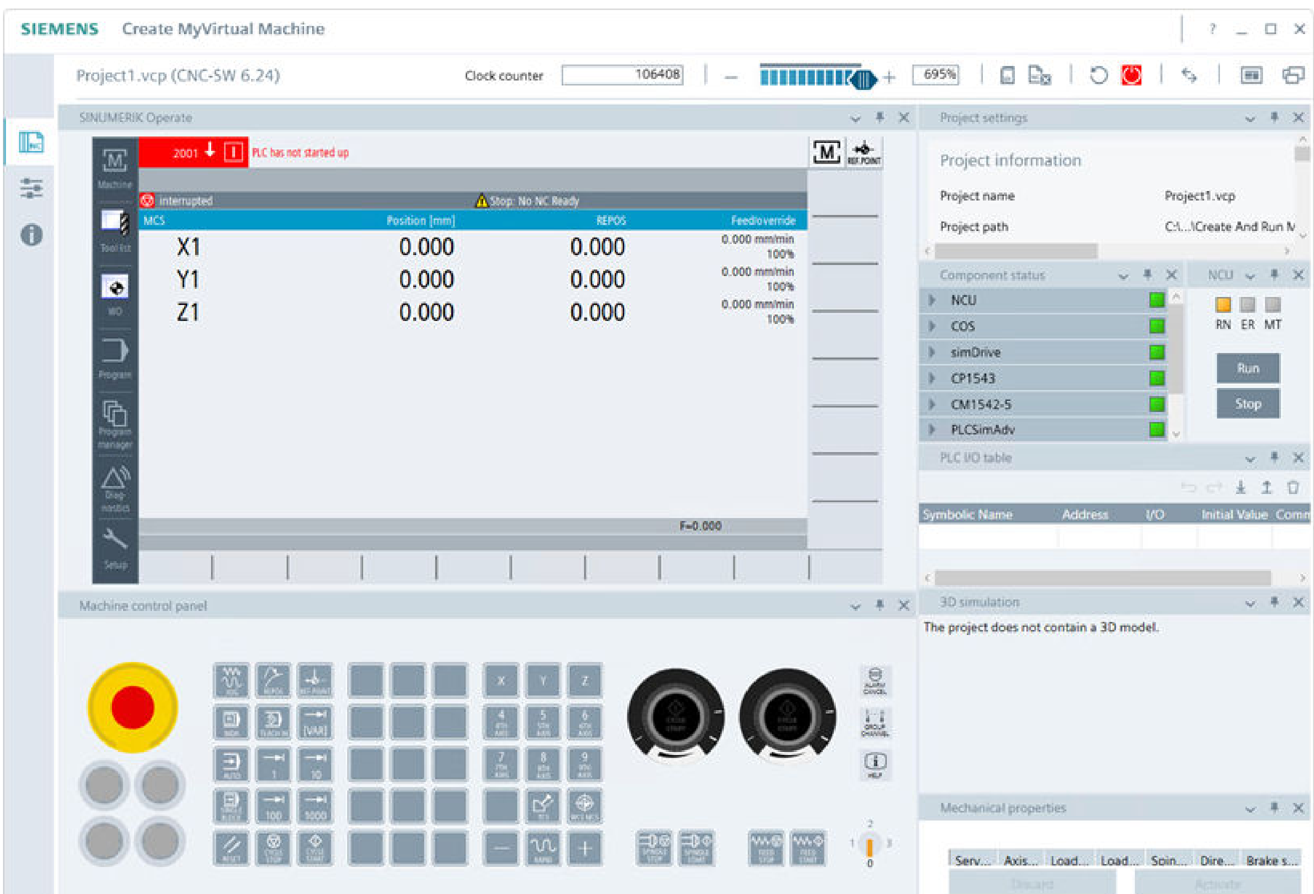


Figure 6-3 Create MyVirtual Machine: Empty, newly created machine project after ramp up

The newly created machine project has a standard configuration. To adapt this machine, you must commission the machine in an additional step, e.g. download the hardware configuration and the PLC program, e.g. from the TIA Portal, or load an archive. Alternatively, import an existing archive of a SINUMERIK control and commission the control (NCK, PLC, HMI).

6.2 Creating a machine project from a template

Description

Different project templates are available in the project management to create machine projects based on existing machines. The newly created project is a copy of the project template.

Note

Installing template projects

The template projects are made available via a dedicated installation package. Install the machine projects if no template projects are displayed in the project management.

More information is provided in the *Installation Manual Template Machines Create/Run MyVirtual Machine*.

This is how you create a new machine project

Create MyVirtual Machine must be opened in the project overview before you can create a new machine project from a template.

1. Click on the "Create new project" tab.
2. Under "Create new project with", select the "Template project" option.

3. Select a template project.

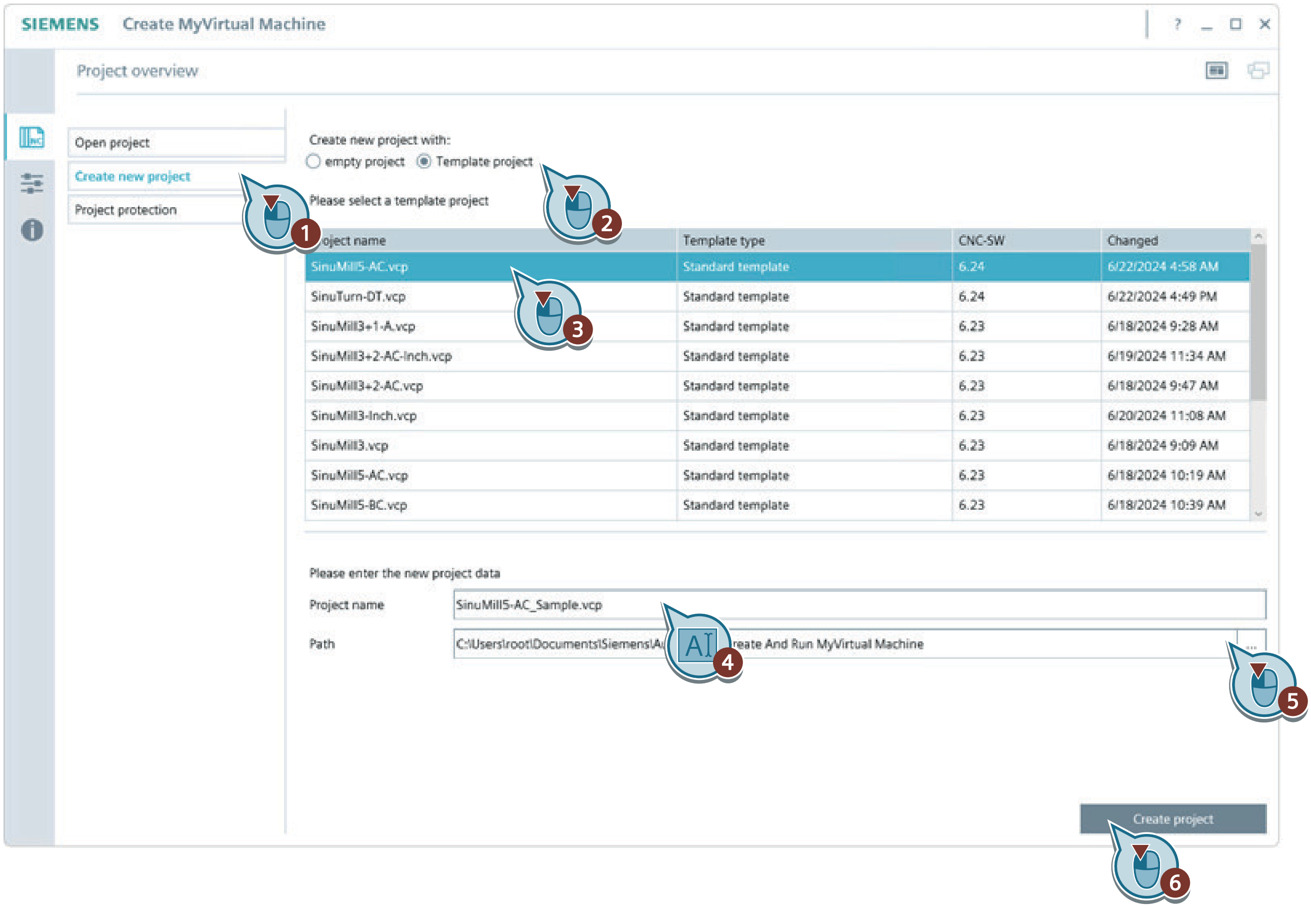


Figure 6-4 Creating a machine project from a project template

4. Enter a project name.
5. Select the storage path.
6. Confirm with "Create project". The project opens.
7. Configure the project in Section "Project settings".
   – Optionally, enter a comment and load a typical machine diagram for the project.
   – Select "HMI resolution" and display of the "Navigation bar" in the HMI.
   – Select "Control panel type" corresponding to the technology involved – turning or milling. Using the "Edit" button you can adapt the images and labeling of MCP buttons to create a customized control panel.
8. To do this, click the  "Start machine" button in the control area to start the machine.

6.3 Opening a machine project

Description

Open existing machine projects in the project in the project management.

How to open an existing machine project

Start Create MyVirtual Machine before opening an existing machine project.

1. Click "Open project".
2. Select the project if the project is on the list of recently opened projects. The CNC SW version used is also stated in the line of the project.
3. Click the "Open project" button. The selected project opens. Continue with step 8.

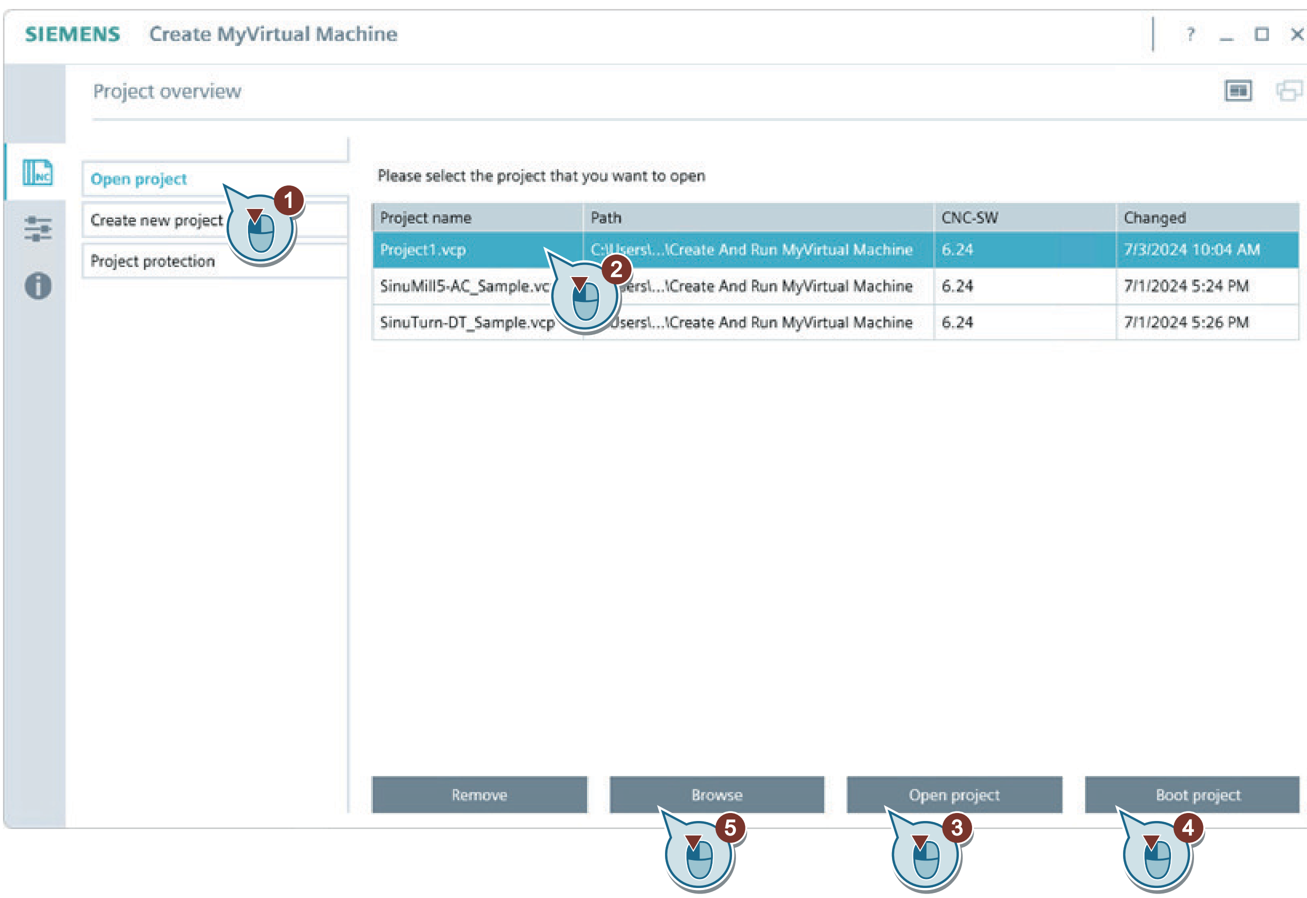


Figure 6-5 Open a project in Create MyVirtual Machine

4. As an alternative to steps 3 and 8, you can also click on button "Start project". The project is opened and the machine project started.
5. If the project is not in the list, click the "Browse" button. The file selection dialog opens.
6. Navigate to the desired project. You have access to all local drives and network drives via the selection dialog.

7. Select the project and click "Open". The project is opened in Create MyVirtual Machine.

   Note

   Virtual CNC SW

   Whether the Virtual CNC SW version used in the project is installed on the computer is checked when the project is opened. If the Virtual CNC SW version is not installed, a message is output stating the missing version. This Virtual CNC SW version must be installed before the project can be opened and edited.

   When the project is open, the Virtual CNC SW version used in the project is displayed in the title bar.

   ---

8. Then, to start the machine project, click on button "Start machine".

The machine project is automatically added to the list of last opened projects.

6.4 Save the machine project and exit

Description

The current state of the machine project is backed up on saving. When the machine project is next opened, you continue working with the most recently saved status. Machine projects can be saved only when the simulation control has Stop status.

File size machine projects

The machine project is saved as a compressed *.vcp file. The maximum size of the stored machine project is limited to 2 GB. The saving of larger machine projects is aborted with an error. If the machine project cannot be saved due to the file size, delete unused user data from the virtual memory card, for example.

This is how you save machine projects

1. In the control area, click the "Exit machine" button. The machine is exited.
2. Select "Save" or "Save as" from the menu bar. The save dialog is displayed
3. Save the project directly, or select a location where you want to save it – and enter a new name for the machine project.
4. Confirm with "Save". The machine project is saved with the file extension "*.vcp".

   Note

   If you exit the program or the project without saving the current status, a message appears. You can also save the current status of the project subsequently.

   ---

5. Select "Close project" from the menu bar. The Create MyVirtual Machine project view is exited and the program management is displayed.
6. Click on "X" in the title bar of the window. The project management and Create MyVirtual Machine are closed.

6.5 Using machine projects

Note

Using machine projects in another version

The portability of machine projects ("*.vcp") to next higher versions is not guaranteed.

WARNING

Machine projects must be checked and approved when being transferred to a real SINUMERIK ONE control system

Archives and data from machine projects in Create MyVirtual Machine must be checked and approved on a real control system.

Transferring the data from a simulation project without carrying out a check is not permitted for machine operation.

6.6 Project template and access rights

Access rights and keyswitch position

Machine projects that were created from the project template can generally be used with access level User and in keyswitch position 0. When simulating or when executing the program examples included, it is possible that an error message is output as write access rights are required once. These are not permissible in keyswitch position 0.

Adapting the keyswitch position

If simulation or executing the program examples is not possible, then the problem can be resolved by adapting the keyswitch position.

1. Start the machine project.
2. Set the keyswitch on the machine control panel to position 3.
3. With the new access rights it is possible to simulate and execute the program examples.
4. Save the machine project if you wish to save keyswitch position 3 in the project.

Setting the password for users

Alternatively, in SINUMERIK Operate in area "Commissioning" you can also set password "CUSTOMER" for access level 3.

6.7 Creating project template

Existing machine projects can be used as a project template. Based on the template you can then create new machine projects as copy of the project template. The project templates are only valid for one SINUMERIK CNC software version in which the project was initially created. The project template can be used as basis for machine projects in Create MyVirtual Machine and Run MyVirtual Machine.

How to create a project template

1. Copy the machine project (*.vcp) to the "template" folder in the installation path of the SINUMERIK CNC software. The installation path of the CNC software corresponds to the creation version of the machine project, e.g. 6.24.
   Path example:
   C:\Program Files (x86)\Siemens\Automation\SINUMERIK CNC-SW\SINUMERIK CNC-SW 06.24\templates
2. Apply write protection to the *.vcp file under Windows.
   The machine project can be used as project template.

After opening Create MyVirtual Machine or Run MyVirtual Machine, the machine project is displayed as project template in the project overview – and can be used for creating new machine projects.

Project template for Run MyVirtual Machine

Protect the project template against unauthorized changes and manipulation. You can find more information in Section Preparing projects for Run MyVirtual Machine (Page 120).

6.8 Virtual memory card

Description

Just the same as on the real SINUMERIK control, the virtual SINUMERIK controller also has a memory card (SD card) to store data and manage programs. The virtual memory card is created temporarily in the Windows User directory when a machine project is started. Each machine project has its own virtual memory card.

When the machine project is exited, the structure and contents of the virtual memory card in the machine project are saved, and deleted from the Windows User directory. The virtual memory card is available when the machine project is next started.

When you save the machine project, the contents of the virtual memory card are stored in compressed form in the machine project. The storage capacity of the virtual memory card is limited by the maximum size of the machine project (max. 2 GB). Delete unused user data from the virtual memory card if the machine project cannot be saved due to the file size.

The structure and the handling of the virtual memory card correspond to those of the real SD card.

Virtual memory card storage path

The virtual memory card is only displayed when the machine project is started. The virtual memory card is saved under the following path:

- C:\Users\<username>\AppData\Local\Siemens\Automation\SINUMERIK ONE\ncu\card

Exchanging data between an NC and a virtual memory card

You can exchange data, e.g. NC programs, with the NC via the virtual memory card. The following shows the directories on the virtual memory card and the corresponding directory in the program manager in SINUMERIK Operate.

Note

To exchange data between an NC and a virtual memory card, the keyswitch on the machine control panel must be at position 3.

Directory on virtual memory card

- C:\Users\<username>\AppData\Local\Siemens\Automation\SINUMERIK ONE\ncu\card**user\sinumerik\data\prog**

Directory in the program manager SINUMERIK Operate with NC Extend

- Softkeys: "Program manager > NC Extend"

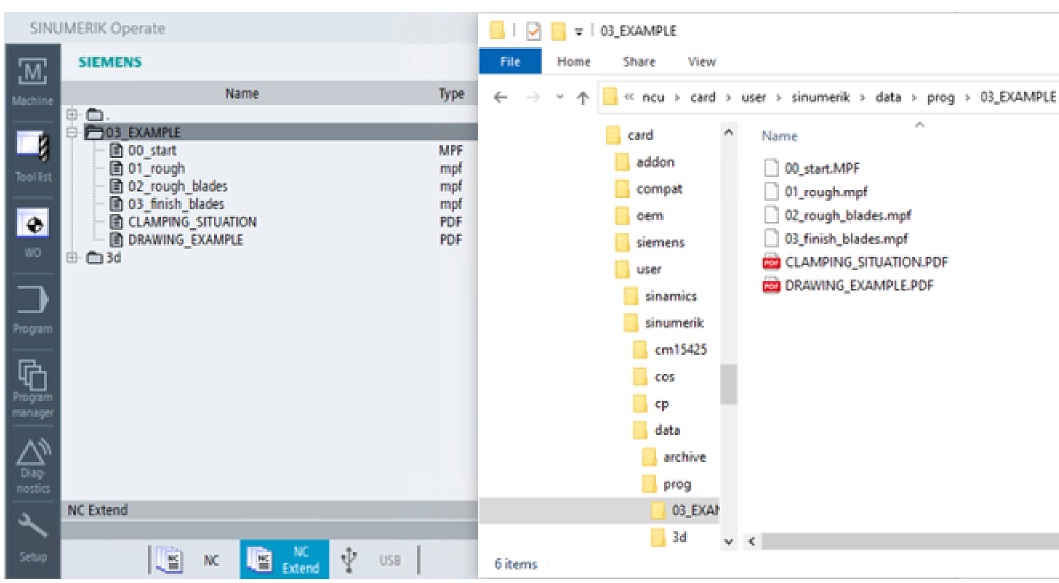


Figure 6-6 Directory opened in the program manager and in Windows Explorer on the virtual memory card (NC Extend)

Directory in the program manager SINUMERIK Operate with local drive (e.g. SINUMERIK 828D)

- Softkeys: "Program manager > Local drive"

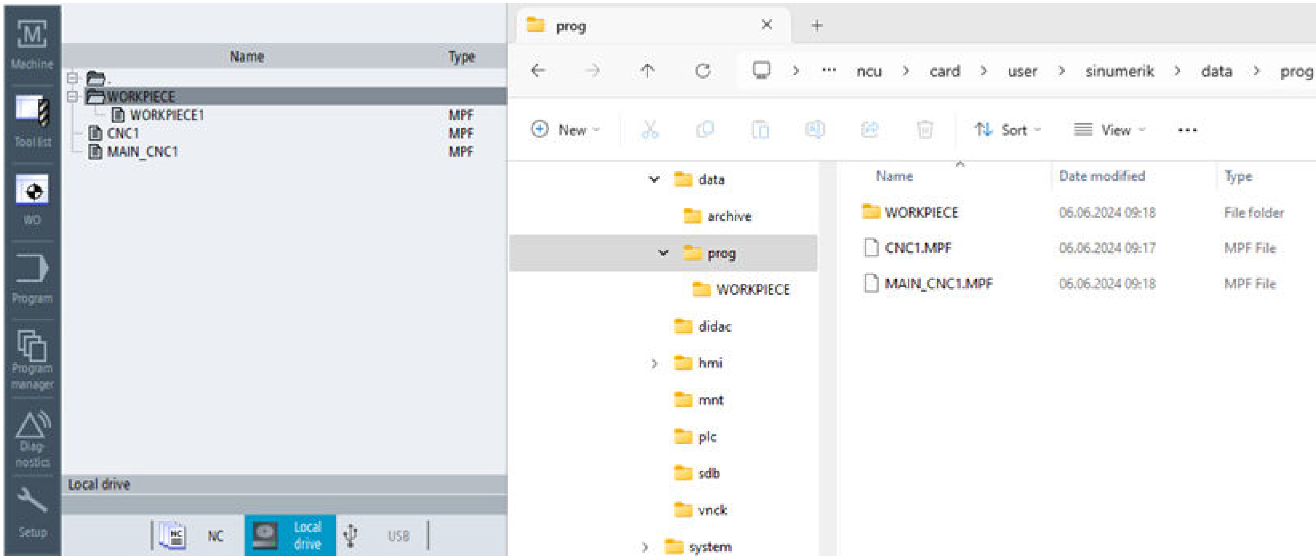


Figure 6-7 Directory opened in the program manager and Windows Explorer on the virtual memory card (local drive)

6.9 Preparing projects for Run MyVirtual Machine

6.9.1 Preparing a machine project

The training software Run MyVirtual Machine simulates a SINUMERIK controller on your PC using the SINUMERIK Operate user interface, and uses the same machine project as Create MyVirtual Machine. You must prepare the machine project before it is used in Run MyVirtual Machine. The changes involve fundamental security measures against unauthorized access and manipulation of the machine project.

This is how you prepare machine projects for Run MyVirtual Machine

If you transfer Create MyVirtual Machine project files (*.vcp) to end users for use in Run MyVirtual Machine, you must prepare these, e.g. in the TIA Portal (SINUMERIK ONE) or in Create MyVirtual Machine.

1. Protecting the blocks
   - SINUMERIK ONE
     In the TIA Portal project, setup know-how protection for the PLC program blocks. Using know-how protection, you password-protect block types OB, FB, FC and global data blocks against unauthorized access.
   - SINUMERIK 828D
     Set up password protection for one or all POE in the PLC Programming Tool.

   After you have activated the know-how protection, load the PLC project into the Create MyVirtual Machine machine project.
2. In "logdrive.ini", remove all access data to manufacture-specific network drives. "logdrive.ini" is on the virtual memory card of the machine project.

3. In SINUMERIK Operate, change the standard passwords, and assign your own passwords for protection levels 0 to 3.
   As default setting, machine projects are delivered with the key-actuated switch set to 0 with protection level 7.
4. Optionally, you can activate project protection for the machine project.
5. Save the machine project after you have modified it. The machine project file (*.vcp) can be opened and started in Run MyVirtual Machine.

6.10 Upgrading a machine project (virtual machine SINUMERIK ONE)

6.10.1 Upgrading a machine project

You can also upgrade existing machine projects ("*.vcp") of Create MyVirtual Machine to a new version of the CNC software identical to the real SINUMERIK ONE control. To upgrade, you must export the project settings and the archive from the old machine project and then import them into the new machine project. You upgrade the TIA Portal project to the new CNC software (firmware) version in a separate step.

Requirement

- The required versions of the TIA Portal and SINUMERIK STEP 7 Toolbox are installed.
- Create MyVirtual Machine and the required versions of the CNC-SW are installed.

Principle workflow when upgrading

The upgrade to a new CNC software is implemented in several steps.

1. Open the existing TIA Portal project of the machine project in the new version of the TIA Portal, and follow the instructions in the TIA Portal.
2. Using "Change device", upgrade the control and the NX modules to the new CNC-SW (firmware), and if required upgrade the PLC basic program and the instructions used to the new version.

   Note

   When replacing the device from Version V6.20 (PLC V2.9), the new functions for protection and PLC security are queried in the wizard. Observe additional information in the TIA Portal and in the SINUMERIK documentation.

3. Save the upgraded TIA Portal project.
4. Open the existing machine project in Create MyVirtual Machine.
5. In SINUMERIK Operate, create a complete backup archive of the SINUMERIK control and save the archive to a local drive.
6. In Create MyVirtual Machine, export the machine project settings. The export of project settings is only supported from Version 1.3.1 and higher.

7. Create a new machine project with the new version of the CNC-SW, to which the machine project should be upgraded.
8. Import the project settings into the new machine project.
9. Import the backup archive into the machine project that has been started.
10. Load the upgraded PLC project from the TIA Portal into the PLC (NCU).
11. Save the machine project and start it again.

The machine and the TIA Portal project are upgraded to the new Version of the CNC-SW.

More information

More information about the upgrade can be found in the following documentation:

- TIA Portal help system in the "Upgrading a PLC project (ONE)" section
- Commissioning guide *SINUMERIK ONE steps for configuring and commissioning*
- Installation Manual *SINUMERIK ONE - new installation and upgrading*
- Siemens Support Center
  You can find detailed upgrade instructions for the new version of the CNC-SW in the download area for the software package of Create MyVirtual Machine.

6.10.2 Special aspects when upgrading TIA Portal projects

In the current version, TIA Portal projects **as of** SINUMERIK ONE STEP 7 Toolbox **V16** with PLC Basic Program **V6.13** and as of SINUMERIK ONE STEP 7 Toolbox **V18** with PLC Basic Program plus **V6.20** can continue to be used.

Existing projects with older versions of the TIA Portal or of the basic PLC program must first be upgraded to this version.

When opening the SINUMERIK project from a previous version < V19 of the TIA Portal, you are prompted to upgrade the project. This means that you can continue to use the project in this new version of the TIA Portal. The configured device version of the NCU (e.g. V6.22) remains unchanged.

Note

CNC SW and TIA Portal project version

When upgrading a project from an older main version of TIA Portal (e.g. V17) to a newer TIA Portal version (e.g. V18), the device version of the NCU/PPU (e.g. V6.20) remains unchanged.

If you not only want to upgrade the TIA Portal version, but also want to benefit from the new functions for the NCU/PPU when configuring, you must then replace the device (e.g. to device version V6.24). You can use the new functions of the SINUMERIK basic program (SINUMERIK PLC Basic Program or SINUMERIK PLC Basic Program plus) once you subsequently update the basic program or the instructions to match the configured device version.

In order that the upgraded TIA Portal project with the configured device version can be loaded to the real or virtual control, the real or virtual control must not contain any CNC-SW older than that configured in the project. In this case, it is irrelevant whether data is loaded directly into the control from the TIA Portal project or a DSF archive generated from the TIA Portal project is used.

An NCU/PPU with newer CNC-SW release can also be loaded from an existing or upgraded TIA Portal project with older configured device versions.

For example, this means that an NCU/PPU with CNC-SW release V6.22 can be loaded from a TIA Portal project V17 or V18 with configured NCU V6.20 either per download or using a DSF archive.

Device version and TIA Portal version

After the TIA Portal project has been upgraded, it is not always necessary to replace the device (Page 124) with a new device version, because TIA Portal V19 also supports older device versions that were already available in previous TIA Portal versions.

Creating new devices or **upgrading to newer device versions** may be restricted compared to earlier TIA Portal versions. Some device versions can possibly only be used in upgraded projects. You can find out which device versions and corresponding PLC basic programs are supported in the current TIA Portal version in the SINUMERIK Readme under "Product features".

In general, a configuration can be downloaded from the TIA Portal to a controller if the configured device version is not more recent than the device version of the real or virtual controller.

It makes no difference whether the download takes place directly from the TIA Portal to the control or indirectly using a SINUMERIK DSF archive. For example, you might already have installed software version V6.22 on the controller, but left the device version configured in the TIA Portal project in the previously supported version V6.21 (older configured device version, new version on the controller).

An attempt to download a configuration for device version V6.22 to a controller in version V6.21, on the other hand, will be rejected with a corresponding message (new configured device version, older version on the controller).

A project you previously worked on with an older TIA Portal version can only contain device versions which were already supported in the old TIA Portal version (such as device version V6.14 in TIA Portal V17).

If, on the basis of such a project and after upgrading to TIA Portal version V19 SP1, you want to create a project for a more recent device version that is supported in TIA Portal V19 SP1, you can adapt the setup by replacing the device (Page 124). The device versions offered are those which are also supported for creating new devices and which are more recent than the previously used device version.

After device replacement, the basic program version should also generally be updated so that all functions of the new controller version can be used.

The details of the procedure depend on the type of the PLC basic program used:

- PLC Basic Program (see *also Function Manual SINUMERIK ONE PLC BP*)
- PLC Basic Program plus (see also *Function Manual SINUMERIK ONE PLC BP plus*)

See also

Upgrading to SINUMERIK STEP 7 Toolbox V19 SP1 (Page 124)

6.10.3 Upgrading to SINUMERIK STEP 7 Toolbox V19 SP1

6.10.3.1 Upgrading hardware

Replacing devices

To replace devices, proceed as follows:

1. Open the project in the TIA Portal. The project structure is adapted automatically and a message is displayed.
2. Highlight the NCU in the device view and select "Change device" in the context menu.

3. Select the new NCU in the displayed dialog. The compatibility information displayed is provided for reference only.

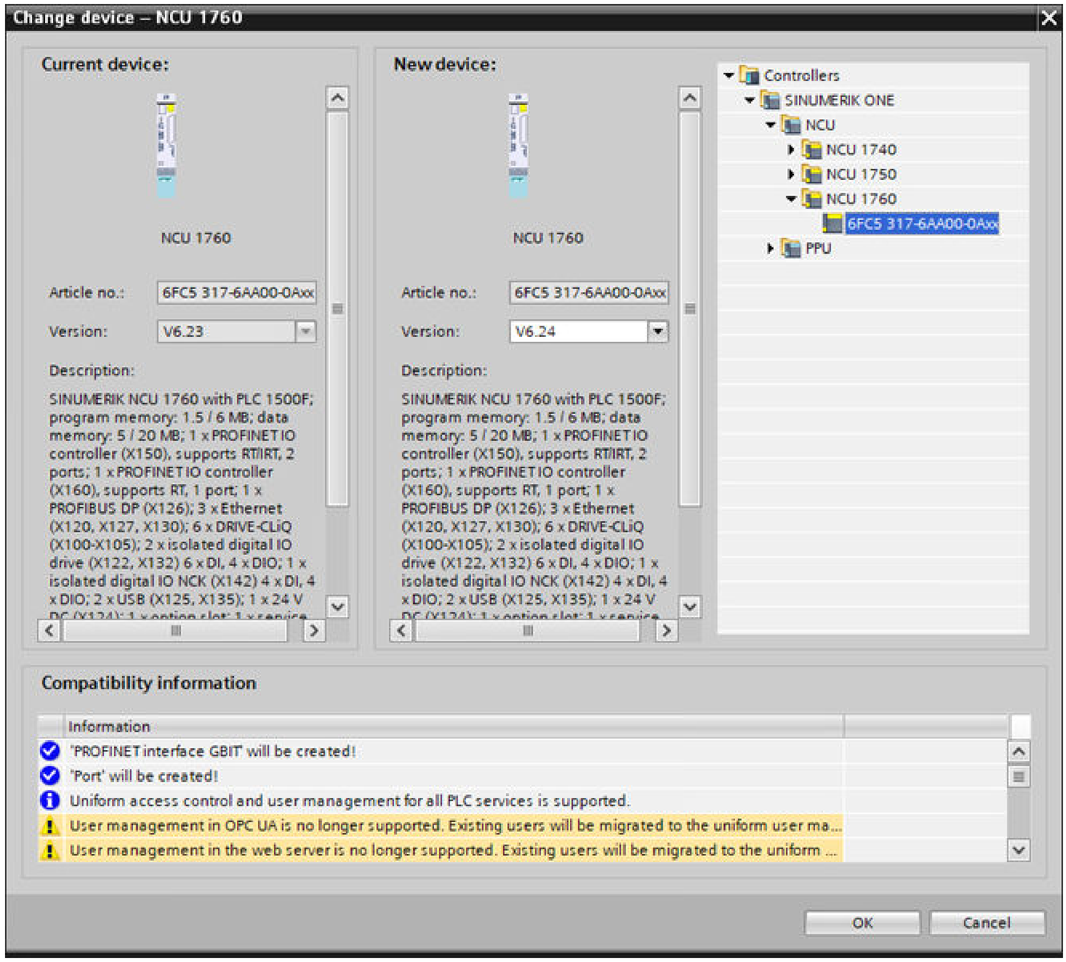


Figure 6-8 Replacement of device for new version

4. Confirm with "OK". The NCU and existing NX modules are upgraded to version V6.24.

Note

When replacing the device to Version V6.20 (PLC V2.9), the new functions for protection and PLC security are queried in the wizard. Observe additional information in the TIA Portal and in the SINUMERIK documentation.

In the next step, you upgrade the PLC basic program and the data types to the latest version.

6.10.3.2 Upgrading PLC Basic Program (blocks and data types)

To upgrade the PLC basic program and the data types, proceed as follows:

1. Open the "Program blocks" folder in the project navigator.
2. Switch to the "Libraries" tab and open the "SINUMERIK ONE PLC Basic Program" library in the desired new version, e.g. V6.24, as the latest version from the Toolbox V19 SP1 scope of delivery.
   You use the variant for the PLC basic program and the data types with (**upgrade**) in the "Copy templates" folder.
   – SINUMERIK ONE PLC Basic Program (upgrade)

   Note

   The folder (upgrade) does not contain the blocks that may contain application-related changes. These are the blocks "LBP_MFuncDecListConfig [DB75]", "LBP_ParamAlarmMsgs [DB5]" or "LBP_CallBackAuxFunc [FC12]". When updating the PLC basic program, the original version of these blocks is retained in your project and they are not overwritten.

   ---
3. Drag and drop the "Copy Templates > SINUMERIK ONE PLC Basic Program (upgrade) > SINUMERIK ONE PLC BP data types" folder to the "PLC data types" folder of your project.
   The PLC data types are updated.
4. Drag and drop the "Copy Templates > SINUMERIK ONE PLC Basic Program (upgrade) > SINUMERIK ONE PLC BP" folder to the "Program Blocks" folder of your project.
   The PLC basic program is updated to the new version.
5. Save and compile the project.

The PLC basic program and the data types are up to date.

6.10.3.3 Upgrading PLC Basic Program plus (blocks, data types and instructions)

Introduction

When opening the SINUMERIK project with the PLC Basic plus user program from an earlier version < V19 of the TIA Portal, you are prompted to upgrade the project. This means that you can continue to use the project in this new version of the TIA Portal. The configured device version of the NCU (for example V6.20) remains unchanged.

Procedure

1. Delete the copies of the SINUMERIK ONE PLC BP plus data types and the SINUMERIK ONE PLC BP plus blocks from your TIA Portal project. The data types and blocks are copies from the SINUMERIK ONE PLC BP plus system library.

   Note

   LSINU_Deprecated* blocks are no longer included in the system library as of V2.0

   The blocks LSINU_DeprecatedConfigOpUnitComm, LSINU_DeprecatedHandwheels, LSINU_DeprecatedOpUnitComm, LSINU_DeprecatedConfigOpUnitCommData, LSINU_DeprecatedInternal1, LSINU_DeprecatedInternalProc2 are no longer part of the scope of delivery of SINUMERIK ONE PLC BP plus V2.0 or higher, but are replaced by instructions.

   If these PLC blocks are to remain in the TIA Portal project until the PLC program has been converted to the new instructions, then these blocks must not be removed from the project in this step.

   For future-oriented continued work, you should change the LSINU_Deprecated* blocks in the PLC user program to the new instructions.

   ---

2. Copy the SINUMERIK ONE PLC Basic Program plus data types and blocks from the SINUMERIK ONE PLC BP plus V2.2 system library to the TIA Portal project.
3. You do **not** have to upgrade the SINUMERIK ONE PLC Basic Program data types to version V6.24.
   They can remain in the PLC project.
4. Switch to the "Instructions" tab and change the SINUMERIK ONE system library to the desired new version in the instruction library.
5. Save and compile the project ("Compile software completely").
   The instructions in the PLC project are upgraded to the set version.
6. Delete the calls of the LSINU_Deprecated* blocks (if they exist) from the PLC BP plus V1.0 in the PLC user program and replace them with the instructions from the current system library of the instructions.
   You can then delete copies of the blocks or LSINU_Deprecated* data types that are no longer required.

Error messages during compilation and remedy

Error message	Remedy
The data type 'xyz' is not supported on this CPU or by the current library version.	The version of the SINUMERIK ONE system library (instructions) must be set to match the NCU firmware version.
The block 'xyz' is not supported by the used CPU or library version.	The version of the SINUMERIK ONE system library (instructions) must be set to match the NCU firmware version.

More information

For more information on upgrading TIA Portal projects, refer to the SINUMERIK STEP 7 Toolbox installation media in Readme (..\Documents\Readme\).

6.10.3.4 Updating instructions in the project

After upgrading the project from older versions (< V6.13), used instructions will not be automatically upgraded to the latest version of TIA Portal. When you compile the project, you receive the following error messages "Library version conflict for Serialize or Deserialize V2.1" if versions are not up-to-date. The current version used in the basic PLC program does not match the version of the instructions.

This is how you update the version of instructions

1. Open any function block in the editor, e.g. Main [OB1]. The program editor and the "Instructions" task card are shown.
2. Click on the "Update program in the current CPU" button in the "Instructions" task card. The instructions are automatically updated to the latest version.
   – Deserialize: V2.1
   – Serialize: V2.1

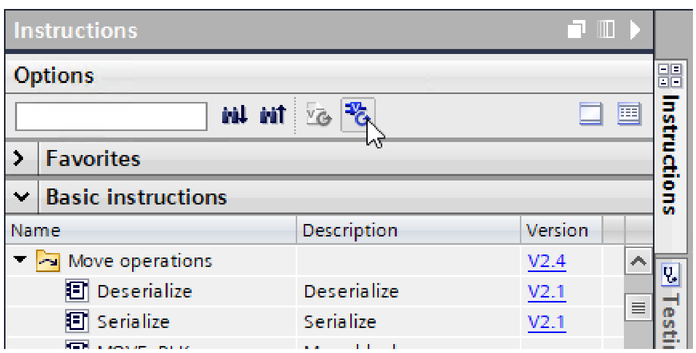


Figure 6-9 Updating instructions to the latest version TIA Portal

   Alternatively, you can also set the version directly in the "Version" column to V2.1.
3. Save the project and compile the software. The project is compiled without error message.

6.10.3.5 Switching from PLC Basic Program to PLC Basic Program plus

If you want to switch from SINUMERIK PLC Basic Program to SINUMERIK PLC Basic Program plus, you usually have to create the PLC user program from scratch. The PLC basic programs SINUMERIK PLC Basic Program and SINUMERIK PLC Basic Program plus are not compatible and cannot be combined.

You must remove the blocks from the SINUMERIK PLC Basic Program and replace them with the blocks and instructions from the SINUMERIK PLC Basic Program plus.

6.10.3.6 Upgrading know-how protected blocks

Know-how protected blocks that were set up with an older version of the TIA Portal can be loaded into the controller when upgrading to the current version without entering a password and are executable.

To open and edit these blocks in the current version, proceed as follows:

- Remove the know-how protection before upgrading in the project for the previous TIA Portal version and then upgrade the project.
- Then make any necessary changes in the upgraded project and, if necessary, activate the know-how protection again.

More information can be found in the TIA Portal help under "Upgrading blocks".

See also

Upgrading hardware (Page 124)

Upgrading PLC Basic Program (blocks and data types) (Page 126)

6.10.4 Tips and tricks for upgrading

This section contains notes that simplify the upgrading of the project.

Changes to CNC software as of V6.11

- **Check the memory size in the NCK machine data 19270 $ON_PLC_USER_MEM_SIZE**
  As from this version, the size of the PLC program and data memory is checked against the active memory size in machine data 19270 $ON_PLC_USER_MEM_SIZE. If alarm 8023 is displayed, the value in machine data 19270 $ON_PLC_USER_MEM_SIZE must be adjusted.
  The test takes place, for example, if you load an archive of older CNC SW.
  If one of the components is in an older version (CNC SW < V6.11), the check is not made. In respect of this subject, the components are compatible with older versions. The check takes place with the real and virtual SINUMERIK ONE.
  For further information, see the description of alarm 8023.

7 Virtual commissioning (SINUMERIK ONE V6.x)

7.1 Transition from SINUMERIK 840D sl to SINUMERIK ONE via Create MyVirtual Machine

This chapter describes a typical data transfer and initial commissioning procedure based on Create MyVirtual Machine. Starting point for the application is an existing, fully commissioned machine based on a real SINUMERIK 840D sl control.

To simplify the commissioning of the new SINUMERIK ONE control generation, use the configuration data of a real SINUMERIK 840D sl control.

Initial commissioning is subdivided into three steps

1. Migrating and transferring the available configuration data of a SINUMERIK 840D on the new control.
2. Checking the defined parts of the imported and changed configuration data in Create MyVirtual Machine.
3. Transfer the created and tested configuration data to the real SINUMERIK ONE

During commissioning, the steps are typically performed per component (PLC, drive, NCK, HMI, and I/O). The component by component data transfer of the existing configuration of a SINUMERIK 840D sl to a SINUMERIK ONE is shown in the following diagram. Depending on the components, data must first be migrated and adapted, or can continue to be used directly as archive data.

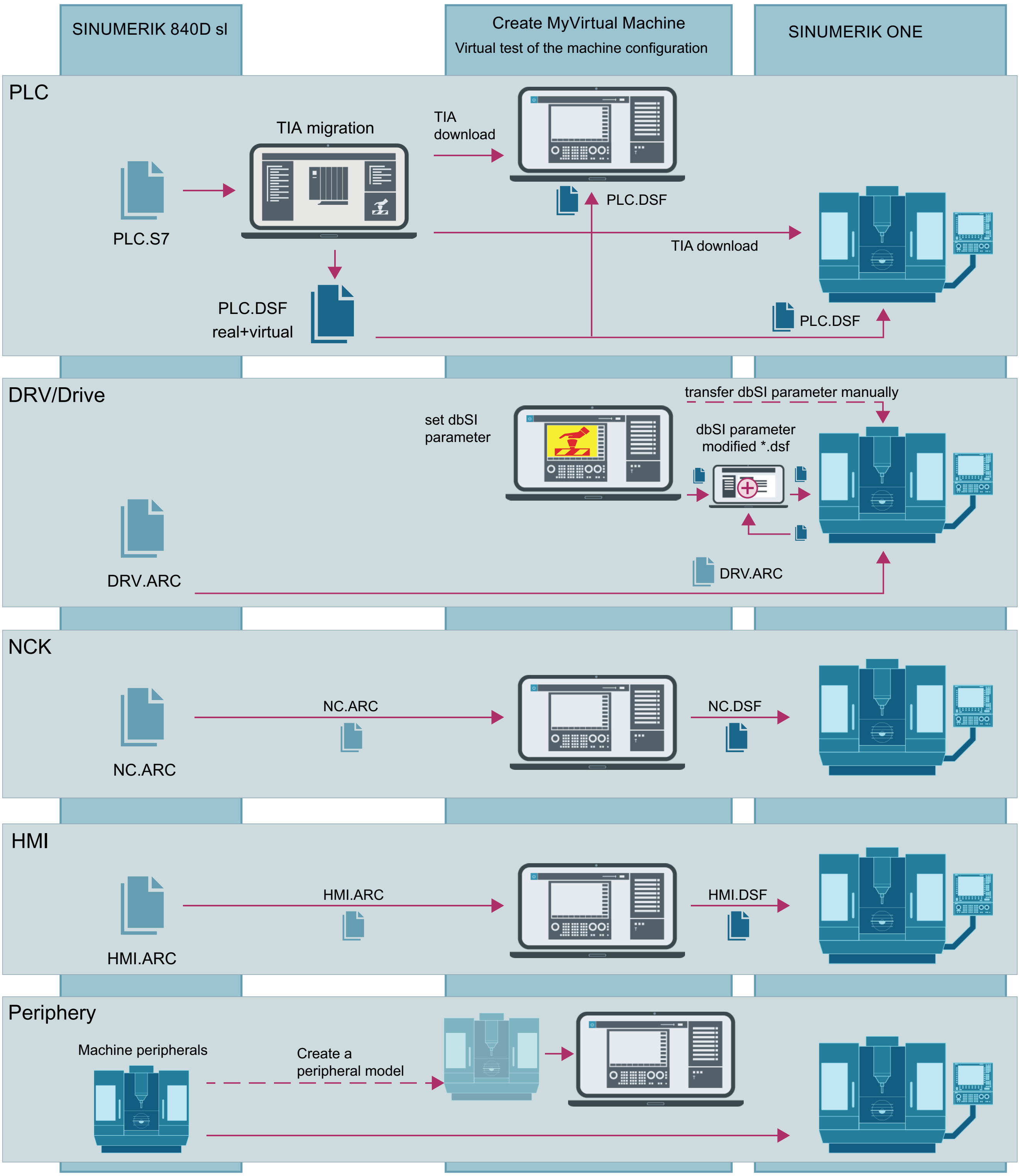


Figure 7-1 Symbolic representation of the data transfer from SINUMERIK 840D sl to SINUMERIK ONE

See also

PLC project (Page 133)

Drive data (Page 134)

NCK configuration (Page 134)

HMI configuration (Page 135)

Machine I/O (Page 135)

7.2 PLC project

The starting point is the PLC project of a SINUMERIK 840D sl (SIMATIC STEP 7 Classic, PLC SIMATIC S7-300). The project must be correspondingly migrated for use in Create MyVirtual Machine or SINUMERIK ONE.

Data transfer to Create MyVirtual Machine

There are two ways of loading data into Create MyVirtual Machine.

- Download directly from the TIA Portal to the Create MyVirtual Machine.
  Only the compilation for the virtual PLC is transferred.
- Generating a DSF archive in the TIA Portal, and importing the archive via the HMI SINUMERIK Operate.
  The DSF archive generated in the TIA Portal contains the compilation for both the virtual and the real PLC of a SINUMERIK ONE

Data transfer to SINUMERIK ONE

There are two ways of loading data into the real SINUMERIK ONE.

- Downloading directly from the TIA Portal to the SINUMERIK ONE
  Only the compilation for the real PLC is transferred.
- Generating a DSF archive in the TIA Portal, and importing the archive via the HMI SINUMERIK Operate.
  The DSF archive generated in the TIA Portal contains the compilation for both the virtual and the real PLC of a SINUMERIK ONE

Additional references

The *Migration to a SINUMERIK ONE* System Manual contains further information about the migration from a SINUMERIK 840 sl.

See also

Transition from SINUMERIK 840D sl to SINUMERIK ONE via Create MyVirtual Machine (Page 131)

7.3 Drive data

In Create MyVirtual Machine, the drive component is simulated by a substitute component (simDrive). This serves the sole purpose of making the drive-based Safety functions testable in interaction between the F-part of the PLC user program and the drive component.

A direct data exchange between real drive components and the simulated drive components is not possible in Create MyVirtual Machine. Create MyVirtual Machine offers the option of configuring and testing safety-specific drive parameters.

Data transfer to SINUMERIK ONE

The data transfer to the SINUMERIK ONE control takes place in two stages.

1. Loading a SINUMERIK 840D sl drive archive (DRV.ARC) into the SINUMERIK ONE via HMI SINUMERIK Operate.
2. Transferring the Safety-specific drive parameters, checked in Create MyVirtual Machine, to the SINUMERIK ONE.
   – Manually transferring the Safety-specific drive parameters to the SINUMERIK ONE
   or
   – Exporting SINAMICS drive data from Create MyVirtual Machine and integration of drive data into a DSF archive for SINUMERIK ONE

See also

Transition from SINUMERIK 840D sl to SINUMERIK ONE via Create MyVirtual Machine (Page 131)

Exporting/importing SINAMICS drive data (Page 151)

7.4 NCK configuration

NCK archives (arc format) can be read directly into Create MyVirtual Machine.

Data transfer to Create MyVirtual Machine

The NCK configuration of a SINUMERIK 840D sl is transferred by importing the NCK.ARC archive.

In doing so, the following NCK machine data are permanently replaced by substitute values for the simulation:

- MD13060 $MN_DRIVE_TELEGRAM_TYPE
  Create MyVirtual Machine only supports the telegram type 136

Data transfer to SINUMERIK ONE

The NCK configuration is transferred from Create MyVirtual Machine to the SINUMERIK ONE on the basis of a DSF archive. The above-mentioned machine data may have to be adapted to the SINUMERIK ONE.

See also

Transition from SINUMERIK 840D sl to SINUMERIK ONE via Create MyVirtual Machine (Page 131)

7.5 HMI configuration

HMI archives (arc format) can be read directly into Create MyVirtual Machine.

Data transfer to Create MyVirtual Machine

The HMI configuration of a SINUMERIK 840D sl is transferred by importing the HMI.ARC archive.

Data transfer to SINUMERIK ONE

The HMI configuration is transferred from Create MyVirtual Machine to the SINUMERIK ONE on the basis of a DSF archive.

Note

Exceptions for the data transfer HMI expansions

All types of OEM-specific HMI expansions are excluded from the data transfer of the HMI because they first have to be tested in special test cases.

HMI OA expansions based on Linux cannot be tested in Create MyVirtual Machine.

See also

Transition from SINUMERIK 840D sl to SINUMERIK ONE via Create MyVirtual Machine (Page 131)

7.6 Machine I/O

To simulate interaction of the PLC with the field device level, the behavior of the machine I/O must be emulated for the simulation. The following options are available for this purpose:

- Use the internal peripheral simulation of Create MyVirtual Machine (simulation via PLC I/O tables)
- Imaging of the logic of the machine I/O via an appropriate simulation block in the PLC user program as part of the TIA project
- Implementation of a separate PLC I/O simulator based on the simulation interface (Open Interface) in Create MyVirtual Machine

See also

Transition from SINUMERIK 840D sl to SINUMERIK ONE via Create MyVirtual Machine (Page 131)

7.7 Commissioning

Description

A virtual SINUMERIK ONE can be commissioned in Create MyVirtual Machine.

Initial commissioning scope

Step	Description	More information/documentation
1	You first create a new machine project in Create MyVirtual Machine.	Creating a machine project (Page 109)
2	In the TIA Portal, configure the hardware using SINUMERIK Toolbox functions.	SINUMERIK Toolbox online help
3	Configure the communication between NCU and drive in the telegram configuration for the TIA Portal.	SINUMERIK Toolbox online help Standard telegram configuration
4	Compile the TIA Portal project and load the hardware configuration into the virtual PLC. An opened machine project must be in simulation operation in Create MyVirtual Machine.	SINUMERIK Toolbox online help Create MyVirtual Machine user interface (Page 56)
5	NCK commissioning: Load the NCK data of an existing SINUMERIK 840D sl archive into Create MyVirtual Machine or Commission the control.	Creating and importing archives
6	Then copy the PLC basic program from the library to your project, and create the PLC user and safety program in the TIA Portal.	SINUMERIK Toolbox online help SINUMERIK ONE List Manual data description
7	In the TIA Portal, activate Safety Integrated and load the compiled TIA Portal project into the virtual PLC. After the download, restart the Create MyVirtual Machine (deactivate/activate simulation operation).	SINUMERIK Toolbox online help Activating Safety Integrated Downloading the project to the PLC
8	Perform the drive and safety commissioning, as well as further NC functions in Create MyVirtual Machine in SINUMERIK Operate.	Safety Integrated (Page 185) simDrive Parameters List Manual
9	In parallel to the commissioning process, test PLC programs and functions in simulation mode.	Open Interface (Page 327) Peripheral simulation (Page 32)

More information

The exact procedure for migrating a SINUMERIK 840D sl to Create MyVirtual Machine is described in:

- System Manual *Migration to a SINUMERIK ONE*

7.8 TIA project settings and download to the target system

7.8.1 Activating the simulation-capability of blocks

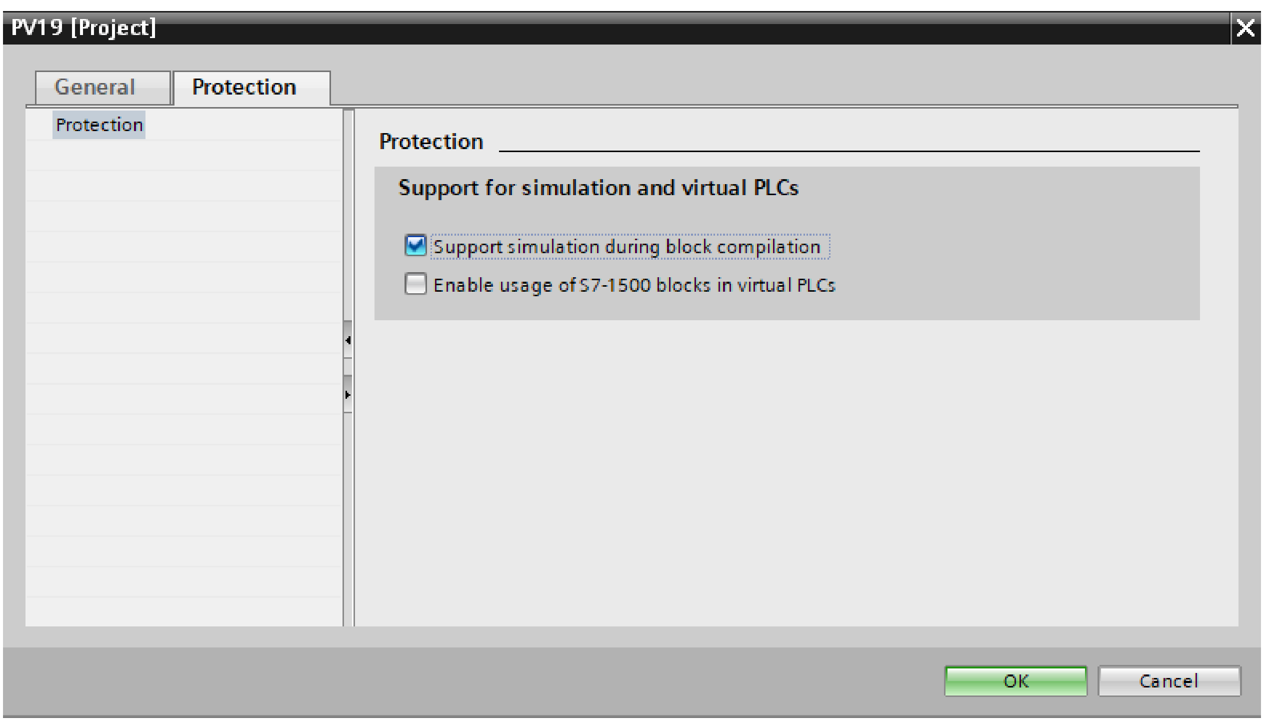
If you want to use a TIA Portal project in a simulated environment (Create MyVirtual Machine), you must activate the simulation capability in the project properties before you compile the project. This setting is deactivated by default because it can affect the know-how protection.

When loaded to the simulation, the blocks are checked to ensure that they can be simulated. In the case of an error, the following message is displayed: "'MyKhpBlock [FC30]' cannot be simulated. If the block originates from a library, then use a library that supports simulation. Otherwise, in the project properties, activate option "Support the simulation-capability of blocks for compilation" and recompile the block.

Procedure

To activate the simulation capability of blocks in a project, proceed as follows:

1. In the project tree, right-click the project and select the "Properties" command.
2. Activate the "Support simulation during block compilation" option under the "Protection" tab. Confirm with "OK".



Note

The option "Enable usage of S7-1500 blocks in virtual CPUs" has no effect on SINUMERIK ONE and is not supported.

7.8.2 Activating the receiving of messages for PLC

To allow messages to be displayed after loading, you must initially set the receiving of messages for the PLC.

Procedure

To receive messages, follow these steps:

1. Double-click the "Online & Diagnostics" folder of the PLC in the project navigation.
2. Click the "Online accesses" group in the area navigation.
3. Select the "Receive messages" option.

Note

If you select this procedure, messages are only received after you have re-established an online connection to the device.

7.8.3 Setting the IP address in the project

To load the project into Create MyVirtual Machine, you must use Create MyVirtual Machine to determine the IP address of the network adapter on the target computer. Use the IP of the computer on which Create MyVirtual Machine is installed as the IP address.

Requirement

The network adapter through which the target computer (with Create MyVirtual Machine) is connected to the shared network must also be assigned to the S7ONLINE and SINUMERIK_CP1543 access points in the computer's communication settings. This allows the machine simulation to communicate via the shared network via the CP and the assigned network adapter.

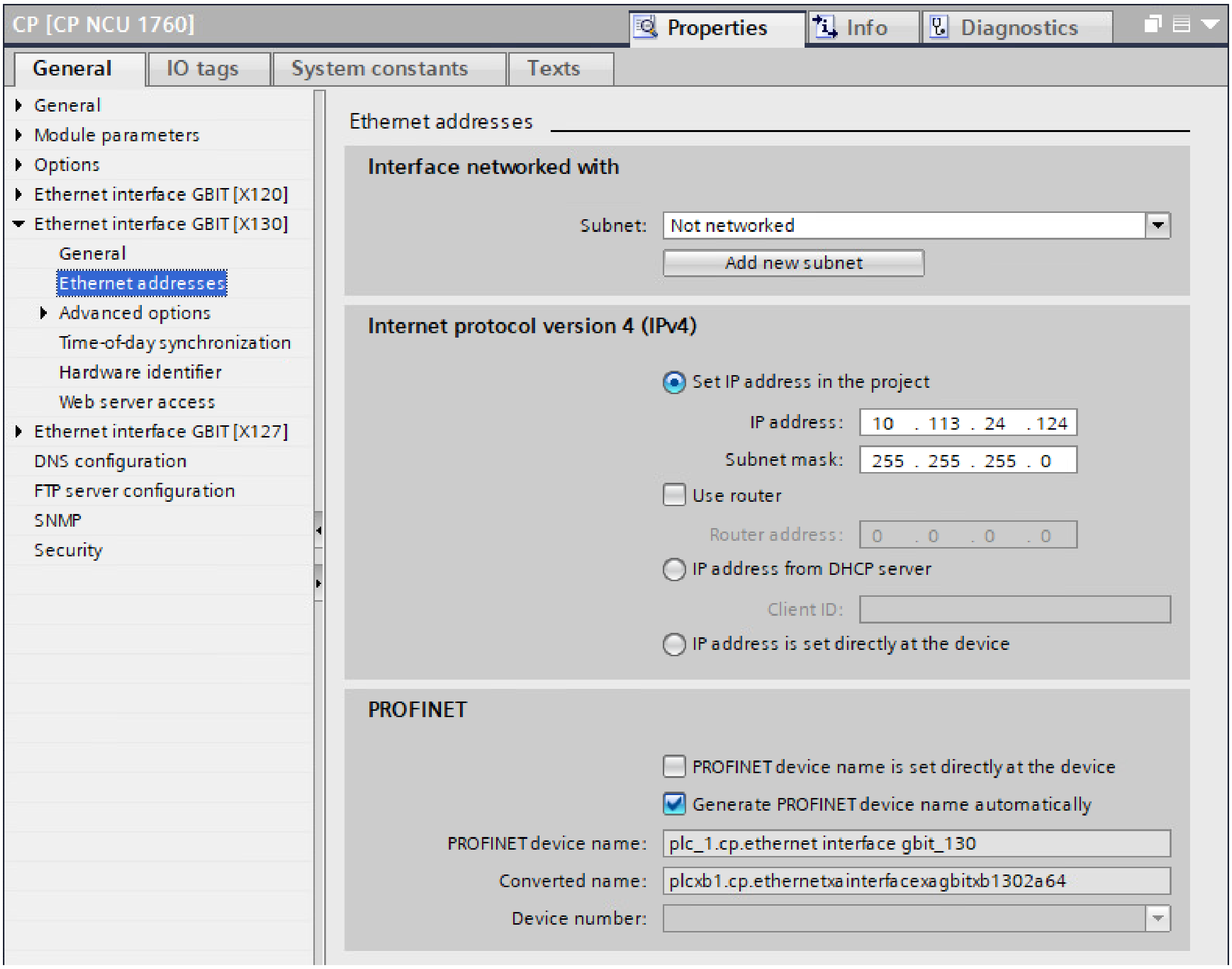
More information can be found in the *SINUMERIK Virtual CNC SW Installation Instructions* in the "Configuring" section.

Procedure

To set the IP address of the CP in the project, proceed as follows:

1. Select the CP in the network view or device view. You can go online via one of the X120, X130 or X127 interfaces. X130 is used in the example.
2. Switch to "Properties > General > Ethernet interface [X130] > Ethernet addresses".

3. Enter the required configuration at "IP protocol > Set IP address in the project".



4. Deactivate the option "PROFINET > Allow adaptation of the PROFINET device name directly in the project". The automatically generated PROFINET name is used.

Enter the IP address during the download

You can also enter the IP address directly during the download. In this case, an IP address is not configured for the CP. If Create MyVirtual Machine and TIA Portal are installed on the same computer, enter either the IP address of the computer or use the virtual IP address of the local host (e.g. 127.0.0.1).

Note

IP address of the local host

You enter the IP address of the local host only during a download or when going online directly via the IP address. This IP address is not permitted in the configuration of an interface, and is rejected with an error message.

7.8.4 Download the project to the PLC

Requirement

- The simulation-capability of blocks is activated (Page 137).
- TIA Portal and Create MyVirtual Machine are installed on the same PC system, or there is a network connection between them.
- The IP address is configured at X130 of the CP.
- The project and/or the hardware setup is compiled.
- Create MyVirtual Machine has started.
- The machine project is loaded or created, and the machine is started:
  - Create MyVirtual Machine works with machine projects which are saved as "*.vcp files". All user data for a selected version of the virtual SINUMERIK CNC software are stored in the machine projects. Before a TIA Portal project can be loaded into Create MyVirtual Machine, such a machine project must be opened and the machine simulation must be started. When an existing project is opened, it is overwritten during the course of the procedure described below. A new machine project is saved in a new "*.vcp file".
  - After opening a machine project, the machine simulation has to be started by clicking the button in the simulation control.

Note

General reset before loading into a PLC with Safety Integrated (F-PLC)

If the actual hardware has been operated in Safety Integrated (F-PLC) mode and you now want to load a configured hardware setup with changed Safety Integrated mode, you must perform a general reset of the PLC prior to loading.

Procedure

To load the hardware and software setups into the virtual SINUMERIK, proceed as follows:

1. In the project navigation, right-click the NCU and select the "Load to device > Hardware and software (only changes)" command.
2. Make the following settings in the "Extended load" dialog:
   - PG/PC interface type: PN/IE
   - PG/PC interface: Deployed network card, e.g. "Intel (R) PRO/1000 MT Network Connection"
   - Connection with interface/subnet: Directly at socket '2 X130'
   - Select target device: "Display devices with the same addresses".

Note

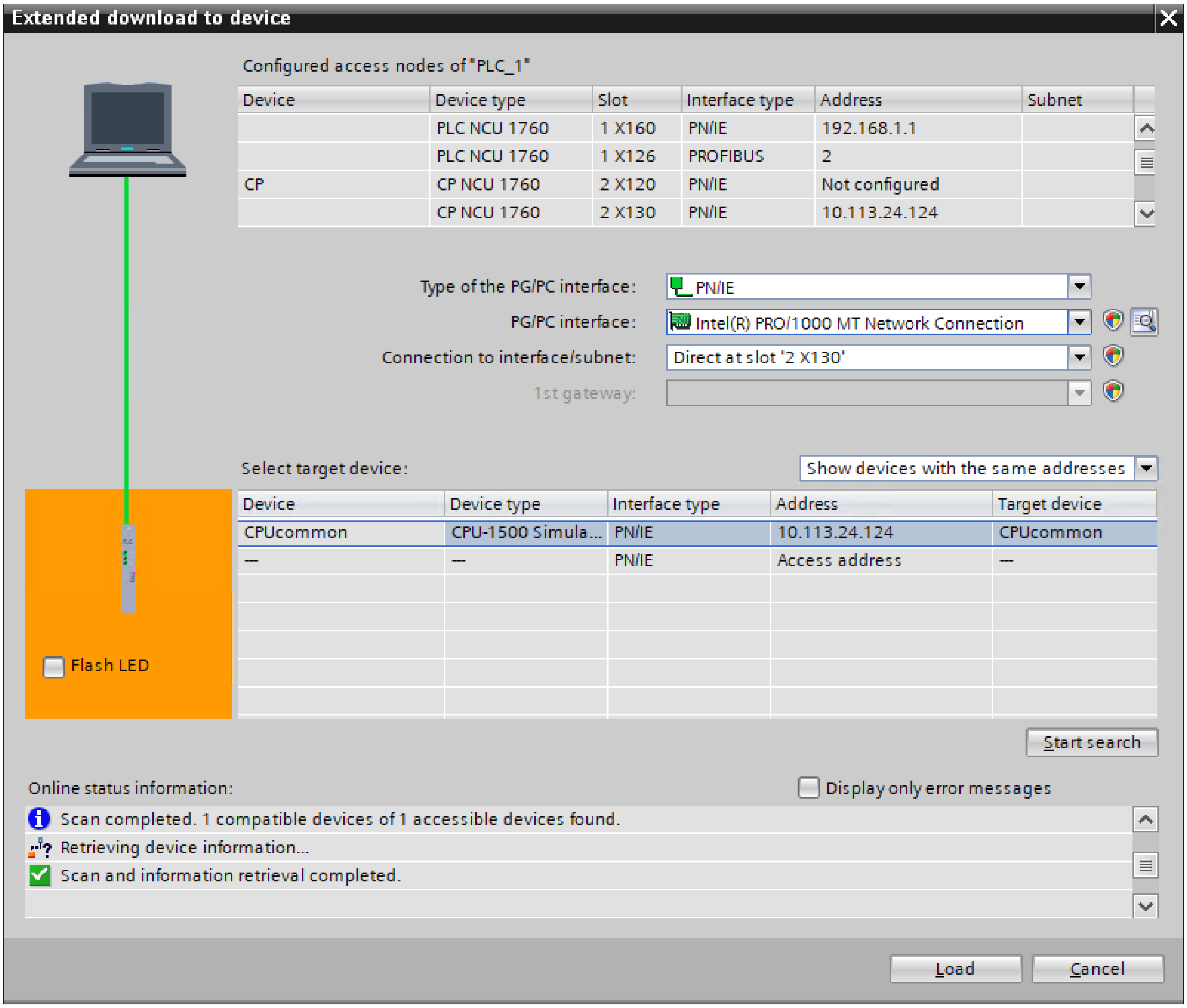
Entering an IP address directly

Alternatively, you can enter an IP address directly in the list "Compatible nodes in the target subnet" in the "Address" column and then press the ENTER button. The search starts immediately, "Start search" does not need to be clicked. If TIA Portal and Create MyVirtual Machine are installed on the same computer, you can use the IP address of the local host (127.0.0.1).

In this case, an IP address does not have to be configured for the CP.

---

3. Click "Start search".
   A search is made for the target devices, and they are displayed in the dialog.



4. Select the appropriate target device, e.g. based on the IP address, and confirm with "Load".
   The "Load preview" dialog opens.
5. Check the information in the "Load preview" dialog and confirm with "Load".

6. In the "Results of the load procedure" dialog, select whether the PLC should be restarted. Confirm with "Finish".

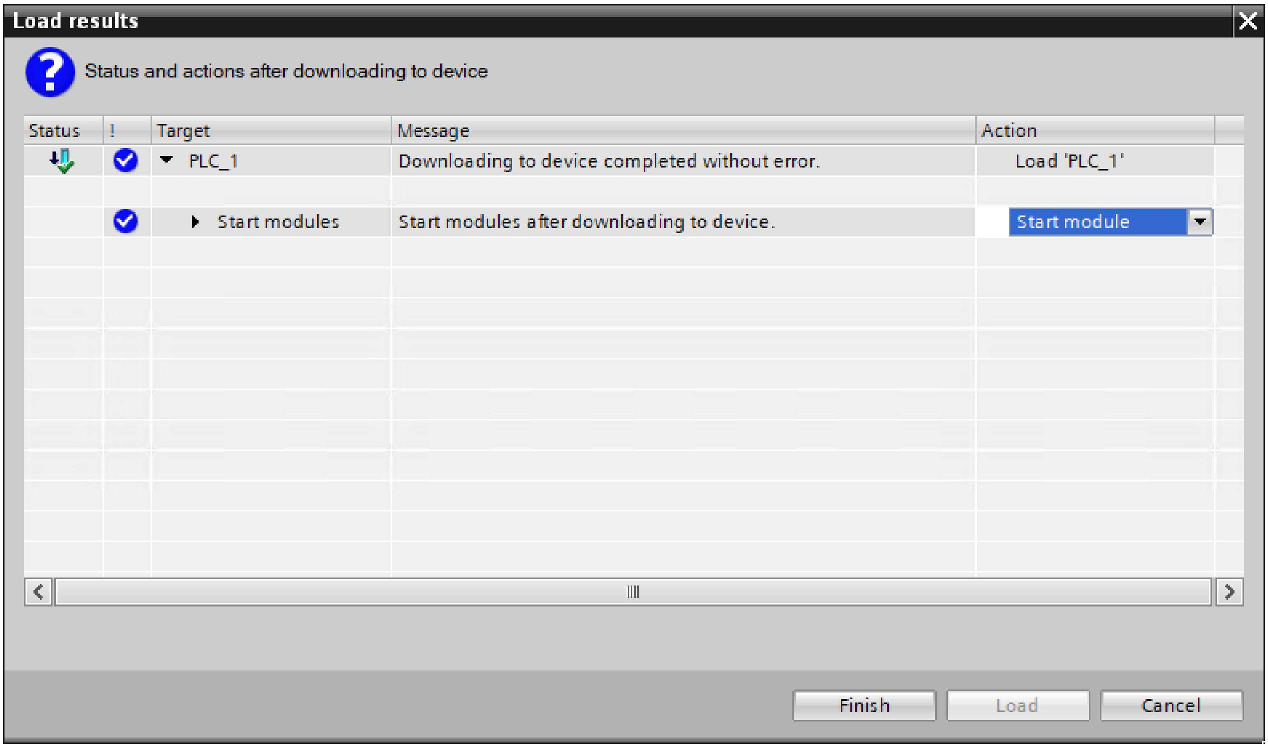


Figure 7-2 Restarting the PLC after a download

Note

If an incompatible device is detected when connecting, the "Communication setting" on the target computer must be checked with Create MyVirtual Machine. (Under LLDP/DCP, uncheck the DCP checkbox for the network adapter used).

7. After a successful download, it is generally necessary to restart the project in Create MyVirtual Machine. To do so, click "Exit machine" and, after the machine has been exited, click "Start machine" .

7.9 Mechanical properties - Mechanical model

7.9.1 Mechanical properties

In the "Mechanical properties" viewlet, you configure the physical structure (mechanics) of the NC machine and define the brake states for a "Safe Brake Test". The configured drive objects of the started machine project are displayed in tabular form.

Note

The displayed values are default values for the simulation model and **do not** correspond to the configured NC and drive data in the machine project.

Requirement

You can only configure the "Mechanical properties" when a PLC project with configured drive objects (ServoDO) has been loaded in the machine project.

Setup of the mechanical system

In the tabular overview you configure the mechanical properties, e.g. axis type, gearbox ratio, and leadscrew pitch. This data is used for the simulation of the mechanical system and is basically used to determine the values of the load encoder. The load encoder supplies the axis values of a direct measuring system.

Setup of the physical design of the NC machine. (Page 145)

Brake states (Safe Brake Test)

For a "Safe Brake Test", you define the status of the brake, e.g. brake defective or functional, from the drop-down list. When commissioning Safety Integrated, test your safety programs with the "Safe Brake Test" (SBT) diagnostic function and at different brake states. In this way you can detect program errors already during the simulation.

Configuring the brake states for the "Safe Brake Test". (Page 149)

7.9.2 Mechanical properties basics

Simulation model

The physical setup of a machine, especially of the drive units, is defined through the machine data of the NC axes (NCK), the drive parameters of the servo drive objects (simDrive), and the pure mechanical structure. The simulation model (as of Create MyVirtual Machine V1.1 SP1) permits you to configure the mechanical properties separately from the NCK and drive data in a viewlet.

Note

Only values of the 2nd encoder

The data of the mechanical properties are used for the simulation of the mechanical system and are basically used to determine the values of the load encoder (2nd encoder). There are no "Mechanical properties" for the 1st encoder, i.e. encoder inversion is not supported for the 1st encoder.

Until now, default values for the mechanical properties were set in the simulation model, which could not be changed. The extended simulation model now allows you to realistically simulate the machine system from the three parts NCK, simDrive and mechanical system in Create MyVirtual Machine.

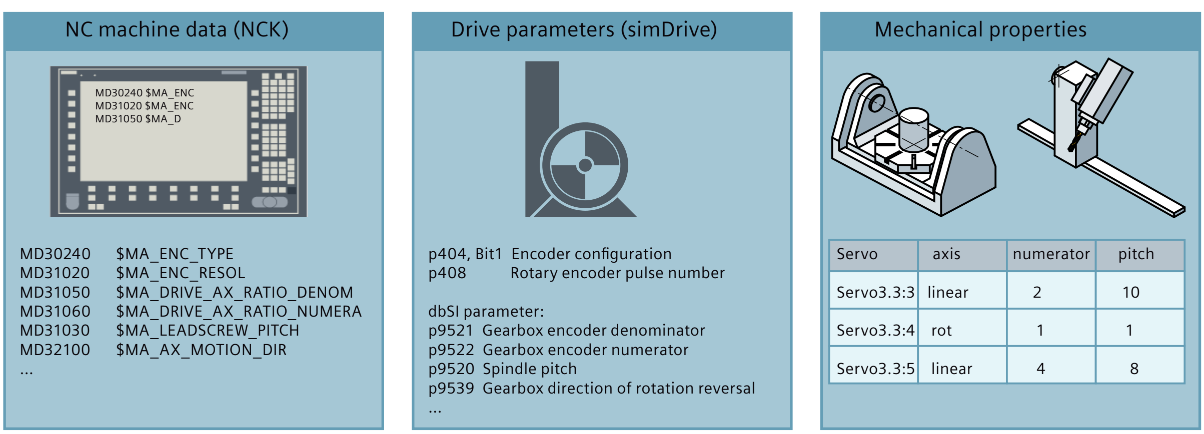


Figure 7-3 Simulation model NCK, simDrive, mechanical properties

The extended simulation model offers the following advantages:

- Mapping as in the real system, i.e. all three components (NCK, simDrive and mechanical system) must fit together, e.g. axis type linear or rotary or gear ratio.
- Deviations in the parameterization between NCK, simDrive and mechanical system can be diagnosed.

If the setup is correct in the three parts, the values of the motor encoder are identical to those of the load encoder. If, for example, different gear ratios are configured (e.g. 1:1 in the NCK and 1:2 in the mechanical properties), the values of motor and load encoder differ by a factor of 2.

"Mechanical properties" parameter

In the "Mechanical properties" viewlet, you define the mechanical design of the machine. The following parameters describe the mechanical design.

Parameter	Selection/meaning
Servo selection	Display of the drive objects configured in the project with associated NC machine axis names.
Axis type MD30300 (MD31000)	Here you select the type of the axis. • Ball screw The axis is a ball screw, i.e. the rotary motion of the drive is converted into a linear motion via a ball screw. **Note:** If it is a ball screw drive with ball screw and the 2nd encoder is attached to the rotating spindle, select "Rotary" as the axis type. • Linear The axis is a linear axis, i.e. the drive is a linear motor. • Rotary The axis is a rotary axis or a spindle.
Numerator load gear-box MD31050[0] MD31064	Here you enter the value for the gearbox ratio counter.
Denominator load gearbox MD31060[0] MD31066	Here you enter the value for the gearbox ratio denominator.
Leadscrew pitch [mm/rev] MD31030	Here you enter the leadscrew pitch in mm/rev if you are using a ball screw.
Direction reversal MD32100	Here you select whether the direction of rotation of the motor corresponds to the traversing direction of the axis or whether a direction reversal takes place. • Direction reversal: Yes Traversing direction of the axis is opposite to the direction of rotation of the motor. • Direction reversal: No Traversing direction of the axis corresponds to the direction of rotation of the motor.

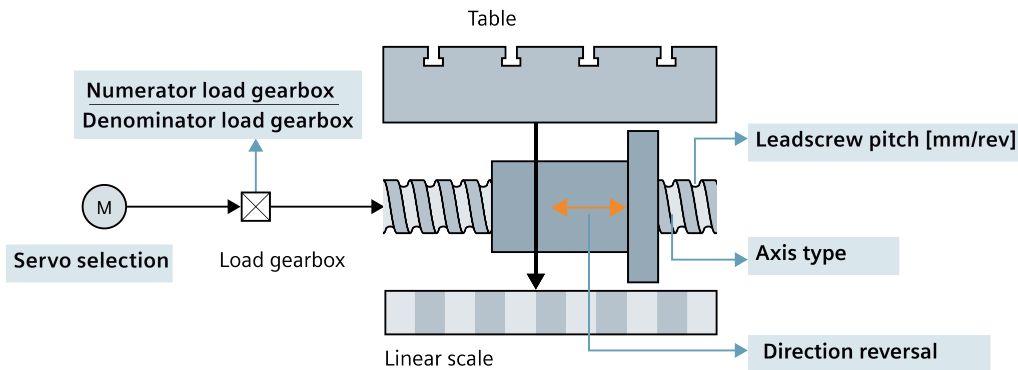


Figure 7-4 Parameters of mechanical properties using the example of a linear axis with linear scale

See also

Configuring mechanical properties (Page 147)

7.9.3 Configuring mechanical properties

Requirement

The PLC project with all configured drive objects (ServoDO) is loaded in the machine project. Only when the PLC project is loaded will the servo selection be displayed in the "Mechanical properties" and can be configured.

How to configure the mechanical properties

1. Open the "Mechanical properties" viewlet.
2. Configure the parameters for the corresponding servo selection. The changed parameters are displayed in color and italics.
   In the example, for example, the axis types, numerator, denominator and leadscrew pitch were changed.

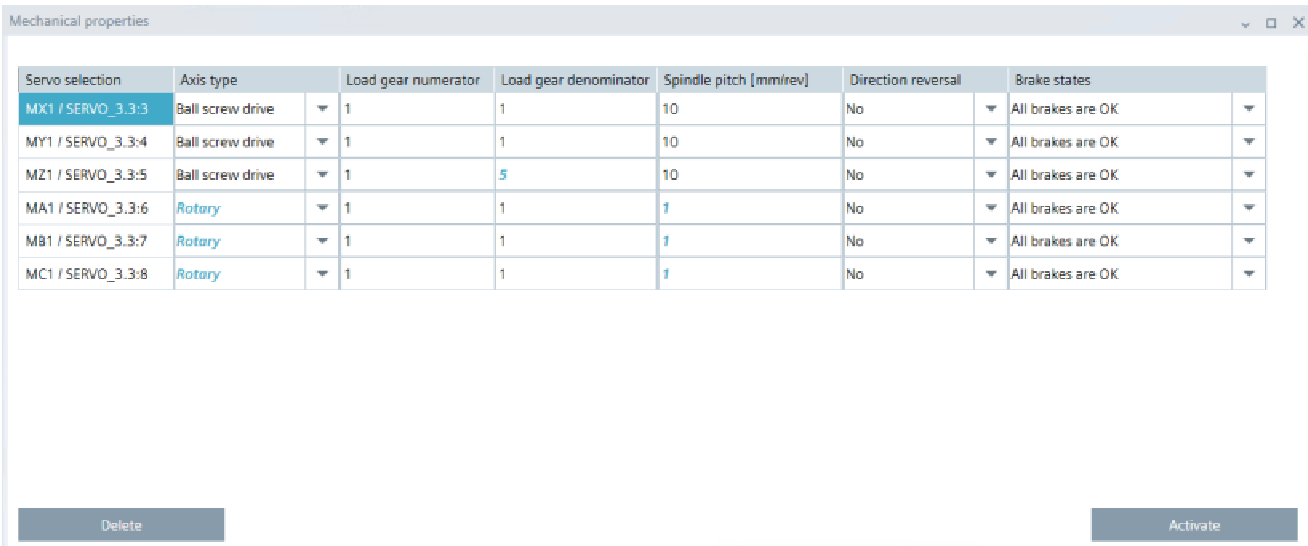


Figure 7-5 Changed parameters of mechanical properties of servo drive objects

3. Click on "Activate" to activate the parameter changes.
   The new values become effective and the parameters are no longer displayed in color.

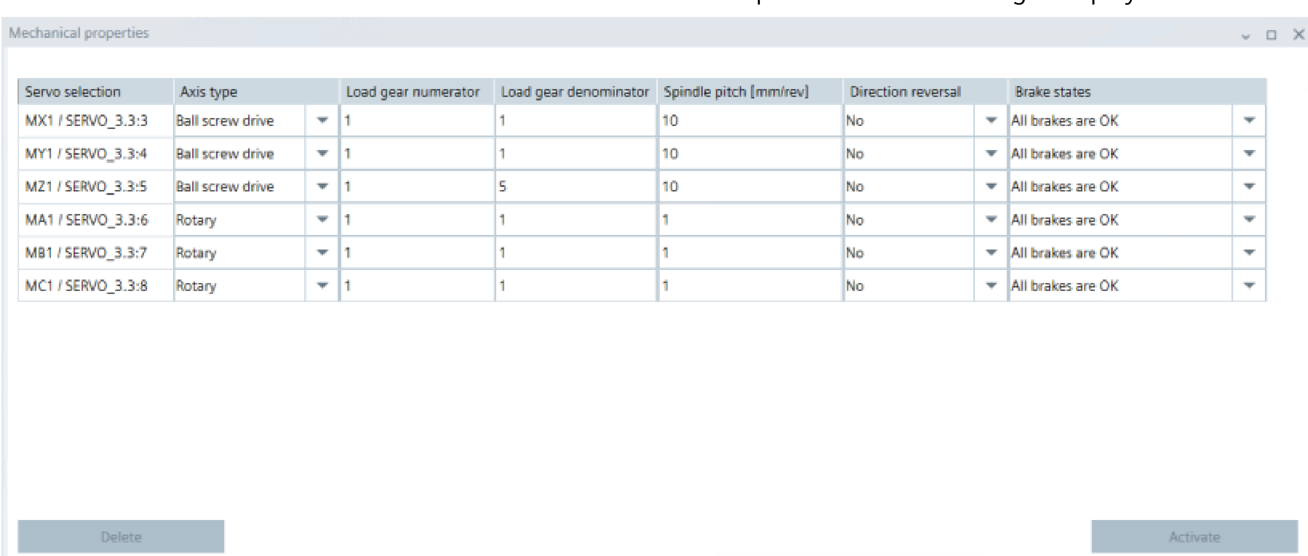


Figure 7-6 Changed parameters of the mechanical properties after activation

4. Alternatively, click on "Discard" if the newly configured parameters should not take effect.
   The original setup is displayed again.

Then, for an initial test, you can traverse the axes in JOG mode and compare the actual values of the motor encoder and load encoder.

See also

Mechanical properties basics (Page 145)

7.9.4 Brake states for "Safe Brake Test"

The diagnostic function "Safe Brake Test" (SBT)" checks the required holding torque of a brake (service or holding brake). You configure the "Safe Brake Test" during commissioning of Safety Integrated in the "SBT" Operate screen. In the "Mechanical properties" in the "Brake states" column, you define whether the brake to be tested should be defective or functional during the brake test.

You configure the "Safe Brake Test" in SINUMERIK Operate during Safety commissioning. For more information, refer to the *Safety Integrated Commissioning Manual*.

Brake states

For all configured drive objects (e.g. axes/spindles), you define the brake state in simulation mode via the drop-down list.

- Undefined
  State of the brake is not defined. This brake state is not used or should not be activated.
- All brakes are functional
  Configured internal and external brakes are functional. Select this state if you want to perform the brake test for the ideal case.
- Internal brake defective
  The internal brake (motor holding brake) is defective.
- External brake defective
  The external brake (e.g. brake on axis) is defective.

Ho to configure the brake state

1. Open the "Mechanical properties" viewlet.
2. Select the brake state in the "Brake states" column of the corresponding drive object (servo selection).
   The selected brake state is shown in color and italics.

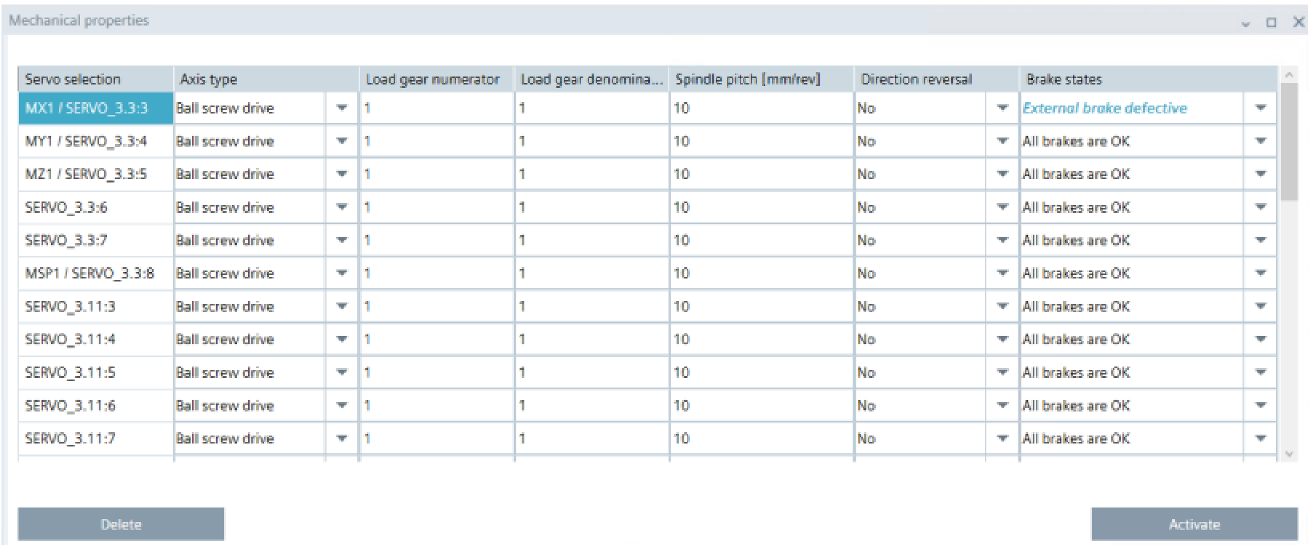


Figure 7-7 Configuring and activating brake states

3. If necessary, select additional brake states for other drive objects (servo selection).
4. Click on "Activate" to activate the selection.
   All selected brake states become effective and the selection is no longer displayed in color.
5. Alternatively, click on "Discard" if the newly configured brake states should not take effect.
   The original setup is displayed again.

You can then perform the "Safe Brake Test" with the new setup. If the brake is faulty, alarm 201784 "SBT brake test completed with errors" is output when the test is executed.

Note

To perform the brake test, you must select the brake on the drive object to be tested when commissioning Safety Integrated from "SBT". You then configure the brake state for the selected brakes in the corresponding "Brake states" column.

7.10 Exporting/importing SINAMICS drive data

7.10.1 Transferring drive data

Create MyVirtual Machine supports the commissioning of the drive-based Safety Integrated. Safety-relevant functions are included in the PLC and simDrive (DRV) components. The PLC data is transferred to the SINUMERIK ONE via the PLC archive or directly from the TIA Portal. For the exchange of drive data (SINAMICS parameters) between simDrive in Create MyVirtual Machine and the SINUMERIK ONE control, an export/import workflow is available from V1.2 (V6.15).

Note

Exported/imported drive parameters

For the data exchange, only relevant drive parameters and parameter indices are exported/imported that are used by the drive replacement component to simulate the Safety Integrated functions. Depending on the version of SINUMERIK Virtual CNC software, the scope of the exported/imported parameters and parameter indices can differ.

The scope of the exported/imported parameters and parameter indices of each drive (ServoDO) can be found in the corresponding "*.txt file" in the "export" folder of Create MyVirtual Machine. Only the parameters and parameter indices contained in the exported "*.txt files" are taken into account when importing.

The actual drive data of the machine project are only exported after the machine project was stopped using button  or the drive parameters were saved by the HMI. Changes to the drive data of the machine project being executed are only saved and only become current after a stop and/or saving in folder "export".

Software requirements

- Create MyVirtual Machine from V1.2
  Export/import of drive data as "*.txt files"
- Create MyConfig Diff from V6.2
  Integrating the "*.txt files" into the "*.dsf" archive
  Extracting the "*.txt files" from the "*.dsf" archive

Basic export/import procedure

When exporting/importing the drive data, a distinction is made between two use cases:

- Create MyVirtual Machine → SINUMERIK ONE
  Exporting safety-relevant drive data from the virtual machine project and importing it as an archive into the real machine with SINUMERIK ONE.
- SINUMERIK ONE → Create MyVirtual Machine
  Exporting modified drive data from the SINUMERIK ONE as an archive and import it into the machine project in Create MyVirtual Machine.

The drive data is not exchanged directly via the archive "*.dsf", but via "*.txt files" that are exported/imported by Create MyVirtual Machine. With Create MyConfig Diff, the "*.txt files" are integrated into the DSF archive for the SINUMERIK ONE, or extracted from the DSF archive.

New import format as of V1.3.2

For importing the drive data into Create MyVirtual Machine as of V1.3.2 (CNC software V6.22), the [PARAMETER] section from the "*.TEA files" can also be used. These files are created directly in SINUMERIK Operate and do not have to be extracted from the archive with Create MyConfig Diff. For the import, the files must be renamed according to the syntax for file names.

For more information on creating the drive data as "*.TEA", refer to the *SINUMERIK Operate online help*.

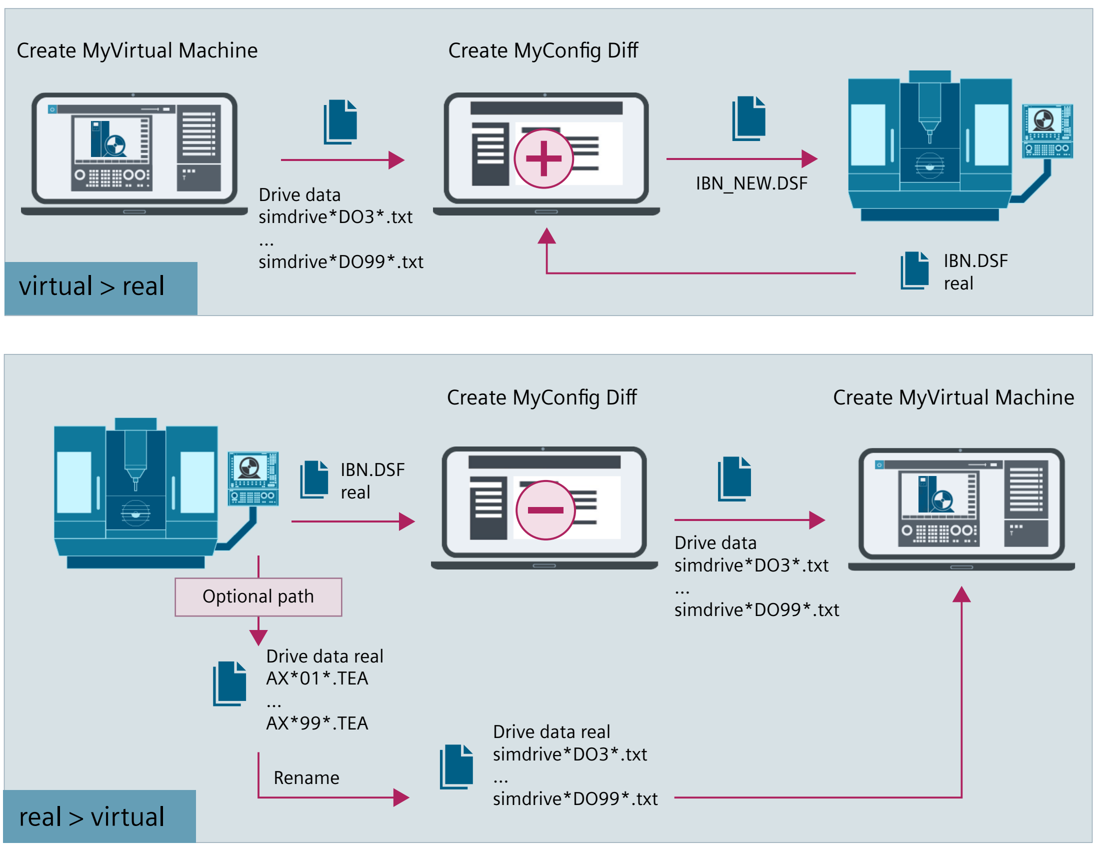


Figure 7-8 Exchanging drive data between Create MyVirtual Machine and SINUMERIK ONE

See also

Export/import format drive data file (Page 153)

Structure of drive data "*.txt file" (Page 154)

Export from CMVM to SINUMERIK ONE (Page 157)

Import to CMVM from SINUMERIK ONE (Page 160)

7.10.2 Export/import format drive data file

For the export/import of the drive data, Create MyVirtual Machine uses "*.txt files", which are stored in specific directories on the virtual memory card. The "*.txt files" have defined file names and a prescribed structure.

Note

Data from other directories, other folder names, or file names that do not comply with the rules will not be exported/imported. Note the case sensitivity and required syntax of the folder and file names.

Directories on virtual memory card

The folders are located under the following paths:

- **Export**
  C:\Users\<username>\AppData\Local\Siemens\Automation\SINUMERIK ONE\ncu\card\user\sinamics\data**export**
  Automatically created during export.
- **Import**
  C:\Users\<username>\AppData\Local\Siemens\Automation\SINUMERIK ONE\ncu\card\user\sinamics\data**import**
  Must be created before importing.

Structure of the "*.txt file names"

A "*.txt file" is used for each ServoDO object (axis). The file names have a fixed syntax. During export, the file names are generated automatically. When importing, you must follow the rules.

The file name has the following structure:

- **simdrive-B<bus number>_S<slave number>_DO<DO number>**<-DO name from P0199>.txt

The bold parts of the file name must match the syntax and must always be present. Only the freely selectable <-DO name...> is optional.

Placeholder/section	Meaning	Examples
`simdrive-`	The file name must begin with this string.	`simdrive-`
`B<bus number>`	The bus number is currently fixed and is always **3**. Other bus numbers are not supported.	`B3`
`_`	Underscore as separator.	`_`
`S<slave number>`	The slave number must have a value between 1-99.	`S3` `S15`
`_`	Underscore as separator.	`_`

Placeholder/section	Meaning	Examples
`DO<DO number>`	The DO number (DriveObject) must have a value between 3-99. **Note:** DO numbers DO1 and DO2 are assigned as default to CU, NX or ALM. Drive objects are only assigned to servo from DO3 and higher. As a consequence, for import/export, only "*.txt files" from DO3 are taken into consideration; DO1 and DO2 are not exported - or are ignored when importing.	`DO3` `DO12`
`<-DO name from P0199>`	Freely selectable string. For the string, only Windows-compliant characters must be used in file names. **Export** During export, the string from P0199 is automatically set and invalid characters are replaced by an underscore. In case of an error, the character is replaced by an exclamation mark.	`-SERVO_3_3_3`
`.txt`	File extension, must be *.txt.	`.txt`

Examples of rule-compliant file names

- `simdrive-B3_S3_DO3-SERVO_3_3_3.txt`
- `simdrive-B3_S3_DO8-SERVO_3_3_8.txt`
- `simdrive-B3_S5_DO12-COMMENT-AXIS-12.txt`
- `simdrive-B3_S12_DO8-comment_axis_8.txt`

Uniqueness of file names

The uniqueness of a file is controlled by the beginning of the file name via bus, slave and DO number. If the files differ only in the freely selectable string at the end of the file, they are recognized as **not** conforming to the rules during import and the import fails.

Note

There must be no *.txt files in a directory that have identical bus, slave and DO numbers.

Example of non-unique file names

- `simdrive-B3_S3_DO3-MY_COMMENT_1.txt`
- `simdrive-B3_S3_DO3-MY_COMMENT_2.txt`

7.10.3 Structure of drive data "*.txt file"

The structure of the "*.txt files" for the export/import of the drive data is predefined. A "*.txt file" contains the SINAMICS parameters for **one** ServoDO.

Rules for the structure

- Only the supported SINAMICS parameters with the supported indices are exported/imported. All unsupported parameters or indices of a parameter are ignored when importing the "*.txt file".

  Note

  The supported SINAMICS parameters and indices for each drive can be found in the corresponding export file of the respective drive in the ..\export folder. Note the section Exporting drive data (Page 157).

- The text file starts with an optional comment. Lines are interpreted as comments if they start with a semicolon ";" or hash mark "#".
- The first evaluated line is the section name. Two variants are allowed for the section name as of CMVM V1.3.2:
  - `[B<bus number>_S<device number>_PS<DO number>]`
    For files exported from CMVM or extracted via Create MyConfig, the section name is subject to the above syntax. This syntax corresponds to the standard up to version CMVM V1.3.2.
    The section name must be placed in square brackets and correlates with the file name. The bus number, device number and DO number in the file name and section name must match to permit a successful import.
    Example:
    File name: simdrive-B**3**_**S3**_DO**3**-SERVO_3_3_3.txt
    Section name: [B**3**_S**3**_PS**3**]
  - `[PARAMETER]`
    As of CMVM V1.3.2, drive data is also imported from the [PARAMETER] section. This section name is used when you import renamed "*.TEA files" with drive data as "*.txt files". For the assignment to a DriveObject DO, the section name is no longer used, but only the file name.

    Note

    Constraints for the [PARAMETER] section

    Additional rules apply to drive data in the [PARAMETER] section to ensure that they are imported without errors. Note the constraints in this section.

- Parameter values as HEX numbers are supported by default in the form `0x<numerical value>`. Further permissible formats for positive numerical values are `'H<numerical value>'` and `H<numerical value>`. The HEX number is of the type Integer or Boolean. The following forms are supported (using the HEX number 1 or -1 as an example):
  - 'H1'
  - H1
  - 0x1
  - -0x1
- Only index 0 is imported/exported from P1135 (P1135[0]).
- Parameters without index must not be represented with an index, e.g. `p9520=10.000000` as `p9520[0]=10.000000`.

- The import does not check whether the parameters are in the valid value range.
- If a parameter exists several times in an import file, the **first** parameter value is imported.
- If a parameter with index is present in the import file only without index, the import will be canceled with errors.

Constraints in dependencies of the section name

Note the following constraints depending on the section name `[B<bus number>_S<device number>_PS<DO number>]` or `[PARAMETER]`.

- If both sections are present in the import file, only the parameter from the [PARAMETER] section will be imported.
- Mixed forms with two sections are not supported, the parameters from the [PARAMETERS] section are always imported if it contains all supported parameters.
- For files with the [PARAMETER] section, the assignment to the DriveObject is only done via the file name.
- For files with the [PARAMETER] section, additional sections with other section names are allowed, but these are ignored during import.
- If there are several sections [PARAMETERS], then only the content of the first section will be evaluated. The contents of other sections [PARAMETERS] are ignored.

Example of a "*.txt file" with standard section names (incomplete)

```
; created by CMVM simDrive
[B3_S3_PS3]
p1135[0]=0.400000
p9320=10.000000
p9321[0]=1
p9321[1]=1
...
p9322[0]=1
...
p9322[7]=1
p9339[0]=0
p9339[1]=0
...
p9520=10.000000
...
```

Example of a "*.txt file" with section names [PARAMETER] (incomplete)

```
[SINUMERIK_HEADER]

#CONTENT=Sinamics_PS

...

[SINAMICS_HEADER]
VERSION=xxxxxxxx

...

[PARAMETER]
p5[0]=2
p5[1]=0
p6=4
p10=0
p13[0]=0
p13[1]=0
p13[2]=0
p13[3]=0
p13[4]=0
p13[5]=0
p13[6]=0
p13[7]=0
p13[8]=0
p13[9]=0

...

p9321[0]=1
p9321[1]=1
p9321[2]=1
p9321[3]=1
p9321[4]=1
p9321[5]=1
p9321[6]=1
p9321[7]=1
p9322[0]=1
p9322[1]=1
p9322[2]=1

...
```

7.10.4 Export from CMVM to SINUMERIK ONE

7.10.4.1 Exporting drive data from CMVM

Drive data is automatically exported to the virtual memory card when the drive parameters are saved. This is the case, for example, when the Create MyVirtual Machine machine project is stopped.

Requirement

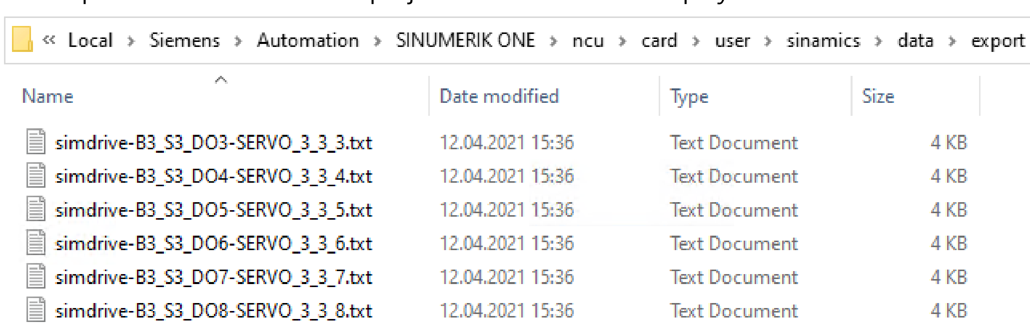
- The Create MyVirtual Machine machine project is open and has been started

How to export drive data

1. Click the button on the Create MyVirtual Machine menu bar.
   The simulation of the machine project is stopped, and current drive data in the machine project are written as "*.txt files" to the export directory on the virtual memory card.

NOTICE
Current "*.txt files" in folder "export"
The actual drive data of the machine project are only exported after the machine project was stopped using button or the drive parameters were saved by the HMI. Changes to the drive data of the machine project being executed are only saved and only become current after a stop and/or saving in folder "export".

2. Click on . The Windows Explorer opens with the storage location of the virtual memory card.
3. Navigate to the export directory.
   C:\Users\<username>\AppData\Local\Siemens\Automation\SINUMERIK ONE\ncu\card**user\sinamics\data\export**
   The exported "*.txt files" for all projected ServoDOs are displayed.



« Local › Siemens › Automation › SINUMERIK ONE › ncu › card › user › sinamics › data › export

Name	Date modified	Type	Size
simdrive-B3_S3_DO3-SERVO_3_3_3.txt	12.04.2021 15:36	Text Document	4 KB
simdrive-B3_S3_DO4-SERVO_3_3_4.txt	12.04.2021 15:36	Text Document	4 KB
simdrive-B3_S3_DO5-SERVO_3_3_5.txt	12.04.2021 15:36	Text Document	4 KB
simdrive-B3_S3_DO6-SERVO_3_3_6.txt	12.04.2021 15:36	Text Document	4 KB
simdrive-B3_S3_DO7-SERVO_3_3_7.txt	12.04.2021 15:36	Text Document	4 KB
simdrive-B3_S3_DO8-SERVO_3_3_8.txt	12.04.2021 15:36	Text Document	4 KB

Figure 7-9 Export directory on the virtual memory card for drive data. In the example there are six ServoDOs in the project.

Note

The valid structure and scope of the exported SINAMICS parameters of each drive (ServoDO) can be found in the corresponding "*.txt files" in the "export" folder of Create MyVirtual Machine.

Further procedure

In the next step, you integrate the exported drive data into a "*.dsf archive" of a SINUMERIK ONE using Create MyConfig Diff.

7.10.4.2 Integrating drive data in a DSF archive

You integrate exported drive data into a "*.dsf archive" using Create MyConfig Diff.

Requirement

- Drive data is stored as "*.txt" in the correct format
- Create MyConfig Diff is opened

How to integrate drive data

1. In Create MyConfig Diff, open the "*.dsf archive" in which you want to integrate the drive data.
   The archive is displayed in the "Data view" tab.

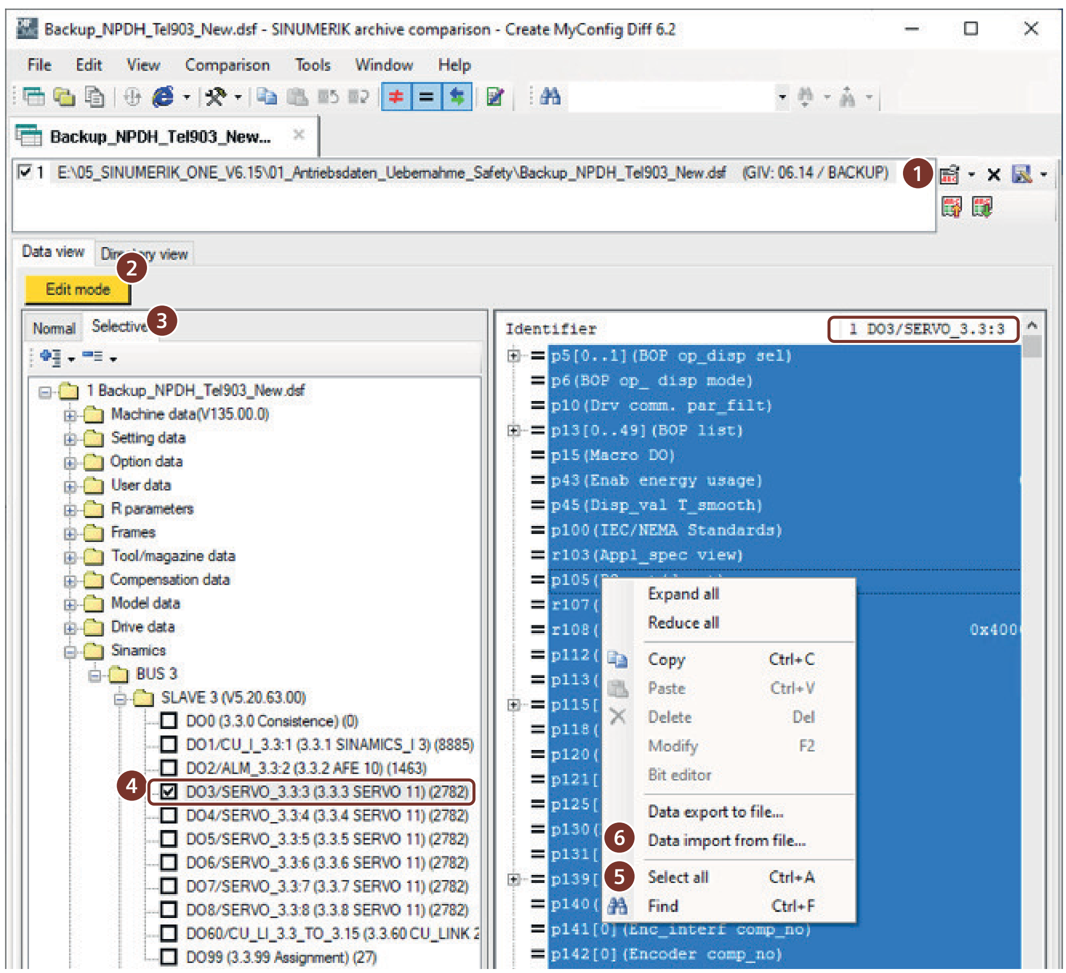


Figure 7-10 Integrating drive data into a DSF archive via Create MyConfig Diff

2. Activate the "Edit mode".
3. Select the "Selective" tab.

4. In the "Sinamics" folder, navigate to the ServoDO in which you want to integrate the drive data and click on the entry.
   The right pane displays a tabular view of the parameters with values. The name of the selected entry is displayed in the right column in the table header. "DO3*" in the example.
5. Click in the table and choose "Select all" in the shortcut menu.
6. Select "Data import from file..." in the shortcut menu.
7. Navigate to the "*.txt file" you want to integrate in the selected ServoDO and confirm with "Open".
   A preview window with the existing and the new values is displayed. Parameters with different values are marked in blue.
8. Click "OK".
   The parameters of the selected ServoDO are overwritten with the new values from the "*.txt file". Unchanged parameters in the DSF archive are retained.
9. Repeat steps 4-8 for all ServoDOs in which you want to integrate the new drive data.
10. Select "File > Save" or "File > Save as..." from the menu to save the DSF archive with the new values.

NOTICE
Copying SI data and confirming SI data
In the modified DSF archive, only a few safety parameters of the second monitoring channel are assigned values from Create MyVirtual Machine. After reading in the DSF archive, you must therefore first perform "Copy SI data" and "Confirm SI data" in SINUMERIK Operate.

Further procedure

In the next step, you read the modified DSF archive into the real SINUMERIK ONE. The drive data from the machine project of Create MyVirtual Machine can be used for further commissioning.

7.10.5 Import to CMVM from SINUMERIK ONE

7.10.5.1 Extracting drive data from a DSF archive

You can extract the drive data as "*.txt files" from a DSF archive of a real SINUMERIK ONE using Create MyConfig Diff.

Requirement

- The DSF archive has been stored
- Create MyConfig Diff is opened

How to extract drive data

1. In Create MyConfig Diff, open the "*.dsf archive" from which you want to extract the drive data.
   The archive is displayed in the "Data view" tab.

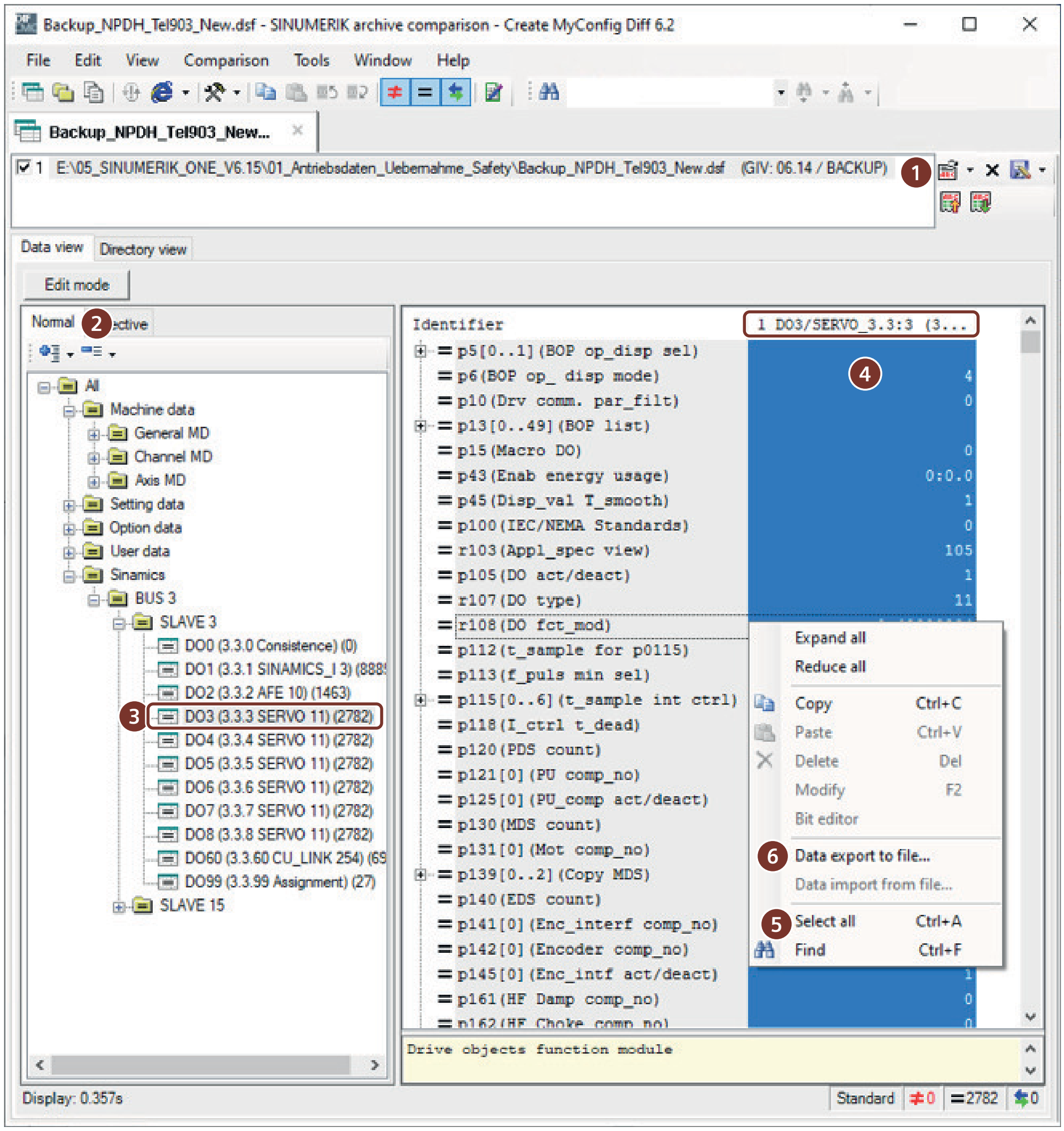


Figure 7-11   Extracting drive data from a DSF archive as "*.txt" with Create MyConfig Diff

2. Select the "Normal" tab.
3. In the "Sinamics" folder, navigate to the ServoDO from which you want to extract the drive data and click on the entry.
   The right pane displays a tabular view of the parameters with values. The name of the selected entry is displayed in the right column in the table header. "DO3*" in the example.
4. In the table, click in the **second** column with the parameter values.

5. Choose "Select all" in the shortcut menu.
   The first column "Identifier" will be highlighted in gray and the second column with the values will be highlighted in blue. Only with this marking do the parameters in the "*.txt file" have the correct formatting.
   - **Correct:**
     `p1135[0]=0.400000  ;OFF3 t_RD`
   - **Incorrect:**
     `p1135[0] (OFF3 t_RD) 0.400000`
6. Select "Data export to file..." in the shortcut menu.
7. Select an export directory and enter a file name.
   Note the syntax for file names (Page 153) if you want to import the drive data back into Create MyVirtual Machine.
8. Click "OK".
   The parameters of the selected ServoDO are saved as a "*.txt file".
9. Repeat steps 3-8 for all ServoDOs you want to extract.

Further procedure

In the next step, import the "*.txt files" into Create MyVirtual Machine.

7.10.5.2 Using drive data from "*.TEA files"

You can save the drive data as a "*.TEA file" from a real SINUMERIK ONE. You can import the drive data of the adapted "*.TEA files" to Create MyVirtual Machine.

Requirement

- "*.TEA files" are stored locally

How to prepare the "*.TEA files" for importing

1. Open the "*.TEA file" in a text editor.
2. In the first section you will find, for example, the bus and device number of the exported DriveObject. You can use this as a specification for the file name if the real topology is identical to the virtual topology. If the topology is not identical, you must adapt the file names according to the virtual topology.
   ```
   [SINUMERIK_HEADER]
   #CONTENT=Sinamics_PS
   #BUS=3
   #DEVICE=3
   #DOTYPEID=11
   #DOID=4
   ```

   Note

   Comments in the file (#...) are ignored during import.

3. Check if the [PARAMETER] section is present.

   Note

   The section name [PARAMETER] must not be changed.

4. Close the file.
5. Rename the files according to the syntax for file names (Page 153). The file extension **must be** "*.txt".
   simdrive-B<bus number>_S<device number>_DO<DO number>*.txt

   Note

   Only the file name serves as an assignment to the DriveObject during import. The information in the [SINUMERIK HEADER] is ignored. Note that the file names must correspond to the virtual topology. Adapt the bus number, device number and DO number accordingly.

6. Repeat the steps for all "*.TEA files" you want to import as "*.txt file".

Further procedure

In the next step, import the "*.txt files" into Create MyVirtual Machine.

See also

Difference between real and virtual topology (Page 166)

7.10.5.3 Importing drive data into CMVM

Drive data is automatically imported from the import directory of the virtual memory card when the drive is switched on or reset. If an error occurs during the import, the import is canceled and any drive data imported so far is discarded.

Requirement

- The Create MyVirtual Machine machine project is open and **not yet** started.
- The corresponding ServoDOs must be available in the machine project. This means that the hardware configuration must already have been loaded from the TIA Portal into the machine project. In this case the ServoDOs (drive objects) are included in the machine project.
- The "*.txt files" for importing are stored in the directory **...\user\sinamics\data\import** on the virtual memory card and comply with the specifications. (Page 154).

How to import drive data

1. Click on . The Windows Explorer opens with the storage location of the virtual memory card.
2. Navigate to the import directory and check the stored "*.txt files".

   Note

   The valid structure and scope of the imported SINAMICS parameters of each drive (ServoDO) can be found in the corresponding exported "*.txt file" in the "export" folder of Create MyVirtual Machine.

   ---
3. Click to start the simulation of the machine.
   When the machine is started, the values of the relevant SINAMICS parameters are imported from the text files. Only files with the extension *.txt are considered during import. Any other files are ignored.
   - Import successful
     After the import, the directory is renamed to import.done_<date>_<time>.
   - Import successful, but directory is empty, or files with invalid file name exist
     After the import, the directory is renamed to import.done_<date>_<time>. Files with invalid names are ignored.
   - Import failed
     After the failed import, the directory is renamed to import.failed_<Date>_<Time>. Already imported data will be discarded and no file will be imported.

   After the import, a log file "import.log" (Page 164) is saved in the import directory.

   Note

   The directory is renamed only if Windows allows renaming. Renaming is not possible, for example, if a "*.txt file" is open in another program (e.g. Editor).

   ---
4. Check if the directory was renamed and the import was successful.
5. Check the log file to see if any errors occurred during import.
6. Copy the Safety Integrated data via "Copy SI data" into the second channel.

NOTICE
"Copy SI data" necessary
Only a few Safety parameters of the second monitoring channel are imported. After the import, you should therefore first perform "Copy SI data" in SINUMERIK Operate to adjust the parameters.
7. Check whether the Safety parameters have been copied into the second monitoring channel.
8. Save the machine project after the successful import.

7.10.5.4 Logging the import (import.log)

When importing the drive data, any errors that occurred and the read "*.txt file" are logged in the log file "import.log" for each "*.txt file". The log file is saved in the "import" folder.

Structure of the "import.log" based on a sample file

The log file is structured as follows:

1. Segment
   Specification of the product
2. Segment
   In this segment, all imported drive data are listed with bus, device, DO numbers with directory and file names. Successfully read "*.txt files" are marked with "is being read" at the end.
3. Segment
   Final message indicating whether the import was successful or failed, with date and time.

Example of a log file with successful import

```
; created by CMVM simDrive

...

B3 S3 DO3: File C:\Users\...\import\simdrive-B3_S3_DO3-
SERVO_3_3_3.txt is being read

B3 S3 DO4: File C:\Users\...\import\simdrive-B3_S3_DO4-
SERVO_3_3_4.txt is being read

...

done 2021-03-29 10:02:42

...

B3 S3 DO3: File C:\Users\ … \import\simdrive-B3_S3_DO3-
SERVO_3_3_3.txt

            --> parameters from section [B3_S3_PS3] were processed
successfully

B3 S3 DO4: File C:\Users\ … \import\simdrive-B3_S3_DO4-
SERVO_3_3_4.txt

            --> parameters from section [B3_S3_PS4] were processed
successfully

...
```

Messages and their meaning

Errors or a successful import are logged in the log file with an English message text.

Message	Meaning
`is being read`	The file has been read. However, if an error subsequently occurs, the import is canceled and any drive data imported so far is discarded.
`Error`	An error occurred while importing the data. The error message is usually followed by a more detailed description of the error, e.g. "The dimension of the parameter p1135[0] is wrong, [0] is missing". Check the corresponding files.

Message	Meaning
`Internal Error`	An internal error has occurred. The error message is usually followed by a more detailed description of the error. If the error occurs again during the next import attempt, contact Technical Support.
`done <date, time>`	Import completed. All listed files have been imported.
`were processed successfully`	The file was read and the parameters were imported successfully.
`done <date, time>` `Warning! No Files were imported!`	The import directory was empty or the file names were not correct. No file was imported. Check the directory and the file names.
`failed <date, time>` `No Files were imported!`	Import failed. No file was imported. Check the files.

7.10.6 Constraints and tips

7.10.6.1 Difference between real and virtual topology

If the real topology of the project differs from the virtual topology specifications, you must adapt the files before importing.

Adapting the import files

- Adjust the file name and section name according to the specifications.
  Observe the specifications for the DO number in the section Export/import format drive data file (Page 153).
- For files with the [PARAMETER] section, you only need to adapt the file name.
- The bus number has a fixed value of 3.
- You adapt the device and DO number from the real to the virtual project.

Example of adapting the names of "*.txt files" and section names

In the following example, the names of the "*.txt drive data" of the real topology are renamed according to the virtual topology and the section name is adapted as an example for a "*.txt file". After renaming and adapting the section name of all files, the "*.txt files" can be imported into Create MyVirtual Machine.

Note

Section name for "*.TEA files"

If you use renamed "*.TEA files", you must not change the section name [PARAMETER]. The assignment is **only** performed through the file name e.g. simdrive-**B3_S3_DO5**-X1_00.txt.

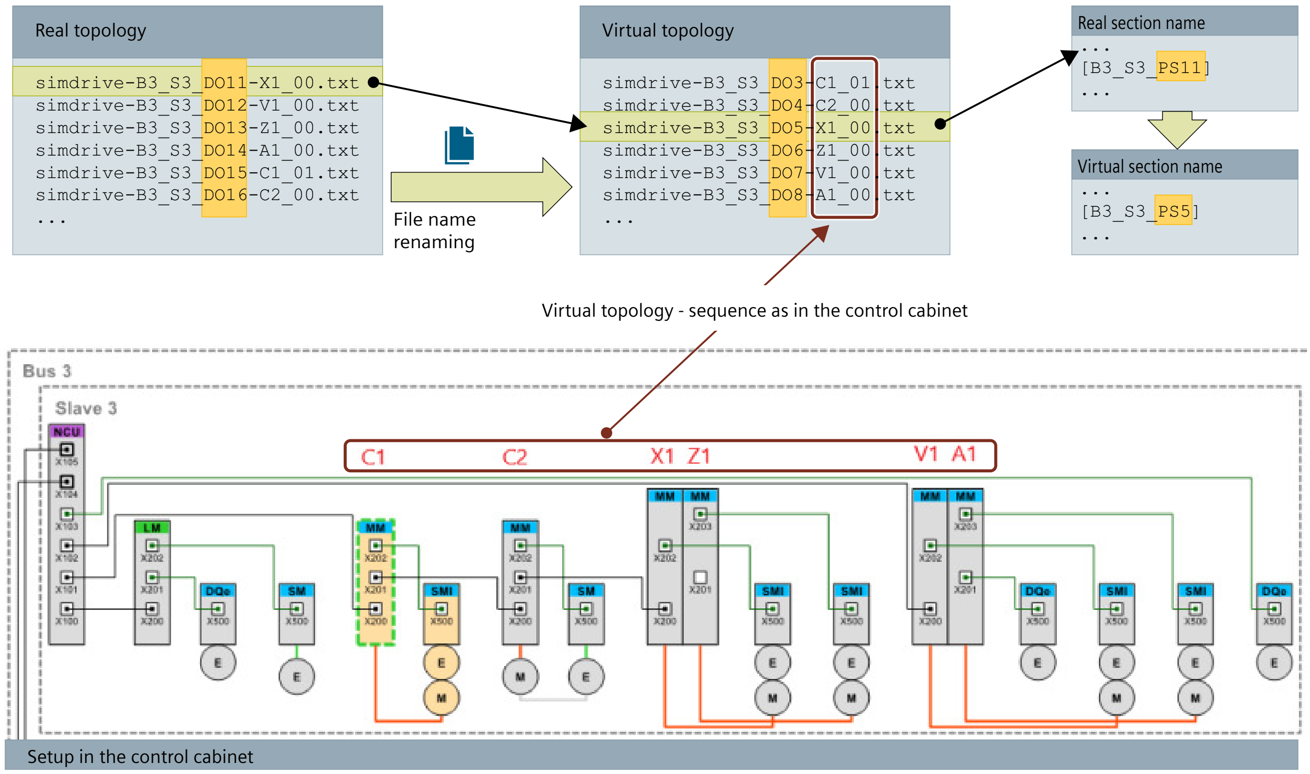


Figure 7-12 Example: Renaming "*.txt files" from real topology to virtual topology before importing into Create MyVirtual Machine

See also

Export/import format drive data file (Page 153)

7.10.6.2 Number of encoder data sets

Create MyVirtual Machine only supports two encoder data sets in the machine project.

Rules relating to encoder data sets

The following rules apply for export from or import in Create MyVirtual Machine regarding encoder data sets.

- A maximum of two encoder data sets is supported, and only two can be configured.
- Parameter p0140 is checked when exporting. This must have a value = 2. The export is canceled for other values.
- When exporting, for parameters P04xy, only the values for indices [0] and [1] are exported. Values for indices > 1 are not exported.

- When importing, for parameters P04xy, only the values for indices [0] and [1] are imported, depending on which are available in the import file.
- If you are using more than two encoder data sets at the real machine (SINUMERIK ONE), you can only import the first two encoder data sets into the virtual machine project (Create MyVirtual Machine).

7.10.6.3 Copying encoder data when running up

When the drive runs up, encoder data values are copied to the corresponding safety parameters. Depending on whether the safety functions (SI Motion) are activated or deactivated, take into account the following system response.

Safety functions deactivated (p9501=0)

- Each time the system runs up, the values of some encoder parameters are copied to the corresponding safety parameters (e.g. P0407[0] to p9517).
- If p9501=0 is set in the import file, then this copy operation is also carried out after the parameter import. This means that the imported values of these parameters are overwritten again by the copy operation.
  This is also the case if p9501 is not included in the import file; however, in the project parameter p9501=0
- Different from the real drive, when copying encoder data when running up, the values of encoder parameters are also copied to the corresponding safety parameters of the second channel, e.g. values from p0407[x] to p9517 and p9317.

Safety functions activated (p9501>0)

When safety functions are active, the encoder parameters are not checked that they match the corresponding safety parameters, as is the case with the real drive. No encoder data is copied to the corresponding safety parameters.

Unwanted parameter changes due to import

NOTICE
If there are "*.txt files" in the import directory **...\user\sinamics\data\import** on the virtual memory card, these are imported first before the drive starts up. If in the imported drive data the values of parameters differ from the saved machine project, e.g. p9501=1 in the import file, then, for example, safety functions are active and the behavior of the drive does not correspond to the expected behavior. Therefore, check whether parameter values have been changed unintentionally by the import.

7.10.6.4 Switching between CMVM and RMVM (as of V1.3.2)

You can switch or change over between the Create MyVirtual Machine and Run MyVirtual Machine applications as of Version 1.3.2. Observe the following tips for exporting/importing SINAMICS drive data when switching between applications.

Tips for drive data export/import when changing the application

- Drive data is exported/imported only in Create MyVirtual Machine.
- Stop and start the machine project if no more SINAMICS drive data is exported/imported as "*.txt" in Create MyVirtual Machine after a performed change of applications. After performing the restart, the drive data is exported again when the machine project is stopped and imported when it is restarted.

7.11 Modular machine

7.11.1 Maximum configuration and modularization

Basic machine with maximum configuration

In this case, a machine consists of a basic machine with several machine modules or several axes. The user configures and programs the base machine with all possible machine modules and axes (maximum configuration).

The simulated machine differs from the configured maximum configuration, e.g.:

- Not all configured machine modules or axes are available.
  (actual structure differs from configured structure).
- Not all machine modules or axes are required in an operating phase.

This is especially the case for axes that are not required and the drive objects configured with them can be implemented by deactivating the drive objects.

7.11.2 Deactivating drive objects

From version SINUMERIK Virtual CNC-SW 6.15 SP1, drive objects in the machine project can be deactivated for simulation. For example, this is the case if a reduced maximum configuration is to be tested. In the simulation mode, deactivated drive objects do not require any computational performance.

This is how you deactivate drive objects

1. In SINUMERIK Operate, in operating area Commissioning, open the drive parameters for the drive object (ServoDO) that is to be deactivated.
2. Set parameter p0105 to a value of 0 or 2.

   Note

   For the simulation mode, there is no difference between a value of 0 or 2. When exporting the drive data for a real SINUMERIK ONE, observe the correct configuring and the effects on the system response. More information can be found in the documentation on the corresponding parameters.

3. Perform a POWER ON. A change to this parameter only becomes effective after POWER ON. Check parameter r0106, as to whether the drive object is deactivated.
4. Save the machine project.

7.12 Tips for commissioning

7.12.1 Starting position axes (encoder) when switching on

The starting position of the axes when the machine is switched on depends on some machine data and drive parameters. Depending on the current values, a distinction is made between the following cases.

Simulated axis

If the machine data has the following values:

- MD30240 $MA_ENC_TYPE = 0
- MD34200 $MA_ENC_REFP_MODE = 0

⇒ The starting position for the simulated encoder corresponds to the value of MD34100 $MA_REFP_SET_POS. The sign of the starting position depends on the value MD32100 $MA_AX_MOTION_DIR.

Note

Gear ratio 1:1 with simulated axis

To enable referencing with simulated axes, the gear ratio for the axis machine data must be set to the following values:

- MD31050 $MA_DRIVE_AX_RATIO_DENOM = 1
- MD31060 $MA_DRIVE_AX_RATIO_NUMERA = 1

Absolute encoder

If the machine data and drive parameters have the following values

- MD30240 $MA_ENC_TYPE = 4
- MD34200 $MA_ENC_REFP_MODE = 1
- p404 Bit1 = 1

⇒ For an absolute encoder, the starting position of the axes corresponds to the reference position if the machine was referenced immediately after being switched on. The starting position is not defined if referencing was performed after an axis was already traversed. This is the reason that referencing should always be performed immediately after switching on.

Raw signal encoder

If the machine data has the following values:

- MD30240 $MA_ENC_TYPE = 1
- MD34200 $MA_ENC_REFP_MODE = 1
- MD34210 $MA_ENC_REFP_STATE = 0

⇒ The starting position is 0.

If the machine data has the following values:

- MD30240 $MA_ENC_TYPE = 1
- MD34200 $MA_ENC_REFP_MODE = 1
- MD34210 $MA_ENC_REFP_STATE = 2

⇒ The starting position corresponds to the position at which the machine was switched off.

7.13 Standard telegram configuration of a SINUMERIK ONE

7.13.1 SINUMERIK-conformal telegram configuring

Rules for SINUMERIK-conformal telegram configuring of SINAMICS drives

To configure the data exchange between a SINUMERIK 828D, SINUMERIK ONE or SINUMERIK MC and SINAMICS S120 drives, the following rules must be observed for the PROFIBUS/PROFINET configuration of the drives:

- For SINAMICS drive devices (CU3xx) on PROFIBUS/PROFINET, the PROFIBUS/PROFINET configuration must be identical to the standard configuration of the telegrams of the drives on the integrated PROFIBUS (SINAMICS Integrated or NX) of a SINUMERIK 828D or SINUMERIK ONE with regard to the telegrams structure.
- The identical structure of the telegrams refers specifically to the sequence of telegrams for a drive (CU3xx). The telegrams must be configured in the following order:
  - Telegrams for SERVO or HLA drive objects
  - Telegram for the Control Unit drive object
  - Telegram for the infeed drive object
- The following rules must be observed for the telegrams of the individual drive objects:
  - The input and output address of a telegram must have the same value.
    Exception: User-specific telegrams that only have input or output values.
  - The input and output data of a telegram are generally transferred via the same slot. If two different slots are used for data exchange (for PROFIBUS or PROFIBUS Integrated), make sure that the input slot is defined first. The output slot must have the following slot number.

7.13.2 PROFIdrive telegrams for standard data

The I/O addresses of standard telegrams are compared to the following telegram configurations in the following:

- SINUMERIK ONE
- SINUMERIK 840D sl

Table 7-1 SINAMICS Integrated: I/O addresses of PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis01	SIEMENS telegram 136	4100	4100	13050[0]	13060[0]
DriveAxis02	SIEMENS telegram 136	4140	4140	13050[1]	13060[1]
DriveAxis03	SIEMENS telegram 136	4180	4180	13050[2]	13060[2]
DriveAxis04	SIEMENS telegram 136	4220	4220	13050[3]	13060[3]

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis05	SIEMENS telegram 136	4260	4260	13050[4]	13060[4]
DriveAxis06	SIEMENS telegram 136	4300	4300	13050[5]	13060[5]
DriveCU01	SIEMENS telegram 391	6500	6500	13120[0]	-
Infeed01	SIEMENS telegram 370	6514	6514	-	-

Table 7-2 NX on DRIVE-CLiQ socket X105; DP address 15: I/O addresses of PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis07	SIEMENS telegram 136	4340	4340	13050[6]	13060[6]
DriveAxis08	SIEMENS telegram 136	4380	4380	13050[7]	13060[7]
DriveAxis09	SIEMENS telegram 136	4420	4420	13050[8]	13060[8]
DriveAxis10	SIEMENS telegram 136	4460	4460	13050[9]	13060[9]
DriveAxis11	SIEMENS telegram 136	4500	4500	13050[10]	13060[10]
DriveAxis12	SIEMENS telegram 136	4540	4540	13050[11]	13060[11]
DriveCU02	SIEMENS telegram 390	6530	6530	-	-
Infeed02	SIEMENS telegram 370	6534	6534	-	-

Table 7-3 NX on DRIVE-CLiQ socket X104; DP address 14: I/O addresses of PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis13	SIEMENS telegram 136	4580	4580	13050[12]	13060[12]
DriveAxis14	SIEMENS telegram 136	4620	4620	13050[13]	13060[13]
DriveAxis15	SIEMENS telegram 136	4660	4660	13050[14]	13060[14]
DriveAxis16	SIEMENS telegram 136	4700	4700	13050[15]	13060[15]
DriveAxis17	SIEMENS telegram 136	4740	4740	13050[16]	13060[16]
DriveAxis18	SIEMENS telegram 136	4780	4780	13050[17]	13060[17]
DriveCU03	SIEMENS telegram 390	6540	6560	-	-
Infeed03	SIEMENS telegram 370	6544	6554	-	-

Table 7-4 NX on DRIVE-CLiQ socket X103; DP address 13: I/O addresses of PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis19	SIEMENS telegram 136	4820	4820	13050[18]	13060[18]
DriveAxis20	SIEMENS telegram 136	4860	4860	13050[19]	13060[19]
DriveAxis21	SIEMENS telegram 136	4900	4900	13050[20]	13060[20]
DriveAxis22	SIEMENS telegram 136	4940	4940	13050[21]	13060[21]
DriveAxis23	SIEMENS telegram 136	4980	4980	13050[22]	13060[22]
DriveAxis24	SIEMENS telegram 136	5020	5020	13050[23]	13060[23]
DriveCU04	SIEMENS telegram 390	6550	6590	-	-
Infeed04	SIEMENS telegram 370	6554	6574	-	-

Table 7-5 NX on DRIVE-CLiQ socket X102; DP address 12: I/O addresses of PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis25	SIEMENS telegram 136	5060	5060	13050[24]	13060[24]
DriveAxis26	SIEMENS telegram 136	5100	5100	13050[25]	13060[25]
DriveAxis27	SIEMENS telegram 136	5140	5140	13050[26]	13060[26]
DriveAxis28	SIEMENS telegram 136	5180	5180	13050[27]	13060[27]
DriveAxis29	SIEMENS telegram 136	5220	5220	13050[28]	13060[28]
DriveAxis30	SIEMENS telegram 136	5260	5260	13050[29]	13060[29]
DriveCU05	SIEMENS telegram 390	6560	6620	-	-
Infeed05	SIEMENS telegram 370	6564	6594	-	-

Table 7-6 NX on DRIVE-CLiQ socket X101; DP address 11: I/O addresses of PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis31	SIEMENS telegram 136	5300	5300	13050[30]	13060[30]
DriveAxis32	SIEMENS telegram 136	5340	5340	-	-
DriveAxis33	SIEMENS telegram 136	5380	5380	-	-
DriveAxis34	SIEMENS telegram 136	5420	5420	-	-
DriveAxis35	SIEMENS telegram 136	5460	5460	-	-
DriveAxis36	SIEMENS telegram 136	5500	5500	-	-
DriveCU06	SIEMENS telegram 390	6570	6650	-	-
Infeed06	SIEMENS telegram 370	6574	6614	-	-

Table 7-7 NX on DRIVE-CLiQ socket X100; DP address 10: I/O addresses of PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)
DriveAxis37	SIEMENS telegram 136	5540	5540
DriveAxis38	SIEMENS telegram 136	5580	5580
DriveAxis39	SIEMENS telegram 136	5620	5620
DriveAxis40	SIEMENS telegram 136	5660	5660
DriveAxis41	SIEMENS telegram 136	5700	5700
DriveAxis42	SIEMENS telegram 136	5740	5740
DriveCU07	SIEMENS telegram 390	6580	6680
Infeed07	SIEMENS telegram 370	6584	6634

7.13.3 PROFIsafe/PROFIdrive telegrams for Safety Integrated (F-PLC)

The I/O addresses of safety-relevant telegrams are compared to the following telegram configurations in the following:

- SINUMERIK ONE
- SINUMERIK 840D sl

From the firmware versions of SINUMERIK ONE, the I/O addresses of SIEMENS telegram 903 no longer have to be entered in the machine data. The corresponding item in the 840D sl machine data is therefore not imported to the SINUMERIK ONE during the SINUMERIK archive migration.

Table 7-8 SINAMICS Integrated: I/O addresses of PROFIsafe/PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis01	SIEMENS telegram 903	6700	1008	-	-
DriveAxis01	SIEMENS telegram 701	5800	5800	13374[0]	13376[0]
DriveAxis02	SIEMENS telegram 903	6716	992	-	-
DriveAxis02	SIEMENS telegram 701	5816	5816	13374[1]	13376[1]
DriveAxis03	SIEMENS telegram 903	6732	976	-	-
DriveAxis03	SIEMENS telegram 701	5832	5832	13374[2]	13376[2]
DriveAxis04	SIEMENS telegram 903	6748	960	-	-
DriveAxis04	SIEMENS telegram 701	5848	5848	13374[3]	13376[3]
DriveAxis05	SIEMENS telegram 903	6764	944	-	-
DriveAxis05	SIEMENS telegram 701	5864	5864	13374[4]	13376[4]
DriveAxis06	SIEMENS telegram 903	6780	928	-	-
DriveAxis06	SIEMENS telegram 701	5880	5880	13374[5]	13376[5]

Table 7-9 NX on DRIVE-CLiQ socket X105; DP address 15: I/O addresses of PROFIsafe/PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis07	SIEMENS telegram 903	6796	912	-	-
DriveAxis07	SIEMENS telegram 701	5896	5896	13374[6]	13376[6]
DriveAxis08	SIEMENS telegram 903	6812	896	-	-
DriveAxis08	SIEMENS telegram 701	5912	5912	13374[7]	13376[7]
DriveAxis09	SIEMENS telegram 903	6828	880	-	-
DriveAxis09	SIEMENS telegram 701	5928	5928	13374[8]	13376[8]
DriveAxis10	SIEMENS telegram 903	6844	864	-	-
DriveAxis10	SIEMENS telegram 701	5944	5944	13374[9]	13376[9]
DriveAxis11	SIEMENS telegram 903	6860	848	-	-
DriveAxis11	SIEMENS telegram 701	5960	5960	13374[10]	13376[10]
DriveAxis12	SIEMENS telegram 903	6876	832	-	-
DriveAxis12	SIEMENS telegram 701	5976	5976	13374[11]	13376[11]

Table 7-10 NX on DRIVE-CLiQ socket X104; DP address 14: I/O addresses of PROFIsafe/PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis13	SIEMENS telegram 903	6892	816	-	-
DriveAxis13	SIEMENS telegram 701	5992	5992	13374[12]	13376[12]
DriveAxis14	SIEMENS telegram 903	6908	800	-	-
DriveAxis14	SIEMENS telegram 701	6008	6008	13374[13]	13376[13]
DriveAxis15	SIEMENS telegram 903	6924	784	-	-
DriveAxis15	SIEMENS telegram 701	6024	6024	13374[14]	13376[14]
DriveAxis16	SIEMENS telegram 903	6940	768	-	-
DriveAxis16	SIEMENS telegram 701	6040	6040	13374[15]	13376[15]
DriveAxis17	SIEMENS telegram 903	6956	752	-	-
DriveAxis17	SIEMENS telegram 701	6056	6056	13374[16]	13376[16]
DriveAxis18	SIEMENS telegram 903	6972	736	-	-
DriveAxis18	SIEMENS telegram 701	6072	6072	13374[17]	13376[17]

Table 7-11 NX on DRIVE-CLiQ socket X103; DP address 13: I/O addresses of PROFIsafe/PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis19	SIEMENS telegram 903	6988	720	-	-
DriveAxis19	SIEMENS telegram 701	6088	6088	13374[18]	13376[18]
DriveAxis20	SIEMENS telegram 903	7004	704	-	-
DriveAxis20	SIEMENS telegram 701	6104	6104	13374[19]	13376[19]
DriveAxis21	SIEMENS telegram 903	7020	688	-	-
DriveAxis21	SIEMENS telegram 701	6120	6120	13374[20]	13376[20]
DriveAxis22	SIEMENS telegram 903	7036	672	-	-
DriveAxis22	SIEMENS telegram 701	6136	6136	13374[21]	13376[21]
DriveAxis23	SIEMENS telegram 903	7052	656	-	-
DriveAxis23	SIEMENS telegram 701	6152	6152	13374[22]	13376[22]
DriveAxis24	SIEMENS telegram 903	7068	640	-	-
DriveAxis24	SIEMENS telegram 701	6168	6168	13374[23]	13376[23]

Table 7-12 NX on DRIVE-CLiQ socket X102; DP address 12: I/O addresses of PROFIsafe/PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis25	SIEMENS telegram 903	7084	624	-	-
DriveAxis25	SIEMENS telegram 701	6184	6184	13374[24]	13376[24]
DriveAxis26	SIEMENS telegram 903	7100	608	-	-
DriveAxis26	SIEMENS telegram 701	6200	6200	13374[25]	13376[25]
DriveAxis27	SIEMENS telegram 903	7116	592	-	-
DriveAxis27	SIEMENS telegram 701	6216	6216	13374[26]	13376[26]
DriveAxis28	SIEMENS telegram 903	7132	576	-	-
DriveAxis28	SIEMENS telegram 701	6232	6232	13374[27]	13376[27]
DriveAxis29	SIEMENS telegram 903	7148	560	-	-
DriveAxis29	SIEMENS telegram 701	6248	6248	13374[28]	13376[28]
DriveAxis30	SIEMENS telegram 903	7164	544	-	-
DriveAxis30	SIEMENS telegram 701	6264	6264	13374[29]	13376[29]

Table 7-13 NX on DRIVE-CLiQ socket X101; DP address 11: I/O addresses of PROFIsafe/PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis31	SIEMENS telegram 903	7180	528	-	-
DriveAxis31	SIEMENS telegram 701	6280	6280	13374[30]	13376[30]
DriveAxis32	SIEMENS telegram 903	7196	512	-	-
DriveAxis32	SIEMENS telegram 701	6296	6296	-	-
DriveAxis33	SIEMENS telegram 903	7212	496	-	-
DriveAxis33	SIEMENS telegram 701	6312	6312	-	-
DriveAxis34	SIEMENS telegram 903	7228	480	-	-
DriveAxis34	SIEMENS telegram 701	6328	6328	-	-
DriveAxis35	SIEMENS telegram 903	7244	464	-	-
DriveAxis35	SIEMENS telegram 701	6344	6344	-	-
DriveAxis36	SIEMENS telegram 903	7260	448	-	-
DriveAxis36	SIEMENS telegram 701	6360	6360	-	-

Table 7-14 NX on DRIVE-CLiQ socket X100; DP address 10: I/O addresses of PROFIsafe/PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)
DriveAxis37	SIEMENS telegram 903	7276	432
DriveAxis37	SIEMENS telegram 701	6376	6376
DriveAxis38	SIEMENS telegram 903	7292	416
DriveAxis38	SIEMENS telegram 701	6392	6392
DriveAxis39	SIEMENS telegram 903	7308	400
DriveAxis39	SIEMENS telegram 701	6408	6408
DriveAxis40	SIEMENS telegram 903	7324	384
DriveAxis40	SIEMENS telegram 701	6424	6424
DriveAxis41	SIEMENS telegram 903	7340	368
DriveAxis41	SIEMENS telegram 701	6440	6440
DriveAxis42	SIEMENS telegram 903	7356	352
DriveAxis42	SIEMENS telegram 701	6456	6456

Virtual commissioning (SINUMERIK 828D V5.x) 8

8.1 Transition from SINUMERIK 828D to the machine project in CMVM

This chapter describes a typical procedure for transferring data from a real SINUMERIK 828D to the machine project for Create & Run MyVirtual Machine. Starting point for the application is an existing, fully commissioned machine based on a real SINUMERIK 828D controller.

The objective of commissioning in Create MyVirtual Machine is to create a digital twin of a CNC machine with a SINUMERIK 828D controller. You can make this machine project available to your customers as a virtual twin of the machine for Run MyVirtual Machine.

> ⚠ **WARNING**
>
> **Machine projects cannot be transferred to a real SINUMERIK 828D controller**
>
> Archives and data from machine projects of Create MyVirtual Machine must not be transferred to a real SINUMERIK 828D controller.
>
> Transferring the data from a simulation project without checking and acceptance is not permitted for operation on the machine.

First commissioning is subdivided into three steps

1. Provision of the archive data ("*.dsf") and the PLC project (PLC Programming Tool) from a real SINUMERIK 828D controller.
2. Import of the relevant archive data or download of the PLC project into a machine project with Virtual CNC software V5.4.
3. Checking and adapting the configuration data in the machine project in Create MyVirtual Machine.

During commissioning, the steps are typically performed per component (PLC, drive, NCK, HMI, and I/O). The component by component data transfer of the existing setup of a SINUMERIK 828D to the machine project is shown in the following diagram.

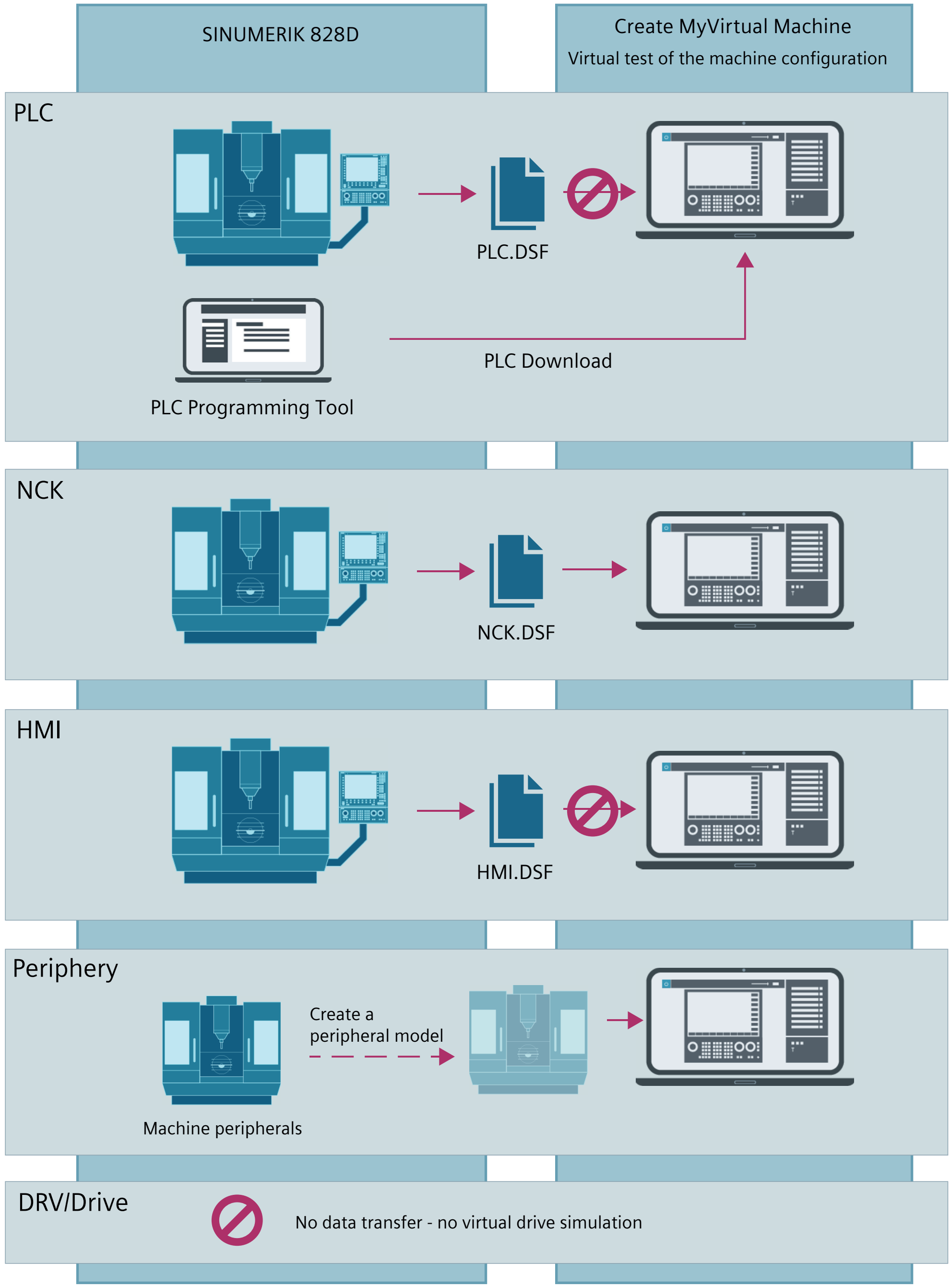


Figure 8-1 Symbolic representation of the SINUMERIK 828D commissioning procedures

8.2 Commissioning

Description

A virtual SINUMERIK 828D can be commissioned in Create MyVirtual Machine.

Requirement

The real SINUMERIK 828D controller must have been fully commissioned.

First commissioning scope

Step	Description	More information/documentation
1	Create an archive "*.dsf" (V5.x) with the components HMI, NCK and PLC in a real SINUMERIK 828D. The SINUMERIK 828D must be commissioned beforehand.	SINUMERIK Operate online help
2	In Create MyVirtual Machine, first create a new machine project with a PPU of the SINUMERIK 828D CNC software V5.24 and select the appropriate machine control panel.	Creating a machine project (Page 109) Machine control panel addresses (Page 182)
3	Import the created archive (NCK, HMI, PLC) into the machine project via SINUMERIK Operate. The archive data that can be imported is marked with a tick.	SINUMERIK Operate online help
4	Open and edit an existing PLC project in the PLC Programming Tool and load it into Create MyVirtual Machine.	PLC Programming Tool online help
5	After the download/archive import, restart Create MyVirtual Machine (deactivate/activate simulation mode).	

8.3 Importing the archive

When importing the real "*.dsf" archive into SINUMERIK Operate in the machine project, archive components that are not read in are deactivated.

The following is imported:

- NCK
- NC Extend

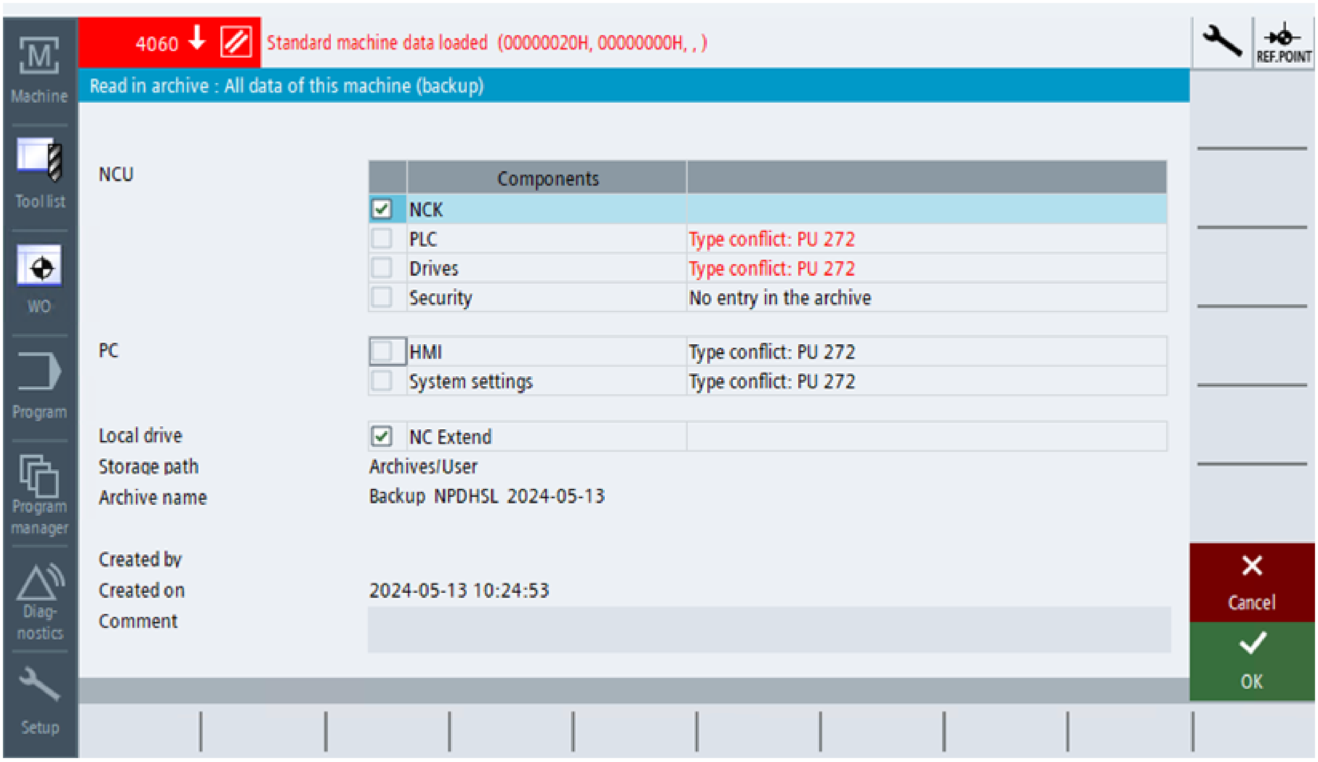


Figure 8-2 Importing the "*.dsf" archive from SINUMERIK 828D

8.4 MCP control panel for SINUMERIK 828D

When creating the machine project for a SINUMERIK 828D CNC software V5.x, only the standard machine control panels MCP 483 Milling or MCP 483 Turning are available.

User control panel

The start addresses for the control panel and the EMERGENCY STOP must match the addresses in the PLC project. After selecting the MCP, adapt the addresses according to the SINUMERIK 828D PLC project.

The standard addresses for the control panel are:

- Start address MCP SINUMERIK 828D %I112.0, %Q112.0
- Start address EMERGENCY STOP %I9.0, %Q19.0

8.5 PLC project

The starting point is the PLC project of a SINUMERIK 828D.

Data transfer to Create MyVirtual Machine

There is an option for importing into Create MyVirtual Machine.

- Direct download from the PLC Programming Tool into Create MyVirtual Machine.

8.6 NCK configuration

NCK archives (*.dsf format) can be read directly into Create MyVirtual Machine.

Data transfer to Create MyVirtual Machine

The NCK setup of a SINUMERIK 828D is transferred by importing the NCK *dsf archive.

8.7 HMI configuration

HMI archives (*.dsf format) cannot be read directly into Create MyVirtual Machine.

Data transfer to Create MyVirtual Machine

You can adapt the standard HMI, which is available through CNC software V5.24 in the machine project, to your specific requirements and commission it.

8.8 Machine I/O

To simulate interaction of the PLC with the field device level, the behavior of the machine I/O must be emulated for the simulation. The following options are available for this purpose:

- Use the internal I/O simulation of Create MyVirtual Machine (simulation via PLC I/O tables)
- Implementation of a separate PLC I/O simulator based on the simulation interface (Open Interface) in Create MyVirtual Machine

Safety Integrated (SINUMERIK ONE V6.x) 9

9.1 Introduction to Safety Integrated

The "Safety Integrated" safety solution combines various safety functions in the SINUMERIK control system:

- F-I/O are connected via the F-capable PLC of the SINUMERIK control system:
- F-blocks are programmed with F-logic using F-FBD or F-LAD editors
- Configurations and the F-library are handled in the same way as for SIMATIC F-CPUs
- Configuring using the Safety Administration Editor
- Controlling the safety functions integrated in the drive (via SINAMICS Integrated):
  - Safety Integrated Basic Functions
  - Safety Integrated Extended Functions

Create MyVirtual Machine supports a series of a safety functions and selected components of the acceptance test. More information for commissioning Safety Integrated is provided in the *Commissioning Manual SINUMERIK ONE Safety Integrated*.

9.2 Activating Safety Integrated in the TIA Portal

Procedure

Proceed as follows to activate Safety Integrated (F-PLC):

1. Click the NCU in the network or device view and select the "Safety Integrated" entry in the "Properties > General" inspector window.
2. Click the "Change Safety Integrated mode" button.
   The "Change Safety Integrated mode" dialog opens. If you select an option, the effects of the mode change are performed here.
3. Select "SINUMERIK Safety Integrated (F-PLC)" and confirm the reconfiguration with "Yes".

Result

The Safety Integrated mode has been changed. The precise effects can be seen in the "Change Safety Integrated mode" dialog (step 2).

If problems occur during the changeover, you can find more information in the "Info > General" inspector window.

Note

Effects on telegram configuration

The Safety Integrated mode used affects the telegram configuration because, in the Safety Integrated (F-PLC) mode, different telegrams are used than when the Safety Integrated mode is inactive.

Telegrams that are added or changed are kept, however, as long as they are compatible with the newly selected Safety Integrated mode.

Make sure, if applicable, that any modifications are still present following the change of mode in the telegram configuration.

As long as you have not saved the project, you can completely undo the change of the Safety Integrated mode by clicking "Undo" in the toolbar.

9.3 Plugin "Acceptance test - Signals" for Safety Activation Test

The "Acceptance test - Signals" plugin supports you in configuring and performing the Safety Activation Test in Create MyVirtual Machine. The input signals used in the Safety Activation Test are provided in the table of the plugin. In the table you can set the signal directly via switches and do not have to work in SINUMERIK Operate via variable tables.

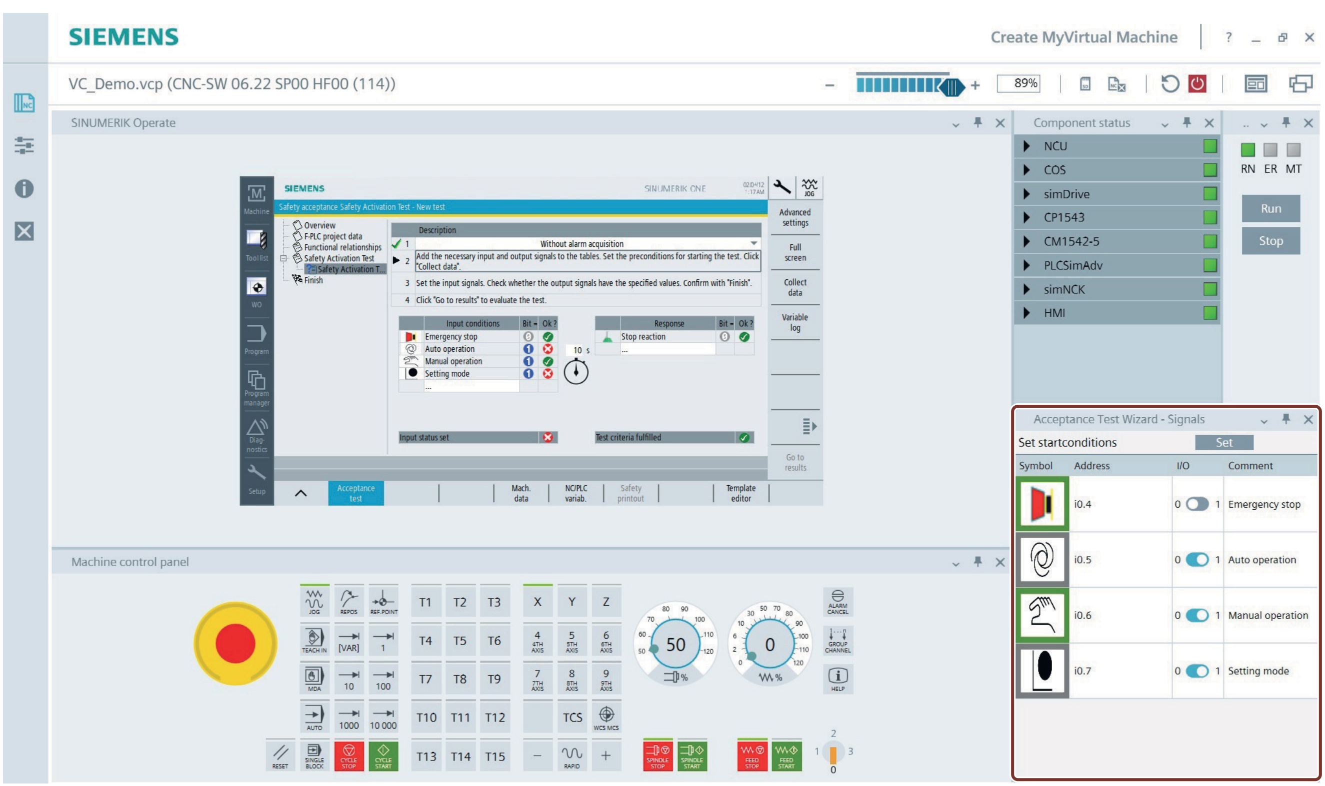


Figure 9-1 Plugin for the Safety Activation Test

Status of the input variables

The following diagram shows the status display of the input variables in SINUMERIK Operate and in the plugin "Acceptance test - signals".

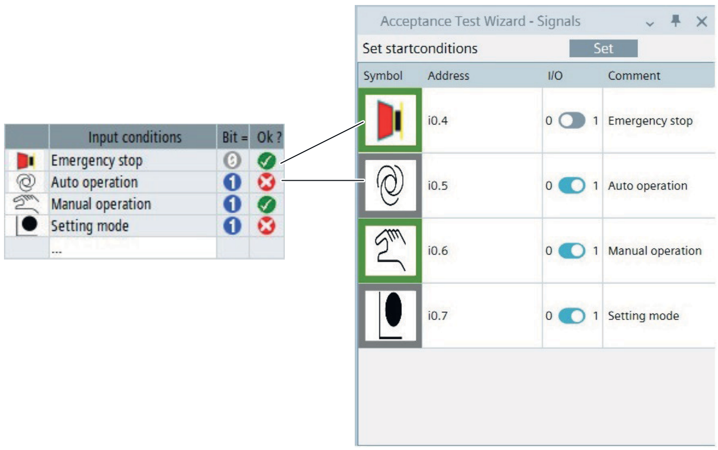


Figure 9-2 Status of the input variables

Status colors in the plugin:

OK = green

not OK = gray

Signal invalid = red (address)

Requirement

The plugin is hidden by default. Before you run the Activation Test, use the button to display the "Acceptance test - Signals" plugin.

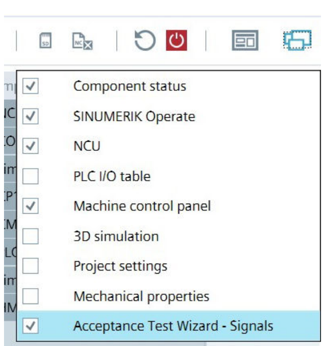


Figure 9-3 Displaying the "Acceptance test - Signals" plugin

More information

For more information on performing the safety acceptance test under Create MyVirtual Machine, refer to the *Function Manual SINUMERIK Operate Acceptance Test*.

Internal I/O simulation 10

10.1 Internal peripheral simulation

To simulate the peripherals (actuators, sensors) in Create & Run MyVirtual Machine, use the internal I/O simulation. The internal I/O simulation implements the concept of a virtual control desk, which simulates the machine behavior to the control. Control commands are visualized via LEDs and process feedback messages to the control system are simulated via switches.

The internal I/O simulation is characterized by the manual interaction between operator and control. Therefore it is only suitable for simple, slow running projects.

Note

Use with Run MyVirtual Machine

In a few exceptional cases, it may be necessary for signals from the integrated adaptation control to be displayed or influenced. Contact your machine manufacturer for this.

I/O simulation via PLC I/O

The following options are available for monitoring and controlling PLC variables.

- **PLC I/O table (V1.3.2 or higher)** (Page 189)
  For absolute and/or symbolic addressing of PLC variables

Functional scope

The internal I/O simulation supports the following functions.

- Writing PLC variables in the input image of the PLC.
- Reading PLC variables in the input image of the PLC.

Restrictions

The internal I/O simulation has the following restrictions.

- Only bit values (0/1) are permissible for PLC variables.

10.2 PLC I/O table

In the "PLC I/O table plugin" you define PLC variables for inputs/outputs in a tabular overview. The PLC variables are represented as switch or as LED.

Displaying the PLC I/O table

You can display and hide the "PLC I/O table" window via the menu.

1. Click on the button and activate the entry "PLC I/O table".

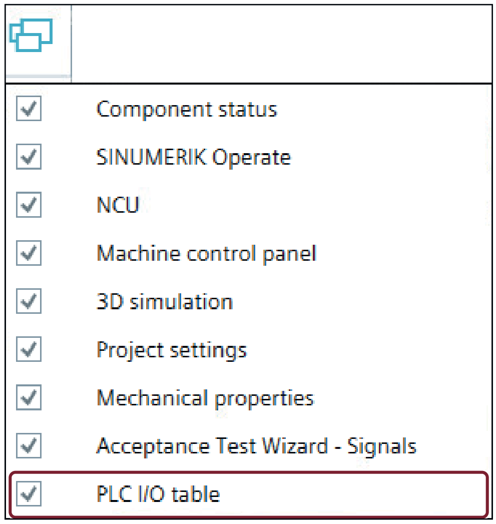


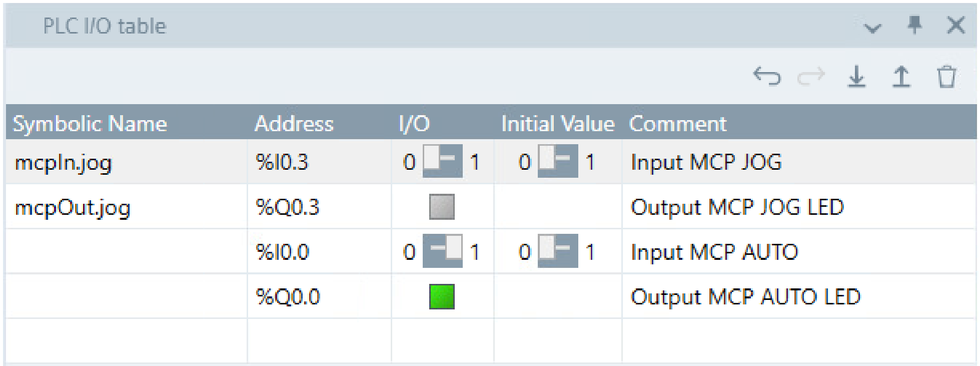
Figure 10-1 Displaying the PLC I/O table

2. To close the "PLC I/O table", click on the "Close window button" or deactivate the window via the button .

Structure of the PLC I/O table

In the "PLC I/O table" you define the PLC variables that you want to control or monitor row by row. The table has five columns and contains one PLC variable per line. You address the PLC variable via the "symbolic name" **or** via the "absolute address".

You can copy, paste and delete cell contents using standard Windows shortcuts or keys.



Symbolic Name	Address	I/O	Initial Value	Comment
mcpIn.jog	%I0.3	0 1	0 1	Input MCP JOG
mcpOut.jog	%Q0.3			Output MCP JOG LED
	%I0.0	0 1	0 1	Input MCP AUTO
	%Q0.0			Output MCP AUTO LED

Undo

Undoes the last action

Restore

Restores the undone action

Export PLC variables from the table as "*.xml".

Import exported "*.xml" of PLC variables into the table. The imported PLC variables are inserted after the last table row.

Delete

Deletes the entire content of the PLC I/O table

Figure 10-2 Example PLC I/O table, symbolic and absolute addressing

Table 10-1 Table columns

Symbolic name	Address	I/O	Initial Value	Comment
Here you enter the symbolic name of the PLC variable. You can find the symbolic name of the PLC variable in the corresponding programs of the TIA Portal project. If the symbolic name is incorrect or the PLC variable does not exist in the project, the cell is displayed with a red frame. **Note** Only absolute addresses can be used for machine projects with SINUMERIK 828D.	You enter the absolute address of the PLC variable in the "Address" column. You take the address of the PLC variable from the corresponding programs of the TIA Portal project. A cell with an incorrect address is displayed with a red frame. **Note** If the symbolic name is entered in the first column, the address is automatically preassigned.	The bit value of the variable is displayed and controlled in the "I/O" column.	Here you can optionally define an initial value for PLC inputs. The next time the machine project is started, the initial value is written. **Note** If you only reset the machine project, the initial value is **not** written.	You enter an optional comment on the PLC variable in the "Comment" column.
The syntax corresponds to the structure of the PLC variables as in TIA Portal. Quotation marks are not included. • **Example input** MCPInput_M_PN.AUTO • **Example output** MCPOutput_M_PN.LED_AUTO	The absolute PLC address (input/output) must correspond to the following syntax. • **Input** %[IE]<Byte address>.<Bit number> e.g. %I3.4; %E3.4 • **Output** %[QA]<Byte address>.<Bit number> e.g. %Q17.4; %A17.4 • **Address range for input/output** 0.0 to 32767.7	Depending on the address type, a toggle switch or an LED is displayed. • At an input, a toggle switch is displayed with the positions 0 and 1. With that you control the bit value. • An LED is displayed at one output. The LED is switched off with bit value 0 and switched on with bit value 1.		

Working with the PLC I/O table

- Create a table row
  Press "Enter" to switch to the next table row. If the last table row is selected and you press "Enter", a new, empty table row is added.
- Delete a table row
  Press "Remove" to delete a selected table row.

- Editing a table cell
  Click in the cell to select it. With the second click you edit the selected cell.
- Blank lines
  Blank lines in the table are permitted. You use blank lines to structure the table, for example.

How to create entries in the PLC I/O table

The machine project must be open to edit the table.

1. Display the "PLC I/O table".
2. Click into the table cell in the "Symbolic name" or "Address" column to define a new PLC variable.
3. Enter the symbolic name or the address of the PLC variable. Depending on the variable type, a toggle switch or an LED is displayed in the "I/O" column.

   Note

   Incorrect name or address

   A cell with an incorrect entry is displayed with a red frame. Incorrect names and addresses are permissible, but they are ignored during processing.

   ---

4. Optionally enter an "Initial value" and a "Comment".
5. Press "Enter" to confirm. A new, empty table call is added.
6. Define any further PLC variables that you want to monitor and/or control.
7. Save the project.
   When saving the machine project, the PLC I/O table is saved in the project. If you close the project without saving, the contents of the PLC I/O table are not backed up.

Note

Project settings

The contents of the PLC I/O table are exported/imported via the project settings. You can also use the XML export/import function of the "PLC I/O table" to exchange the table contents between projects.

10.3 Working with the internal peripheral simulation

Requirement

To be able to use the internal I/O simulation, there must be an executable PLC project in the machine project.

How to work with the internal I/O simulation

1. Open the previously created I/O table in the PLC I/O table of the PLC variables.
2. Start the machine project.
3. Monitor the configured outputs on the LED displays.
4. Control the inputs by setting the bit value to 1 with the toggle switch.

Principle of operation and constraints

Monitor the following mode of operation if you work with the internal I/O simulation.

- The table manages a maximum of 4000 entries (PLC variables).
- Multiple entries of the same PLC variables are allowed.
- If PLC input variables are contained several times in the table, each time the value of the last switch becomes effective in the table with the cycle of a PLC run.
- The toggle switch of the input variable always has an initial value of 0 when the machine is ramping up and in the first scan cycle of the PLC run, even if the initial value is set to 1. The set value only becomes effective or is displayed in the second cycle of the PLC (machine has completely started up).
- The values of the PLC variables (inputs/outputs) are updated on each cycle.
- The set switch position of the PLC input variable is permanently written. Simultaneous operator actions on the control system which write to the PLC input variables used are ignored.
- Deleting a PLC input variable in the PLC I/O table results in the following behavior:
  - The previously set value of the connected PLC input is retained.
- If the value 1 or 0 is newly set at a PLC input in the HMI SINUMERIK Operate in the "NC/PLC Variable" view, the toggle switch is not updated in the PLC I/O table at the corresponding PLC variable.

Creating and importing archives using SINUMERIK Operate 11

11.1 Overview for archiving and data backup

On the one hand, commissioning archives are used to save a specific control status and to restore it (Backup), on the other hand, they allow you to configure a machine series using the same data (Setup). In SINUMERIK ONE, these two archive types are supported with the DSF format (Data Storage Folder).

In this case, NC, PLC, and HMI system settings and drives can be saved either separately or together in archive files, and downloaded again from there. When selecting, any combinations are possible. The files can be reimported independently of each other and with maximum flexibility.

In contrast to the backup, no specific machine data are considered during a setup. A detailed list of contents of the archive types is included in the table in the section "Data areas".

With the "User" access level, you can read in a backup file only on the control system on which the archive was created. The "Manufacturer" access level is required to read in a backup file on another control. The "Manufacturer" access level is always required to read in a setup file. You can find an overview in the section "Archiving options".

Time of the data backup

It is recommended that data backups are performed at the following times:

- After completion of a prototype machine, to create a setup archive for a machine series
- After a commissioning
- After changing machine-specific settings
- After replacing a hardware component
- Before a software upgrade
- Before activating memory-configuring machine data (only for inactive NC function Automatic Memory Reconfiguration (AMR))
- After migrating ARC archives as new backup in the *.dsf format

---

Note

The DSF archive is compressed as a zip file, which contains a file tree with user data and attributes.

Archive options

There are various ways of creating and reloading archives via the SINUMERIK Operate user interface.

- **Data archive:** Specific data can be selected in the data tree as usual, and backed up by pressing the "System data" softkey and via the "Program Manager" operating area.

  Note

  A data archive is saved in the *.arc format.

- **Commissioning archive**: The following selection is offered with the "Commissioning archive" softkey:
  - Create and import the data backup of all data of the machine (Backup)
    The "User" access level is required (for backup of the same controller).
  - Creating and importing data for a machine series (without specific machine data) (setup)
    The "Manufacturer" access level is required.
  - Create and import the archive for the machine factory setting (Original)
    The "Manufacturer" access level is required.

  Note

  If you transfer the commissioning archives to another system, the "Manufacturer" access level is required to read in the data.

  Note

  A commissioning archive is saved in the *.dsf format.

  Archive files can be imported in the *.dsf and *.arc formats.

Storage locations

The following directories are available in the "Commissioning > System data" operating area:

- Archive > User
  and
  Archive > Manufacturer
- All configured logical drives (USB, network drives)

Note

Logs for the last import can be found in the following directory in the *.log format:

HMI data > Logs > Commissioning

Data areas

The following data areas are backed up in a commissioning archive:

Components	Data	Backup	Setup [2)]	Setup [2)] adapted
NC data [1)]	Meta information	●	●	●
	Option data	●	●	●
	Machine data	●	●	●
	Global user data (GUD)	●	●	●
	Definitions and macros	●	●	●
	Frame data	●	●	●
	Kinematic data	●	●	●
	Working and protection area data	●	●	●
	Compensation data • QEC - quadrant error compensation • CEC - operation/angularity compensation • EEC - leadscrew pitch / encoder error compensation **Note:** It only makes sense to archive machine-specific compensation data if the setup file is reloaded into the same control.	●		○
	Data of the axis optimization (AST)	●		○
	Tool and magazine data	●	●	●
	Setting data	●	●	●
	R parameters	●		○
	Synchronized action data	●	●	●
	System variables	●	●	●
	Standard cycles	●		○
	Manufacturer cycles	●	●	●
	User cycles	●		○
	Workpieces, part, dressing, main and subprograms	●		○
	Compile cycles (manufacturer, user)	●	●	○
	Collision avoidance data	●	●	●
	I/O data	●	●	●
PLC data	PLC project	●	●	●
	Remanence data	●		
Drive data	Drive data archiving	●	●	●

Components	Data	Backup	Setup 2)	Setup 2) adapted
HMI data	Applications (HMI, OEM applications)	●	●	●
	Setups, incl. display of machine data	●	●	●
	Data backups	●		○
	Trace data	●		○
	EasyExtend scripts (DVM)	●	●	○
	Help files	●	●	●
	Symbol data	●	●	●
	Picture information	●	●	●
	Language files (user and alarm texts)	●	●	●
	PLC program list	●	●	●
	Engineering data	●	●	●
	HMI skins	●	●	●
	Individual templates, workpiece templates	●	●	●
	Autostart data	●	●	●
	Service overview	●		
	Screenshots	●		○
	Original archive			○
	Safety data	●	●	●
System settings	Drive configurations	●		
	TCU settings	●		
	Network settings (for embedded only)	●		
	mmc.ini	●		
Security	Password to protect confidential PLC configuration data (if set)	●	●	
	Access level password to protect the PLC against unauthorized access (if set)	●	●	
	Configuration for user management (if activated)	○	○	○
	Configuration for Secure Event Log	○	○	○
	IPC-NCU pairing configuration (if set)	○	○	○
Programs on a local drive/NCextend	Programs contained in the user memory area. **Note**: Because the user data can become very large, the created archive file may require more storage. The content is only backed up if it does not exceed 1 GB.	●	●	●

Data area is available in the archive: ●

Data area can be added to the archive: ○

Note

1) For NC data, only the deviations from the standard default values are backed up. Machine data MD11210 $MN_UPLOAD_MD_CHANGES_ONLY and MD11212 $MN_UPLOAD_CHANGES_ONLY do not influence the archive content. An overview of all archive data is available via Create MyConfig.

Note

2) The scope of data will be individualized further in future software versions.

11.2 Transferring an archive to SINUMERIK ONE

Archives can be transferred to the SINUMERIK ONE environment in the *.arc or *.dsf formats.

Note

If you use a virtual machine, the archive must be transferred from a real storage to the storage medium of the virtual machine.

Note

You can transfer a SINUMERIK 840D sl archive to SINUMERIK ONE. Create a commissioning archive as usual in the *.arc format on the SINUMERIK 840D sl control system.

SINUMERIK 840D sl commissioning archives are of the backup type and include specific machine data. When transferring data to SINUMERIK ONE, the existing data are overwritten, e.g. basesys.ini. Incompatible settings between control systems are ignored, e.g. mmc.ini and systemconfiguration.ini.

Requirement

- The "Manufacturer" access level is required for importing a transferred backup or setup.

Component transfer

SINUMERIK ONE accepts the following components from the archive of a different system:

Archive	Transfer to system	Components
ARC	Virtual	NC, HMI
	Real	NC, HMI, drives
DSF (from virtual systems)	Virtual	NC, PLC, HMI, drives, system settings
	Real	NC
DSF (from real systems)	Virtual	NC
	Real	NC, PLC, HMI, drives, system settings, security

Note

HMI component

A DSF archive with the HMI component of a virtual machine is not compatible with a real machine and vice versa. Only those PLC alarm system texts in the format *.xml and *.ts are imported from the archive.

If necessary, import your own SINUMERIK ONE settings manually. For example, copy system texts to the directory
`.../oem/sinumerik/hmi/Ing`.

Note

PLC component

If the DSF archive was created in the TIA Portal, SINUMERIK ONE also accepts one existing PLC component. The following requirements apply:

- The NCU type in the TIA Portal matches the type in the target control, e.g. NCU 1750.
- The CNC software in the TIA Portal is compatible with the target control version.

Note

Security component

If the DSF archive from another system contains a security component, the **PLC data** is confidential and therefore password-protected. For the transfer you need the security password of the archive.

Enter the security password in the dialog before the archive transfer or in the operating area "Setup > Security > Security settings".

Note

Prevent inadvertently interchanging archives when transferring several archives.

It is recommended that an individual VNC password is set up for each system in the same company network. This means that you avoid inadvertently reading a DSF archive with security component into the wrong machine.

11.3 Importing an archive into SINUMERIK ONE

A DSF archive or an ARC archive created under SINUMERIK 840D sl can be imported as usual via the user interface into the SINUMERIK ONE environment. This enables commissioning of NC, PLC, and HMI components.

NOTICE
Data loss caused by archive difference when importing
Data not contained in the archive can be lost during the import.
Always create a backup file before reading in data.

Note

Compatibility check

To prevent the user from damaging a running system due to incorrect archive data, SINUMERIK Operate checks the archive compatibility with the machine before reading in the data. For example:

- The PLC data from an archive for an NCU 1750 are not compatible for an NCU 1760.
- PLC version 6.22 in the archive is not compatible with version 6.20 on the control system.

Machine status following read-in

After reading in, the machine has exactly the status that was previously defined with the archive type. The import differs principally with the following behavior:

Backup (for users)

- The existing control data are overwritten by the data from the DSF archive and may be added to the machine status.

Setup (for manufacturers)

- The data from the DSF archive map the exact status of the previously stored control.
- The components selected from the DSF archive are generally reset on the control system when the data is imported.

Requirement

- The "Manufacturer" access level is required for importing a setup.
- The "User" access level is required for importing a backup (backup of same control).
- You have a commissioning archive in the format *.dsf or *.arc.

Procedure

1. Switch over to the "Setup" operating area in SINUMERIK Operate
   "MENU SELECT > Commissioning > Commissioning archives".
2. Select the "Select archive" option for importing an archive and confirm with "OK".
   The "Import archive: Select Archive" window opens.
   - OR -
   To import the existing factory setting, select the "Restore factory setting" option and confirm with "OK".
   SINUMERIK Operate automatically accesses the "original.dsf" file.

3. Select the archive and confirm with "OK".
   You obtain an overview with path details, version information, name of the archive, etc. as well as a list of the archived components.
   Deactivate a checkbox to exclude a component from the import process.

   Note

   You must enter a password if the archive contains the "Security" component.

4. To import the archive, confirm with "OK".
   The "Import archive" window shows the import process with a progress display.

11.4 Creating a DSF archive on SINUMERIK ONE

Archives can be created as usual via the SINUMERIK ONE user interface. The data backup is made as commissioning archive in the *.dsf format. A commissioning archive can be generated, for example, after the control has been commissioned. To do this, control components can be saved individually or jointly. It is also possible to transfer the data backup to other controls so they can be updated to the same status.

The following archive types can be selected for the data backup:

All data of this machine (backup)

- Complete backup for restoration
- Complete backup for software upgrades

Data for a machine series (Setup)

- Data inventory for equipping a machine series
  The archive does not contain specific machine data, such as
  tools, part programs, address settings, compensations, PLC retentivity data, workpiece counters, etc.

Factory setting of this machine (original)

- Data backup at a defined storage location

Note

We recommend that a backup archive is created regularly for specified work states of the SINUMERIK ONE environment so a required state can be reproduced when necessary.

Note

Restriction

An original archive is represented as backup.

Requirement

- The "User" access level is required for creating a backup (backup of same control).
- The "Manufacturer" access level is required for creating a setup or original.

"Create archive" view

Parameter	Remark for configuration
Header	The header shows the selected archive type.
NCU/PC components	Selected components to be written to the archive: • NCK • Drives • HMI • System settings • Security • NCextend A progress display appears for each selected component during the archive creation. When all components have completed their actions, the status of each component is displayed. The archive is saved when all components have stored their data correctly. If any errors occur, even only for a single individual component, the archive is not saved. The error log is displayed.
Storage path	The archive path is preassigned, but can be changed with the "Change storage path" softkey.

Parameter	Remark for configuration
Archive name	The system suggests a generic archive name. The generic archive name is formed from: • Archive type (e.g. Backup) • Abbreviation for selected components: NCK: N PLC: P Drive: D HMI: H System: S Security: S NCextend: L • Abbreviation for customization: CUST • Date (ISO) • Possibly an extension (1, 2, 3, etc.) **Example** Backup_NH_2022-06-03 Backup_NDHSL_2022-06-03_1 **Note** The generic archive name does not differentiate between the HMI runtime environments (NCU, PCU, ...). The "original.dsf" archive name for restoring the factory setting cannot be changed.
Created by	Input field for the creator as well as the creation date of the archive (optional).
Comment	Input field for possible comments regarding the archive (optional).

Procedure

1. Switch over to the "Setup" operating area in SINUMERIK Operate
"MENU SELECT > Commissioning > Commissioning archives".
2. Select one of the options for creating an archive and confirm with "OK".
The "Create archive" window opens.
This provides an overview with path details, name of the archive, etc. as well as an overview of the components to be archived.
3. Deactivate the checkbox to exclude a component from the creation process.
The displayed archive name is automatically changed appropriately.
4. If required, change the storage location with the "Change storage path" softkey.
5. To create the archive, confirm with "OK".
The "Create archive" window shows the creation process for each component with a progress display.

Note

You must enter a password if the archive contains the "Security" component.

11.5 Creating a user-specific DSF archive on SINUMERIK ONE

In addition to the HMI and NC control components, you can also adapt and create their data areas specifically for a user-specific setup archive.

Procedure

1. Switch over to the "Setup" operating area in SINUMERIK Operate
   "MENU SELECT > Setup > Setup archive".
2. Select the option Setup to create an archive and confirm with "OK".
   The "Create archive" window opens.
3. Click the "Individual" softkey.
   The "Change" softkey is displayed.
4. Click the "Change" softkey.
   The dialog "Change customization list" with all HMI and NC data areas is displayed.
5. Check or uncheck the checkboxes to include or exclude the data areas from the archive creation process.

   Note

   System-relevant data areas are marked with grayed out checkboxes and cannot be adapted.

6. To reset the user adjustments, click the "Reset" softkey.
   All changes in the "Change customization list" dialog are reset to the default.
7. To confirm the customization, click "OK".
   At the edited component it is indicated that it has been adapted.
   The displayed archive name is supplemented with the addition CUST.
8. To disable the customizations, click the "Customized" softkey again.
   The "Change" softkey is hidden. The archive standard is restored.

   Note

   The customizations are reactivated when you click on "Customized" again. Settings that have already been adapted are not reset.

9. To create the customized setup archive, confirm with "OK".

3D Simulation (option) 12

12.1 Product information

This product includes or uses libraries of the following software:

- Open CASCADE Technology (https://dev.opencascade.org/)

12.2 Using 3D Simulation

Description

Create & Run MyVirtual Machine visualize the machining process and machine movements using 3D Simulation. You can simulate the processing of NC programs in AUTOMATIC mode, for example, or manual traversing movements and tool changes in JOG mode.

Note

License

The "Create MyVirtual Machine /3D" or "Run MyVirtual Machine /3D" license is required to use the 3D Simulation.

NOTICE
Saving 3D Simulation data in the machine project
All changes in the 3D Simulation (e.g. storage folder, library, configurations) are only finally saved after saving the machine project. Before closing the machine project, you should save the current state so that no changes are lost.

Overview of 3D Simulation

The 3D Simulation is divided into functional areas. To switch between the areas, click on the corresponding tab.

Figure 12-1 3D Simulation, operating areas and functions using the example of a milling machine

You can perform the following tasks in the areas.

- ① Machine
  In the "Machine" tab, you configure the simulation components and visualize the machining process.
  - ⑤ Simulation of the machining process and machine movements (Page 322)
  - ⑥ Defining tools (Page 255)
  - ⑦ Selecting and activating the setup (clamping) (Page 304)
  - ⑧ Open the additional options:
    Reset workpiece view
    Save the current setup as library elements (current machining state of the workpiece and setup)
  - ⑨ Activating collision detection
  - ⑩ The icon indicates, for example, an active collision detection.
  - ⑪ Show/hide layer menu
  - ⑫ Click on the buttons to switch between the predefined views of the 3D display.
- ② Library (Page 229)
  In the "Library" you manage the necessary components for the simulation.
  - Tools
  - Adapters (tool components/holders)
  - Clamping (clamping device)
  - Blanks
  - Configurations (clamping)
- ③ Collisions (Page 318)
  In the "Collisions" tab, the detected collisions are logged during the execution of an NC program or during the manual procedure.
- ④ Settings (Page 224)
  - Language selection
  - Adapter diameter
  - Exporting/importing archives

More information

More information with example data and documentation with detailed examples can be downloaded from the Siemens Service Portal (https://support.industry.siemens.com/cs/ww/en/view/109815969).

12.3 Function scope and configuring

12.3.1 Function scope of the 3D Simulation

Machine processes and machine motion are visualized in the 3D Simulation.

Functional scope

- Spatial simulation of machine movements on the basis of a stored kinematic machine model (geometries and kinematic description)
- Support of interchangeable heads (changing of head kinematics)
- Support of multi-spindle machining
- Simulation of drilling, turning, milling and grinding operations
  - Simulation of stock removal for single and multi-channel machining processes on the basis of the active setup and tool data
  - Several tools being used
  - Resetting of the workpiece to the original geometry of the blank
  - Monitoring of collision (can be switched on/off) between collision groups specified in the machine model
  - Display of a log of detected collisions and deletion of the log entries (only C/RMVM /3D)
- Turning with driven tools, such as drills or milling cutters, on turning machines with a Y-axis. This allows you to carry out milling and turning operations on the face and cylinder surfaces of the workpiece, for example.
- Simulation of measuring processes with switching probe
- Support of inch and metric systems of units
- Tool manager
  - Display of tools from the SINUMERIK tool management based on their geometric values
  - Support of various tool types
  - Linking adapters (tool holders) as "*.stl" and "*.stp" geometries or basic parameterizable geometry elements (primitive model) with tools from the SINUMERIK tool management

- Library and setups
  - Creating, deleting, and editing clampings ("*.stl" and "*.stp" geometries) in a library
  - Creating, deleting, editing, and managing blanks ("*.stl" or "*.stp" geometries or from basic geometry shapes) in a library
  - Parametric changing of the spatial position and orientation of library components. Depending on the type, the components have different reference/coordinate systems. By defining Reference Points, workpieces and clamping can be easily positioned.
  - Creation, deletion, and editing configurations from the clamping and blank library components
  - Exporting and importing library components and setups
- Activating single or multiple selected setups for consideration in the spatial simulation, e.g. simulation of multiple workpiece machining operations on one machine (multi-spindle machine).
- Saving and exporting the in-process workpiece geometry
- Tool-specific stock removal in different colors. In the tool manager, you can define a specific cutting edge color for each tool. This means that in stock removal simulation, you can immediately identify which tool is currently being used for machining or the tool that was used.
- Show and hide layer structure: Depending on the machine model, you can show or hide different layers in the 3D Simulation, e.g. showing or hiding machine housings.
- Transfer of workpieces between clamping setups. Among other things, workpieces can be transferred between the main and counterspindle. In addition, it is possible to simulate loading and unloading processes, e.g. using robots.
- Travel to fixed stop
- Support of two-channel machines

12.3.2 3D simulation restrictions

The following functions are explicitly not supported for the 3D Simulation:

- Simulation of grinding operations
- Consideration of tools deviating from the tool types (Page 258) listed in the document (deviating tools are shown as replacement tool)
- Using file formats other than "*.stl" and "*.stp" to import 3D geometries
- For parametric tools (definition of the tool via parameters), only the first cutting edge is supported. It is only possible to position the reference point of the tool on D1.
- Parallel kinematics
- All channels are considered as measuring during a simulated measuring process
- Turning operations are restricted to the tools defined in the document

- The "Machine" tab on the user interface must be active during the inch/metric switchover process, as this can lead to data loss when processing data.
- If the spindle is stopped by MCP in AUTO mode during a machining operation and the NC is not configured to stop when the spindle is stopped, PMM /3D Twin cannot stop the machine when the tool is moved inside the workpiece.

12.3.3 Constraints 3D Simulation in C/RMVM

Simulation of stock removal and collision detection have the following properties.

Stock removal AUTO/MDI (general)

Stock removal with the cutting part of the tool is simulated if the following conditions are met.

Conditions

- The machine (channel of the machine) is not in rapid traverse mode (≠ G0).
  - The channels of all axes located above the tool node in the kinematic tree are taken into account. If an axis does not move, its channel mode has no effect.
    If the spindle is rotating, the status of the spindle axis is not taken into account (jog, G0 or G1).
- Tool or workpiece spindle in rotary motion
  Milling machines: The tool spindle rotates
  Turning machines: The workpiece spindle rotates

If these conditions are not met, no material is removed.

Properties

- If the above conditions are not met, the contact between the cutting part of the tool and the workpiece is treated as a collision.
- Stock removal is also simulated if the above conditions are met and other components collide (e.g. machine with adapter).
- Stock removal is carried out at the current position.
- Stock removal is independent of collision detection (active/inactive).
- Stock removal is independent of feedrate/speed of rotation.

Stock removal JOG

In JOG mode, the following properties apply in addition to the general conditions.

- Stock removal is simulated when using machining cycles in JOG mode.
- During the manual process in JOG with rotating spindle, no stock removal is simulated.

Collision detection

Collision detection has the following properties.

- Collisions are displayed and stored in the log.
- Collision is displayed in color.
  - Orange
    The minimum clearance between colliding parts within the safety clearance is met. The default value for the safety clearance is 3 mm. This can be configured in the machine model (machine manufacturer).
  - Red
    Collision of the components has been detected.
- If the above conditions in the "Stock removal" section are not met, contact between the cutting part of the tool and the workpiece is detected as a collision.
- The collision pairs of the machine must be defined in the machine model.
- A collision is detected for collision pairs that are configured in the machine model (machine manufacturer).
- The contact of machine parts with other machine parts (except tool and workpiece) is always detected as a collision.
- Collisions in rapid traverse (G0) are always detected irrespective of whether the spindle is rotating or stopped.
- Collision is detected while the spindle is stopped and during traversing movement G1, G2 and G3.
- There is a special mode for "measuring". Measuring processes are not detected as collisions. More information can be found in the Measuring processes in 3D simulation (Page 213) section.

Simulation properties

As a result of the motion modeling, simulation has the following properties.

- To model motion (axis motion) the 3D simulation directly uses the setpoints from the NC, and not the actual motion executed by the drive system. Functions, which deactivate the setpoints at the drives, e.g. when using simulation axes or for the program test (PRT) therefore have no impact on the 3D simulation. Although the drives are not assigned any setpoints, axis motion is executed in the 3D Simulation.

12.3.4 Simulation of measurement procedures and machine data

Probe

Measurement performed with switching probes is supported in all operating modes and can be carried out with active collision avoidance.

The following tool types (probes) are supported:

- 710-714
- 725
- 730

Measuring cycles in the AUTO/MDI mode

During a measuring cycle in the AUTO/MDI mode, the NC sends signal MEAS1 or MEAS2, depending on the type of measuring cycle, i.e. tool or workpiece measuring cycles. These signals are interpreted by considering the bit values of MD52740 $MCS_MEA_FUNCTION_MASK. The bits in $MCS_MEA_FUNCTION_MASK define the significance of the MEAS1 and MEAS2 probe signals.

- Bit 0 = 0: MEAS1 is connected with a workpiece probe
- Bit 0 = 1: MEAS2 is connected with a workpiece probe
- Bit 16 = 0: MEAS1 is connected with a tool probe
- Bit 16 = 1: MEAS2 is connected with a tool probe

If bit 0 = bit 16, the measuring cycle type is determined based on the tool type in the spindle. If the tool in the spindle is a probe (see Section Probe above), then the MEAS signal corresponds to a workpiece measuring cycle. Otherwise, the MEAS signal corresponds to a tool measuring cycle.

Measuring process and collisions

Collision components treat measuring cycles as a special case, so that a collision alarm is not initiated for certain collision types.

These types of collisions include:

- In the workpiece measuring cycle
  Collisions between the probe/tool shank and other objects, e.g. machine parts, workpieces or fixtures.
- In the tool measuring cycle
  Collisions between the tool shank/unclamped length and the tool measuring system.

If there is still a collision between the tool shank and other objects, when the MEAS signal is deactivated, collisions between the tool shank and other objects will continue to be ignored until the tool leaves the collision state. Only afterwards is general collision avoidance reactivated.

The tool measuring system must be defined in the machine model. A generally valid specification has currently still not been defined. This is the reason that tool measuring systems will only be supported in a future version.

The NC (NCK version ≥ 4.93 or ≥ 6.13) displays alarm 26352 if a measuring cycle is active in the special collision type cases listed above. This warning is deleted as soon as the measuring cycle is exited.

Note

Currently, only workpiece measuring cycles are supported. The use of tool measuring cycles will be implemented in future versions.

Measuring cycles in JOG

A manual measuring cycle can be executed in JOG. However, the machine must be in no-load operation (idling) to activate the manual measuring cycle via API. During the manual measuring cycle, the collision avoidance component does not initiate any collision alarm for collisions between the tool shank/unclamped length and another part of the machine, the workpiece or fixtures.

The NC (NCK version ≥ 4.93 or ≥ 6.13) displays alarm 26352 if a measuring cycle is active in the special cases of the collision component listed above. This warning is deleted as soon as the manual measuring cycle is deactivated.

A manual measuring cycle can either be deactivated via the API if the machine is in no-load operation (idling mode) or by switching into the AUTO operating mode.

Restrictions for Create MyVirtual Machine

If machine data MD13210 $MN_MEAS_TYPE is = 1, measuring in Create MyVirtual Machine does not function.

12.3.5 Cutting off the workpiece and transferring to a counterspindle

Machining and transferring workpieces between the main spindle and counterspindle are supported in the 3D Simulation.

Transferring the workpiece

Transferring workpieces between two clamping operations, e.g. transferring a premachined workpiece from the main spindle to the counterspindle for turning machines is supported in the 3D Simulation.

Workpiece transfer sequence

1. In "Settings", activate machining setting "Activate/deactivate workpiece transfer".
2. Activate a setup with a blank on the main spindle.
3. Activate a setup without a blank on the counterspindle.
4. The workpiece transfer procedure is started if the limitation frame of the setup in the counterspindle intersects with the limitation frame of the setup in the main spindle.
5. The transfer is realized as soon as the distance between the Mount Stations increases.

Cutting off the workpiece

3D Simulation functionally supports cutting off the workpiece and subsequently transferring it.

Cutting off sequence

1. Activate the machining setting "Activate/deactivate workpiece cutting off" in the settings.
2. Activate a setup with a blank on the main spindle.
3. Activate a setup without a blank on the counterspindle.
4. The workpiece transfer procedure is started if the limitation frame of the setup in the counterspindle intersects with the limitation frame of the setup in the main spindle.
5. When the counterspindle grips the blank and moves in the opposite direction, the blank is transferred and moves together with the counterspindle to the initial position.
6. If the blank is cut before or after the transfer, some of the blank remains in the main spindle and the part that has been cut off is clamped in the counterspindle.

Notes and restrictions

- Even if a collision pair is defined between the setups of the main spindle and counterspindle, collisions between the workpiece to be transferred and the clamping fixture to grip the workpiece should be ignored if a workpiece transfer is involved.
- If both spindles have workpieces, a transfer is not made and a collision is documented if a collision group was defined.
- A workpiece falling when clamping or when cutting off is not simulated.

12.3.6 Traversing positioning axes (POS, POSA)

Positioning axes are traversed independently of the path axes at a separate, axis-specific feedrate. With the POS/POSA commands, the positioning axes are traversed and the sequence of motions coordinated at the same time.

Behavior of commands POS/POSA in 3D simulation

The following applies when programming commands POS/POSA:

- Material removal and collision avoidance/detection based on G code Group 1 and the spindle state/status of the axis that is positioned.

12.3.7 Travel to fixed stop

With the "Travel to fixed stop" function, moving machine parts, e.g. tailstock or mandrel, can be traversed so that they can apply a definable torque or force with respect to other machine parts over any time period.

Note

The simulation of "Travel to fixed stop" movements is supported for the processes that are available in the NC programs for "Travel to fixed stop", e.g. `FXS` in the NC program.

Implementation in 3D Simulation

Implementation of the function is comparable to the measurement functionality in Create MyVirtual Machine /3D. 3D Simulation considers overlaps between the 3D geometries during a "travel to fixed stop" process. As soon as the geometries make contact, the simulation reacts with the signal "Travel to fixed stop reached" and stops the movement.

Application example

- Parts transfer
- Tailstock moves up to the workpiece contact and then further rotation takes place
- Bar loader pushes the blank to the defined stop, e.g. tool in the turret

Restrictions

- The collision groups in the machine model for the overlapping of the affected components should be defined in the machine model.
- If the axes continue to move in collision mode, e.g. due to incorrect programming, this is not detected as a collision.

12.3.8 Simulation for thread turning

In the 3D Simulation, the threads and edges are not displayed during thread turning on the turning machine. To monitor thread turning in the 3D Simulation, define the settings in the "mwcas.ini" file.

How to change the settings for thread turning

To monitor the cutting process during thread turning in the 3D Simulation, proceed as follows:

1. Navigate to the following folder:
   "C:\Program Files (x86)\Common Files\Siemens\VMx Middleware\option3d"
2. Open the "mwcas.ini" file in a text editor.

3. Change the following options in the `[Behavior]` area:
   – `InterpolateLatheThreading=true`
     Set the option to "`true`" to switch on the interpolation for thread turning in the 3D Simulation.
   – `InterpolateLatheThreadingMoveAngle=2.0`
     Enter here an angle in degrees for the position interval in which the stock removal is to be monitored during thread turning. The default value is 2.0 °.
4. Save the file.
5. In the 3D Simulation, switch to the "Settings" tab.
6. Activate the option "Improved options for turning tools when turning".
7. Restart the application, e.g. restart the machine project. The settings become effective.

12.3.9 Simulation of PLC axes

The 3D Simulation in Create & Run MyVirtual Machine simulates PLC axes if they are correctly defined in the 3D model. The model is created in Create MyVirtual Machine /3D Builder.

More information

For the definition of PLC axes, you can find more information in the *Configuration Manual Configuring of 3D models with Create MyVirtual Machine /3D Builder*.

12.3.10 Tips

12.3.10.1 3D Simulation is not started/displayed

Error case

The 3D Simulation is not displayed or is terminated immediately after starting the machine project.

Requirement

First check that the following requirements are met.

- The system requirements are fulfilled.
- The option "Create MyVirtual Machine /3D" or "Run MyVirtual Machine /3D" is licensed.
- The machine project contains a 3D machine model.

Possible cause graphics card driver

If the installed graphics card driver is not compatible with the graphics hardware or offers insufficient OpenGL support, the 3D Simulation cannot be started.

Remedy

If possible and available, install an up-to-date graphics card driver with OpenGL support.

Possible cause remote connection

If you use Create MyVirtual Machine or Run MyVirtual Machine with the 3D option activated via remote access through Microsoft "Remote Desktop Connection" (RDP) from a second computer, there may be display errors or a black 3D window due to the lack of OpenGL graphics drivers for this RDP transmission protocol. This depends on the graphics hardware used or the installed graphics drivers on the remote computer on which Create MyVirtual Machine or Run MyVirtual Machine is running.

Remedy

A possible remedy is to install a software OpenGL renderer, such as the "Mesa 3D" freeware on the remote computer running Create MyVirtual Machine or Run MyVirtual Machine.

12.4 Operation and setting

12.4.1 Data archiving, export/import, file format

Storage folder, data exchange 3D Simulation

The 3D Simulation uses a storage folder on the virtual memory card. As default, this folder is used, for example, to store the exported data or to search for the data to be imported (e.g. library). Geometry data can only be exchanged with the library using this folder, e.g. geometries of adapters and workpieces.

You can find the folder on the virtual memory card in your user directory.

- "C:\Users\<username>\AppData\Local\Siemens\Automation\SINUMERIK ONE\ncu\card\user\sinumerik\3d\"

Note

New storage folder

As of version SINUMERIK Virtual CNC software V6.15, the 3D Simulation uses the new path specified above.

If the term "storage folder" is used in the following description, the specification refers to this path.

NOTICE
Saving data in the storage folder in the machine project
The data in the storage folder is only finally saved in the machine project when you save the machine project. All changes since the last time the machine project was saved are no longer available after exiting the machine project without saving.

Geometry data, geometry files, 3D geometries

3D Simulation can use the geometry data of adapters, workpieces, protection areas and setups in the following formats:

- STL file ("*.stl")
- STEP file ("*.step", "*.STEP", "*.stp, "*.STP")

When geometry data, geometry files and/or 3D geometries are discussed in the documentation, then it always involves files in these formats.

12.4.2 General information on operation

Tips and tricks when working with 3D simulation

When working with the 3D simulation, you are supported by helpful functions. The special features are listed below.

- The 3D simulation is operated with mouse and keyboard. The mouse should have a scroll wheel.
- Generally, when entering values, only valid values are permitted. Values cannot be saved or messages are displayed.
- If an error is detected, a red error message is displayed in the upper right area. You can close it by clicking it or the "X" in the error message.

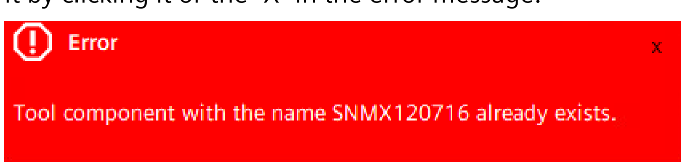


Figure 12-2 Example of an error message

- Correctly performed actions, e.g. saving, are indicated by a green message in the upper right area.

- Notes or warnings, e.g. an active component cannot be edited, are displayed as a yellow message in the upper right area.

Figure 12-3 Example of warning/information

- More information, help screens and videos for the entry fields or functions are displayed when you click on the i button.
- The view of all 3D images, e.g. for library components or in the 3D simulation, can be zoomed and moved to see details better.
  To do this, click in the 3D image and change the view.
  - Zooming the view: rotate mouse wheel up/down
  - Moving along the axes: left mouse button and move mouse
  - Rotating the view: right mouse button and move mouse
  - Operation via the keyboard (Page 221)

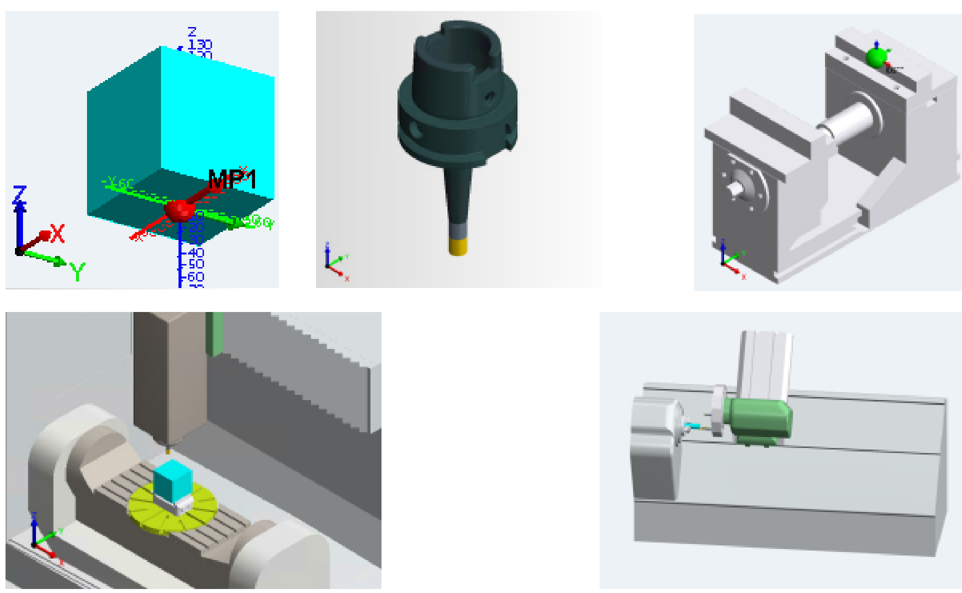


Figure 12-4 Examples of 3D images that can be zoomed, rotated and moved

12.4.3 Operating 3D Simulation using the keyboard

The view of all 3D images, e.g. for library components or in the 3D Simulation, can be zoomed and moved to see details better. You can also use these functions via the keyboard.

Functions of the keys and key combinations

The most important functions of the keys are listed in the function overview.

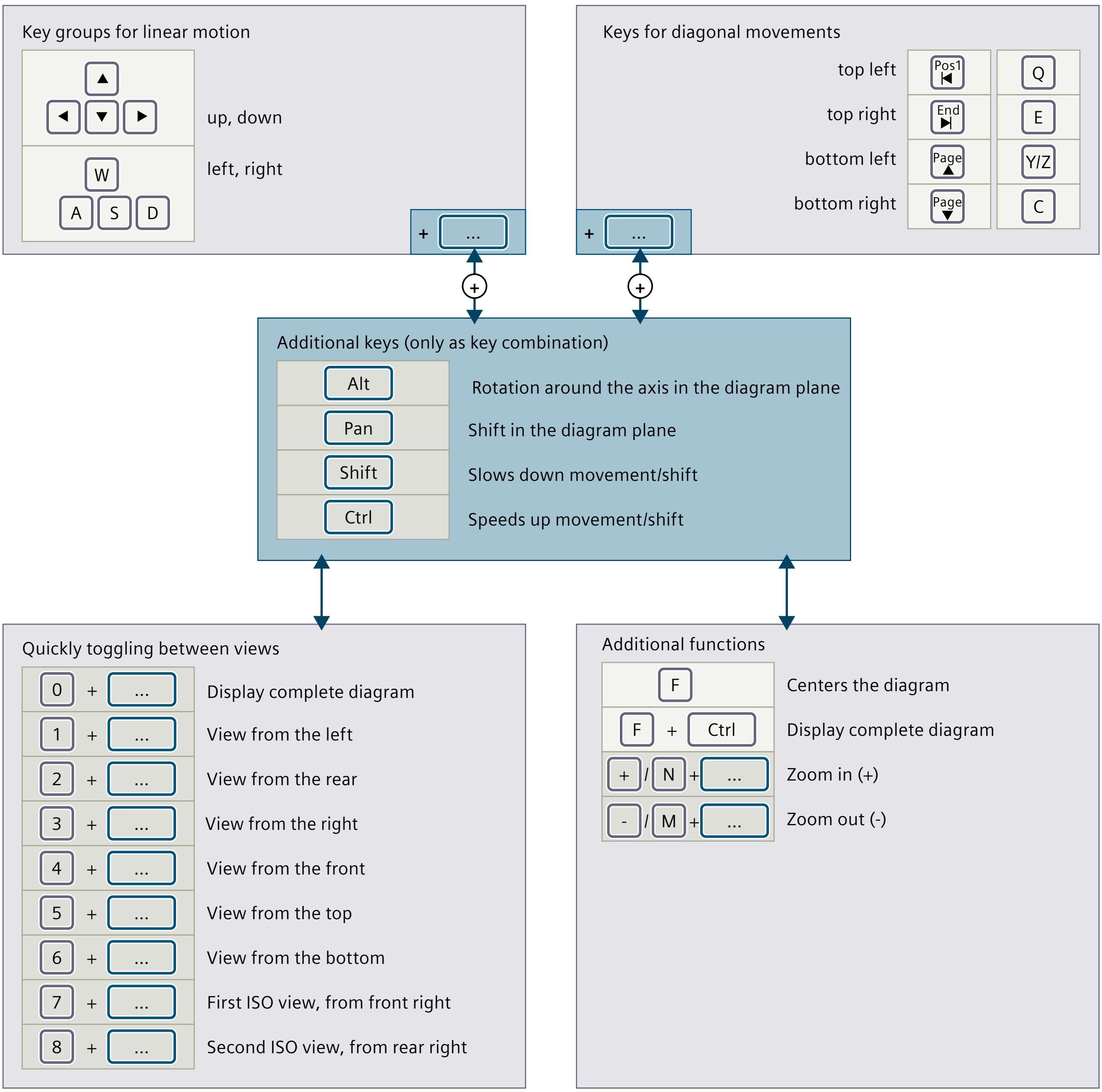


Figure 12-5 Functions of keys in 3D Simulation

12.4.4 Using layers

The 3D Simulation used layers to hide certain layers during the simulation. Depending on the machine model, you can show or hide different layers in the 3D Simulation. By default, all layers are displayed.

Examples of layers:

- Symbol of the active work offset
- Machine housing
- Tool table
- Setup (clamping)

Displaying and using layers

You define the visible layers using the layer menu.

1. For example, in the Machine view, click the Layer button to display the menu.
2. Click the button of the layer you want to hide. The button is grayed out.

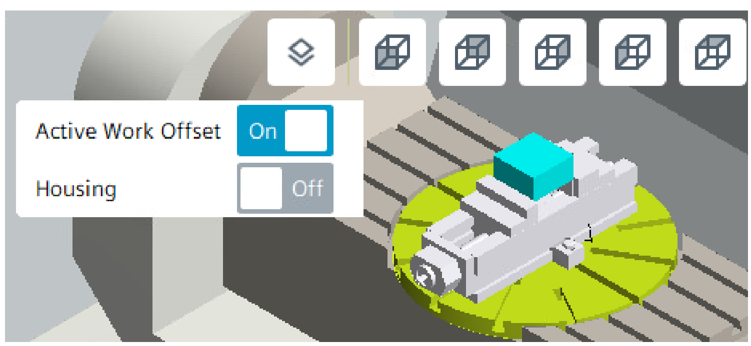


Figure 12-6 Showing and hiding a layer: machine housing and table hidden

3. Click the Layer button to hide the menu. The layer setting is saved centrally and used again at the next start.

Layer settings

The display of layers is used in the "Machine", "Setup" and "Collisions" views. The layer settings are centrally managed and the same settings are used in all views.

Restrictions

Work offsets are visualized in reference to "Mount Stations". The work offset is incorrectly visualized if the "Mount Station" is not located at the machine zero.

The work offset only shows the active offset for the 1st channel, referred to the first "Mount Station" of the machine model.

12.4.5 Settings

12.4.5.1 Settings

In the "Settings" tab for example, you switch over the user interface language, define a standard diameter for the tool holder and export/import archives.

Adapter diameter with definition via parameters

For 3D Simulation, enter a default value for the definition of the tool holder diameter via parameters for milling/drilling/grinding tools. The default value for the adapter diameter is 50 mm.

How to change the default value for the adapter diameter

1. Enter a new value for the "Adapter diameter for definition via parameters" in the "Settings" tab.
2. Click "Save".
   The change to the adapter diameter only becomes effective for new definitions. You can still change the default value when defining the adapter in the tool manager.
3. Switch back to the "Machine" tab.

Selecting the mouse click behavior

The setting is used to assign the "Move" or "Rotate" behavior for the 3D images to the left or right mouse button. For example, with the first selection, the 3D image is moved when the mouse is moved with the **left** mouse button pressed and rotated when the **right** mouse button is pressed.

User interface language

The 3D Simulation is available in several user interface languages.

How to change the user interface language

1. Select the new user interface language in the "Settings" tab under "Language selection ".
   The user interface language is switched to the selected language.
2. Switch back to the "Machine" tab.

Show edges in 3D Simulation

Activate this option if you want the body edges to be displayed in the 3D Simulation. A change to this option only takes effect after restarting the application.

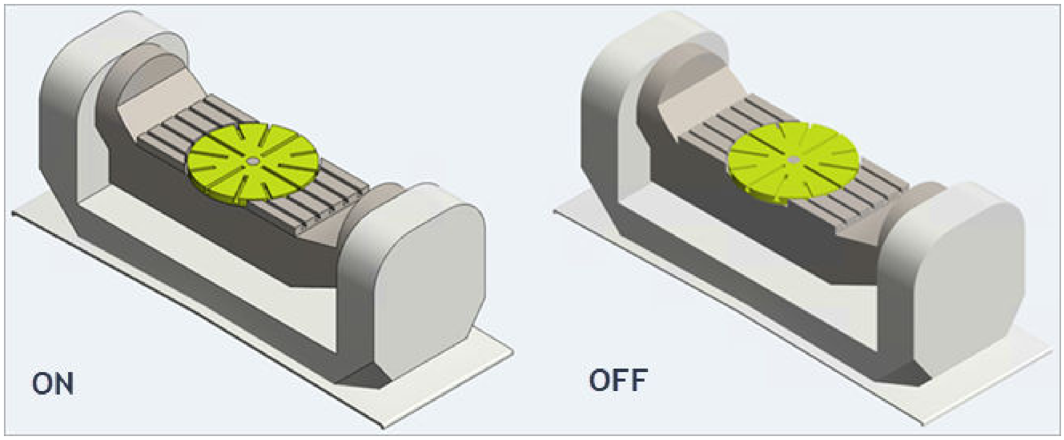


Figure 12-7 Showing or hiding edges in 3D Simulation

Exporting/importing archives and machine model

Archives

In archives you can save settings and data of the 3D Simulation or exchange them between two machine projects.

More information on archives can be found in the Exporting/importing archives (Page 226) section.

Machining settings

Workpiece transfer/cutting off

Activate these machining settings to allow cutting off functions with subsequent workpiece transfer, e.g. into the counterspindle, in the 3D Simulation.

- Activate/deactivate workpiece transfer
- Activate/deactivate workpiece cutting off

More information on this function is provided in Section Cutting off workpiece and transferring to the counterspindle (Page 215).

Improved options for turning tools when turning

By activating this function, it is possible to simulate the "Shaping". If this option is activated, the turning tools (type 5xx and 6xx) shape material when the tool spindle or the workpiece spindle is in positioning mode.

Note

SINUMERIK interpolation cycles are not supported. CAM-based "shaping" and off-center turning and taper turning are supported.

CAD export settings when using "*.stp" files

You enter the tolerances here for the converting process from STEP to STL. When converting from STEP to STL, the 3D model is approximated using triangles. Using these tolerances, you configure permissible tolerances for deviation to the model.

Tolerance	Description
Chord tolerance	The chord tolerance specifies the maximum distance between a chord and the real curved surface in mm or inches. The value of the chord tolerance lies between 0.001 mm (0.00003 inches) and 0.1 mm (0.00039 inches). The default value is 0.08 mm (0.00315 inches).
Angular tolerance	The angular tolerance specifies the maximum angle between adjacent chords in degrees. The angular tolerance lies between 0 and 90 degrees. The default value is 18 degrees.

This is how you change the tolerances

1. Enter the values for chord and angular tolerance in the "Settings" tab under CAD settings.
2. Click "Save". The tolerances become effective.
3. Switch back to the "Machine" tab.

12.4.5.2 Exporting/importing archives

For data backup or transfer between machine projects, you can export and import "*.zip" archives in the 3D Simulation. You export/import the archive in the "Settings" tab.

Data in the archive

The archive contains the following data.

- All library components (e.g. blanks, tool components)
- Tool data (tools with protection definition)
- Machine model
- Settings (e.g. adapter diameter, language)

Note

You can only export/import archives when 3D Simulation is not active.

Exporting an archive

How to export the 3D Simulation data to an archive.

1. Click on the "Export" button.
   The "Export archive" window with the selection of the data to be exported and any already existing archives is displayed.
2. Select the export data. By default, all data is exported.

   Note

   Tool data can only be exported together with the library data.

3. Enter a name for the "*.zip file" or keep the suggested name.
   The length of the name is limited to 40 characters.
4. Click "Export".
   The data are saved as "*.zip" file in the selected folder. Once the export is done, a message about the successful export is displayed.
5. Check the displayed error message if the export is canceled.

Importing an archive

You can import archives in the exchange folder into the 3D Simulation.

Requirement

- No setup (clamping) is active in the 3D Simulation.
- The "*.zip file" and the data it contains must conform to the import format.
- If the zero point is not present in the machine from an imported setup (clamping connected to a work offset), the connection is made to the default Mount Station.

How to import an archive

1. Copy the "*.zip" archive to the storage folder.
2. Click on the "Import" button.
   The "Import archive" window with the selection of existing archives is displayed in the selected folder.
3. Select the archive file.

4. Click on "Import" and confirm the message with "Yes".

   Note

   Before the import, all current data (library, tool data, machine model, settings) are deleted. Changes since the last archiving are lost in this case.

   The selected archive is imported. Once the import is done, the import dialog is closed and a message about the successful import is displayed.
   If an error occurs during an import step, all changes are undone through a rollback mechanism.

5. Save the machine project before closing it to save the imported data.

12.4.6 Switching between different unit systems ("metric"/"inch")

Unit system in 3D simulation

The 3D simulation works with the system of units that has been set in SINUMERIK Operate. You can set the effective system of units directly in SINUMERIK Operate or toggle between "metric" and "inch".

Note

Switching over the system of units

After switching over the system of units in SINUMERIK Operate, the new system of units is not yet effective in the 3D simulation. To make it effective, you have to restart the NCK. To do this, you perform a machine project reset, or you end the machine project and restart it.

Requirements

- Machine project has started
- No NC program is being processed
- 3D simulation is not active

How to switch over the system of units

1. In SINUMERIK Operate, click on the extended horizontal softkey bar 2 in the JOG or AUTOMATIC operating mode.
2. Click the "Settings" softkey in the horizontal softkey bar.
3. In the vertical softkey bar, click the "Toggle inch" or "Toggle Metric" softkey depending on which system of units is active.
   SINUMERIK Operate is switched to the new system of units.

4. Click the "Reset" button to restart the machine project.
   Following reset, the unit system switchover also becomes effective in the 3D simulation. All the tool data and other geometric data are displayed and processed in the new system of units.
5. Save the machine project to ensure that the unit system switchover is permanently saved in the project.

12.4.7 Requirements for 3D simulation

Requirements

Before you run a 3D simulation with collision detection, the following requirements must be met.

- The machine model is integrated into the machine project ("*.vcp") (by the machine manufacturer) and the project is saved
- Tools, adapters, setup, blank and protection area are defined in the library
- The protection function and protective areas (workholders) of the tools used are defined
- Setup, matching the NC program, is activated
- Collision detection is activated

You can find more detailed information in the following sections.

See also

Integrating 3D simulation into a project (Page 324)

Components in the library (Page 229)

Protection definition tool and adapter (Page 255)

Setup (clamping) (Page 304)

Collisions (Page 318)

Simulating machining operations and workflows (Page 321)

12.5 Components in the library

12.5.1 Library

In the library, you manage the components tools, adapters, clampings, blanks and setups for 3D Simulation.

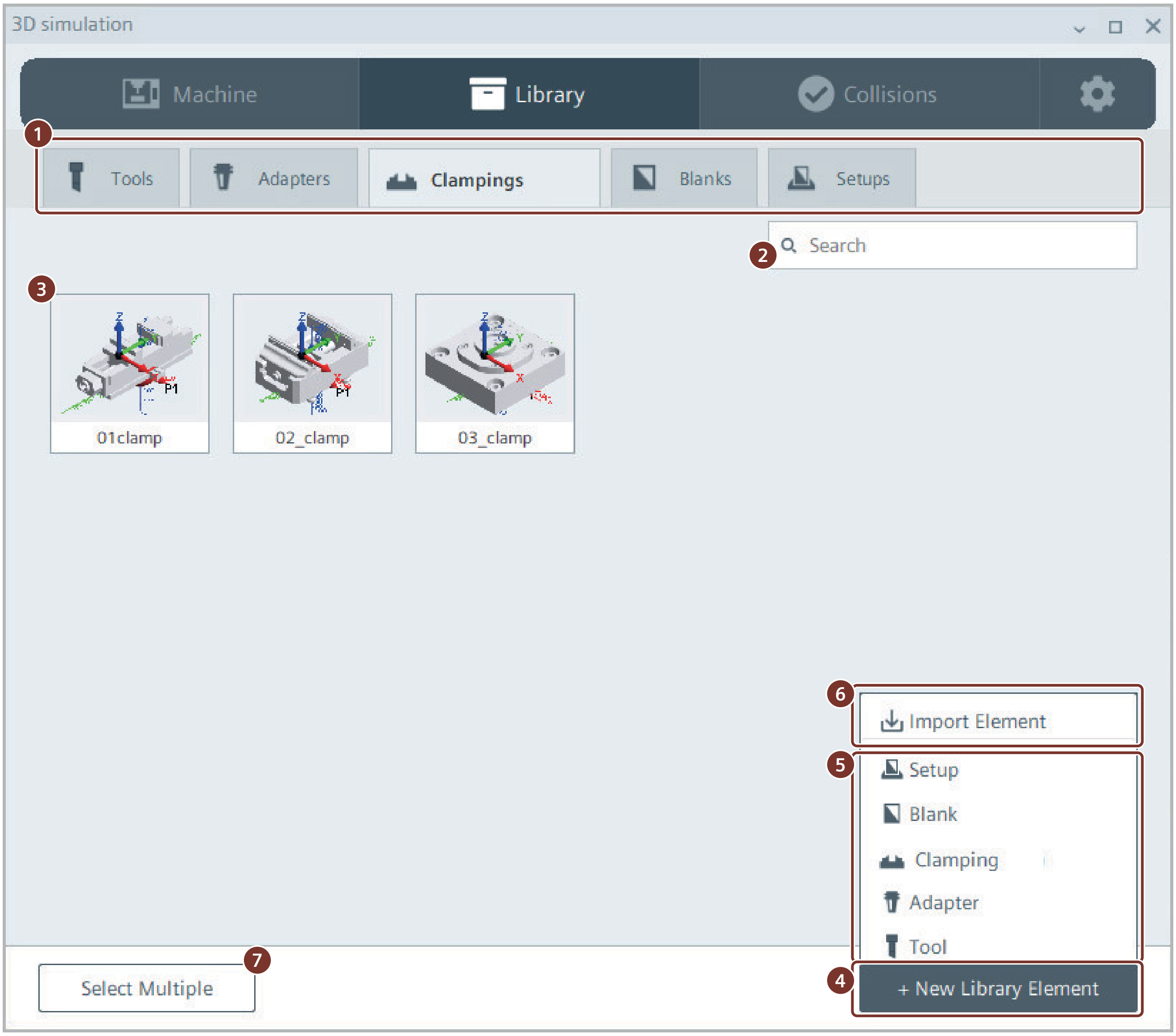
Overview of library

You create, edit and manage components in the symbolic view of the library. A separate tab is available for each component.

Note

Active components are blocked

Components that are currently active in the 3D Simulation cannot be edited or changed.



① Components belonging to a type are saved in different tabs in the library. Click on the appropriate component tab to manage the components.

② Here, enter a term that you want to search for in the active library tab. The hits are displayed in the tab.
Click on the "X" in the search field to delete the search term.

③ An overview of all configured components of the same type is displayed together with a preview image and names. To edit, click on the component.

④ By clicking on "+ New library element", the menu is displayed with the component types to be created and for importing library elements.

⑤ By clicking on the menu entries you create new components of the selected type.

⑥ Using "Import element", you import library elements into the library as "*.zip". The imported components are extracted and displayed in the library. With this function you can import exported components from other machine projects.
The "*.zip" files in the storage folder and/or in the selected directory are available for import.

⑦ Click "Select several " to select one or more components from the library. You can, for example, delete the selected components or export them as "*.zip". The exported component is saved as a file in the storage folder and/or in the selected directory.

Figure 12-8 Managing 3D Simulation components in the library using the "Clamping" component

Automatic creation of library elements

You create components in the library. During protection definition for adapters and tools, library elements are automatically generated from the imported "*.stl/*.stp" geometries.

12.5.2 Component types and properties

You configure and manage the following components and their parameters in the library.

Component types

In the following table the components are shown with icon and description.

Symbol	Component	Description
	Tool	Cutting or non-cutting geometry of the tool, e.g. inserts and shank
	Adapter	Tool adapter, tool holder For example, holders for tools with shanks with a steep or hollow taper
	Clamping (clamping device)	A clamping locks the blank into position. Clamping includes, for example, machine vises, chucks or clamping jaws.
	Blank	Workpiece blank E.g. block, cylinder
	Setup	The setup consists of a clamping and the matching blank. You can also set up several clampings and blanks, e.g. clamping towers or machine vises, in one setup.

Properties and parameters of components

The following table shows the parameters of the components.

Properties/parameters	Description
Component name and ID	A component has a component name that is unique throughout the project. The name can be a maximum of 40 alphanumeric characters long. Valid characters are: • A-Z • a-z • 0-9 • Underscore (_) **Note:** The character and length restrictions apply to all names assigned within the 3D Simulation.
"*.stl", "*.stp"	Components are defined as 3D geometry files in the "*.stl", "*.step", "*.STEP", "*.stp", "*.STP" (3D model) formats. You create the 3D geometry using an external program and import it when you create a new component. The 3D geometries are available for import as files in the storage folder.
Geometrical shapes	Optionally, blanks can be created using parameterizable standard geometries in the library

12.5.3 Reference system of components

Reference systems and meaning

Depending on the type, the components have different reference/coordinate systems. The coordinate origin/zero point is the basis of a coordinate system that you define for the components. The reference system can be rotated or moved.

The reference systems of the components in the 3D geometry files (clamping, blanks, adapters) usually cannot be used for 3D Simulation without modifications. Therefore, after importing, you can change the zero point and rotations of the coordinate system within the components.

Note

The files with the 3D geometries for a setup (clamping, blank) should be exported from the design system with an identical component zero point. In this case, the positions for the clamping, blank, and positioning in the machine can be used without offsets.

Table 12-1 Overview of the reference systems

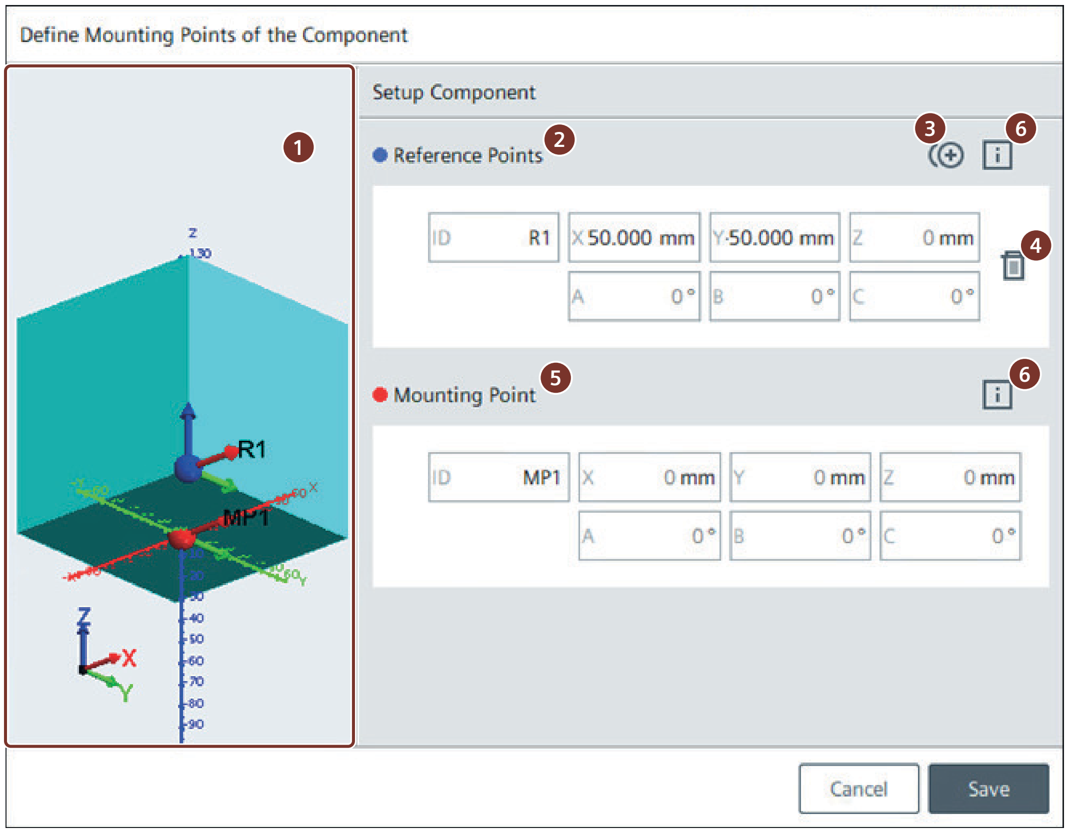
Reference system	Description
Reference Point **R**	This point is used to position the component in relation to the machine zero point. A newly created component has no Reference Point; only an "empty" Reference Point is displayed. You must first define the Reference Point, i.e. you must enter and save the values for the position. Blanks and clampings can have several Reference Points.
Mounting Point **MP** (Plug, Mounting Point)	This point is used to connect a component with other components. The Mounting Point of a component can be connected to the Mount Station of another component. Components can only have one Mounting Point.
Mount Station **MS** (Socket, Mount Station)	The Mounting Point of another component can be connected at this point. The components are aligned at the defined points. Mounting Point and Mount Station lie above one another. Using the Mounting Point and Mount Station functions, you can define a Mount Station on a machine vice and a Mounting Point on the blank. When defining the setup, the machine vice and the blank are aligned at this point.
Reference systems in the preview image	• The zero points of the reference system are displayed as a colored sphere in the preview image. • The color of the sphere in the preview image corresponds to the color code in the parameters of the reference system, e.g. the Reference Point is blue.

Table 12-2 Overview of the parameters of reference systems

Parameters of reference systems	Description
ID	ID of the reference system. The ID is generated automatically and should not be changed.
Coordinates X, Y, Z	The values X, Y and Z define the position of the component along the coordinate axes. Positive and negative values can be entered for the values. The value range is: [-9999.999 to +9999.999].
Rotation of axes A, B, C	The values A, B, C define the rotation of the component around the coordinate axes. Positive and negative values from -359.999° to +359.999° can be entered.

Example of the blank component

A Reference Point (blue) was created in the following example at position (140, -140, 0) at the lower left-hand corner of the blank. The Mounting Point (red) lies centered at the lower side at (0, 0, 0).



①	Preview image of the "*.stl/*.stp" file. You can zoom, rotate or pan the preview image. Changes to the coordinates of the reference systems are immediately displayed in the preview image.
②	Coordinates of the created Reference Point.
③	Click "+" to create new Reference Points.
④	Click the "recycle bin" button to delete existing Reference Points.
⑤	Example of a Mounting Point, centered at the lower side of the blank
⑥	More information, help screens and videos about the input field are displayed by pressing the information button.

Figure 12-9 Example of blank with defined Reference Point and Mounting Point

12.5.4 Tool

Parameter

A tool has the following parameters.

Parameter		Description
Definition		Importing an "*.stl file" or "*.stp file" into the library with name and ID.
Reference systems		
	Reference Point (R)	1
	Mount Station (MS)	-
	Mounting Point (MP)	1

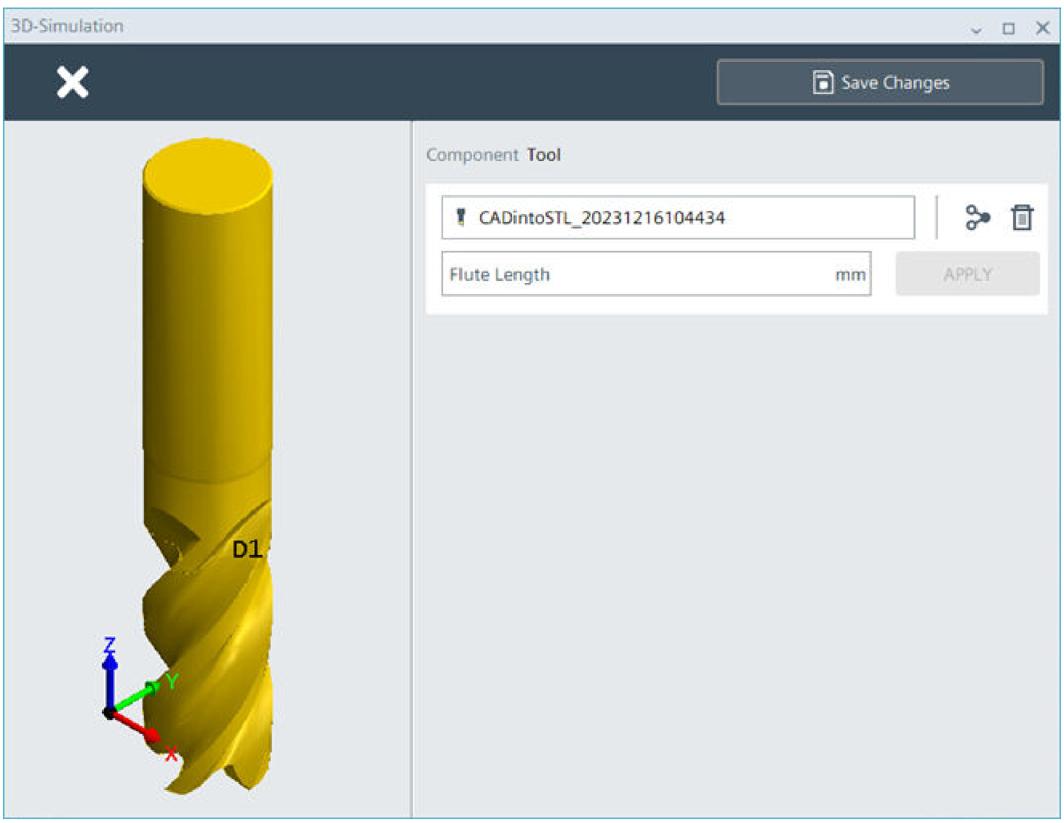


Figure 12-10 Tool: Example end mill

Cutting edge length tool

You can directly define a cutting edge length for imported tool geometries. If you enter the cutting edge length and click on "Apply", a new tool geometry with a new name and a cutting and non-cutting part is created. The cutting edge and the shank are colored differently and two icons are displayed as symbols in front of the new component name. Enter a new name for the tool.

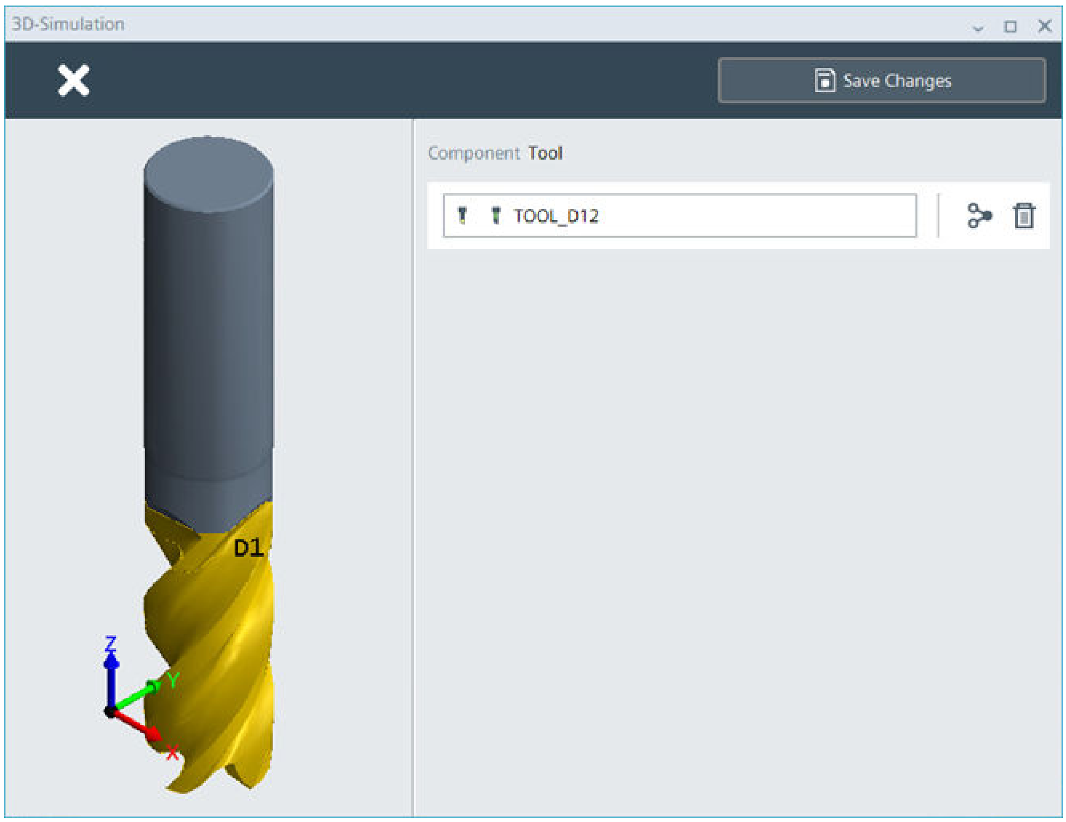


Figure 12-11 Tool: Example end mill with cutting edge length

Note

You can use the cutting edge length only once. If you want to change the cutting edge length, you must import the tool geometry again.

12.5.5 Adapter

Parameter

An adapter has the following parameters.

Parameter		Description
Definition		Importing an "*.stl file" or "*.stp file" into the library with name and ID.
Reference systems		
	Reference Point (R)	-
	Mount Station (MS)	1
	Mounting Point (MP)	1

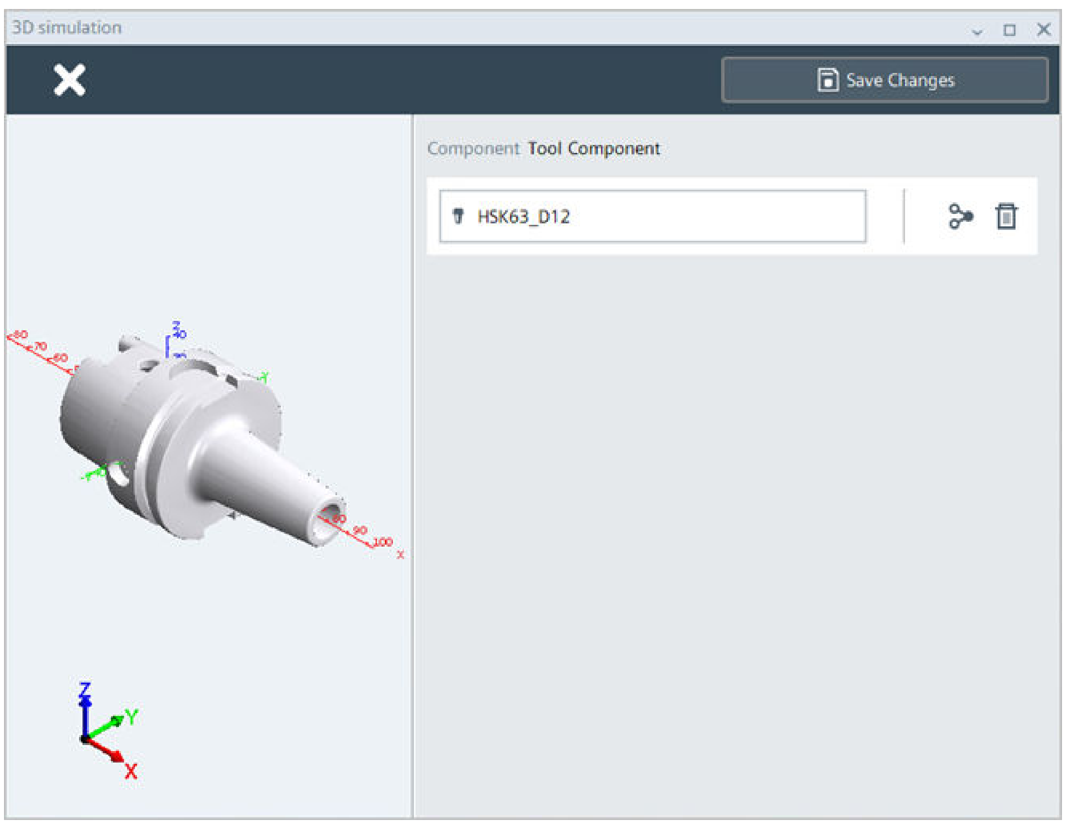


Figure 12-12 Tool component: example milling cutter holder

12.5.6 Blank

Definition

A blank has the following parameters.

Parameter		Description
Definition		Importing an "*.stl file" or "*.stp file" into the library with name and ID. Blank from "*.stl/*.stp" file (Page 243) Creating a 3D model from parameterizable, geometrical shapes, e.g. block. Blank from a parameterizable form (Page 246)
Reference systems		
	Reference Point (R)	n (must first be defined)
	Mount Station (MS)	-
	Mounting Point (MP)	1

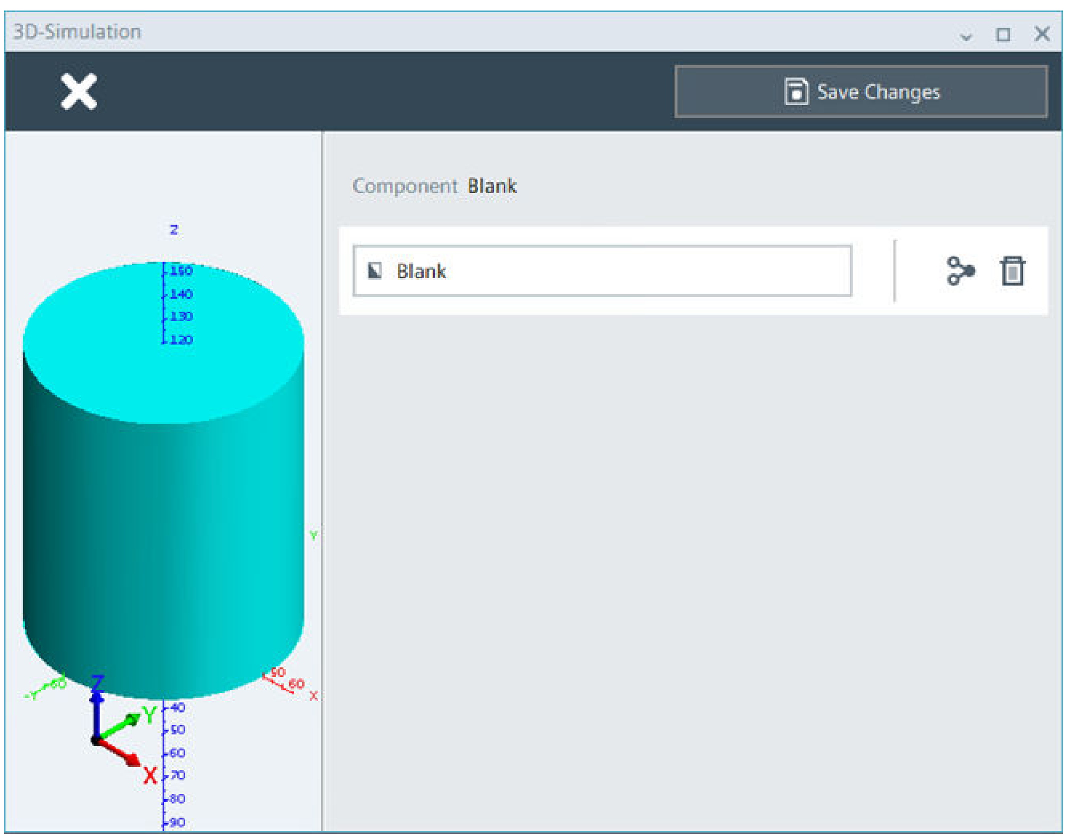


Figure 12-13 Blank imported from *.stl file and Reference Points defined

12.5.7 Clamping (clamping device)

Parameter

A clamping has the following parameters.

Parameter		Description
Definition		Importing an "*.stl file" or "*.stp file" into the library with name and ID.
Reference systems		
	Reference Point (R)	n (must first be defined)
	Mount Station (MS)	n (must first be defined)
	Mounting Point (MP)	1

A clamping can also consist of several components, e.g. a stationary part and the movable part of a machine vise. In this case, you define several clampings in the library and for the setup, you select the total clamping from the individual clampings.

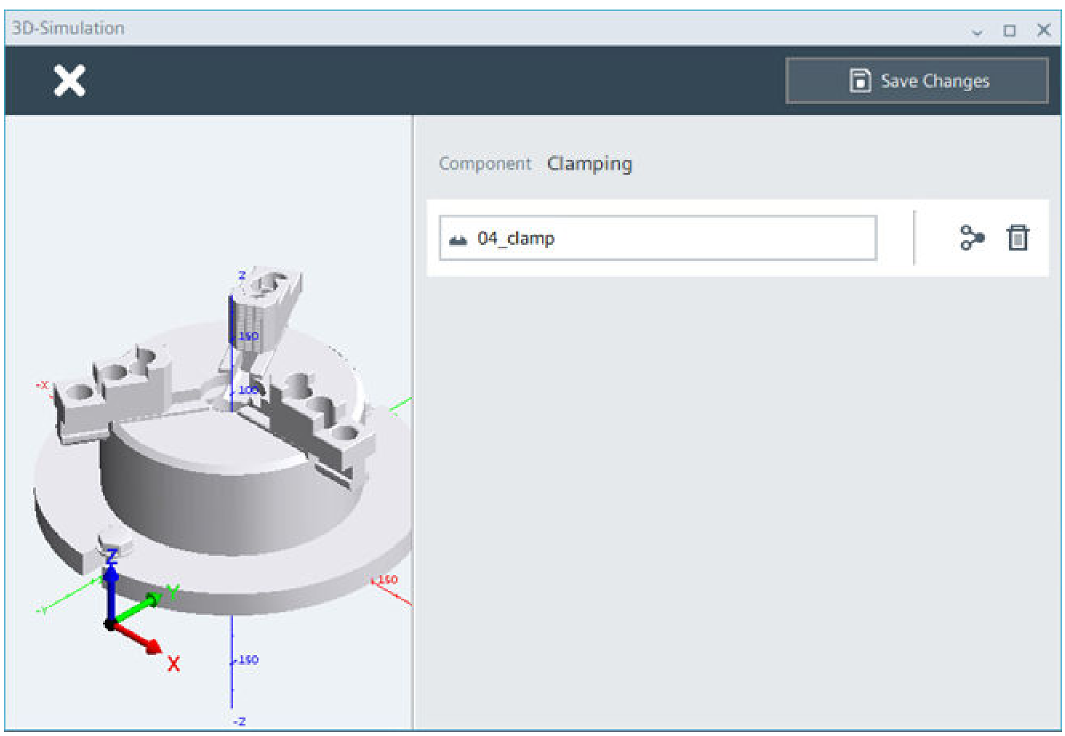


Figure 12-14 Clamping example: Machine vise

12.5.8 Configuration (clamping + blank)

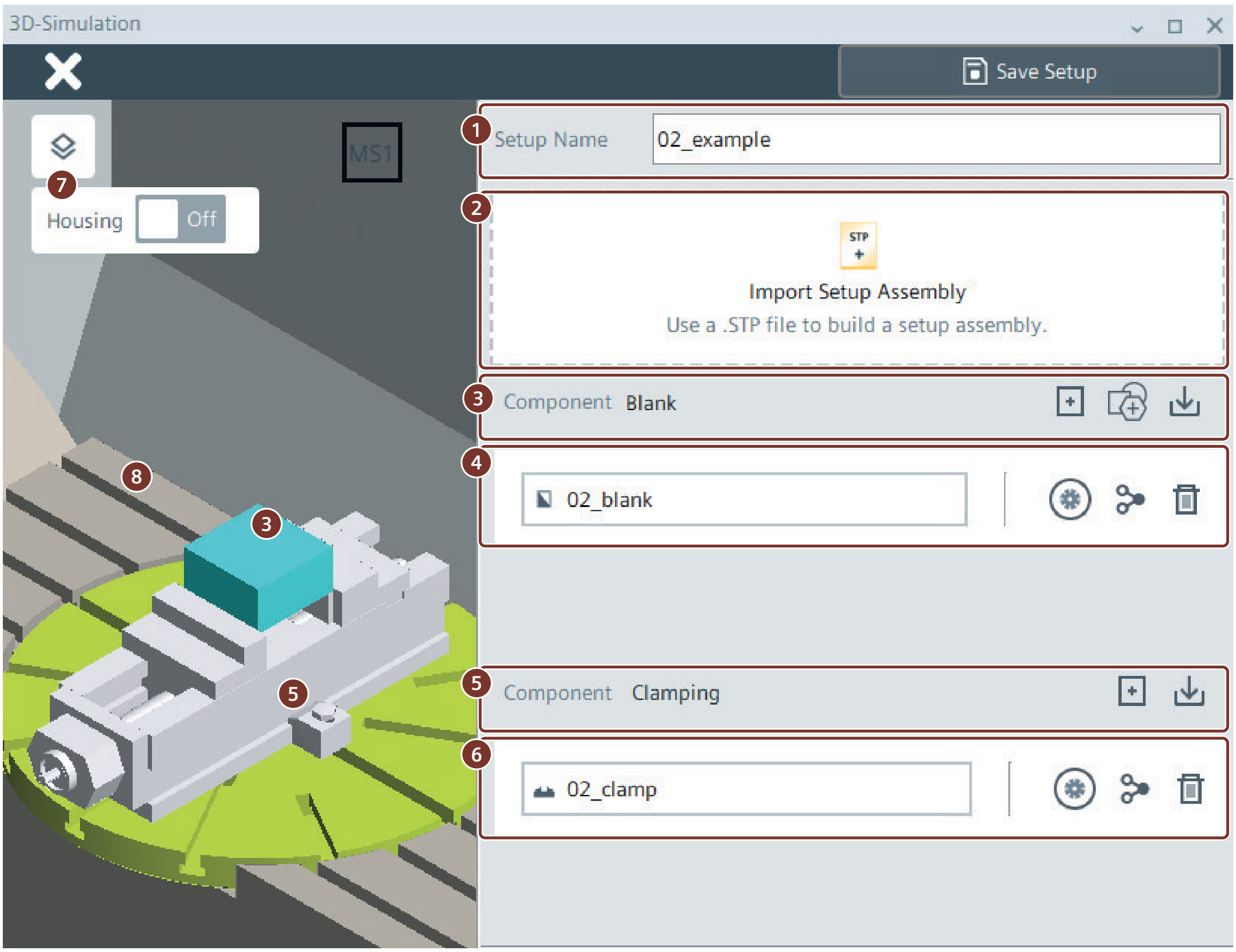
Parameter

A setup is the combination of clamping and blank and can consist of one or several blanks and clampings, e.g. multiple clampings.

Parameter		Description
Definition		
	Blank	Import of 1 to n blanks from the library.
	Clamping	Import of 1 to n clampings from the library. A setup can be composed of several clampings, e.g. a stationary part and the moving part of a machine vise.

Overview of "Setup"

A setup with a blank and a machine vice (clamping) is defined in the following example. The individual setup functions are briefly explained.



① Name of the setup

② Click on the button [STP] to import a complete setup (blank and clamping) as "*.stp" file.

③ **Blank**

Click on [+] to create a new blank from an "*.stl" or "*.stp" file.

Click on [shapes] to create a blank from simple geometric shapes.

Click on [import] to import a blank from the library.

④ Name of the blank

Click on [mount] to link the Mounting Point of the component with the Mount Station of another component in the setup (Page 250).

Click on [reference] to configure the reference systems.

Click on [delete] to delete the blank.

⑤ **Clamping**

Click on [+] to create a new clamping from an "*.stl" or "*.stp" file.

Click on [import] to import a clamping from the library.

⑥ Name of the clamping

Click on to link the Mounting Point of the component with the Mount Station of another component in the setup (Page 250).

Click on to configure the reference systems. For clampings with several Mount Stations, also define the assignment for the Mounting Point of the blank.

Click on to delete the clamping.

⑦ Use the layer to hide the machine housing if you want to check the position of the setup in the machining area.

The layer settings are only applied in the view of the setup in the library. The settings in area "Machine" and "Activate setup" remain unchanged.

⑧ The setup is displayed at the configured position in the machining area. This means that you already have the possibility of checking the position when creating the setup. If necessary, adapt the reference systems of the components so that the clamping equipment is positioned to address your specific requirements.

Figure 12-15 Example of a setup with blank and clamping

12.5.9 Creating components using the example of a blank

You create components in the "Library". The creation procedure is identical for all component types except "Setup". The procedure is illustrated using a blank as an example.

Define at least one blank in order to use the 3D Simulation. All components are necessary for realistic collision detection and simulation.

- Blank
- Clamping (optional)
- Setup (optional)
- Adapter (optional)
- Tool (optional)

How to create a component in the library

1. Click the "Library" tab.
2. Click on the "+ New library element" button and in the menu that is displayed select "Blank".
   A window with an empty component is displayed.
3. Click on button "New blank from" to import a geometry.
   A dialog opens.
   More information: Optionally, you can also directly create blanks from basic geometrical shapes (Page 246) in the library.
4. Select the "*.stl / *.stp" file of the 3D model.

5. The next steps differ depending on the file format of the 3D model.
   "*.stl" file
   The 3D model is immediately imported.
   "*.stp" file
   – For multi-part 3D models, select the components that are to be imported.
   – Click on button "Add Selected Items as Blank".

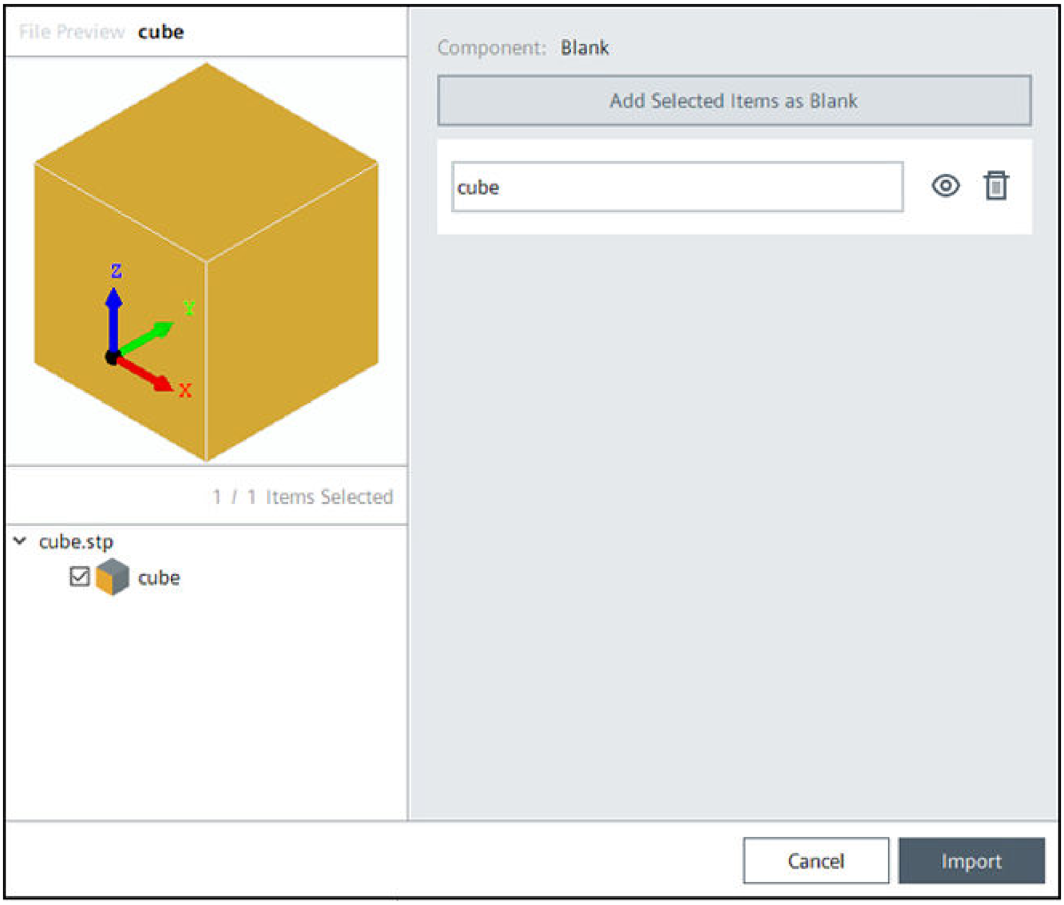


Figure 12-16 Example, blank with a component imported as "*.stp" file

   – The selection is accepted. Click on ◎ to display the selection in the 3D image for checking purposes.
   – Confirm with "Import".

   The imported 3D model is displayed.

6. Optionally, you can define the reference systems using button .
   - Click "+" to create a new Reference Point.
   - Enter new coordinate values for the reference system.

   In the example, a new Reference Point (blue) was defined at the left-hand lower corner. A Mounting Point (red) was defined centrally on the lower side.

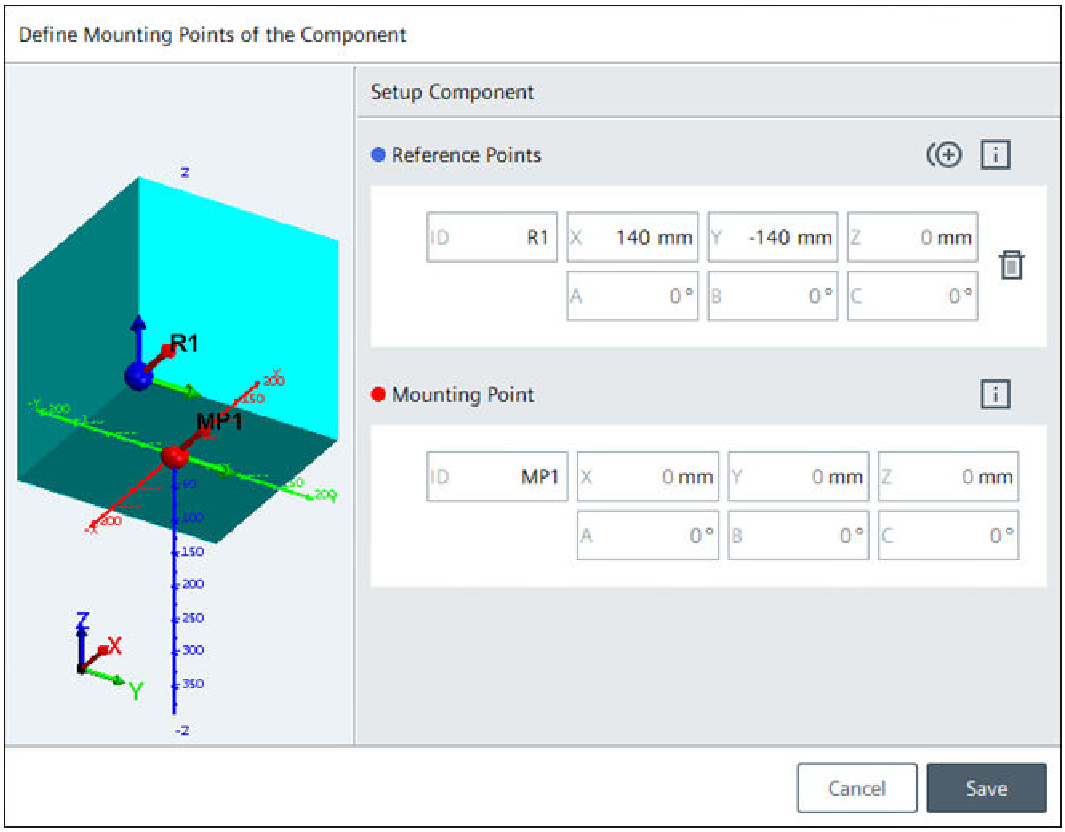


Figure 12-17 Example of blank: Reference Point left-hand corner, Mounting Point, centered at the lower side

7. Click "Save". The dialog is closed and the defined geometry for the component is displayed.

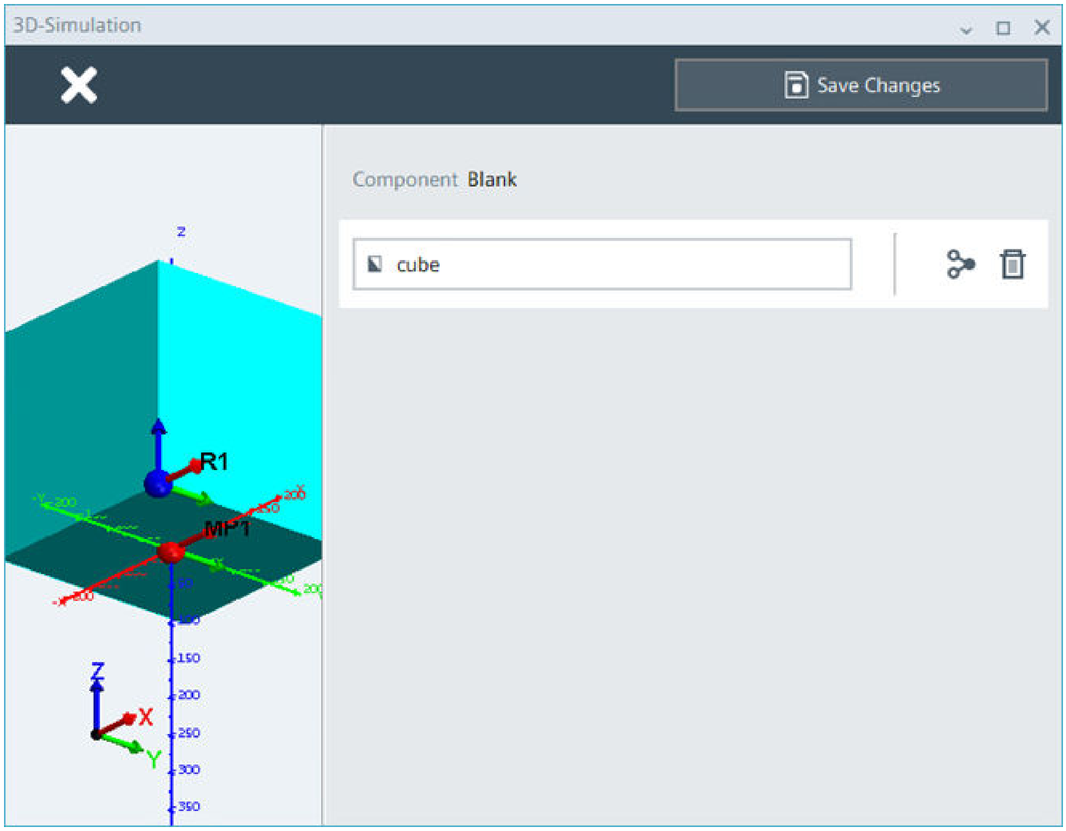


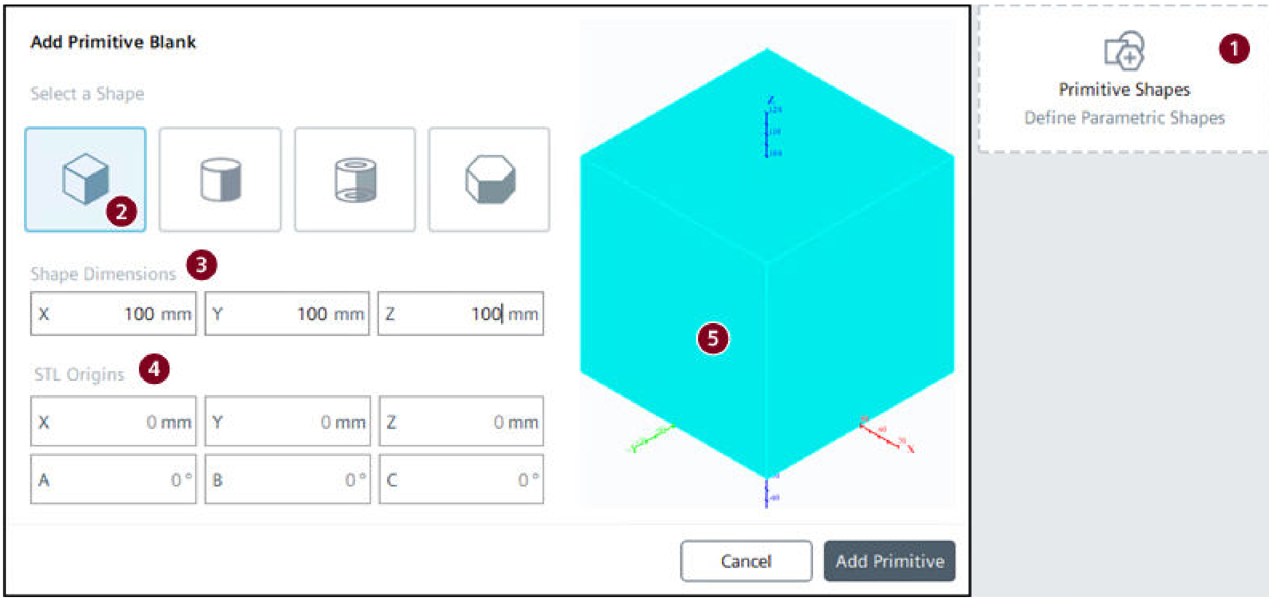
Figure 12-18 Example of blank: Components created for the library

8. Save the changes or the component. The window is closed and the new component is displayed in the library.
9. Create additional components in the library.

12.5.10 Blank from basic geometrical shapes

You create the blank in the library from specified geometrical shapes. You parameterize the standard shapes when creating the blank. "*.stl" or "*.stp" files are not necessary.

Overview of specified shapes for blanks



① When creating a new blank, click on the button to create the blank from a parameterizable shape.

② Select the basic geometrical shape of the blank. The following basic shapes are available:

- Block (dimensions in X, Y, Z)
- Cylinder (diameter and height)
- Pipe (diameter, wall thickness and height)
- N-corner (number of corners, edge length and height)

③ Depending on the selected basic shape, parameterize the dimensions of the geometric shape. The preview image is displayed.

④ As default, the basic shape has a Mounting Point at the bottom center of the blank. You can shift the Mounting Point or rotate the reference system.

⑤ Preview of the parameterized shape

Figure 12-19 Parameterizable geometric shapes to create blanks

12.5.11 Multi-part STP component for individual components

When creating a component from the STEP file with subordinate components (e.g. complex clamping), when importing the STEP file, you can select individual components and import as new component.

Requirement

A new component is created in the library.

An "*.stp" file is selected as 3D model.

This is how you work with STEP files with several components

In the example, a new clamping is created from a multi-part component.

1. Activate the checkbox in front of the component which is to be imported as new clamping.
2. Click on the button "Add Selected Items as clamping".

3. Enter a name for the new component.

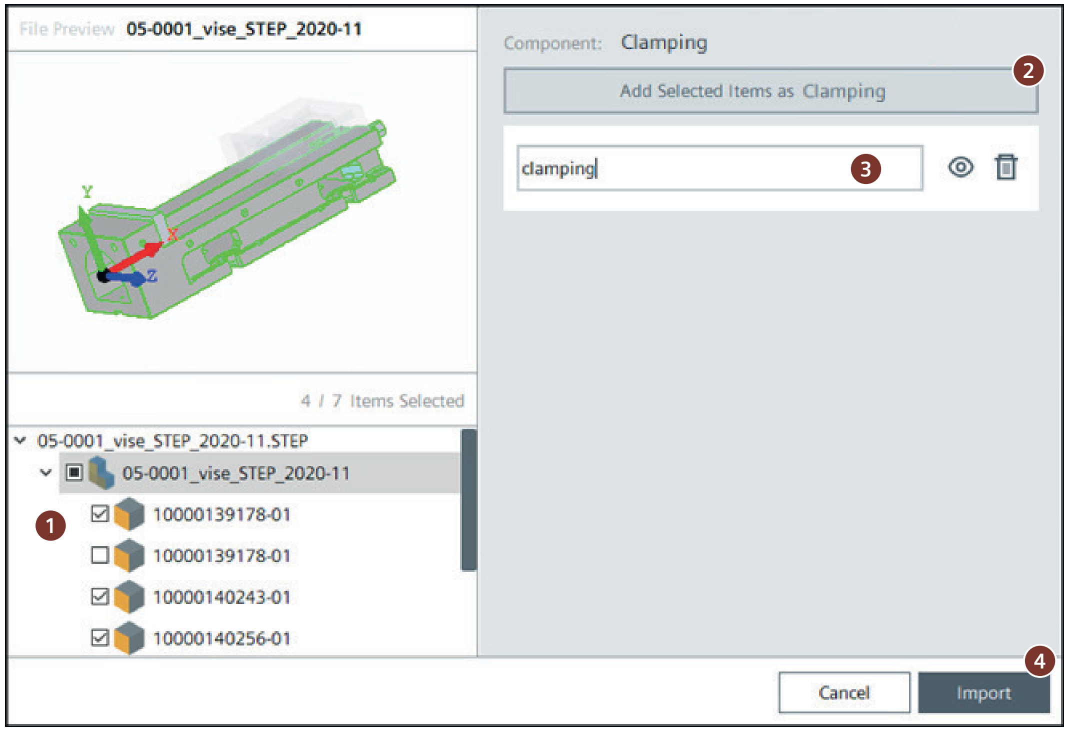


Figure 12-20 Individual components of a multi-part STEP model selected for import

4. Confirm with "Import". The imported selection is displayed as 3D model.

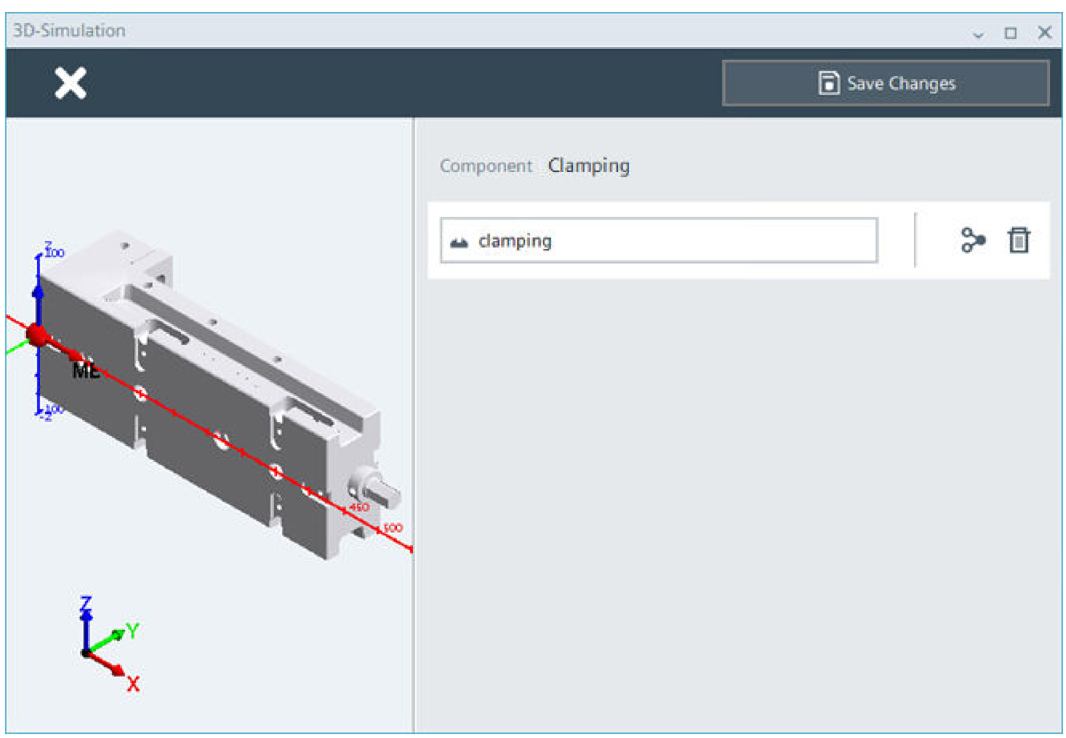


Figure 12-21 Creating clamping from a STEP model

12.5.12 Mount Station of components in a setup

The blanks and the clamping within a setup are positioned by default at the defined blank node (Machine station) in the machine model, regardless of their Mounting Point. If you define an additional positioning for a component during the setup of the clamping, the positioning is applied to the specific component.

For complete assemblies or if you want to position certain components together, it is helpful to link the Mounting Points (MP) with the Mount Stations (MS) of the components, e.g. blanks to clampings with multiple clampings (clamping towers) or clampings to each other.

Requirement

- A setup with blank and clamping is open.
- Mount Stations must be defined for the components (clamping) to which the other components can be linked.

This is how you link components within a setup

In the following example, a setup with 2 blanks and 2 clampings is defined. The clampings each have a defined Mount Station. By default, the components are linked with the "Default Machine Station". This is marked with the default icon.

1. Click on the button next to the component to display the defined Mount Stations within the setup.

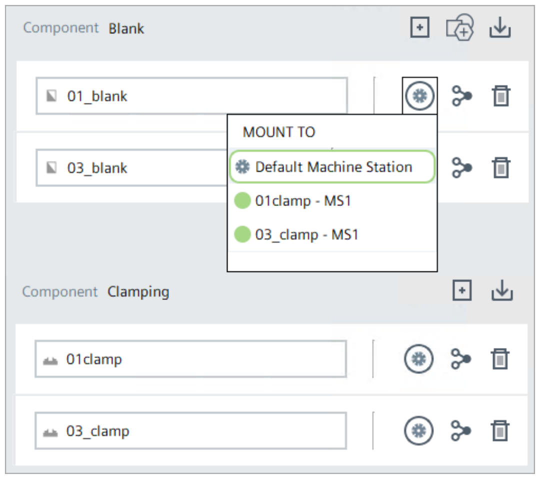


Figure 12-22 Displaying and changing linked mounting points of the component within the setup

2. Select the Mount Station to which the Mounting Point of the component is to be linked. In the example, the "01_blank" blank is to be linked with the MS1 Mount Station of the "01clamp" clamping.
   The two components are positioned in relation to each other at the defined mounting points. The linking of the component is indicated by a green circle symbol.

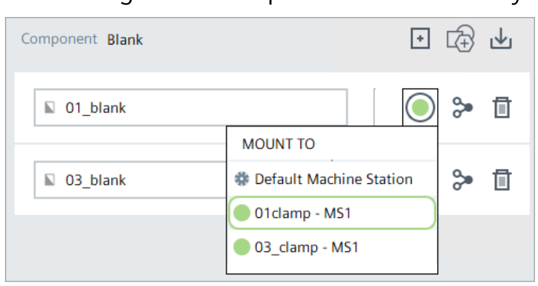


Figure 12-23 Mounting Point of the component is linked to another component

3. Repeat the process if you want to link further points of components.
4. Save the setup and confirm the messages.

12.5.13 Multi-part STP component for setups

When creating a setup from a STEP file with several components (e.g. finished clamping towers with blanks), you can select individual components when importing the STEP file and define them as clampings or blanks.

Requirement

A new setup has been created and the STEP file has been imported with the clamping and the blanks.

This is how you create a setup from a STEP file

In the example, a setup is created from a clamping tower with three blanks.

1. Activate the checkbox in front of the component which is to be imported as new clamping.
2. Click on the button "Add Selected Items as clamping".
3. Enter a name for the new clamping.
4. Activate the checkbox in front of the component, which is to be imported as new blank.
5. Click on button "Add Selected Items as Blank".
6. Enter a name for the new blank.
7. Repeat the operation if wish to add additional blanks.

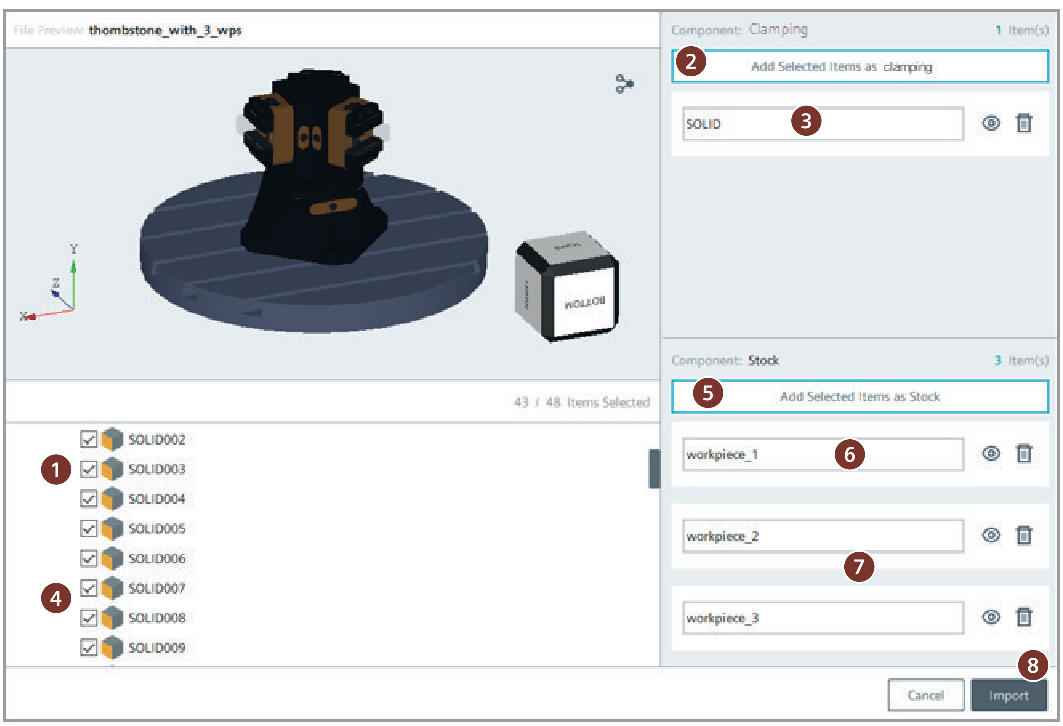


Figure 12-24   Importing a clamping tower with blanks as new setup

8. Confirm with "Import". The new setup is imported.

12.5.14 Setting the Mounting Point for setups in the 3D model

When creating a setup from a STEP file, you can manually set the Mounting Point in the 3D model with the mouse pointer when importing.

Requirement

A new setup has been created and the STEP file has been imported with the clamping and the blanks.

This is how you define the Mounting Point in the 3D model

In the example, the Mounting Point is set in the 3D model for a clamping tower.

1. Click on the button in the 3D model . The coordinate table is displayed.
2. Select a surface in the 3D model. The vertex of the surface is marked with a blue cross.
3. Double-click on the point. The new Mounting Point is displayed as red sphere and the coordinates are displayed.
4. You can still shift or rotate the Mounting Point using the coordinate table.
5. Select the components for blanks and clamping and assign the setup.

6. Confirm with "Import".

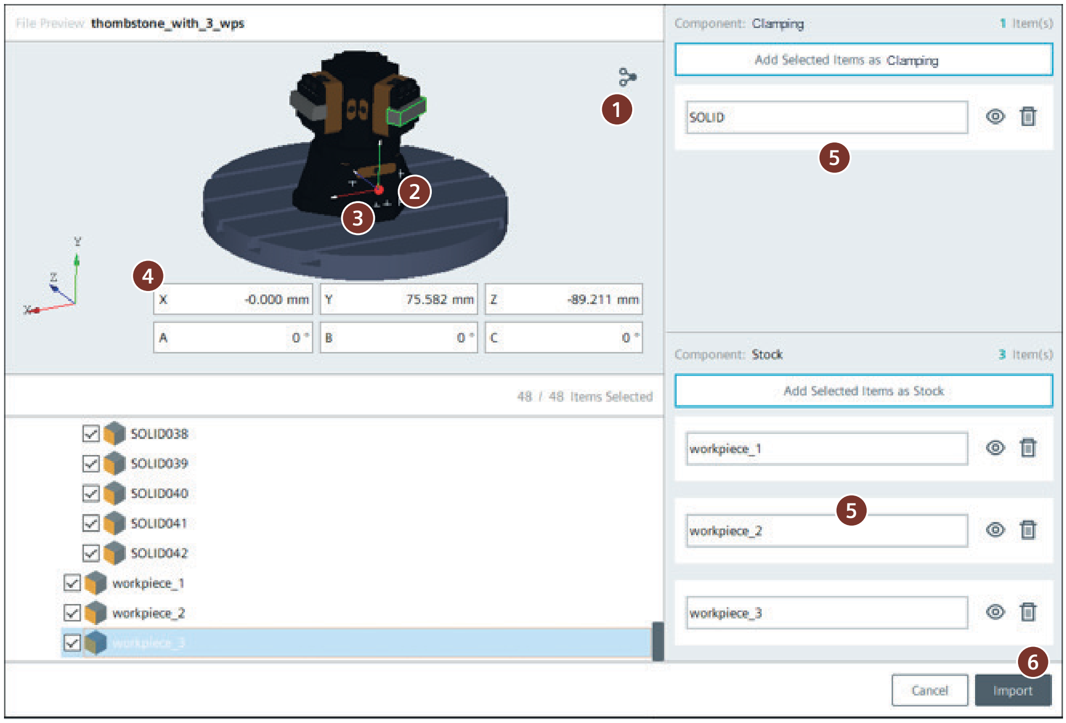


Figure 12-25 Setting the Mounting Point in the 3D model

7. The Mounting Point is used and displayed in the setup.

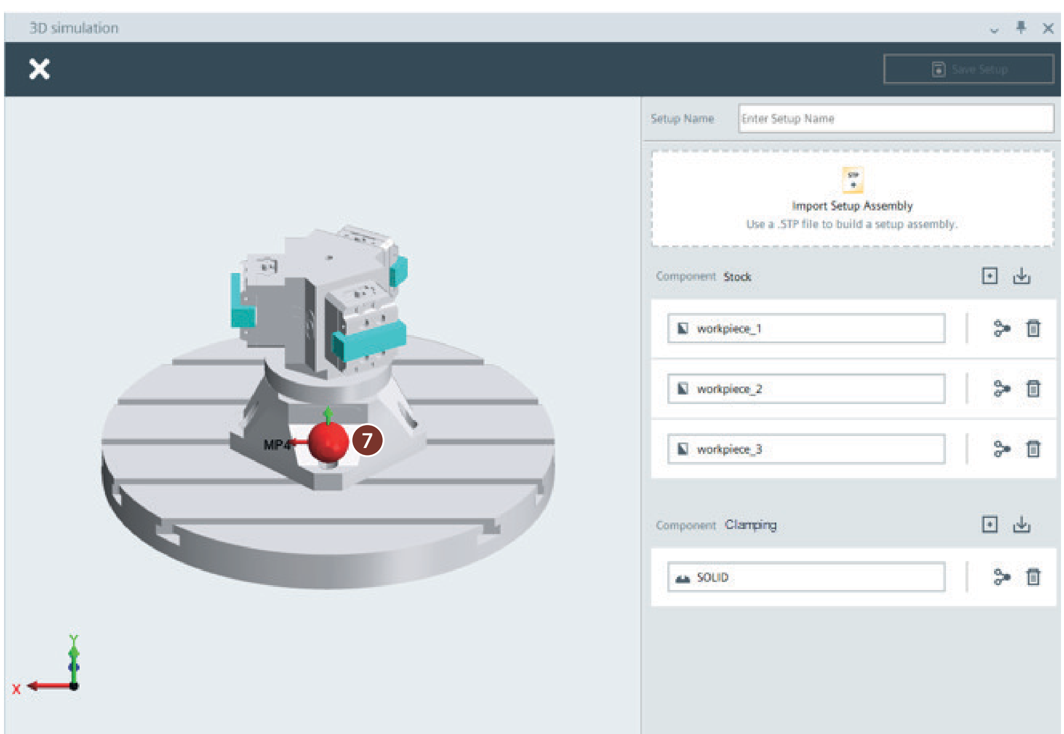


Figure 12-26 Mounting Point in the setup

12.5.15 Exporting/importing library components

You can export/import library elements as a "*.zip" file, for example to exchange data with other projects. The files are exchanged via the storage folder or via a freely selectable directory.

Exporting components

1. In the library, click on the "Select Multiple" button.
2. In the individual tabs of the library, select the component that you wish to export. Multiple selection is possible.
3. Click on "Export selection".
4. Enter a name in the dialog that appears and confirm with "Save".
   The exported "*.zip" file is saved in the storage folder or in the selected directory.

Importing components

1. Copy the "*.zip" file to be imported into the storage folder or into a directory of your choice.
2. In the library, click on the "+ New library element" button and in the menu that is displayed select "Import element".
3. Select the "*.zip" file in the dialog that appears and confirm with "Open".
   The components are extracted and created in the library. If components with the same name exist, the import is canceled.

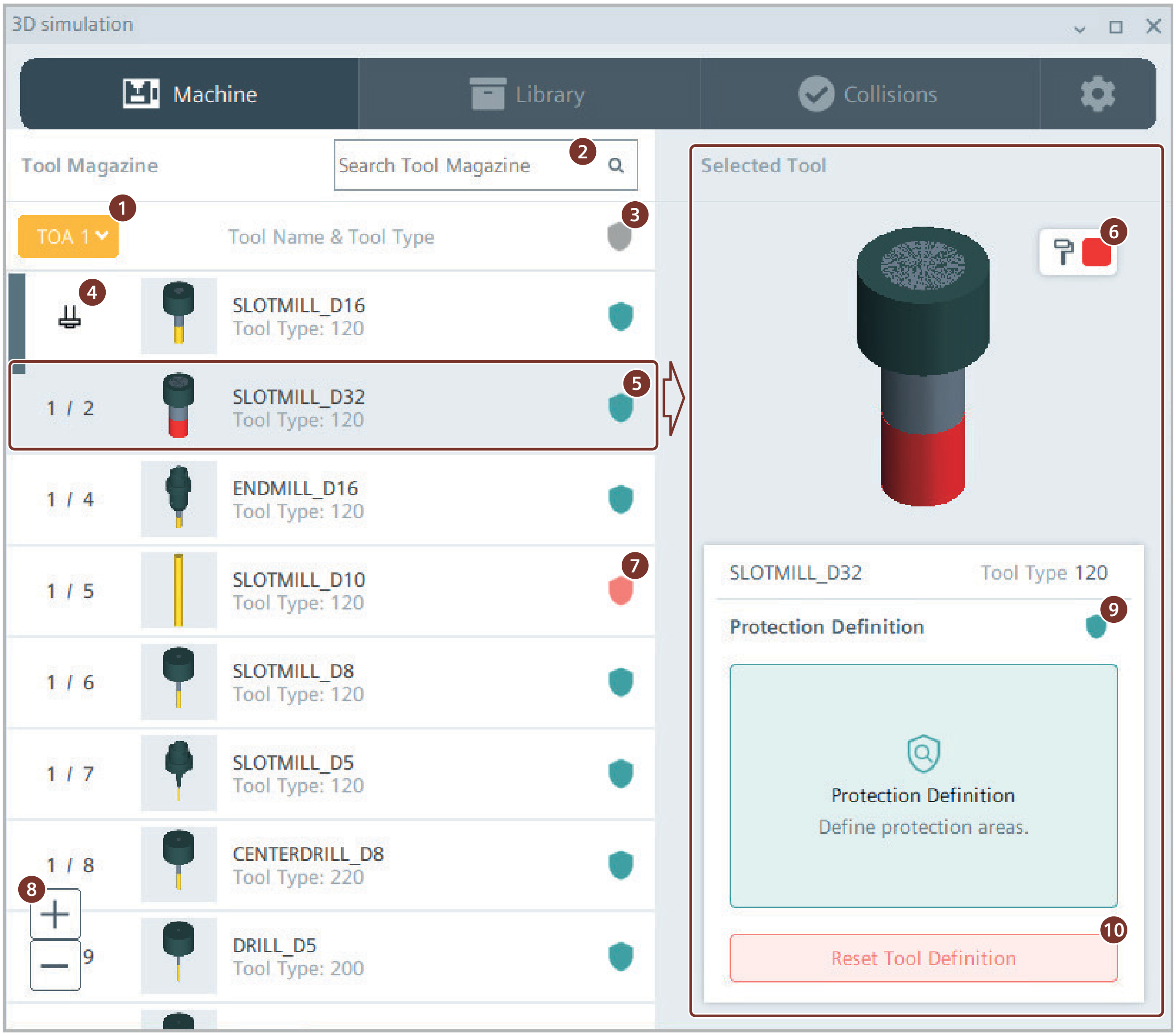
12.6 Protection definition tool and adapter

12.6.1 Tool manager

Managing tools for 3D Simulation

The tool manager is displayed when you click on the tool icon  on the start page of the 3D Simulation. All tools are displayed with the magazine/location number, the tool name, a preview image and the protection status in a vertical list. You can move the list up or down to display additional tools by clicking on the tool list with the left-hand mouse key pressed or using the slider. Tool details are displayed in the right-hand area by clicking on the corresponding tool.

The tool manager is synchronized with the tool list in SINUMERIK Operate and contains the tools defined there.



① TOA area for multi-channel machines

For multi-channel machines, each channel has a TOA area with its own tool list. These are selected from the selection list in the tool manager, e.g. TOA 1 and TOA 2. The corresponding tools are contained within each TOA tool list. Only TOA 1 is displayed for 1-channel machines.

② Searching for tools in the tool list

Here, enter the search term in the tool manager. At the same time as the entries are made, hits are displayed in the tool list.

③ The tool list is filtered by clicking on button (shield icon). By clicking several times, the filter criteria change and the button color correspondingly changes.

- Gray: **All** tools are displayed
- Green: Only tools **with** protection definition are displayed
- Red: Only tools **without** protection definition are displayed

④ The active tool in the spindle is marked with a spindle symbol.

⑤ The selected tool is shown with grey background, and the tool details are shown in the right-hand area. A green shield icon is displayed if the protection (adapter) has already been defined for the tool.

The magazine number/location number of the tool is displayed in the first column. If no location has been assigned for the tool in the magazine, then only the magazine is displayed, but not a location number, e.g. 1/-.

For multitools, the magazine and location numbers are displayed for the complete multitool adapter. The individual tools in the multitool are displayed below the adapter without magazine and location numbers.

⑥ You can define a color for every tool. For stock removal simulation in the 3D view, the machined surface is displayed in the tool color. Click on the paint roller icon to assign a color to a tool. "Red" was selected in the example.

⑦ Tools where protection has not been defined or not completely defined are shown with a red shield icon.

Tools where protection has not been defined are all those tools without a configured adapter (tool holder).

⑧ You can zoom in and out of the tool list using buttons "+" or "-".

⑨ "Fast protection" for the tool is defined in the example.

⑩ Deletes the current protection definition

Click on the red button "Reset tool definition" to delete the current protection definition. You can define a new protection after deleting the protection definition.

Figure 12-27 Example: Tool manager for a 1-channel machine

Meaning of the protection

In addition to the geometry data from the SINUMERIK Operate tool list, you also define the protection. The protection definition describes the tool holder and the adapter geometry (adapter component) and other geometry data of the cutting edge or tool (tool component). If all of these components are defined, a realistic simulation with collision detection is achieved. You set the additional data before starting the simulation.

Note

Changes made to the protection during simulation only take effect when the 3D Simulation is restarted.

Tools with a defined protection geometry for adapters and cutting and non-cutting parts of the tool are designated as "Defined" and are identified by a green shield icon.

12.6.2 Tool manager and tool list in SINUMERIK Operate

The tools in the Manager correspond to the tool list in SINUMERIK Operate. If data of the SINUMERIK Operate tool list changes, it is also updated in the 3D Simulation. If protection variants have already been defined for the tools, they are transferred to the changed tool or deleted according to certain rules.

Changed tools and protection definitions

- If you change a tool parameter in SINUMERIK Operate while you are defining a protection for this tool in the 3D Simulation, the window for defining tools is closed automatically.
- If you change the tool type in SINUMERIK Operate for a tool that has already been defined with protection in the 3D Simulation, the following rules apply.
  The defined protection remains in place:
  - The new tool type is also a milling tool or even an unsupported tool type.

  The defined protection is deleted:
  - The old tool type and the new tool type are a turning tool.
  - The tool type is changed between milling, turning or drilling.
  - The tool length is changed to a value of the < unclamping length.

Tool geometry 3D Simulation and tool data in the tool list

By default, tool data are taken from the SINUMERIK Operate (NC) tool list. Optionally, you can also import the geometry file ("*.stl/*.stp") of the tool. For collision consideration, in this case, you can use the geometry data of the imported tool and not the data from the SINUMERIK Operate tool list, e.g. tool length and diameter. When using an imported tool geometry, you must compare the dimensions of the tool in the geometry file with the tool data in the SINUMERIK Operate tool list.

More information

Aligning cutting edge D1 and tool geometry (Page 290)

12.6.3 Overview of tool types

Only a selection of the SINUMERIK Operate tool types is supported in the 3D Simulation. Supported tools are read in with all parameters from the SINUMERIK Operate tool list. Depending on the tool type, different protection variants are defined.

Note

Constraints relating to tools

- For unsupported tools, the replacement tools are used when defining the protection variant and for simulation. The replacement tools can be found in the table of supported tool types.
- For tools with several cutting edges (flutes), D1 is used as criteria as to whether the tool is a milling or turning tool.
- Internally, drill bits have the same logic as milling tools

---

Overview of the supported tool types

For more information on the tool types and the associated parameters, refer to the online help of SINUMERIK Operate.

Technology	Tool type number	Tool type name/description
Milling tools		
	110	Ball nose end mill
	111	Ball end mill tapered
	120	End mill
	121	Tapered ball nose end mill
	155	Bevel cutter
	156	Bevel cutter with corner rounding
	---	Tool types that are not listed are still not supported. These are interpreted as end mills (type 120).
Drill bits		
	200	Twist drill
	220	Centering tool
	--	Tool types that are not listed are still not supported. These are interpreted as end mills (type 120).
Grinding tools		
	400	Surface grinding wheel
	401	Surface grinding wheel
	402	Surface grinding wheel
	403	Surface grinding wheel
	410	Facing wheel
	411	Facing wheel
	412	Facing wheel
	413	Facing wheel
	--	Tool types that are not listed are still not supported. These are interpreted as end mills (type 120).
Turning tools		
	500	Roughing tool
	510	Finishing tool
	520	Plunge cutter
	530	Cutting tool
	540	Threading tool
	550	Button tool
	560	Rotary drill
	580	3D probe turning machine (probe with cutting edge position parameters)
	---	Tool type 585 calibrating tool is interpreted as end mill (type 120). Tool types 525 and 535 are interpreted as plunge cutter (type 520). Other tool types not listed above are interpreted as roughing tools (type 500).
Special tools **Probes**		
	710	3D probe

Technology	Tool type number	Tool type name/description
	711	Edge finder
	712	Mono probe
	713	L probe
	714	Star probe
	725	Calibrating tool
	730	Stop
	---	Tool types that are not listed are still not supported. These are interpreted as end mills (type 120).
Options (from CNC-SW V6.15 SP2)		
	---	Angle head

12.6.4 Protection definition for tools

Protection definition

For tools (milling, drilling, grinding and turning tools), you define the protection for the adapter (tool holder) and the tool (tool or tool shank incl. inserts). You can specify the geometry of the adapter and the tool by importing a geometry file or via parameters.

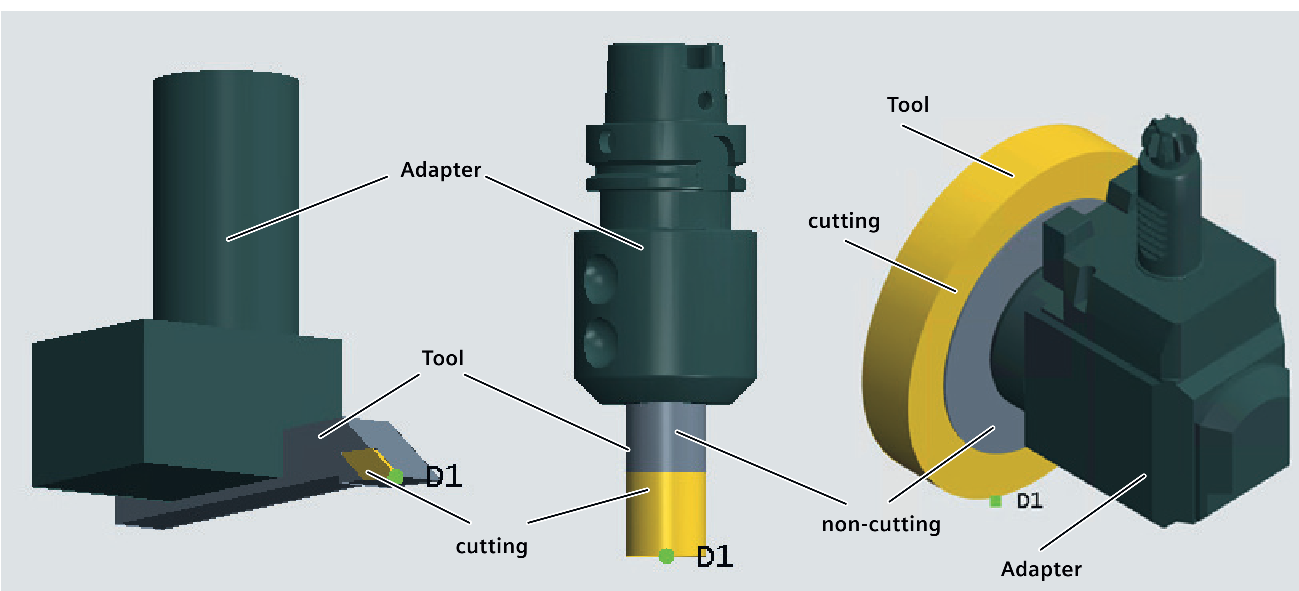


Figure 12-28 Example: Adapter and tool components for turning, milling/drilling and grinding tools

The definition of protection for adapters and tools is optional. If no protection is defined, the 3D Simulation only checks for collisions between the tool and other components. For the geometry of the tool without a defined protection, the tool data is taken from the SINUMERIK Operate tool list (NC) and used for the 3D Simulation.

To ensure that the collision consideration is realistic, the adapter should always be defined for each tool used so that it is also taken into account in the collision check.

Representation and properties of the tools in the 3D application

For collision analysis and visualization, the tool is made up of the two components **adapter** and **tool**.

Adapter properties

- Adapters are collision-relevant objects.
- Adapters can be defined parametrically or by importing 3D geometries as "*.stl" or "*.stp/*.step" files.
- 3D adapter geometries can be saved in the library as "adapter" component and reused in several tool protection definitions.
- Up to 5 adapters can be defined for a tool.
- Positioning of adapters
  - **Adapter with parameters defined**
    The following applies for milling tools/drill bits:
    Adapters are positioned in the preview based on the input parameters at the tool node defined in the machine model.
    The following applies for turning tools:
    Adapters are positioned in the preview based on the input parameters for tool tip D1.
  - **Adapter with 3D geometry defined**
    The first adapter is positioned at the tool node defined in the machine model. The other adapters are each positioned on the adapters above it.

Tool properties

- Tools consist of a cutting and a non-cutting part.
- Non-cutting (non-chipping) parts are collision-relevant objects.
- Tools can be defined parametrically or by importing 3D geometries as "*.stl" or "*.stp/*.step" files.
- Tool geometries can be saved in the library as a "tool" component and reused in several tool protection definitions.
- Positioning of tools
  - **Tool with parameters defined**
    Tools are positioned in the preview based on the input parameters with the tool tip on D1.
  - **Tool with 3D geometry defined**
    You can either position the tool on the adapter or define a Reference Point for the tool and position it on D1. By default, tools are mounted with their Mounting Point on the adapter.

How to open the protection definition for a tool

1. Open the tool manager.
2. Select the tool for which the protection definition is to be carried out.
3. Click on the "Protection Definition" button framed in red to define the protection for the selected tool.

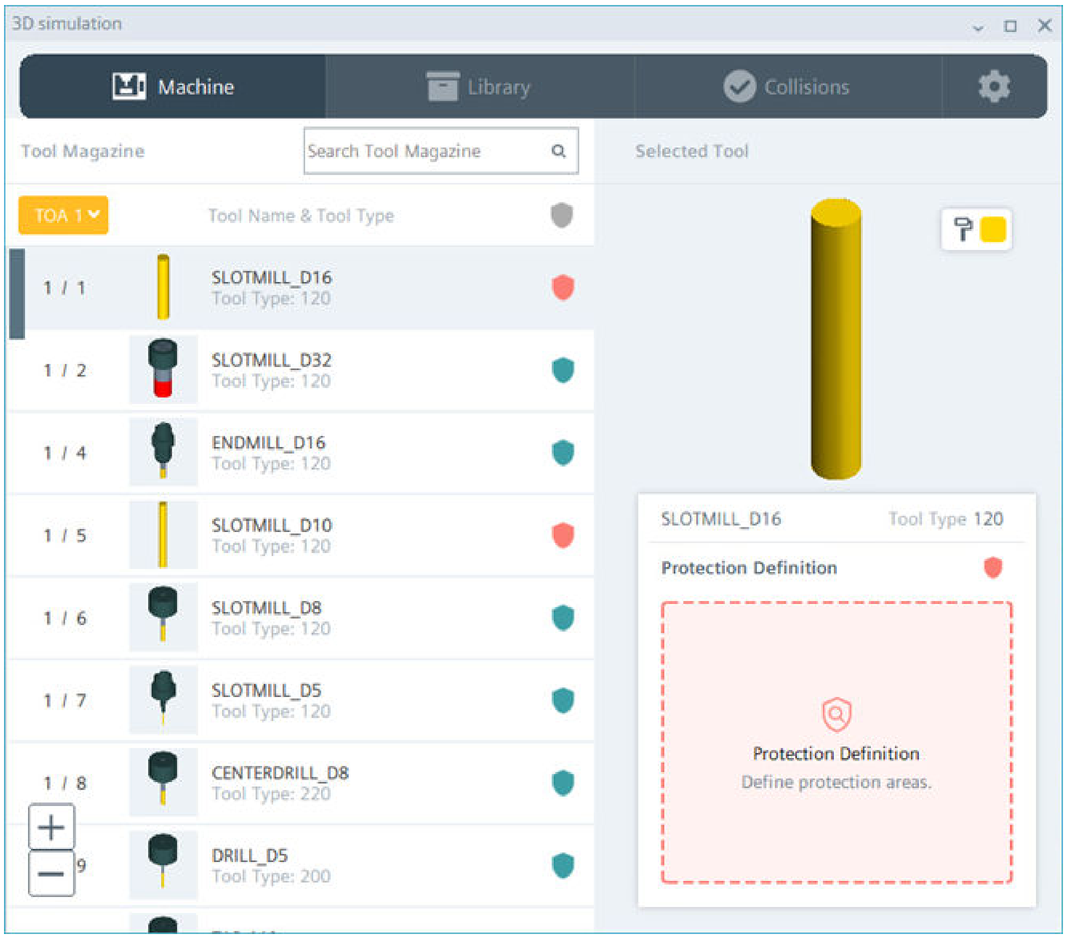


Figure 12-29 Protection definition for a tool using the example of an end mill

The window for defining the protection is displayed and you can specify the protection definition in the next step.

Options for protection definitions

The protection for the adapter and tool is defined independently of each other. You can define protection for the adapter and tool or only for the adapter, for example.

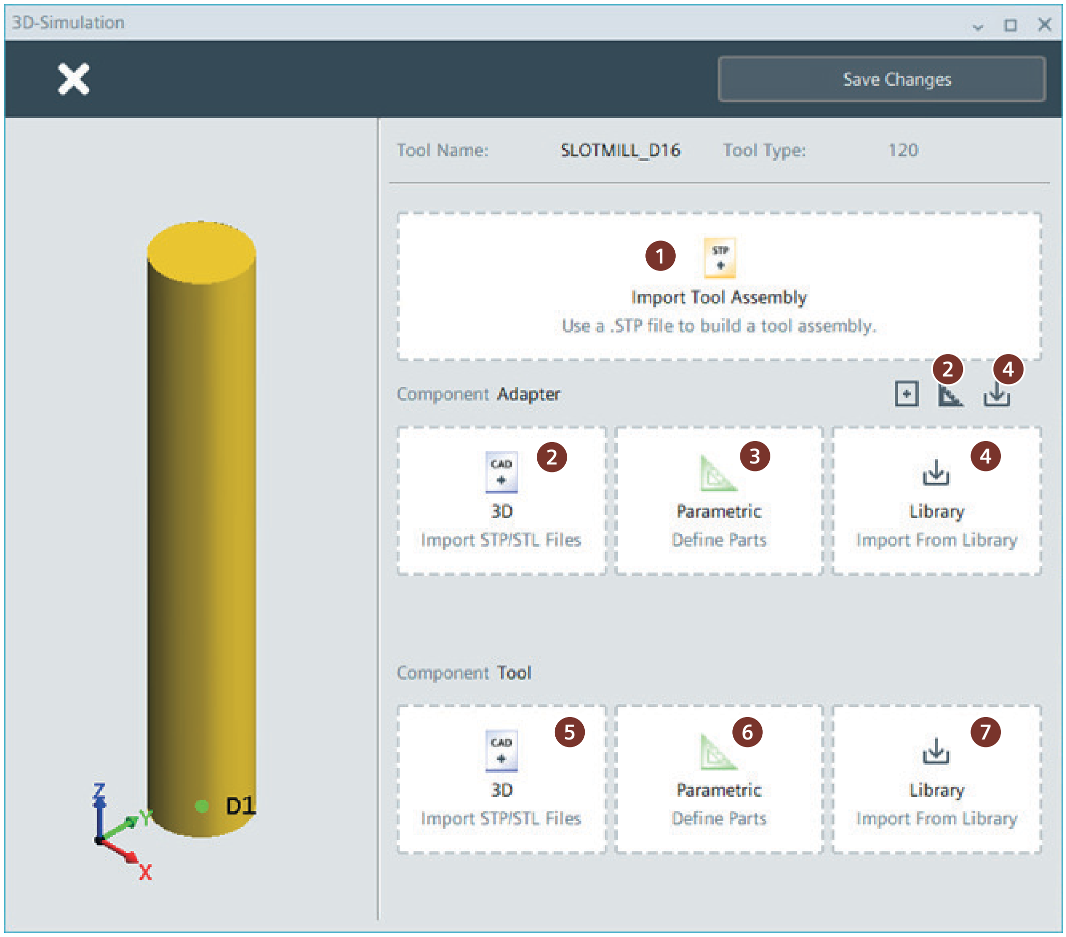


Figure 12-30 Protection options for a tool using the example of an end mill

The following options are available for defining the protection:

① Import complete assembly consisting of adapter and tool geometry as "*.stp" file

② Import adapter geometry as "*.stl" or "*.stp" file

③ Adapter geometry is defined via parameters

④ Import adapter geometry from the library

⑤ Import tool geometry as "*.stl" or "*.stp" file

⑥ Tool geometry is defined via parameters

⑦ Import tool geometry from the library

Note

When defining the protection via parameters, the geometry for the adapter and the tool is defined by entering values for predefined parameters without importing an "*.stl" or "*.stp" file. This option allows you to quickly define a protection without 3D geometry files for adapters or tools.

Protection definition and library

If you define a new protection and import adapter or tool geometries as "*.stl" or "*.stp" files, these components are automatically saved as library components when the protection definition is saved.

More information

Defining protection via parameters for milling tools/drill bits (Page 264)

Defining protection via parameters for turning tools (Page 267)

Defining protection via parameters for grinding tools (Page 272)

Defining protection for milling tools/drill bits (Page 275)

Defining protection for turning tools (Page 277)

Defining protection for grinding tools (Page 278)

12.6.5 Defining protection via parameters for milling tools/drill bits

You can define the geometry of the protection areas for the adapter and optionally for the tool using predefined parameters. The following parameters are available.

Adapter

- Standard cylindrical shape with defined diameter.
  The diameter value entered in the "Settings" tab is used for the adapter diameter. You can still change this value.
- Protruding length (unclamping length/collar length) of the tool when used in an adapter
  The protruding length must always be shorter than the tool length stored in SINUMERIK Operate.

Tool (cutting and non-cutting area)

- Cutting edge length of the tool (colored area of the tool in the diagram)
- Tool length (taken from SINUMERIK Operate tool list)

How to define protection using parameters

1. In the tool manager, click on the tool for which you want to define a protection.
2. Click on the "Protection Definition" button. The parameterization window appears.

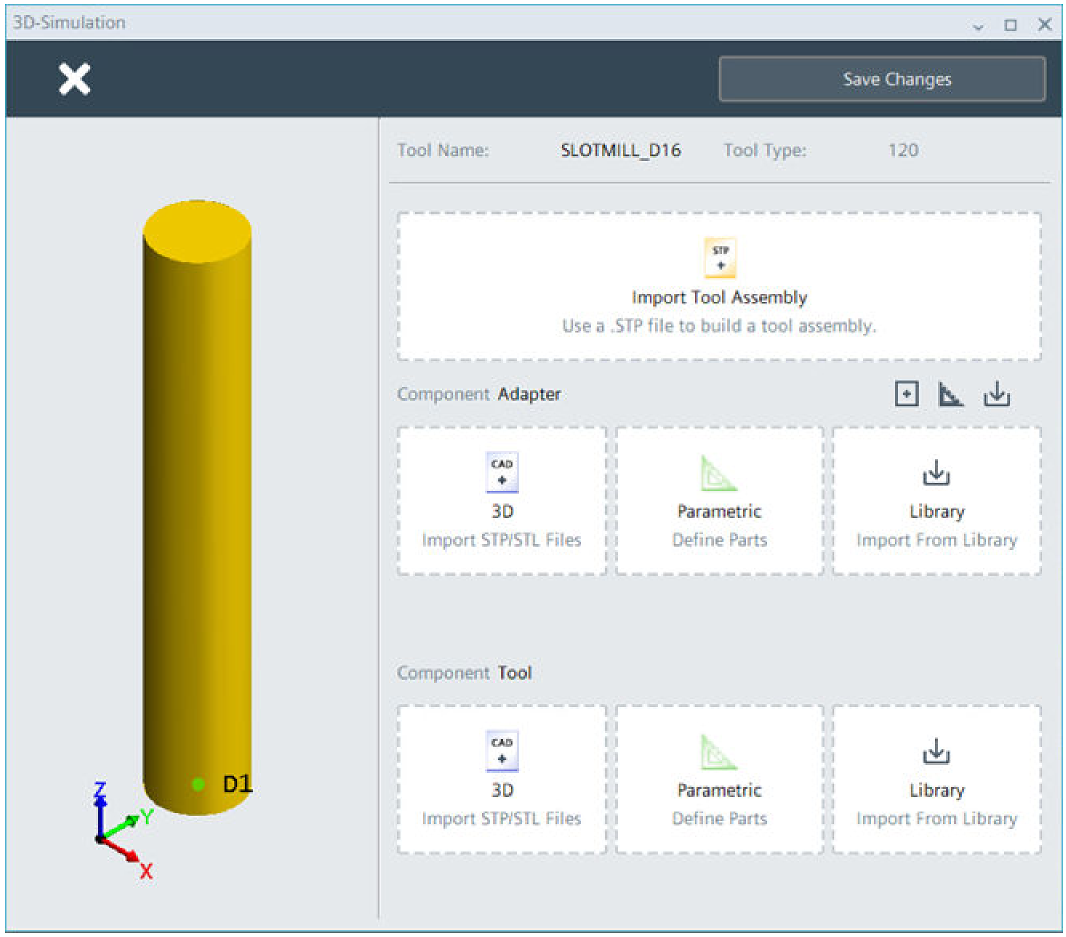


Figure 12-31 Protection for adapters and tools via parameters

3. In the "Component adapter" area, click on the "Parametric" button. The parameters are displayed.
4. Enter the values in mm for the "Protruding length" and the "Adapter diameter".
5. In the "Component tool" area, click on the "Parametric" button. The parameters are displayed.

6. Enter the value in mm for the "Flute length". The other tool data is taken from the SINUMERIK Operate tool list.
   The protection definition for the adapter and the tool is displayed in the preview image.

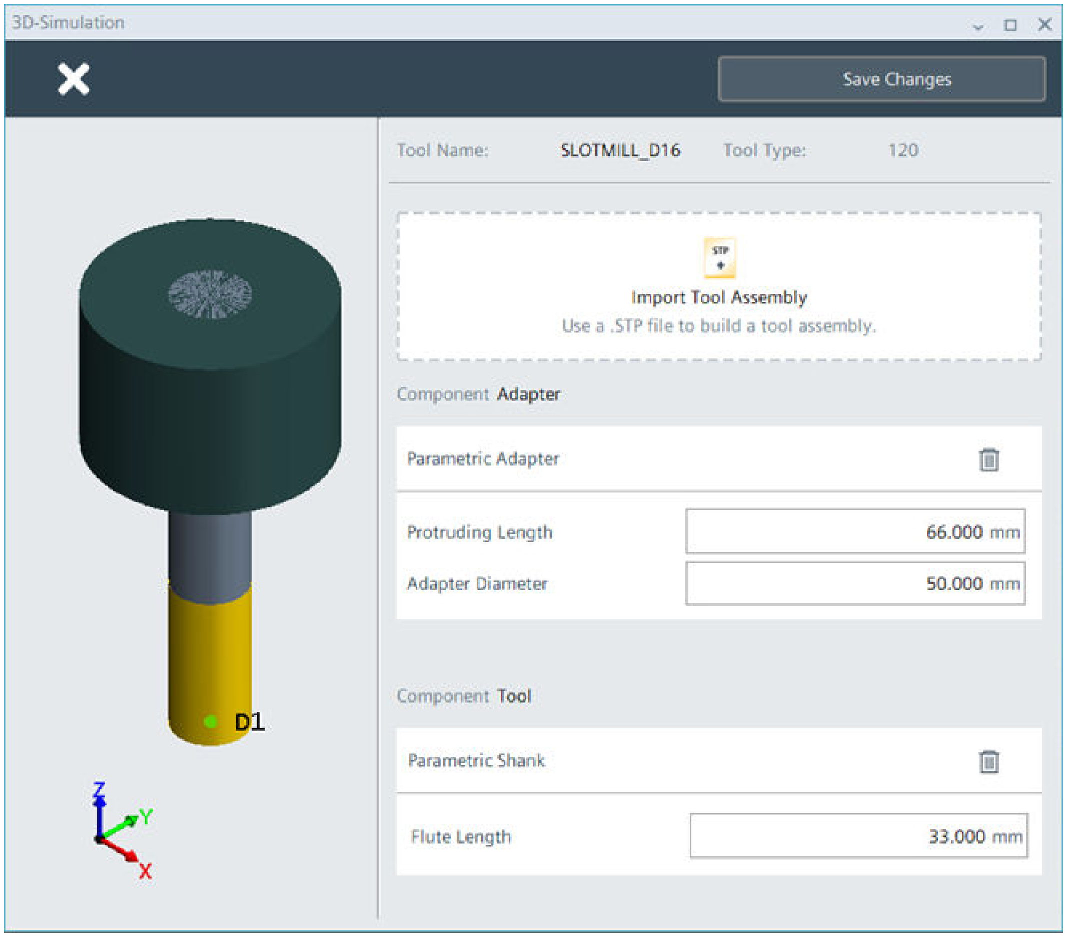


Figure 12-32 Defining protection for adapter and tool via parameters using the example of an end mill

7. Click on "Save changes". The values are saved and a preview image with a yellow flute length is displayed.
   The tool has the status "defined".

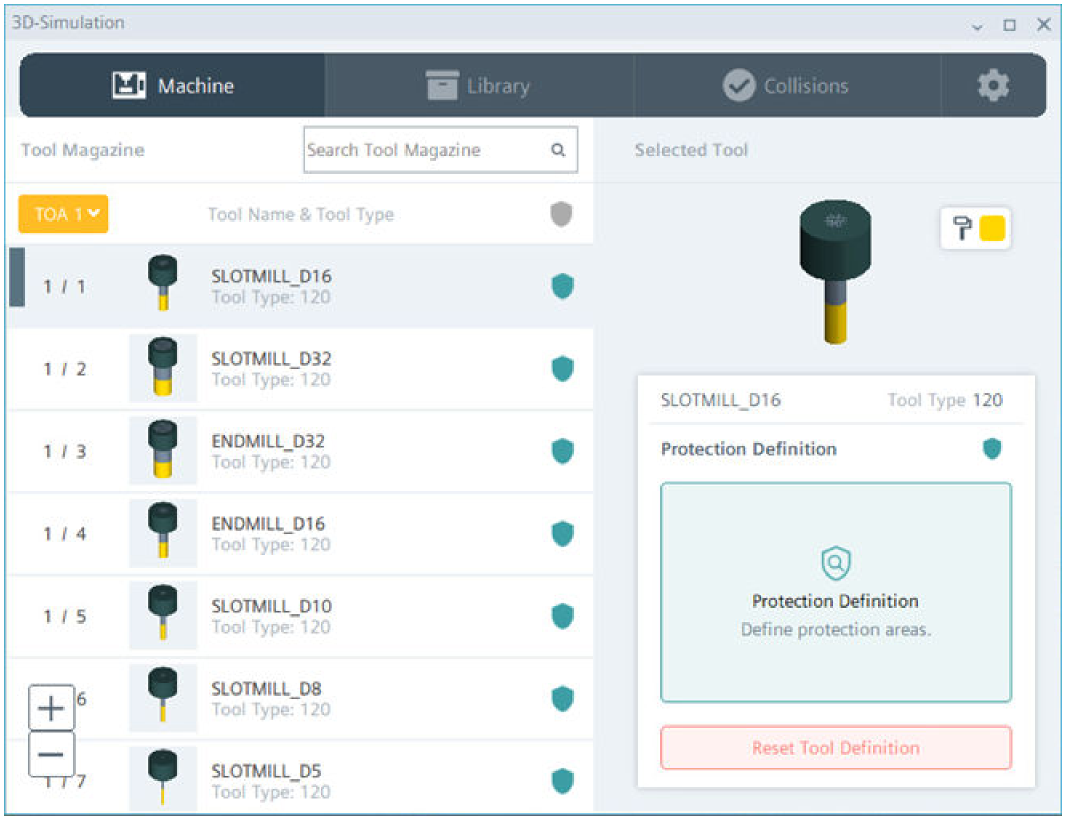


Figure 12-33 Adapter and tool with defined protection

8. Repeat the work steps if you want to define more tools.

Click on the "Machine" tab to close the tool manager.

See also

Defining protection for milling tools/drill bits (Page 275)

12.6.6 Defining protection via parameters for turning tools

You can define the geometry of the protection areas for the adapter and for the tool (tool shank and cutting plate) using predefined parameters. The adapter and tool parameters are preset with default values. Change the parameters according to the adapter and tool used. The adapter and the tool are displayed in the 3D preview. Press the button "V" or "Λ" next to "Legend" to show or hide a drawing with explanations of the individual parameters.

The following parameters are available, for example:

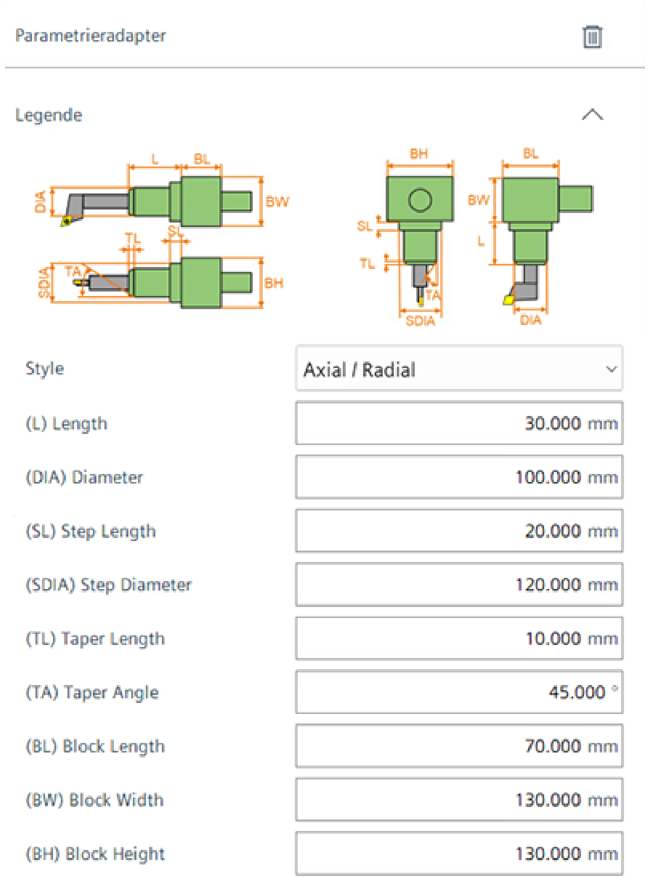
<table>
<tr><th>Adapter</th><th>Tool</th></tr>
<tr><td>

- "Axial" or "Radial" adapter

</td><td>

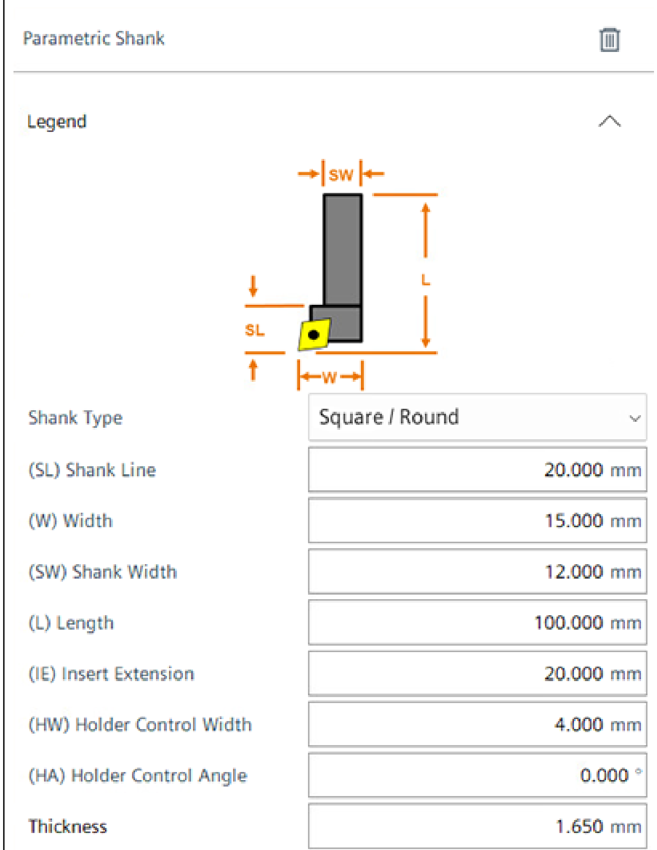
- Tool shank "square" or "round"
- Thickness of the cutting plate

</td></tr>
<tr><td>



Parameters for the adapter with display of the legend

</td><td>



Parameters for the tool (shank, insert) with display of the legend

</td></tr>
</table>

How to define protection using parameters

In the following, the procedure is illustrated using a turning tool as an example.

1. In the tool manager, click on the turning tool for which you want to define a protection.

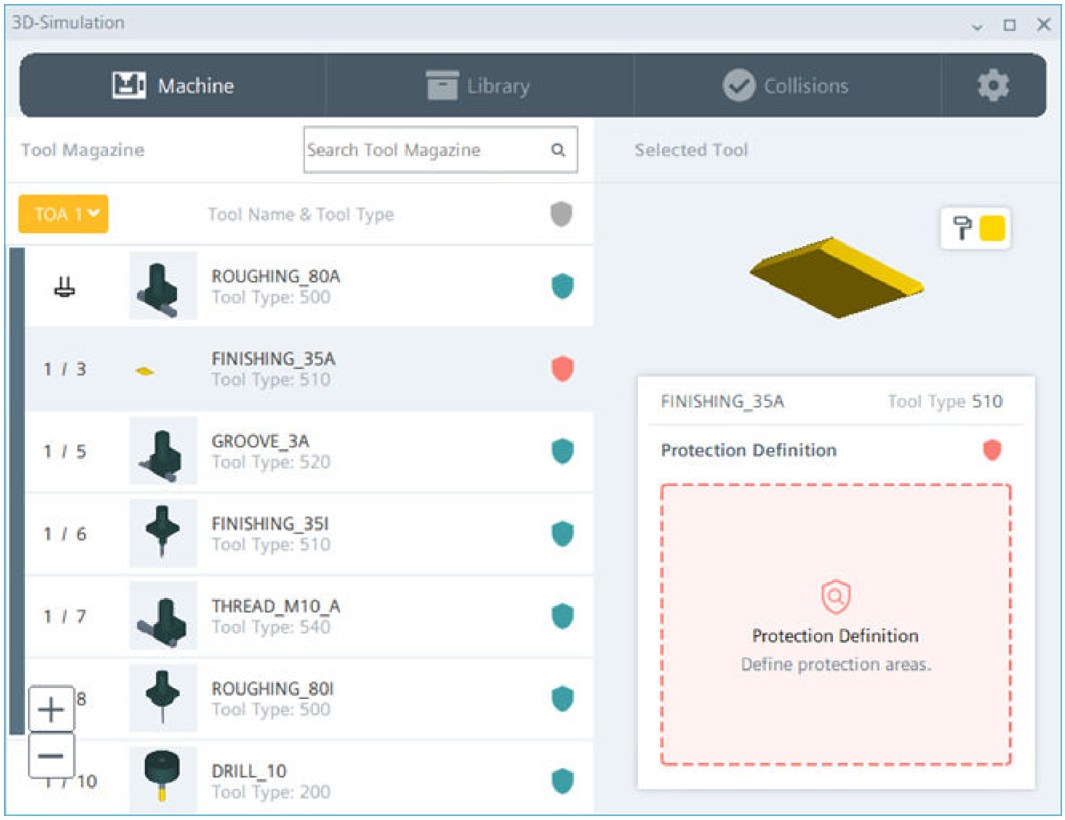


Figure 12-34 Protection definition for a turning tool

2. Click on the "Protection Definition" button. The parameterization window appears.
3. In the "Component tool" area, click on the "Parametric" button . The parameters are displayed.

Note

Sequence when defining

When defining, you should first parameterize the tool and then the adapter. This is because the parameters for the adapter are automatically restricted depending on the shank type. First define the adapter to be able to use the full selection of parameters.

4. Click the "v" button to display a detailed drawing of the shaft values.

5. Select the shank type and enter the parameter values.

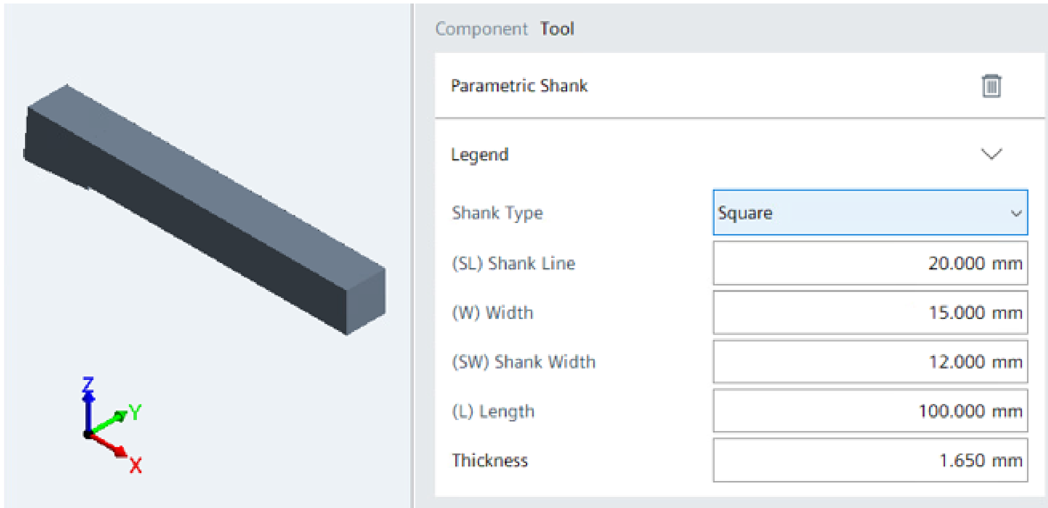


Figure 12-35 Defining the shank of the turning tool with parameters

6. In the "Component adapter" area, click on the "Parametric" button . The parameters are displayed.
7. Click on the "v" button to display a detailed drawing of the adapter.

8. Enter the parameter values. The other tool data is taken from the SINUMERIK Operate tool list. The selection of parameters is restricted for a square shank. For a round shank, first select the "axial" or "radial" design of the adapter. Other parameters are displayed dependent on this. The protection definition for the adapter and the tool is displayed in the preview image.

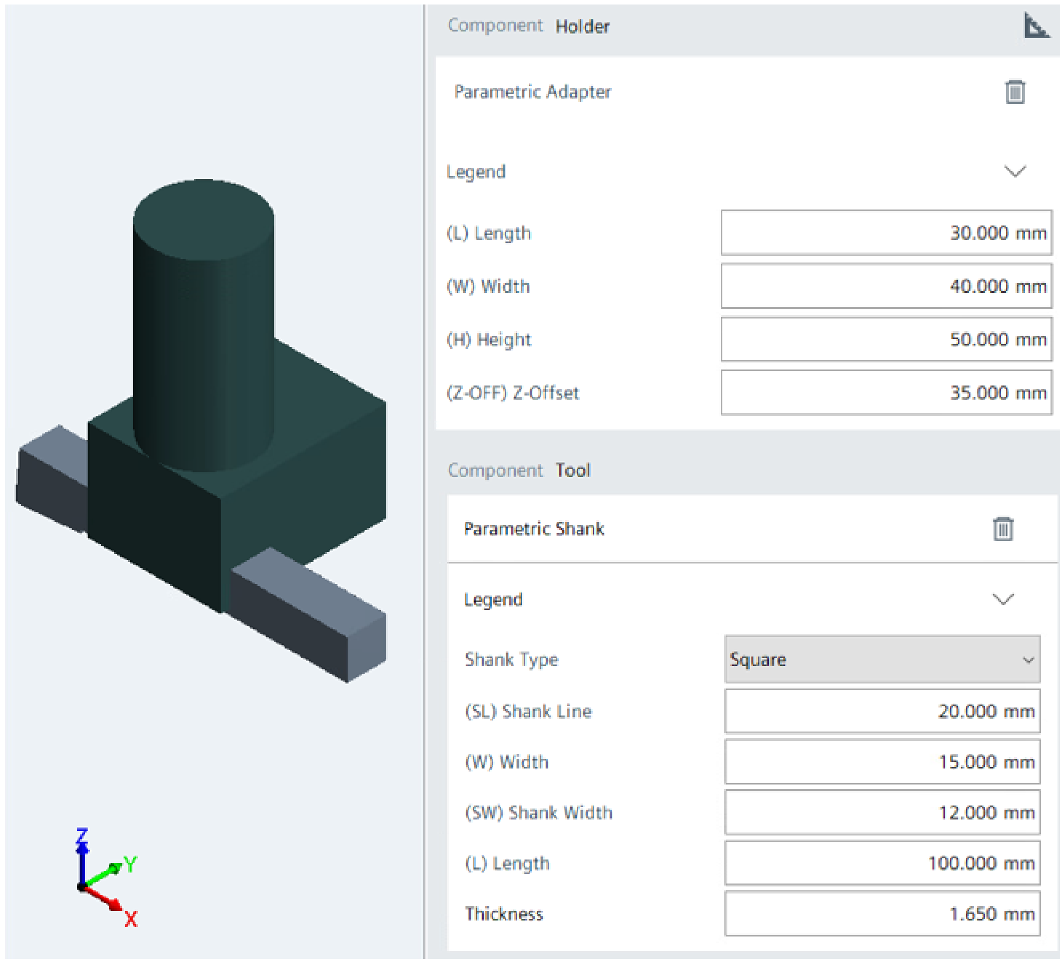


Figure 12-36 Defining a parametric adapter using a turning tool as an example

9. Click on "Save changes". The tool has the status "defined".

Note

If you define invalid values for the tool or adapter parameters, no 3D preview is displayed for this tool. The tool then has no defined protection.

10. Repeat the work steps if you want to define more tools.

Click on the "Machine" tab to close the tool manager.

See also

Defining protection for turning tools (Page 277)

12.6.7 Defining protection via parameters for grinding tools

You can define the geometry of the protection areas for the adapter and for the tool using predefined parameters. The following parameters are available.

Adapter

- Standard cylindrical shape with defined diameter.
  The diameter value entered in the "Settings" tab is used for the adapter diameter. You can still change this value.
- Protruding length (unclamping length/collar length) of the tool when used in an adapter
  The protruding length must always be shorter than the tool length stored in SINUMERIK Operate.

Tool (cutting and non-cutting area)

- Flange diameter of the tool (non-cutting area of the grinding tool).
- Outer diameter of the grinding wheel (taken from SINUMERIK Operate tool list).

How to define protection using parameters

1. In the tool manager, click on the grinding tool for which you want to define a protection.
2. Click on the "Protection Definition" button. The parameterization window appears.

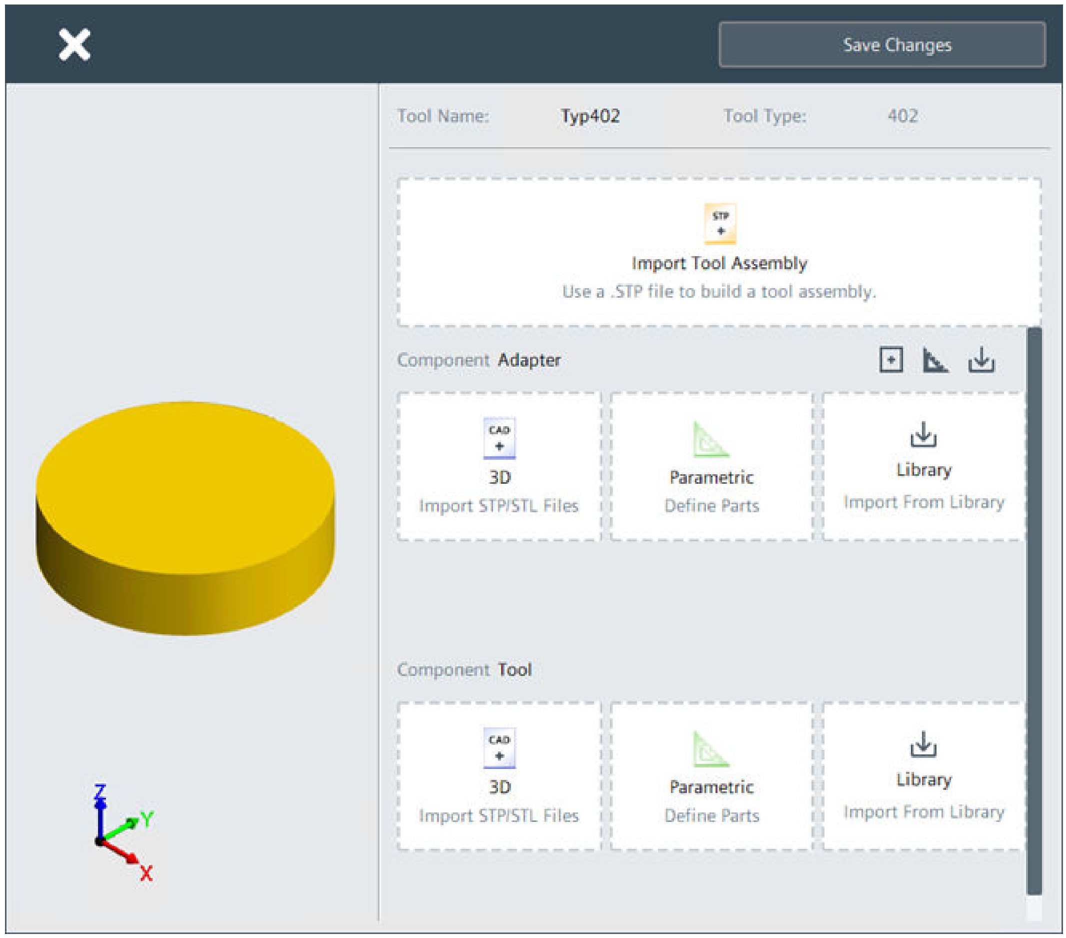


Figure 12-37 Protection for adapter and grinding tool via parameters

3. In the "Component adapter" area, click on the "Parametric" button . The parameters are displayed.
4. Enter the values in mm for the "Protruding length" and the "Adapter diameter".
5. In the "Component tool" area, click on the "Parametric" button . The parameters are displayed.

6. Enter the value for the "Flange diameter" in mm. The other tool data is taken from the SINUMERIK Operate tool list.
   The protection definition for the adapter and the tool is displayed in the preview image.

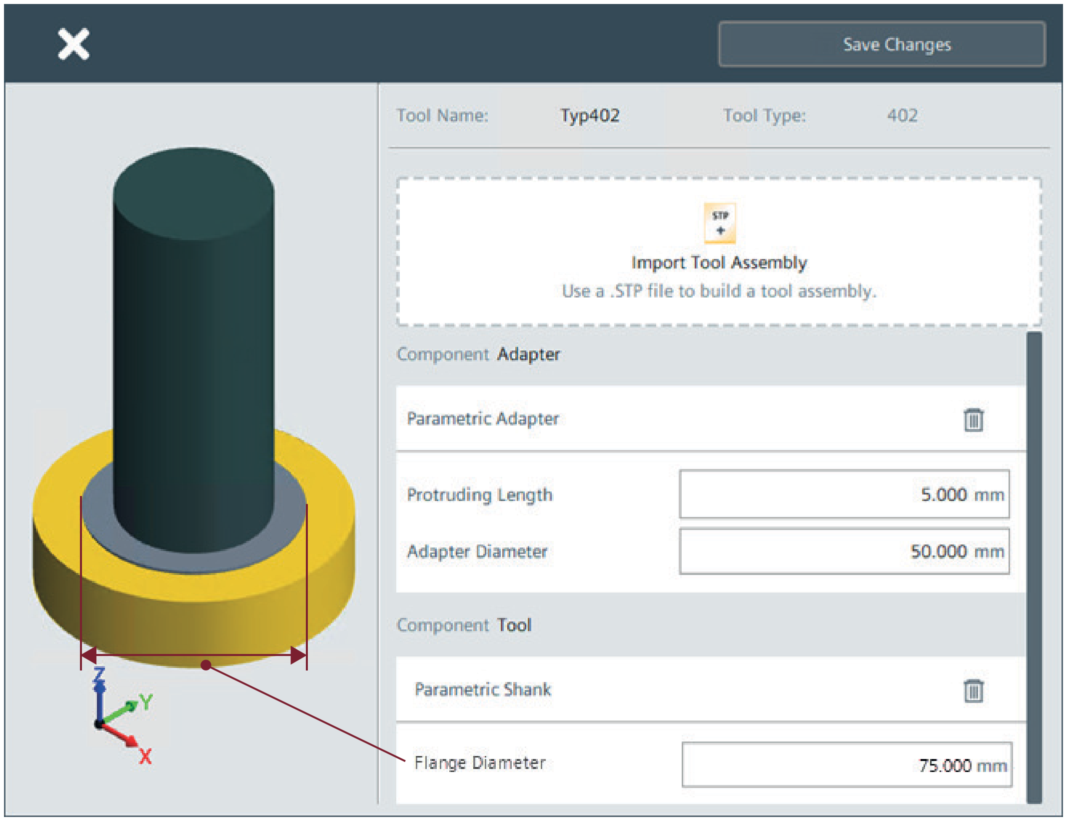


Figure 12-38 Protection for adapter and grinding tool defined via parameters

7. Click on "Save changes". The values are saved and a small preview image with yellow-colored plunge depth (cutting part) is displayed.
   The tool has the status "defined".

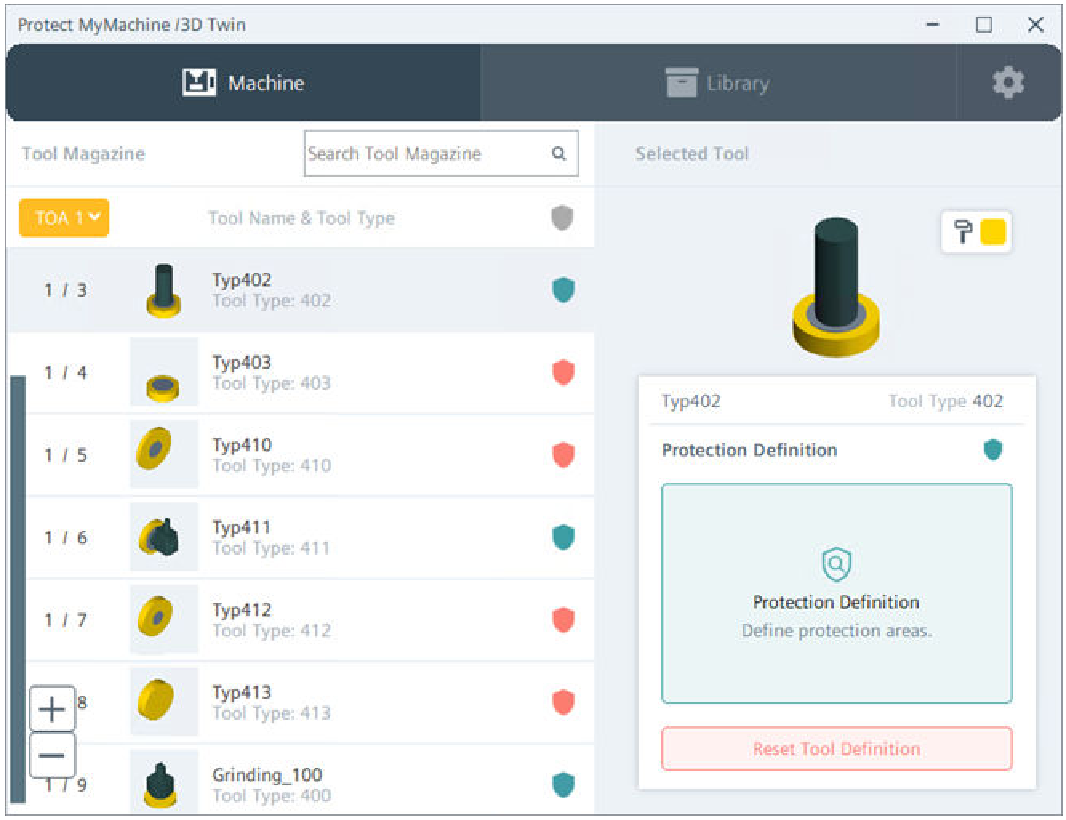


Figure 12-39 Grinding tool: Adapter and tool with defined protection

8. Repeat the work steps if you want to define more grinding tools.

Click on the "Machine" tab to close the tool manager.

12.6.8 Defining protection for milling tools/drill bits

When defining protection, you assign an adapter to the tool in the tool manager. Optionally, you can still import a tool geometry. To define protection you can use various import variants of the 3D geometry, and combine them as required; e.g. the geometry of the adapter from the library and the geometry of the tool by importing a tool assembly ("*.stp").

How to define protection for milling tools/drill bits

An adapter for an end mill is defined in the example. Optionally, you can specify the tool geometry data using an "*.stl/*.stp" file.

1. Click on the tool for which you want to define protection.
2. Click on the "Protection Definition" button. The protection options are displayed.
3. Import an adapter geometry (Page 280) or define an adapter geometry via parameters (Page 264).

4. Optionally, you can import a tool geometry or define it via parameters. For this example, a tool geometry is used by importing a "*.stl/stp" file.

Note

Generating a component from NC

As standard, tool data are taken from the SINUMERIK Operate tool list. Optionally, you can also import the tool geometry file. For collision avoidance, in this case, you can use the geometry data of the imported tool and not the data from the SINUMERIK Operate tool list, e.g. tool diameter.

5. Import a tool geometry as "*.stl/stp" file.

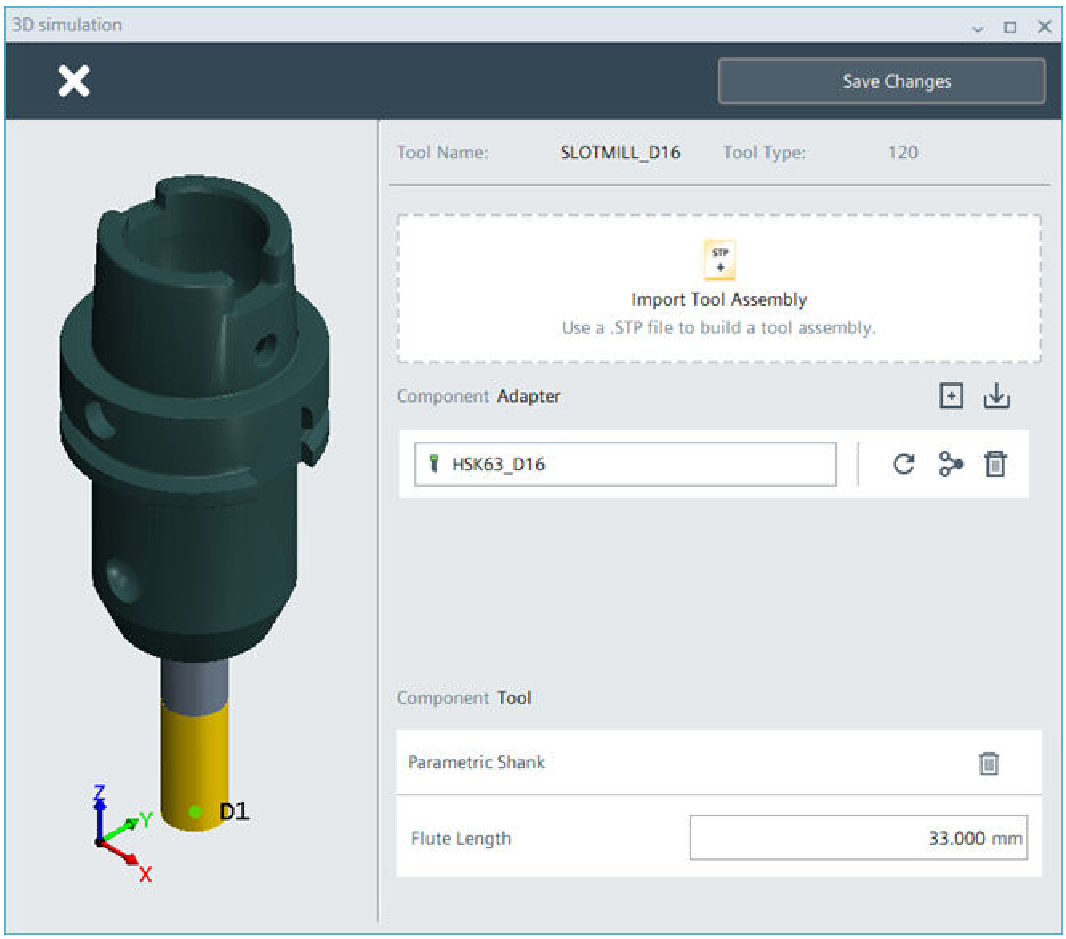


Figure 12-40 Example of an end mill with imported adapter geometry

6. Click on "Save changes". The values are saved and the tool manager is displayed. The tool is defined and is displayed with a green shield symbol.
7. Repeat the work steps if you want to define more tools.

Click on the "Machine" tab to close the tool manager.

See also

Importing a tool geometry as "*.stl/*.stp" (Page 285)

12.6.9 Defining protection for turning tools

When defining protection for turning tools, you assign an adapter to the tool in the tool manager. You also define the tool geometry (shank and cutting plate). To define protection you can use various import variants of the 3D geometry, and combine them as required; e.g. the geometry of the adapter from the library and the geometry of the tool by importing a tool assembly ("*.stp").

How to define a protection for turning tools

1. Click on the turning tool for which you want to define the protection.
2. Click on the "Protection Definition" button. The protection options are displayed.
3. Import an adapter geometry (Page 280) or define an adapter geometry via parameters (Page 267).
4. Optionally, you can import a tool geometry or define it via parameters. For this example, the tool geometry was imported via "*.stl".

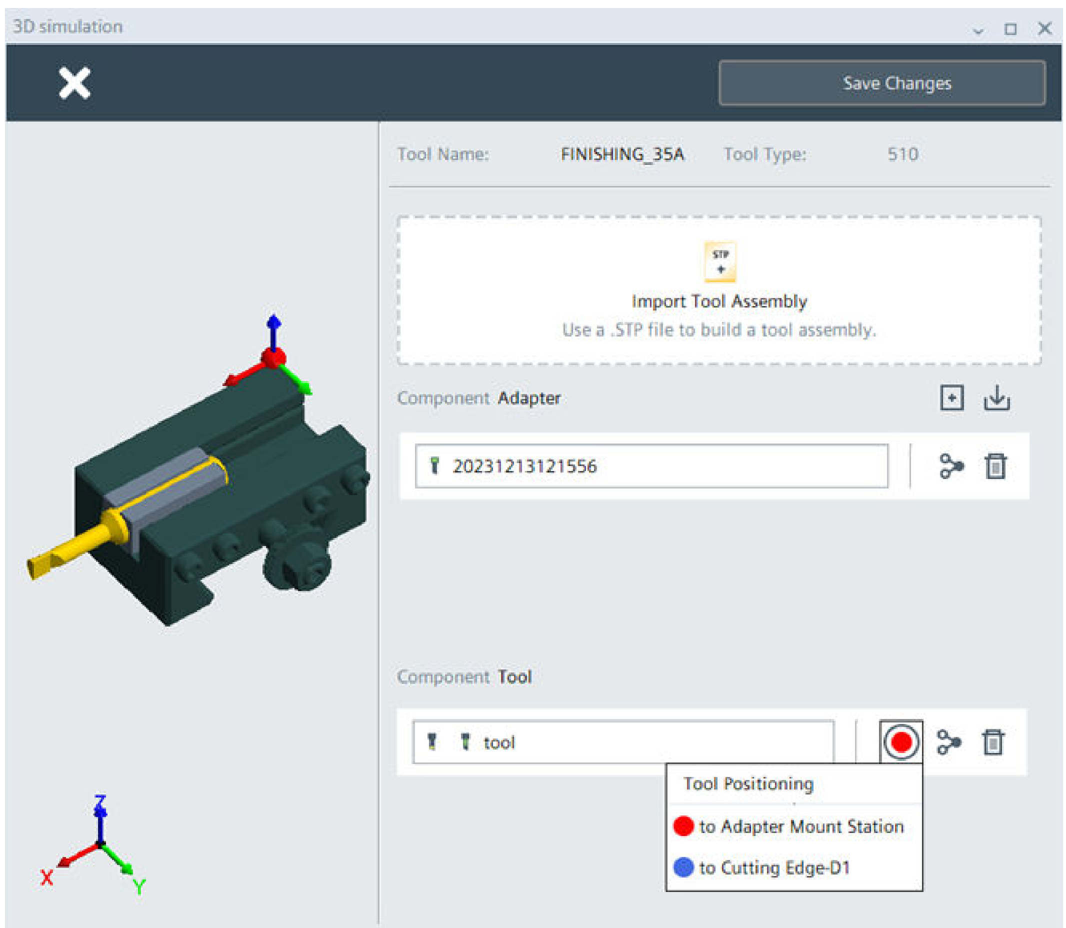


Figure 12-41 Example with imported geometries of the adapter and the tool

5. Click on if you wish to configure the reference system to align the components. The tool must be positioned so that the cutting edge D1 lies on the cutting edge of the tool.
   More information: Aligning cutting edge D1 and tool geometry (Page 290)

6. Click on "Save changes". The values are saved and the tool manager is displayed. The tool is defined.
7. Repeat the work steps if you want to define more tools.

Click on the "Machine" tab to close the tool manager.

12.6.10 Defining protection for grinding tools

When defining protection, you assign an adapter to the tool in the tool manager. Optionally, you can still import a tool geometry. To define protection you can use various import variants of the 3D geometry, and combine them as required; e.g. the geometry of the adapter from the library and the geometry of the tool by importing a tool assembly ("*.stp").

How to define protection for grinding tools

An adapter for a grinding wheel is defined in the example. Optionally, you can specify the tool geometry data (grinding wheel) using an "*.stl/*.stp" file.

1. Click on the tool for which you want to define protection.
2. Click on the "Protection Definition" button. The protection options are displayed.
3. Import an adapter geometry or define an adapter geometry via parameters (Page 272).
4. Optionally, you can import a tool geometry or define it via parameters. For this example, a tool geometry is used by importing a "*.stl/stp" file.

   Note

   Generating a component from NC

   As standard, tool data are taken from the SINUMERIK Operate tool list. Optionally, you can also import the tool geometry file. For collision avoidance, in this case, you can use the geometry data of the imported tool and not the data from the SINUMERIK Operate tool list, e.g. tool diameter.

5. Select an adapter geometry as "*.stl/stp" file and click on "Import".

6. Select a tool geometry as "*.stl/stp" file and click on "Import". In the example, a non-cutting part and a cutting part are defined for the grinding wheel.

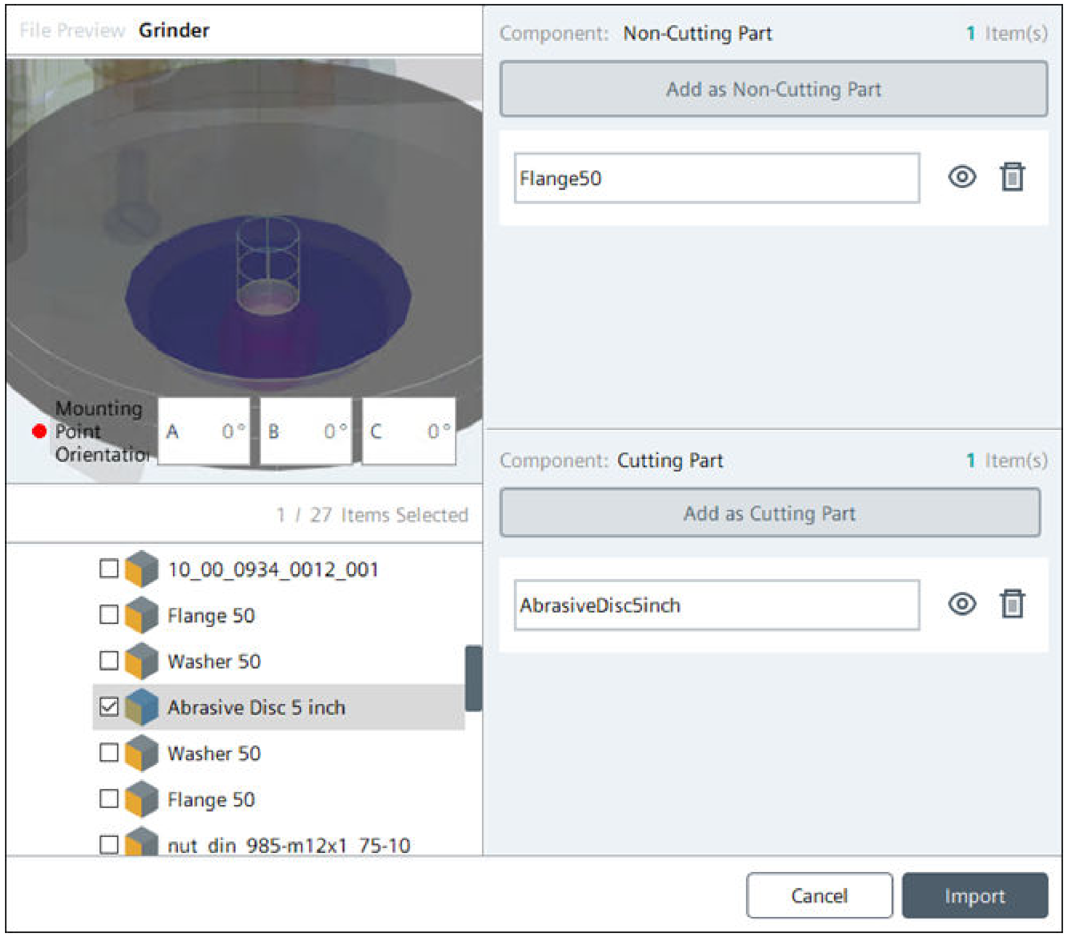


Figure 12-42 Grinding tool: tool geometry imported (non-cutting and cutting part)

7. Click on [icon] if you wish to configure the reference system to align the components. The tool must be positioned in such a way that the cutting edge D1 lies, for example, on the cutting edge of the outer diameter of the wheel or centered on the tool tip.
   More information: AUTOHOTSPOT
   After positioning the tool on D1, the tool is defined.

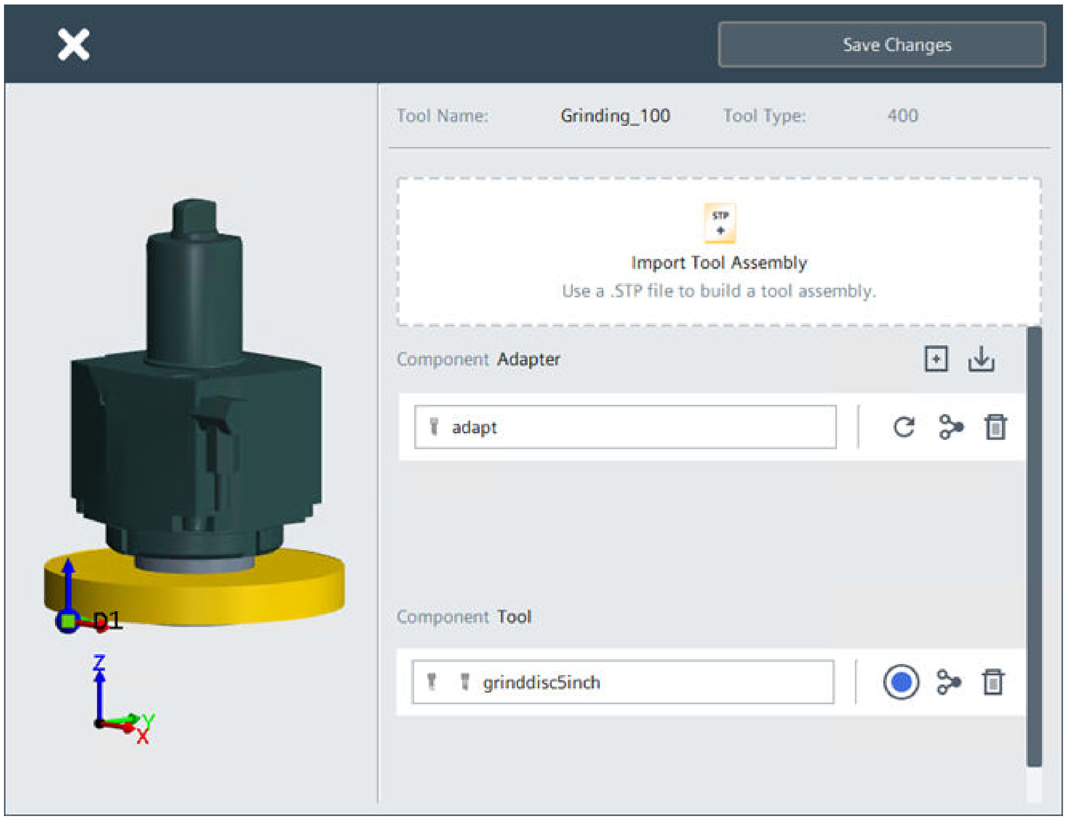


Figure 12-43 Grinding tool: adapter and tool with imported geometry data

8. Click on "Save changes". The values are saved and the tool manager is displayed. The tool is defined and is displayed with a green shield symbol.
9. Repeat the work steps if you want to define more tools.

Click on the "Machine" tab to close the tool manager.

12.6.11 Adapter geometry "*.stl, *.stp" and library

You import adapter geometries to define the tool protection. This section contains the basic information for importing and using adapters.

Requirement

The dialog for configuring the "protection definition" for the tool is opened.

How to import the adapter geometry for protection definition

In the following, the procedure is illustrated using a milling tool as an example. The procedure is identical for turning/grinding tools.

1. In the window that appears, you can import the geometries via the "Import tool assembly" button or in the area "Component: Adapter".

   – Button
     Import an adapter geometry and optionally a tool geometry from a tool assembly ("*.stp")
     In parallel to the import, an adapter geometry is created in the library, which can then also be used as library component.

   – Button or
     Imports an "*.stl/*.stp" file of the adapter geometry
     In parallel to the import, an adapter geometry is created in the library, which can then also be used as library component.

   – Button
     Uses the already defined adapter geometries from the library

   The following conditions apply to the adapter geometries:

   – An adapter can be composed of up to 5 part geometries (import via "*.stl/stp" or library component) in the specified sequence.

   – The positions of the Mounting Points and Mount Stations of the individual adapter geometry define the overall geometry of the adapter.

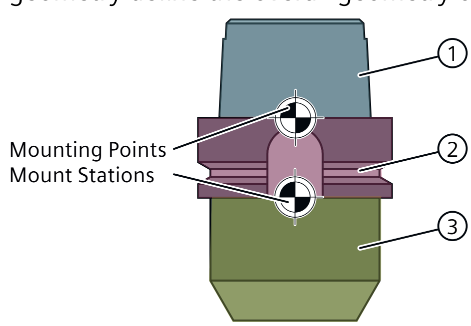
   

   Figure 12-44 Example adapter milling tool/drill bit, composed of three partial geometries

   – You set the position of the adapter with respect to the tool using the Mounting Point, e.g. you can shift the Mounting Point in the Z direction to set the unclamped length of the tool.

2. Click on if you wish to configure the reference system to align the components.

   Note

   Adapter from library

   If you change the values of the reference system, the values of the library component are also changed.

3. For the milling tool/drill bit/grinding tool adapter, define the property as to whether "Rotating" or "Rigid" is used. By default, all adapters should be configured as "Rotating". For multi-part adapters, you only need to define the first element. The subordinate adapter geometries inherit the property.

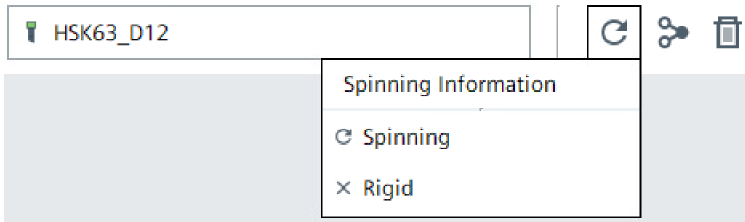


Figure 12-45 Defining an adapter as rotating or rigid

Note

Angle head/probe

If an angle head or probe is used, the adapter must be configured as "rigid" (tools in the angle head (Page 300)).

Figure 12-46 Angle head SINUMERIK Operate tool list

See also

Using the adapter geometry from the library (Page 282)

Defining the adapter and tool geometry via the assembly (Page 283)

12.6.12 Using the adapter geometry from the library

Use adapters from the library to define the tool protection.

Requirement

The dialog for configuring the "protection definition" for the tool is opened.

How to import an adapter from the library

In the following, the procedure is illustrated using a milling tool as an example. The procedure is identical for other tool types.

1. In the area "Component: Adapter", click the button . The library is opened.
2. Select an adapter and click on "Import". The adapter is assigned to the tool.
3. Click on the button next to the geometry if you want to change the values for "Mounting Point" and "Mount Station".
4. For milling tool/drill bit adapters, define whether it should be used "Rotating" or "Rigid". By default, all adapters should be configured as "Rotating".
5. Repeat the last steps if you want to assign additional part geometries to the adapter.

6. Click on the button if you wish to delete existing adapter geometries.
7. Confirm with "Save changes".

See also

Defining protection for milling tools/drill bits (Page 275)

12.6.13 Defining the adapter and tool geometry via the assembly

To define the protection, you can import an entire assembly (adapter and tool) as an "*.stp" file. You can import either all or only individual elements of the assembly, e.g. only the tool or only the adapter.

Requirement

The dialog for configuring the protection for the tool is opened.

How to define protection with an assembly

In the example, an assembly consisting of an adapter and a drill bit with a replaceable head is imported as an example. The procedure is identical for other tool types.

1. Click on "Import tool assembly".
2. In the dialog that is displayed, select the "*.stp" file and click "Open".
   The 3D model ①, the individual elements ②, the "*.stp" file and the selection of the adapter ④ or the tool ⑤ are displayed in the window.

   Note

   Mounting Point orientation (Mounting Point) ③

   You change the orientation of the tool and/or the assembly in the coordinate system by specifying the rotation in axes A, B, C of the Mounting Point. Before the import, possibly adapt the orientation to the current requirements. The orientation must be defined for each element of the assembly (adapter, non-cutting part of the tool, cutting part of the tool).

3. When importing the "*.stp" file, a check is made as to whether Reference Points are defined. Defined Reference Points are identified and the individual elements with Reference Point are marked using a gray circle. You can accept **one** Reference Point by clicking on it. The circle of the selected Reference Point is then shown in blue. If the file does not contain any Reference Points, a message is output that no Reference Points were found.
   More information: Accepting a Reference Point for a file (Page 294)
4. To import, activate the checkboxes for the individual elements ② that you wish to import as part geometry. You can activate 1-n elements for a part geometry.

5. Then click on the "Add as ..." button to import the selected individual elements into the component as an adapter or as part of the tool geometry. For multi-part tools, e.g. with tool tips (inserts), you can import the tool shank (non-cutting part) and the tool tip (cutting part) separately.
   – An adapter can consist of a maximum of 5 adapter part geometries ④.
   – A tool can consist of a part geometry for cutting and non-cutting components ⑤. In the example, the drill shank is defined as a "non-cutting part" and the replaceable head as a "cutting part".

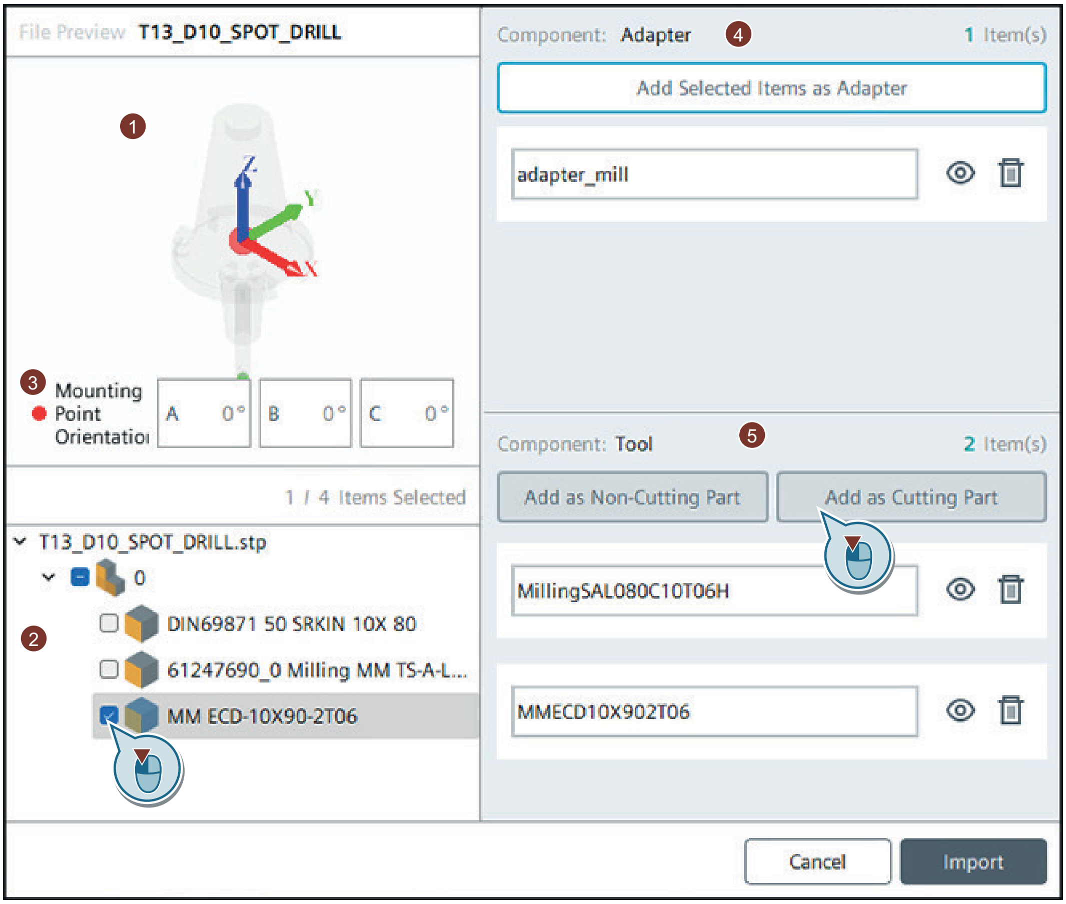


Figure 12-47 Importing an assembly comprising adapter and tool as protection

6. Optionally, enter a name for the imported geometry.

Note

Name that is unique throughout the project

The name of the component must be unique throughout the project. If the name is already being used for an existing component, then an error message is displayed when saving the component. In this case, enter a unique name for the component.

7. By default, the Mounting Point③ is set at the zero point of the reference system of the STEP file. You change the orientation of the reference system by rotating axes (A, B, C).

8. Click on "Import" if you have created the required components.

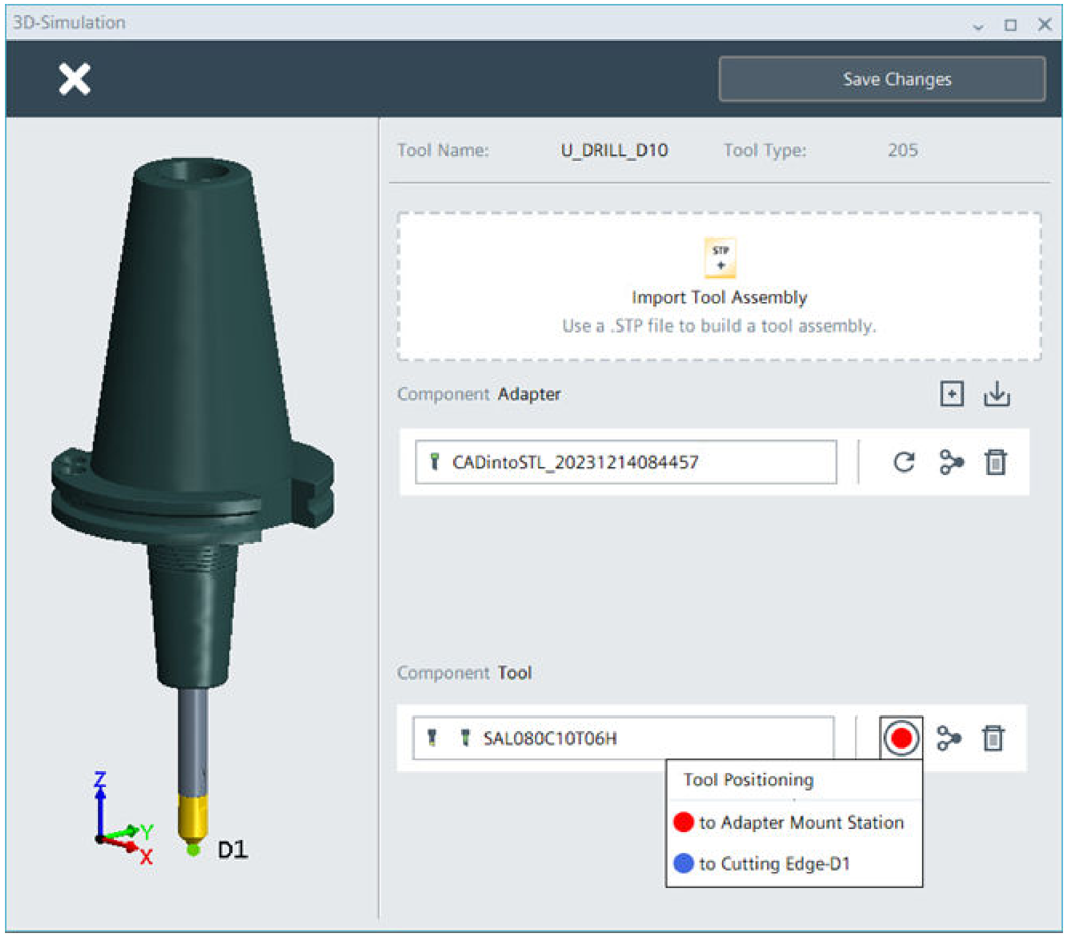


Figure 12-48 Protection created from "*.stp" assembly for adapter and tool

9. If you defined only one tool component (cutting part **only**), you must enter a cutting edge length and set it using the "Apply" button.
10. Click on if you wish to configure the reference system to align the components. The tool must be positioned according to the tool type, e.g. cutting edge D1 is centered on the tip of the tool.
    More information: Aligning cutting edge D1 and tool geometry (Page 290)
11. Repeat the last steps if you want to assign additional part geometries to the adapter.
12. Click the button if you wish to delete existing adapter geometries or the tool geometry.
13. Click on "Save changes" to complete the setup.

12.6.14 Importing a tool geometry as "*.stl/*.stp"

To define the tool geometry, import an "*.stl/*.stp" file. For the collision avoidance, tool data from the SINUMERIK Operate tool list are no longer used, but instead imported tool geometry. For tools, the tool geometry is made up of the non-cutting part (e.g. shank) and the cutting part (e.g. inserts).

Requirement

The "Protection definition" dialog for the tool is opened.

This is how you define a tool geometry using imported "*.stl/*.stp" files

In the following, the procedure is illustrated using a milling tool as an example. The procedure is identical for other tool types.

1. In the area "Component: Tool", click the button . The dialog to select the "*.stl/*.stp" file is displayed.
2. Select a file with the 3D geometry of the tool.

3. Confirm with "Open". The 3D program is displayed.
   The next step depends on the selected file type. The following steps are identical again.
   – "*.stl" file
     The tool geometry is immediately imported.
   – "*.stp" file
     If necessary, change the orientation of the reference system ①. To import, activate the checkboxes for the individual elements ② that you wish to import as part geometry. You can define a geometry for the non-cutting and cutting part ③. Enter a name for the component ④. Confirm with "Import".
     In the example, the tool is imported as a "cutting part".

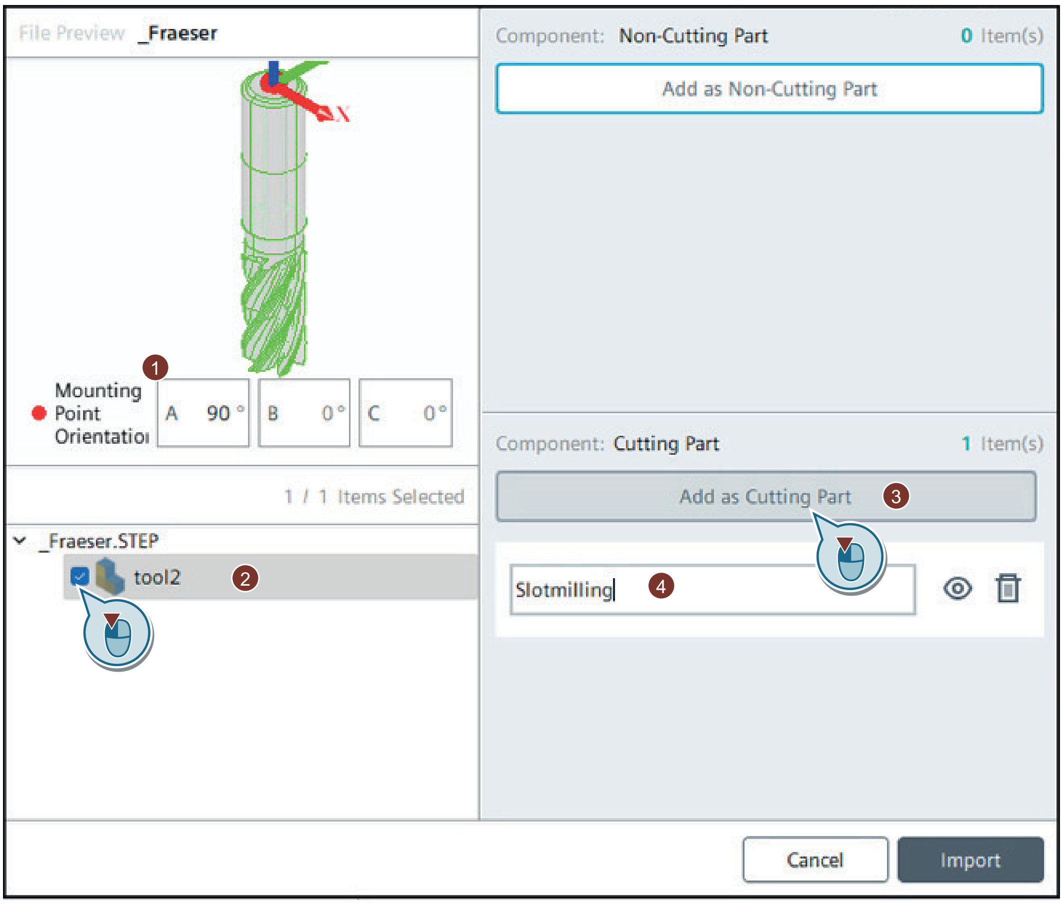


Figure 12-49 Tool geometry imported as "*.stp" file for the cutting part

The imported tool component is displayed. Cutting edge D1 is displayed in the preview image. This allows you to check whether the imported 3D model matches the data of the tool offset.

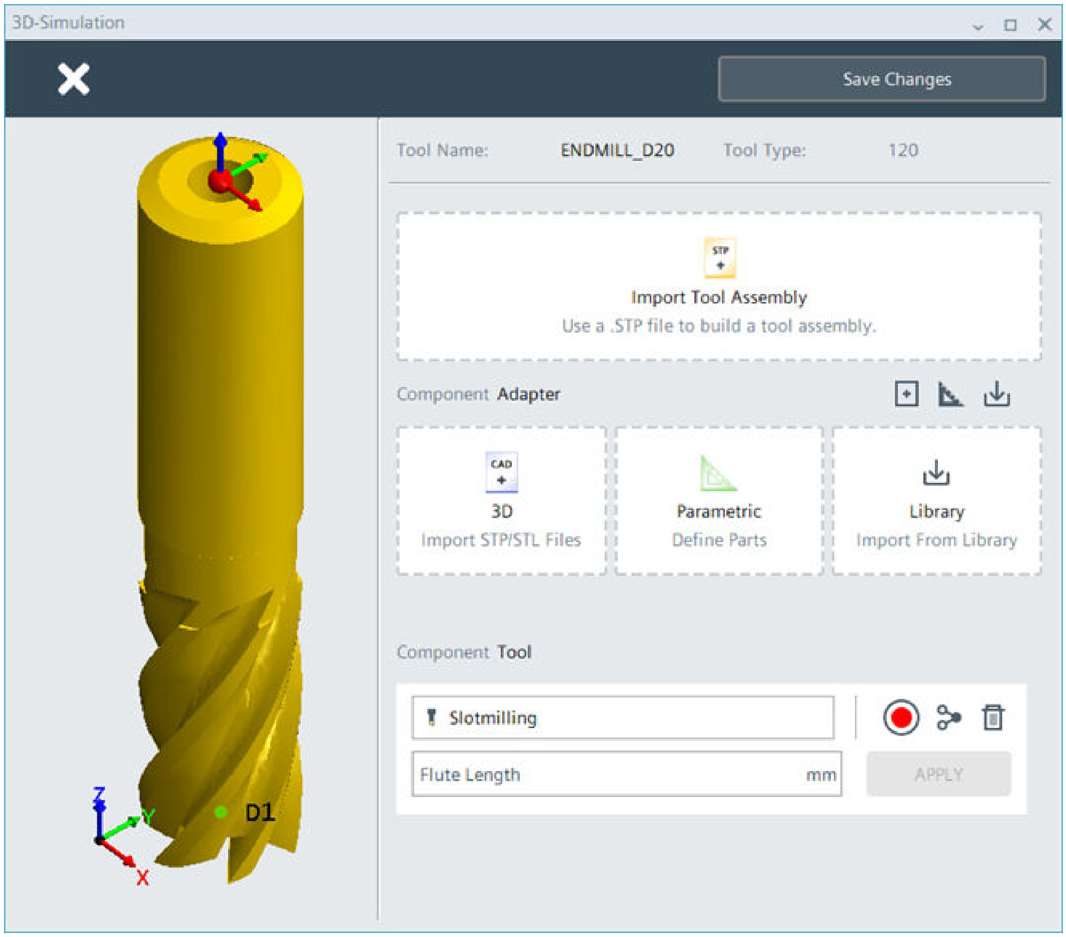


Figure 12-50 Tool geometry imported as "*.stp" file

4. Enter a "Flute Length" or "Plunge Depth" and click on "Apply". A new tool geometry with a cutting and non-cutting part is created. When creating the new tool geometry, all existing offset values of the reference systems (e.g. Reference Point) are set to 0.
   The cutting edge and the shank are colored differently and two icons are displayed as symbols in front of the new component name.

Note

You can change the cutting edge length until you have saved the tool. After saving, you can only change the cutting edge length by importing a geometry file again.

5. Click on if you wish to configure the reference system to align the components. The tool must be positioned according to the tool type, e.g. cutting edge D1 is centered on the tip of the tool.
   More information: Aligning cutting edge D1 and tool geometry (Page 290)
   After assigning the cutting edge length and positioning the tool on D1, the tool is defined.

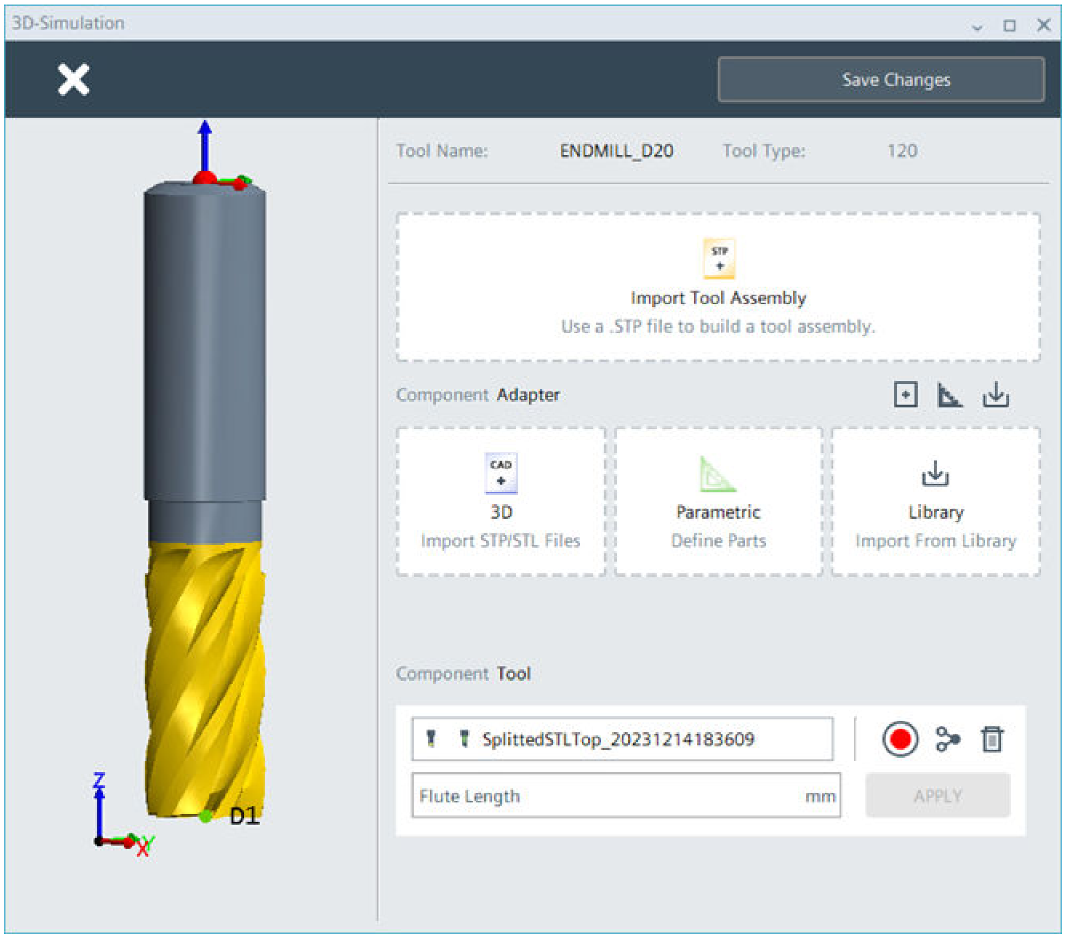


Figure 12-51 Tool with cutting edge length and correct position of D1

6. Import another geometry for the adapter to complete the protection for the tool. The tool is displayed as "Not-defined" in the tool manager if you do not define an adapter.
7. Confirm with "Save changes". The tool geometry is also saved in the library.

The tool geometry is defined.

12.6.15 Using the tool geometry from the library

To define the protection of the tool, import the tool geometry from the library.

Requirement

The "Protection definition" dialog for the tool is opened.

How to import a tool geometry from the library

In the following, the procedure is illustrated using a milling tool as an example. The procedure is identical for other tool types.

1. Click the button in the area "Component: Tool". The library is opened.
2. Select a tool geometry and click on "Import".
3. Click on the button next to the component if you want to configure the reference system for aligning the component. The tool must be positioned according to the tool type, e.g. cutting edge D1 is centered on the tip of the tool.
   More information: Aligning cutting edge D1 and tool geometry (Page 290)
4. If no cutting edge length has yet been assigned in the imported tool geometry, you can add it.
5. Click on the button if you want to delete imported tool geometries.
6. Confirm with "Save changes".

12.6.16 Aligning cutting edge D1 and tool geometry

After importing a tool geometry, the imported tool is usually not aligned with the defined cutting edge D1 of the tool in the SINUMERIK Operate tool list.

The cutting edge D1 must be positioned on the imported tool geometry. This means, for example, that D1 must be positioned centrally on the tip of the milling cutter for milling cutters and on the tip of the insert for turning tools. For grinding tools, positioning on the outer diameter of the wheel edge is also common.

You can define the correct position by aligning the reference systems (e.g. values of the Reference Point) of the imported tool and adapter components.

Note

Alternatively, you can change the tool data, e.g. the tool or adapter lengths, in the SINUMERIK Operate tool list. However, this only makes sense if you are working with dummy data in the tool list for the tool lengths in C/RMVM /3D and not with real tool data in PMM /3D Twin.

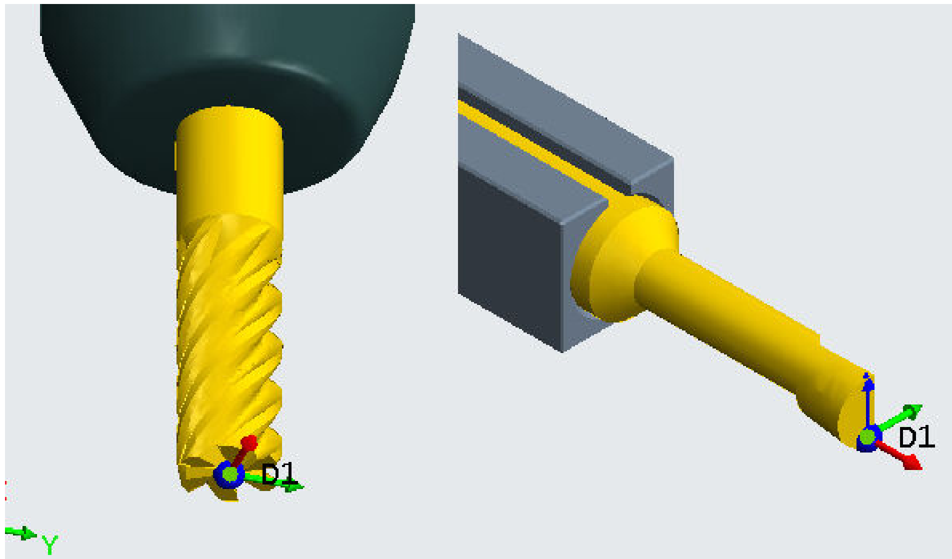


Figure 12-52 Cutting edge D1 positioned on tool geometry of milling cutter or turning tool

How to position the cutting edge D1 on the tool geometry

In the following example, an adapter and tool geometry was imported and the cutting edge length was set. The cutting edge D1 is to be positioned on the tool tip. The procedure is briefly described using the example of an end mill and can be transferred to other tool types. In the example, the cutting edge D1 is centered on the end face of the adapter.

1. First, select the Reference Point for tool positioning. You can choose between the two variants.

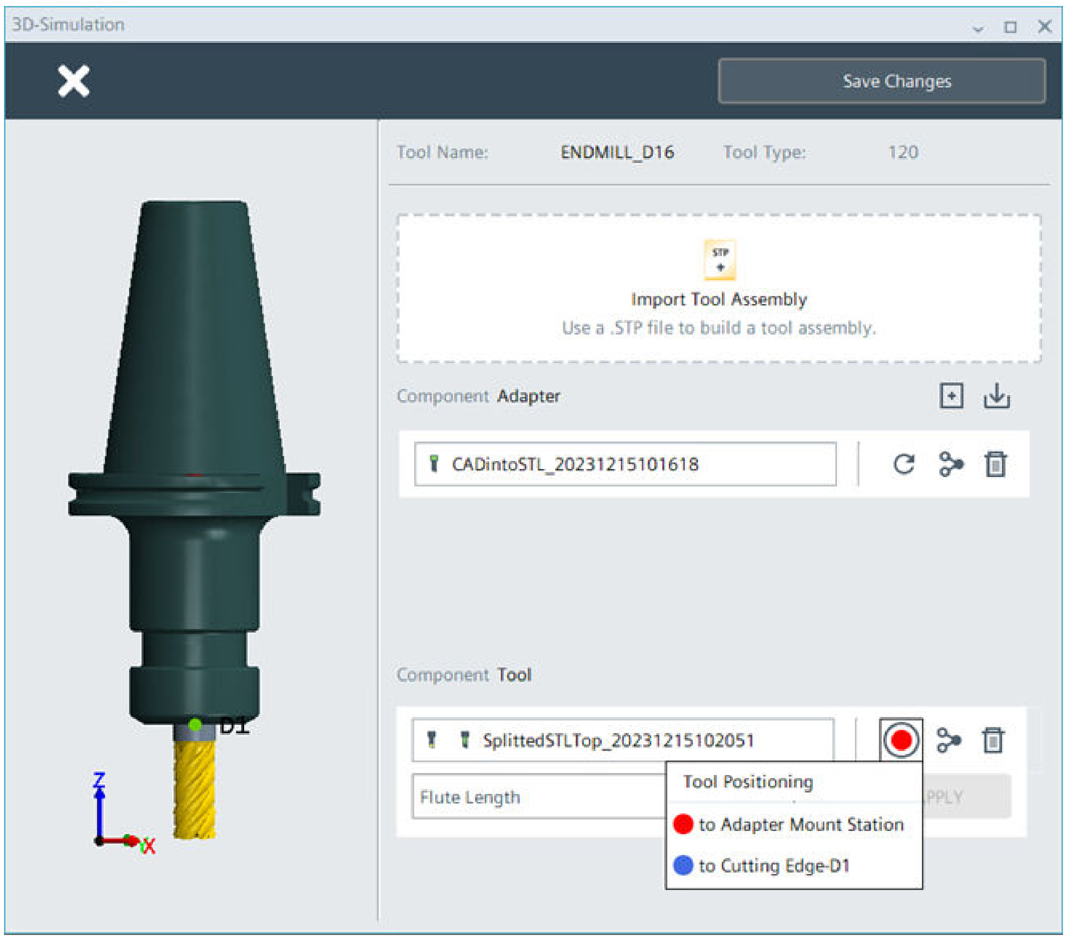


Figure 12-53 Tool and adapter: Tool should be positioned on cutting edge D1

🔴 The Mounting Point of the tool is positioned at the Mount Station of the adapter.
🔵 The Reference Point of the tool is positioned at cutting edge D1.

2. Click on the button to configure the reference system for aligning the components.

   – Variant 1 🔴 is selected
   For example, move the Mounting Point of the adapter by the corresponding value in the z direction. The adapter and tool components are moved together and D1 is positioned correctly.

– Variant 2 🔵 is selected.
If a Reference Point is defined on the cutting edge of the tool geometry (tip of the tool), you can automatically position the tool correctly using the "🔵 on cutting edge D1" variant.
With a parametric adapter, the tool and adapter are moved together and are positioned. In the case of an imported adapter geometry, adjust the offset in the adapter's reference system if necessary.

After positioning, D1 is on the tool tip.

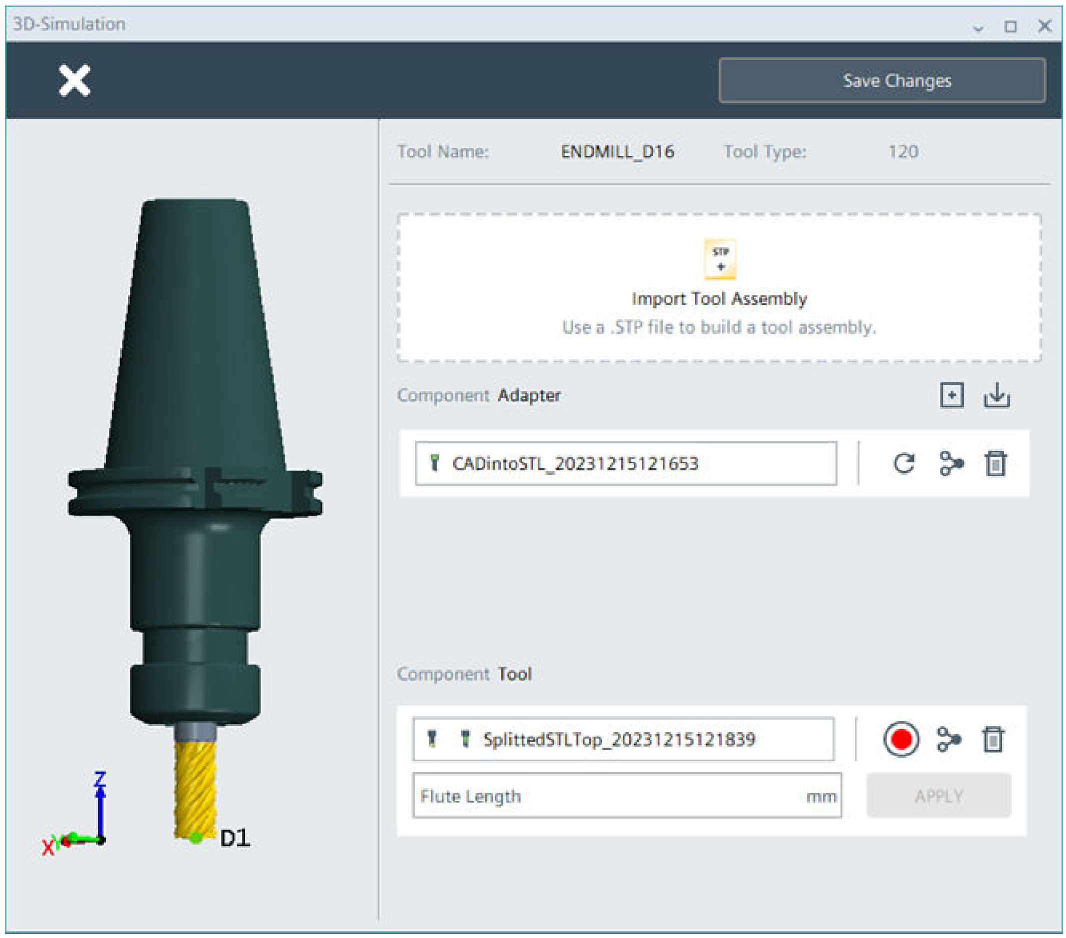


Figure 12-54 Tool positioned on cutting edge D1 using end mill as an example

3. Click on "Save changes" to complete the definition.

12.6.17 Accepting a Reference Point from "*.stp" assembly

If corner points of a Compound or Assembly construction are defined in the "*.stp" file, then these can be accepted as Reference Point for tools.
If a Reference Point is found when importing the file, then this is displayed with a gray circle symbol and is simultaneously active as toggle button. The Reference Point can be activated and accepted using the toggle button.

Note

Suitable "*.stp" files can be found on the websites of the tool manufacturers.

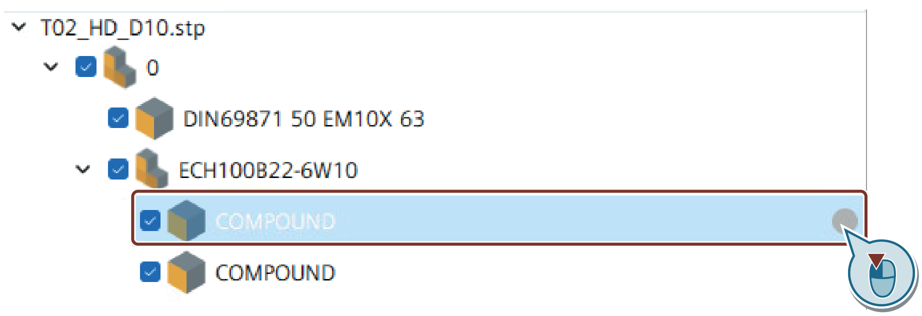


Figure 12-55 Reference Point is marked in the imported "*.stp" file

Rules for transferring the Reference Point

- If the "*.stp" file contains only one element, the Reference Point is not found.
- If no Reference Point is found in the "*.stp" file, a message is displayed by default stating that no Reference Point can be transferred.
- Only one Reference Point (toggle button) can be activated. If there are several Reference Points, only one can be active.
- The combo box in front of the individual element does not have to be activated in order to accept a Reference Point. However, at least one individual element must be imported as tool component in order that the activated Reference Point is accepted.

This is how you accept predefined Reference Points of an "*.stp" file for import

1. Import the "*.stp" file of an assembly.
   Reference Points that are found are marked with a gray circle symbol and can be activated.
2. Click on this gray circle symbol (toggle button) next to the individual element whose Reference Point you wish to accept.
   The circle symbol is shown in blue and the Reference Point is displayed in the preview image.

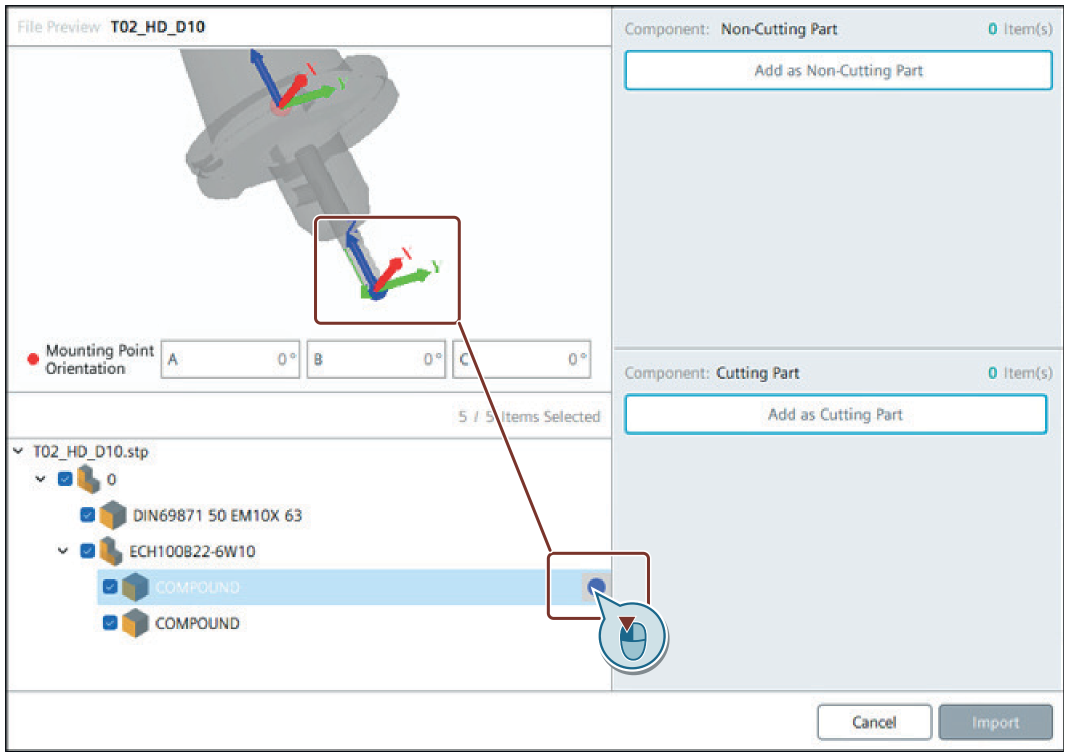


Figure 12-56 Accepting a Reference Point and saving in the tool components using a milling cutter as example

3. Accept the selection as non-cutting or cutting part and import the tool. The tool and the marked Reference Point are accepted.

12.6.18 Protection for multitools

Using a multitool you have the possibility of storing more than one tool at a magazine location. The multitool itself has 2 or more locations to accept tools. The tools are directly mounted on the multitool. The multitool is located at a location in the magazine.

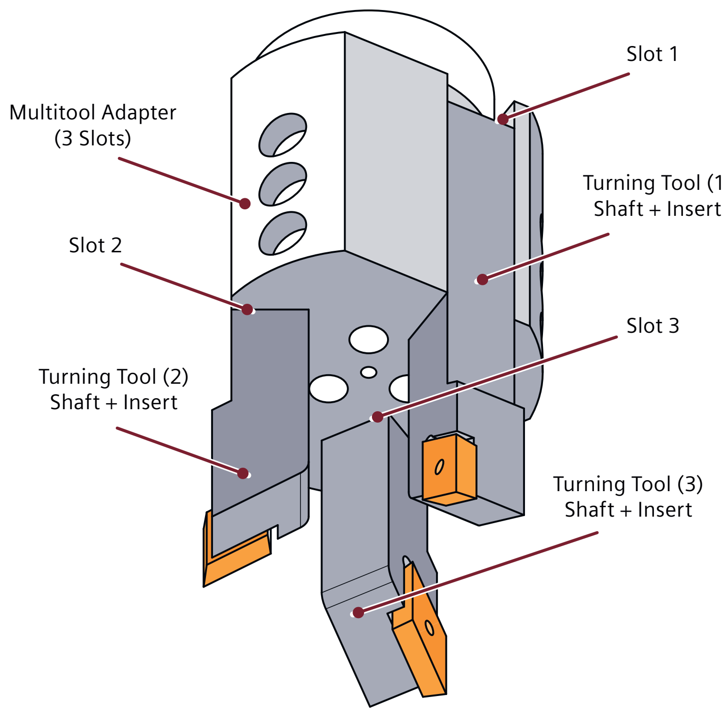


Figure 12-57 Example: Multitool adapter with 3 slots for turning tools

Multitool in the SINUMERIK Operate tool list

In the tool list, a multitool is displayed as an adapter and the tools (slots) it contains are displayed below it.

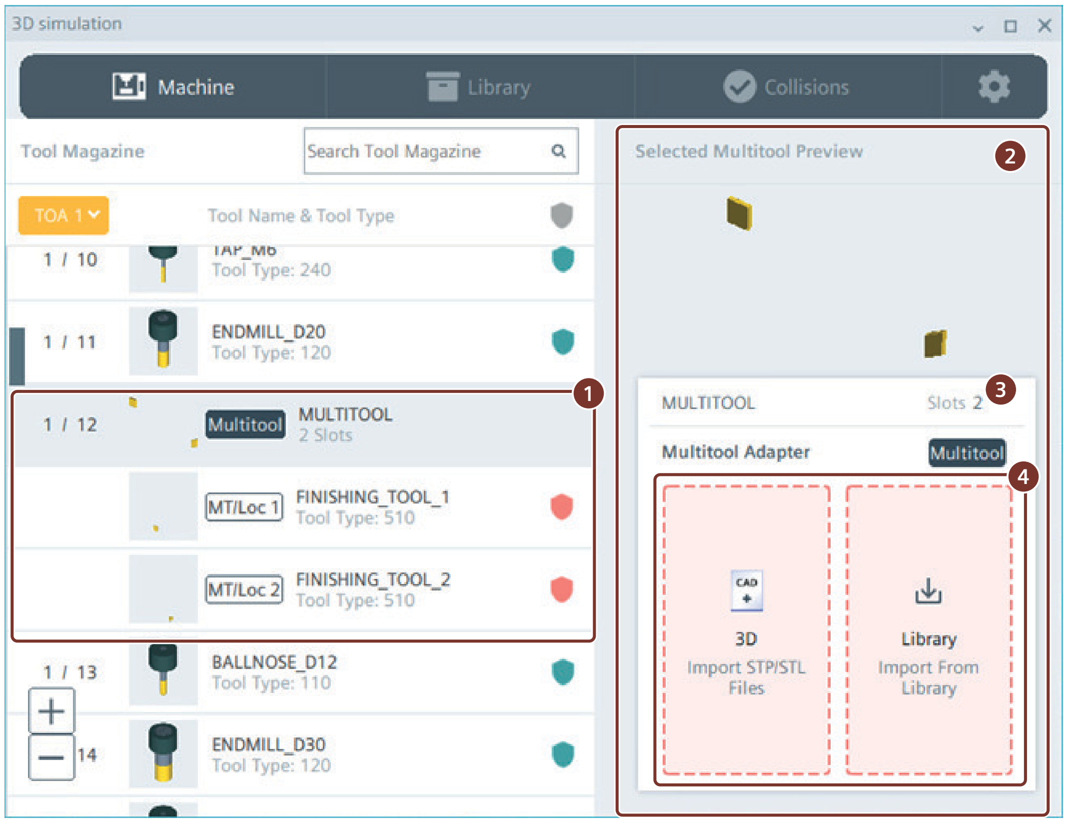
Tool list

Loc.	MT LO.	Type	Tool name	ST	D	Length Z		Radius						1	2
12			MULTITOOL												
	1		FINISHING_TOOL_1	1	1	140.000	50.000	0.000	←	93.0	80	11.0		☐	☐
	2		FINISHING_TOOL_2	1	1	150.000	-50.000	0.000	←	93.0	55	11.0		☐	☐

Figure 12-58 Multitool with 2 tools in the SINUMERIK Operate tool list

Overview of multitools in the tool manager

The multitool and all tools in the multitool are displayed with a common magazine/location number. The multitool slots with the tools defined in them are listed below the multitool adapter.



① Multitool with the tools contained in it

② Details of the multitool

③ Number of slots in the multitool. In the example, 3 slots.

④ Defining the adapter geometry (protection) for the multitool.

Figure 12-59 Multitool with 2 slots for tools

Defining protection for a multitool

1. Select the multitool in the tool manager.
2. Define a multitool adapter and the positions (Page 298) of the slots in the adapter.
3. Define an adapter (protection) and optionally a tool geometry for each tool in the multitool.

12.6.19 Defining multitool adapters and slots

This is how you define the multitool adapter and the slot positions

1. Select the line with the multitool in the tool manager.
2. In the multitool details you have 2 options for defining the adapter geometry.
   – Button
   Imports an "*.stl/*.stp" file of the adapter geometry
   When importing, an adapter geometry (marked with **multitool**) is created in the library, which can then also be used as library component.

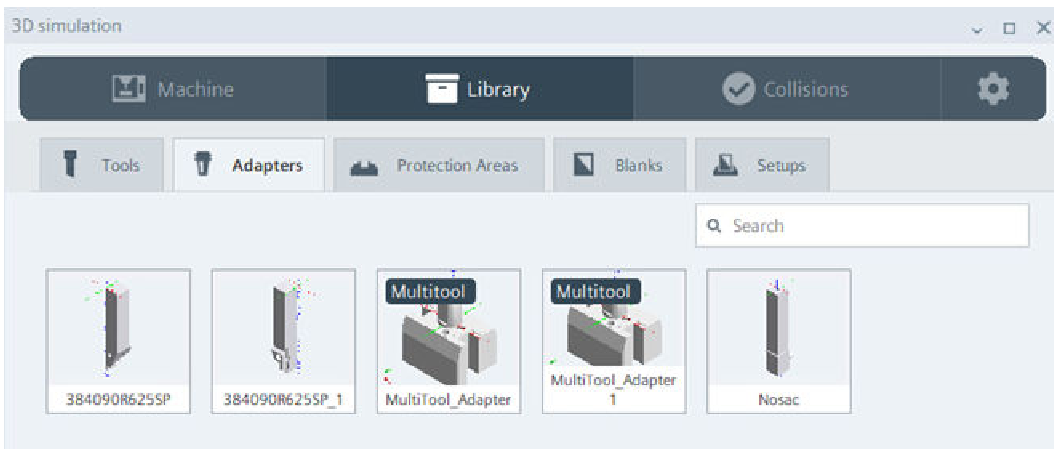


Figure 12-60 Multitool in the library

Note

The adapter geometry in the library cannot be edited.

   – Button
   Uses the already defined adapter geometries from the library

   The adapter geometry is imported and displayed in the multitool details. The multitool adapter is applied to the Mounting Point of the tool defined in the machine model (or via a defined adapter transformation).

3. Optionally, enter a name for the multitool adapter and confirm with "Save"
4. After importing the multitool adapter geometry, define the positions of the multitool slots. This ensures that the adapters of the individual tools under a multitool are located at the defined multitool slots. The number of multitool locations is obtained from the NC definition (SINUMERIK Operate tool list). In the example, a multitool with 2 slots was defined in the NC tool list.
   After importing the adapter geometry, define the positions ("Mount Station") of the multitool adapter slots. To do this, click on the button "Edit slot positions".

5. For the existing slots, enter the values for the "Mount Station".

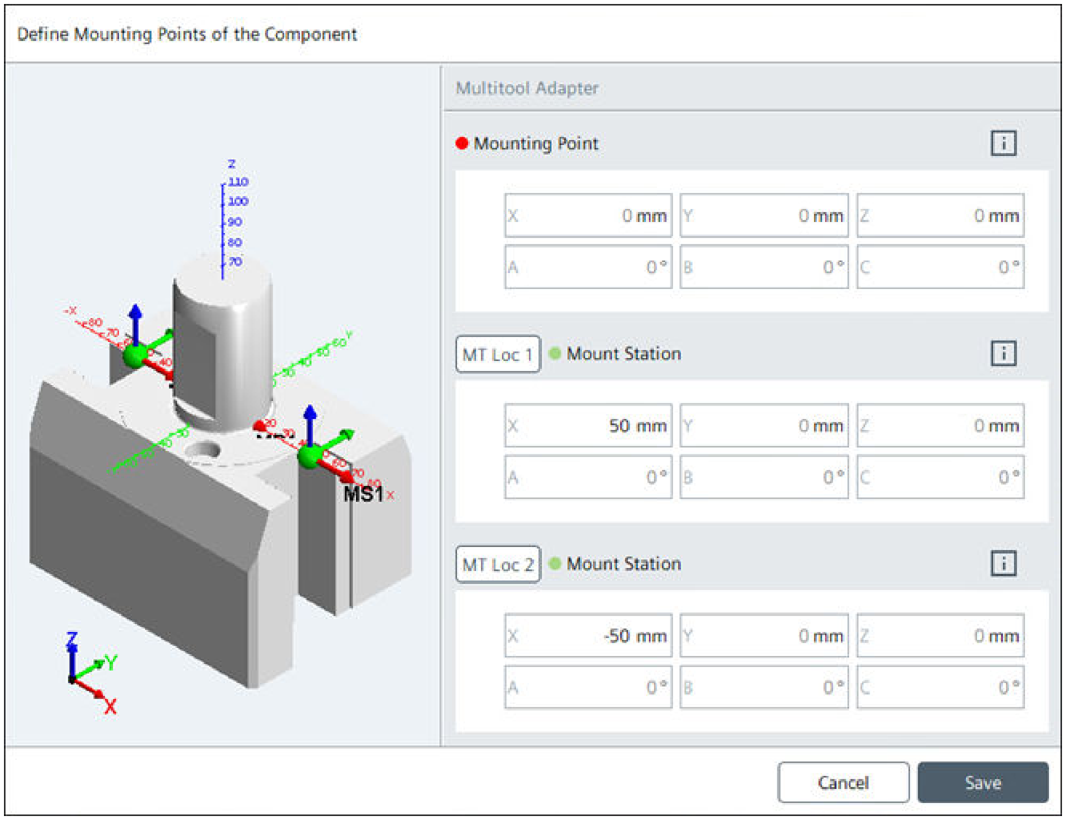


Figure 12-61 Example with 2 slots: Defining the positions (Mount Stations) of the slots

6. Confirm with "Save".
7. Define the protection of the individual multitool tools, e.g. import adapter and tool geometry via an assembly. After the protection definition, the multitool is displayed with the multitool adapter and the adapter and tool geometry.

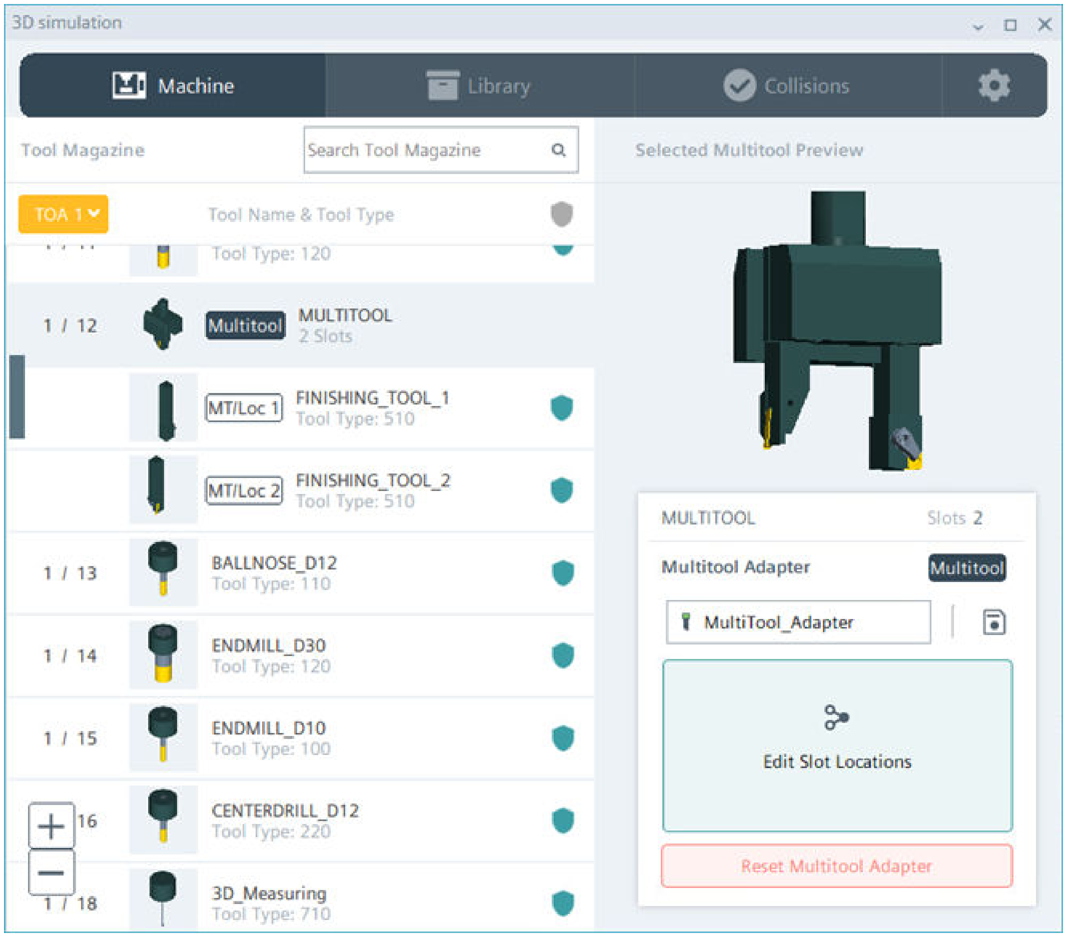


Figure 12-62 Multitool adapter with 2 turning tools

Note

If a tool under a multitool is active on the NC, all tools under the multitool are also active and can cut.

12.6.20 Tools in the angle head

Angle heads are tool components comprising a stationary part (that does not rotate when the spindle rotates) and a rotating part. Normally, the axis of rotation of the angle head is not aligned to the axis of rotation of the spindle. As a result of the angle head, the rotation of the spindle is "deflected" into another direction e.g. 90° or 45°. This means that the tool cutting edge has an orientation direction other than the standard orientation.

Configuring the angle head

To configure the angle head, in addition to the tool length offset (length 1 to length 3 from $TC_DP3 to $TC_DP5), the adapter length offset (length 1 to length 3 from $TC_DP21 to $TC_DP23) is also taken into consideration. The adapter length defines the origin of the deflected axis of rotation.

The axis to be rotated is derived based on the values of the system variables for tool orientation $TC_DPV (if possible, based on the value of MD18114 $MN_MM_ENABLE_TOOL_ORIENTATION) or the values of orientation vector $TC_DPV3 to $TC_DPV5.

MD number	Identifier	Values	Description
MD18114	$MN_MM_ENA-BLE_TOOL_ORIENTATION	2 or 3	Necessary, if the tool alignment is to be defined using a vector via the tool data. If the vector definition is deactivated, although the HMI always displays the fields to enter data, these data are not saved and are not transferred to the 3D simulation.

The tool tip is located at the point of intersection obtained from the tool and adapter offset, and is aligned corresponding to the tool orientation.

Tool components can be configured so that these belong to the stationary part of the angle head. The placing for tool components remains unchanged, only the higher-level kinematic element (either rotates or does not rotate with the spindle) is adapted, based on this setup.

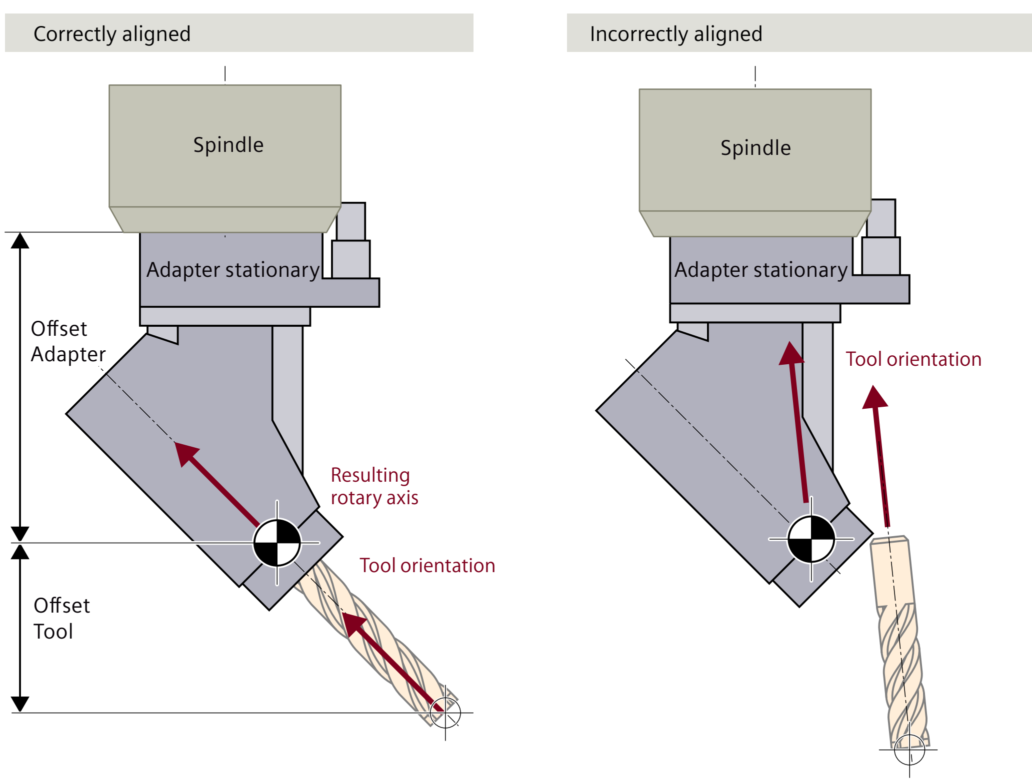


Figure 12-63 Angle head at 45° with specification of the relevant key variables

Note

Aligning the tool and axis of rotation

If the tool is not aligned to the axis of rotation, the geometry of the tool together with the cutting edge is displayed in the 3D simulation; however, it is shown as non-cutting part depicted in dark grey.

12.6.21 Tool-specific stock removal in different colors

In the tool manager, define a specific cutting edge color for each tool. For stock removal simulation, in the 3D model, the surface machined by the tool is displayed in the defined cutting edge color. In stock removal simulation, you can immediately identify which tool is presently being used for machining or the tool that was used.

This is how you define a tool-specific cutting edge color

The cutting edge color of the tool can only be defined if the spindle and feedrate have been stopped.

1. In the tool manager, for details for the selected tool, click on icon to select the color.
   The window to select the color is displayed.
2. Select a color and confirm with "OK".
   The tool cutting edge is displayed in the tool manager with the defined color.

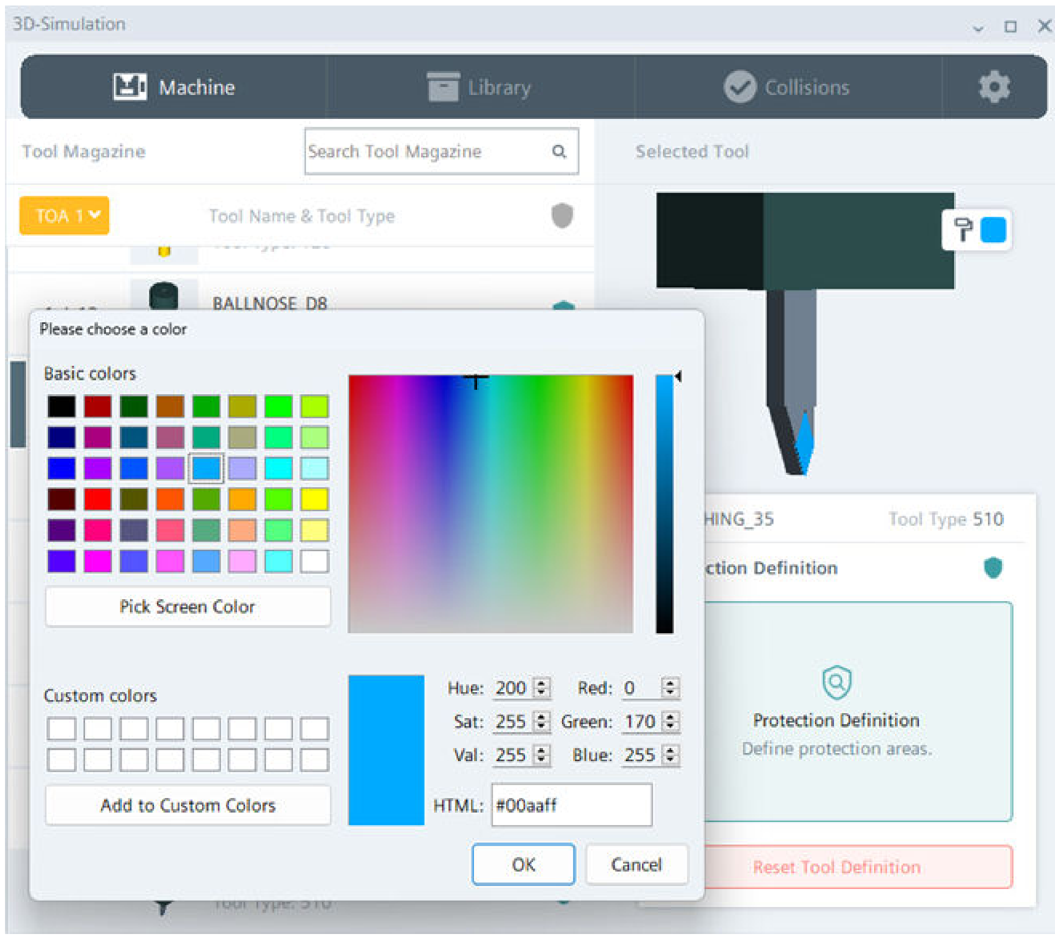


Figure 12-64 Example of an end mill: Defining a cutting edge color for a tool

3. Repeat the steps if you want to define additional cutting edge colors for tools.

In the stock removal simulation, the machined surface is displayed in the color of the tool cutting edge.

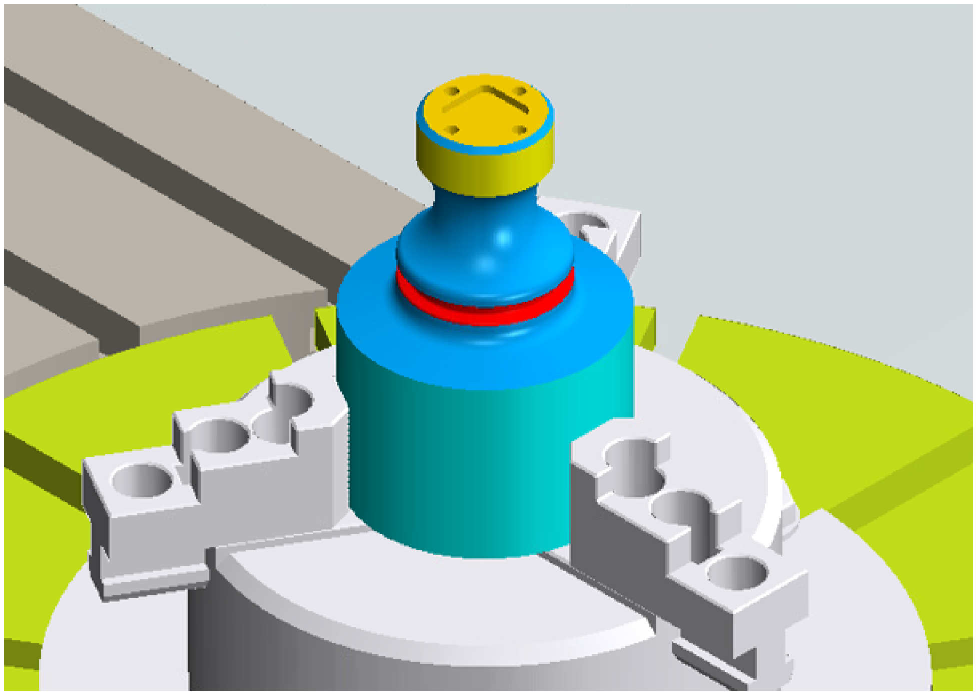


Figure 12-65 Stock removal simulation Machined surfaces are displayed in the colors of the tool cutting edges, e.g. blue for machining with a "FINISHING_35" tool.

12.7 Setup (clamping)

12.7.1 Setup Manager

Active setup

For 3D Simulation, activate/deactivate the effective setup in the "Setup Manager". The "Setup Manager" is displayed when you click the button on the 3D Simulation start page.

When first opened, the empty machine room is displayed with the existing Mount Stations (MS) ① of the machine. Typically, the setup is positioned at the machine's Mount Station.

Note

Hiding the enclosure layer

Hide the layer for the enclosure of the machine model if you want to activate or edit a setup.

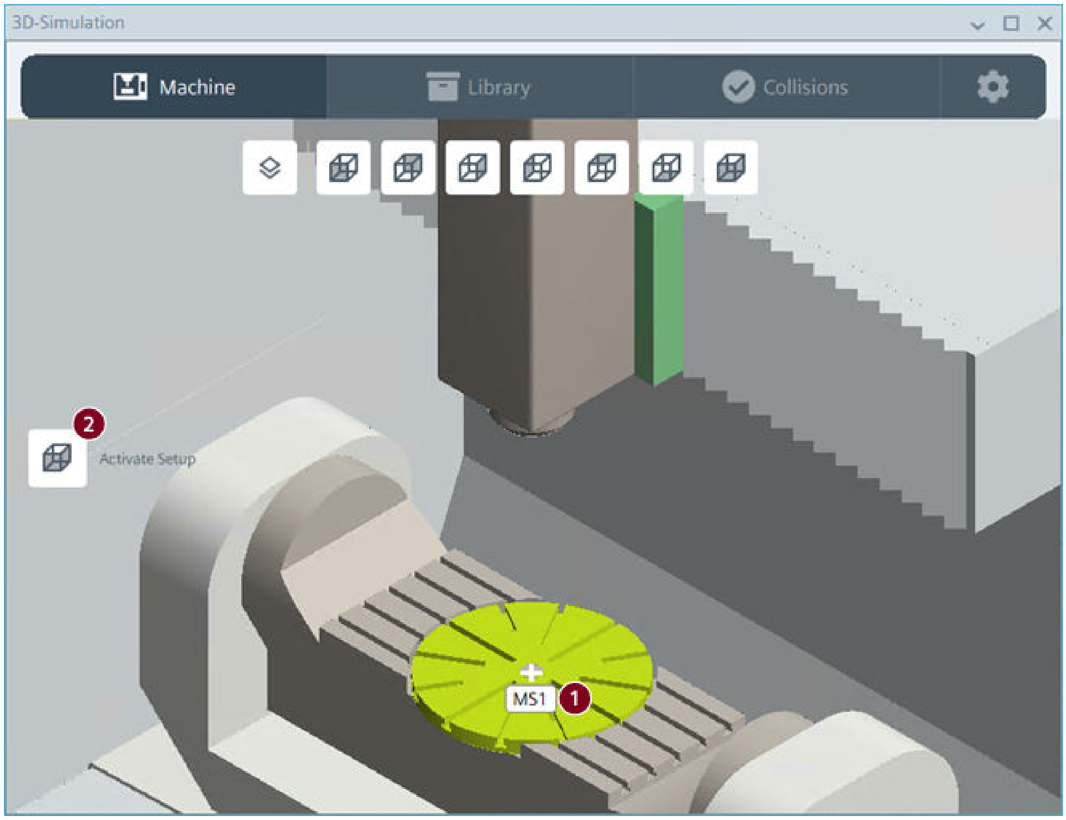


Figure 12-66 Setup Manager on first opening with a Mount Station MS1

Functional scope of the Setup Manager

After you have clicked the "Activate Setup" button ②, the window for inserting setups is displayed.

The following functions are available to you in the Setup Manager:

- Select the Mount Station on which the setup is to be positioned.
- Activating a setup with a blank consisting of basic geometric shapes ("Fast protection").
- Activating a setup from the library ("Detailed protection").
- Positioning of the active setup.
  - Shifting/rotating the entire setup or blanks or clamping devices individually
  - Aligning the reference point to a work offset
- Deactivating the active setup.
- You can activate up to 9 setups on multiple Mount Stations (MS).

Overview of Setup Manager

Setup Manager with displayed functions for defining blanks and clamping devices (setup)

① Preview of the machine space
② Number of Mount Stations (MS). An MS1 is available as standard.
③ Window for inserting setups
④ Search for setups in the library
⑤ Insert blank (simple geometric shape) as setup "Fast protection".
⑥ Mark setup from the library. All available setups from the library are displayed.
⑦ Insert marked setup at Mount Station. Alternatively, you can drag and drop the marked setup to the Mount Station.
⑧ Click "Cancel" to close the window for inserting setups.
⑨ The marked setup is inserted at the Mount Station as the active setup ("Detailed protection").
⑩ Toolbar for editing the selected setup, e.g. moving it.
⑪ Shifting/rotating the marked setup (blank/clamping)
⑫ Assign Reference Point of the marked setup (blank/clamping) to a work offset
⑬ The setup is reset to the original state. Any shifts/rotations and zero point assignments are deleted.
⑭ Deactivate the setup by clicking on "X".

Figure 12-67 Setup Manager: Example "Detailed protection" is configured

12.7.2 Activating setup with a blank

The simplest setup consists of just a blank without clamping (fast protection). No 3D geometry required as clamping.

Requirement

- The Setup Manager is opened and the window for inserting setups is displayed.
- The enclosure layer is hidden

How to activate a setup with a blank

The procedure for activating the setup from a blank is shown using the example of a milling machine with an MS1 Mount Station.

1. Click the button "Add Primitive Blank". The window for defining the blank is displayed.
2. First, select the basic geometric shape ①.

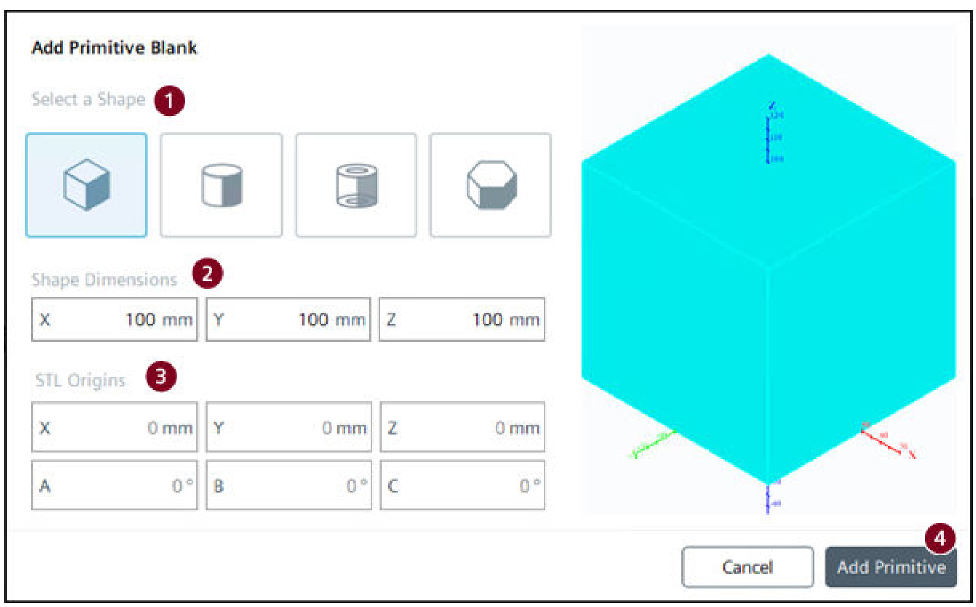


Figure 12-68 Defining a blank for setup

3. Depending on the selected basic shape, parameterize the dimensions of the geometric shape ②. The preview image is displayed.
4. As default, the basic shape has a Mounting Point at the bottom center of the blank. You can shift the Mounting Point or rotate the reference system ③.
5. Click on "Add Primitive" ④.
   The defined blank is accepted as setup and activated.

6. Optionally, you can change the position of the blank. As standard, the mounting point defined for the blank is placed on the Mount Station of the machine.
   – Changing the configuration in the machine space (Page 310)

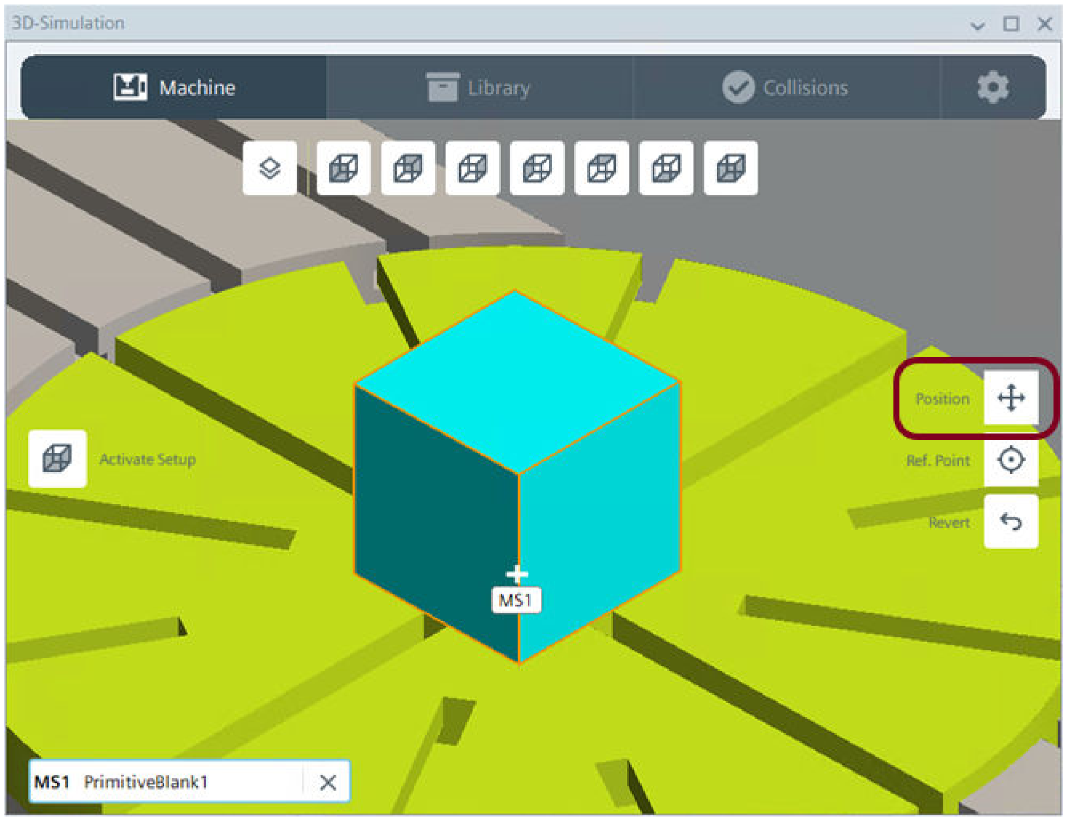


Figure 12-69 Active setup with a blank from a simple geometric shape

7. You can disable the active protection by clicking the "X" next to the setup.

Note

If you deactivate the setup, the created blank is deleted. If you want to work with a blank as setup for the 3D Simulation, define a setup in the library that only has a blank and no clamping. You can then activate this setup repeatedly whenever required.

8. Click the "Machine" tab to close the configuration manager.

12.7.3 Activating a setup from the library (detailed protection)

To define "Detailed protection", enable a setup from the library.

Requirement

- The Setup Manager is opened and the window for inserting setups is displayed.
- The enclosure layer is hidden

How to activate a setup from the library

The procedure for activating the setup from the library is shown using the example of a milling machine with an MS1 Mount Station.

1. Select a setup from the library shown in the setup window.
2. Drag & drop the configuration to the Mount Station or click the "Import Setup" button. The setup is applied and activated.
3. Optionally you can also change the position of the setup (Page 310). By default, the Mounting Point defined for the clamping device is placed on the Mount Station of the machine.

Figure 12-70 Setup Manager: Example setup from library

4. Click on "Cancel" to close the window with the setups from the library.

The setup from the library is active.

Note

Active setup and library

The components of an active setup cannot be edited in the library. If you want to edit the component in the library, you must first deactivate the setup.

More information

Using several active setups (Page 316)

Using several Mount Stations (MS) of a machine (Page 317)

12.7.4 Changing the position of the setup

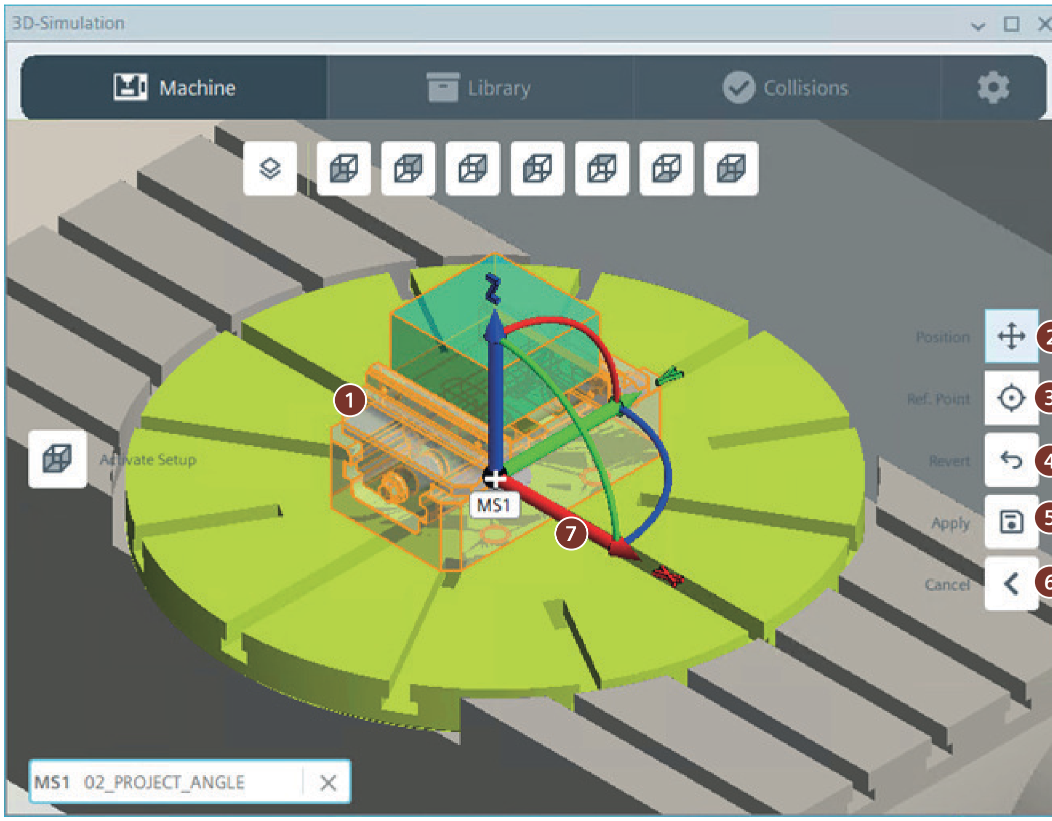
Once the setup has been activated, you can change the position of the setup in the Setup Manager. This is useful, for example, if you want to move the entire setup (clamping + blank) on the machine table.

You have 2 options for changing the position:

- Change the position of the setup or individual components (blank, clamping) by moving or rotating them (Page 312).
- Assigning the Reference Point of the blank or clamping device to a work offset. (Page 312)
  The Reference Point of the component is positioned at the work offset after the assignment.

Functions for positioning

If the configuration or a component of the configuration is highlighted (orange edges), the toolbar is expanded. You can click on the name of the configuration or the configuration in the machine room to select it. You can position the setup or the components using the toolbar that appears.



① Click on the setup to select it. Double-click to select the individual component (blank or clamping device). Use the toolbar to position the entire setup or the selected component.

② Click on "Position" to move or rotate the selected component. A coordinate system is displayed ⑦.

③ Click on "Ref. Point" to assign the reference point of the component to a work offset. A single component must be selected. In the window that appears, select the reference point and the work offset.

A reference point must be defined on the blank or clamping device for the assignment to be possible.

④ Click on the "Revert" button to delete all offsets/rotations and the zero point assignment. The setup is reset to the original state.

⑤ Click on "Apply" to save and apply the position change.

⑥ Click on "Cancel" to discard the position changes and hide the toolbar.

⑦ Click on a coordinate axis or the arc of an angle. The selected axis is colored orange and you can position the component by holding down the mouse button. Alternatively, enter the position in the position fields that appear.

Figure 12-71 Positioning a setup (component)

See also

Align Reference Point R to a work offset (Page 315)

12.7.5 Changing the position of the setup by moving/rotating

You can change the position of the setup or the components of a setup after activating it, e.g. move or rotate the setup.

Requirement

- The Setup Manager is displayed
- The setup is activated in the Setup Manager.

How to position a setup or a component

In the example, the entire setup is repositioned. The procedure for positioning individual components is identical.

1. Select the setup in the machine room.
2. Click the "Position" button in the toolbar.
   A coordinate system is displayed.

3. The X axis is moved in the example. Click on the X axis of the coordinate system. The X axis is highlighted in orange.

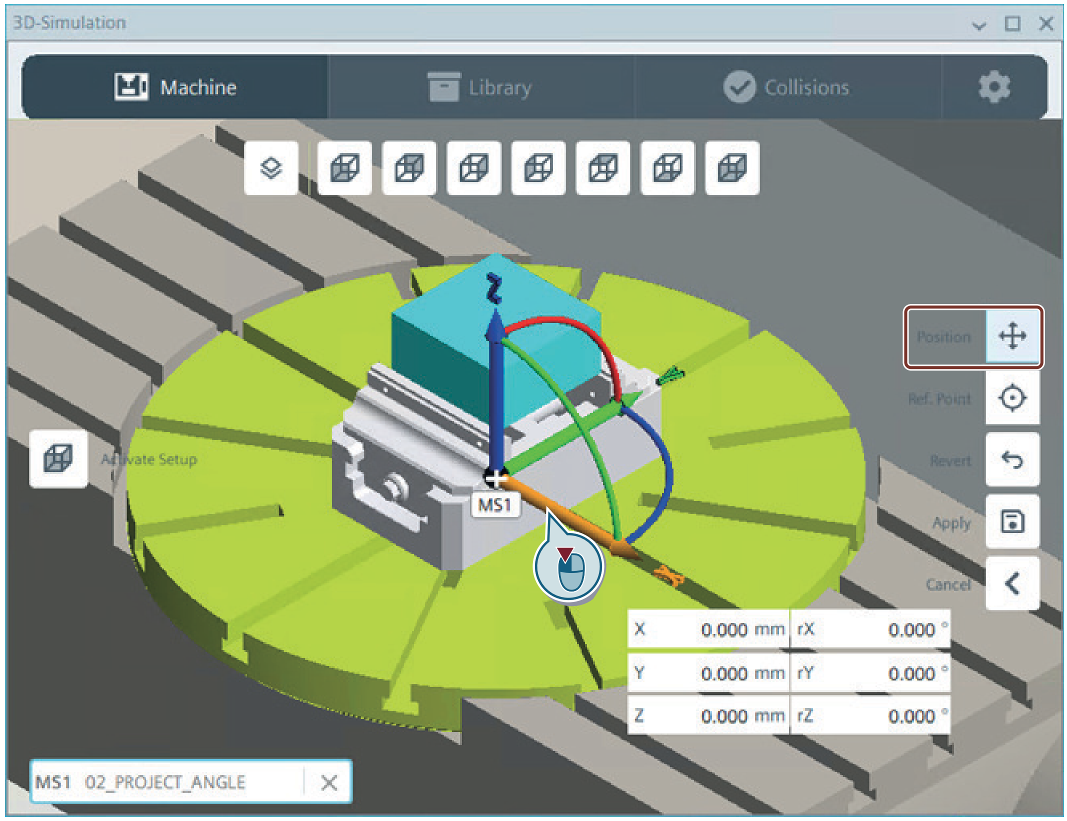


Figure 12-72 Changing the position of a setup

4. Hold down the mouse button and move the setup along the X axis. Alternatively, you can enter the position value in the display/input fields that appear. In the example, the new position is **X 40.000 mm**.

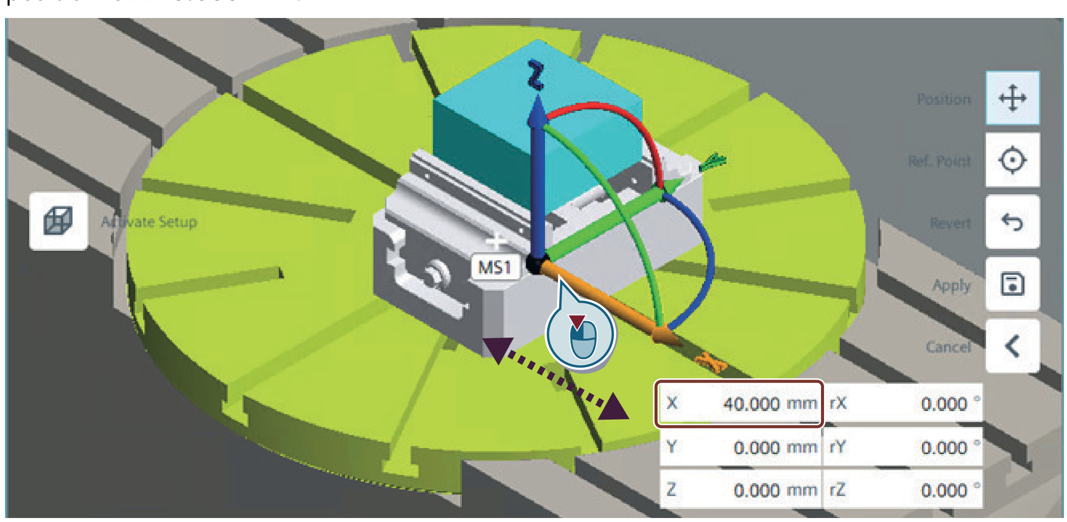


Figure 12-73 Moving the setup along the X axis

5. In the example, the setup is to be rotated around the Z axis. Click on the arc between the X axis and the Y axis. The arc is highlighted in orange.

6. Hold down the mouse button and rotate the setup around the Z axis. Alternatively, you can enter the angle in the display/input fields that appear. In the example it is **rZ -20.000** °.

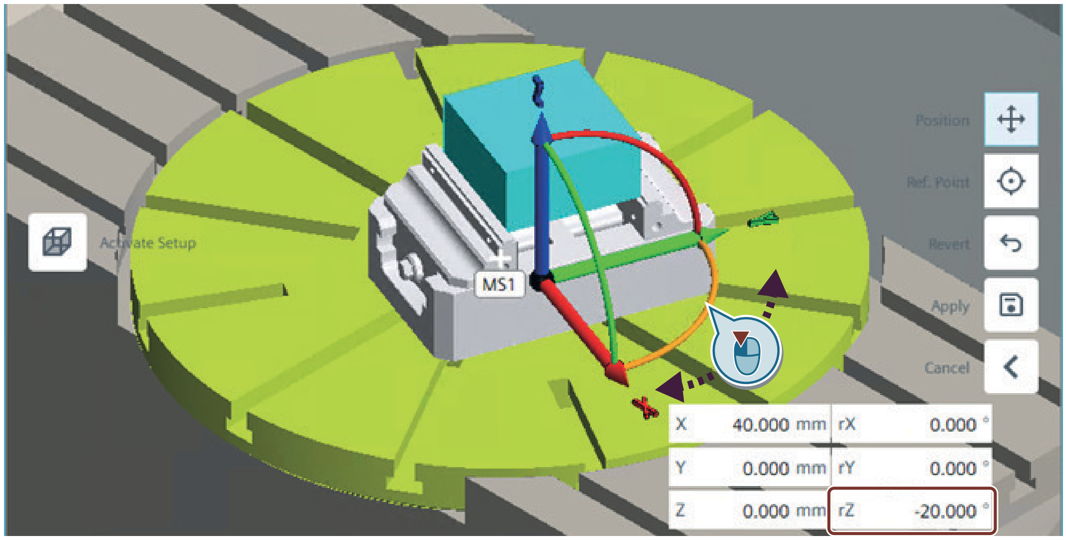


Figure 12-74 Rotating the setup around the Z axis

7. Click on "Apply" to apply the position change.
   The setup is displayed at the new position in the machine room.

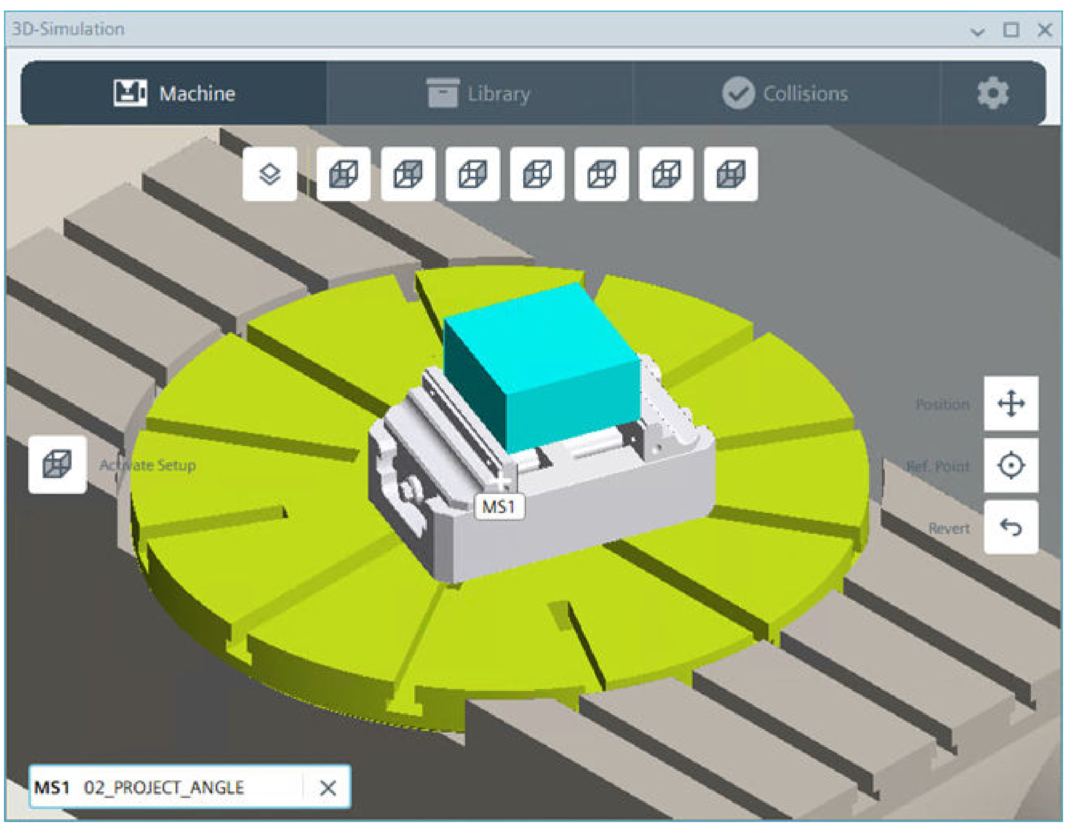


Figure 12-75 New position has been applied to the setup

12.7.6 Align Reference Point R to a work offset

Reference point R of a component (blank, clamping) can be assigned to a work offset in the Setup Manager.

Requirement

- The Setup Manager is displayed
- The component of the setup is selected in the Setup Manager.
- The component has at least one Reference Point.

How to assign a Reference Point to a work offset

1. Double-click on the component whose Reference Point is to be assigned to the work offset. The component is highlighted in orange. A clamping device is used in the example.

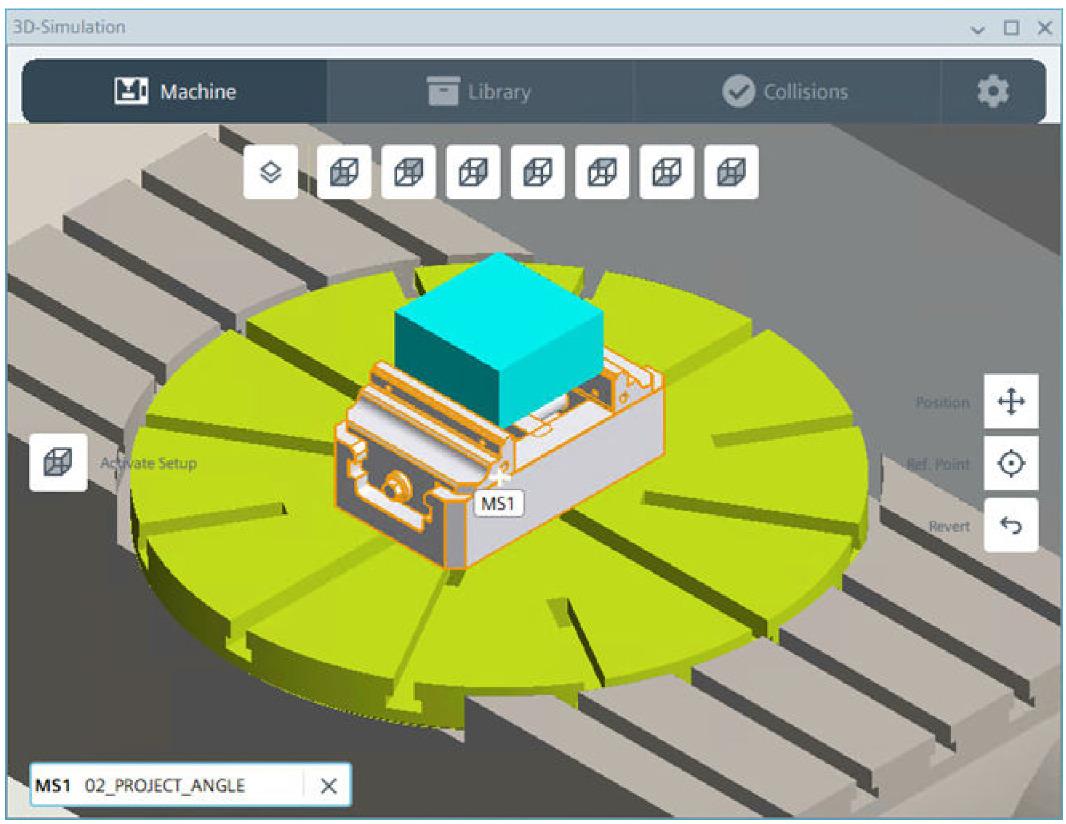


Figure 12-76 Clamping component of the setup marked

2. Click the "Ref. Point" button. A window is opened.
3. Select the Reference Point, e.g. R1.
4. Select the channel in which the work offset is active. For 1-channel machines, the channel is permanently preassigned with CHAN1.

5. Select the work offset, e.g. G54.

Figure 12-77 Reference Point R1 of the clamping device is assigned to work offset G54

6. Click on "Apply" to apply the position change.
   The component (in the example, the clamping device) is assigned to the work offset and the Reference Point is positioned on the work offset.

Note

Changed values for work offsets are not automatically updated

If you change the values for the work offset, e.g. by setting the WO again, the component is not automatically repositioned in the setup. To update, switch to the Setup Manager, select the component with the assigned Reference Point and click on "Ref. Point". You can then click the "Apply" button. The Reference Point of the component is positioned at the new value of the work offset.

12.7.7 Several setups for a Mount Station

You can define and activate multiple setups for a Mount Station in a machine. This is automatically used for a machine with only one Mount Station. With multiple Mount Stations, first select the Mount Station (e.g. MS1 or MS2) that you want to use.

Requirement

- The Setup Manager is opened and the window for inserting setups is displayed.
- The enclosure layer is hidden
- A setup is already activated.

This is how you define several setups

1. Import further setups.
2. Position further setups.
3. To edit an active setup, click on the corresponding setup. The setup is highlighted in orange.

Figure 12-78 Example of milling machine with one Mount Station (MS1): Two setups are imported and activated

4. Repeat the steps if you want to import and activate additional setups.

12.7.8 Using several Mount Stations

If the machine has several Mount Stations (Mount Station MS), you can define setups for each Mount Station and then switch between these. In the 3D Simulation, the Mount Stations are displayed with MS1 to MSx.

12.8 Collisions

12.8.1 Collision detection

During 3D Simulation of the machining process, collisions that occur while collision detection is active are logged and visually displayed in the 3D Simulation. The collision components are marked in color.

- Orange: Safety clearance of the components violated, but no collision yet
- Red: collision of the components

Collision log

In the "Collisions" tab, all collisions that have occurred are displayed in tabular form and with a 3D image and additional information. The collisions are saved at the same time in the "collision.log" log file.

Storage path for log file:

"C:\Users\<username>\AppData\Local\Siemens\Automation\SINUMERIK ONE\ncu\card\user\sinumerik\3d\collisions\collision.log"

List of collisions

The following data is listed in the collision list or saved in the log for each collision:

- Collisions type
- Date, time
- Number of components involved

All logged collisions and the saved log can be deleted using the "Delete" button. Single collisions can be deleted line-by-line in the table.

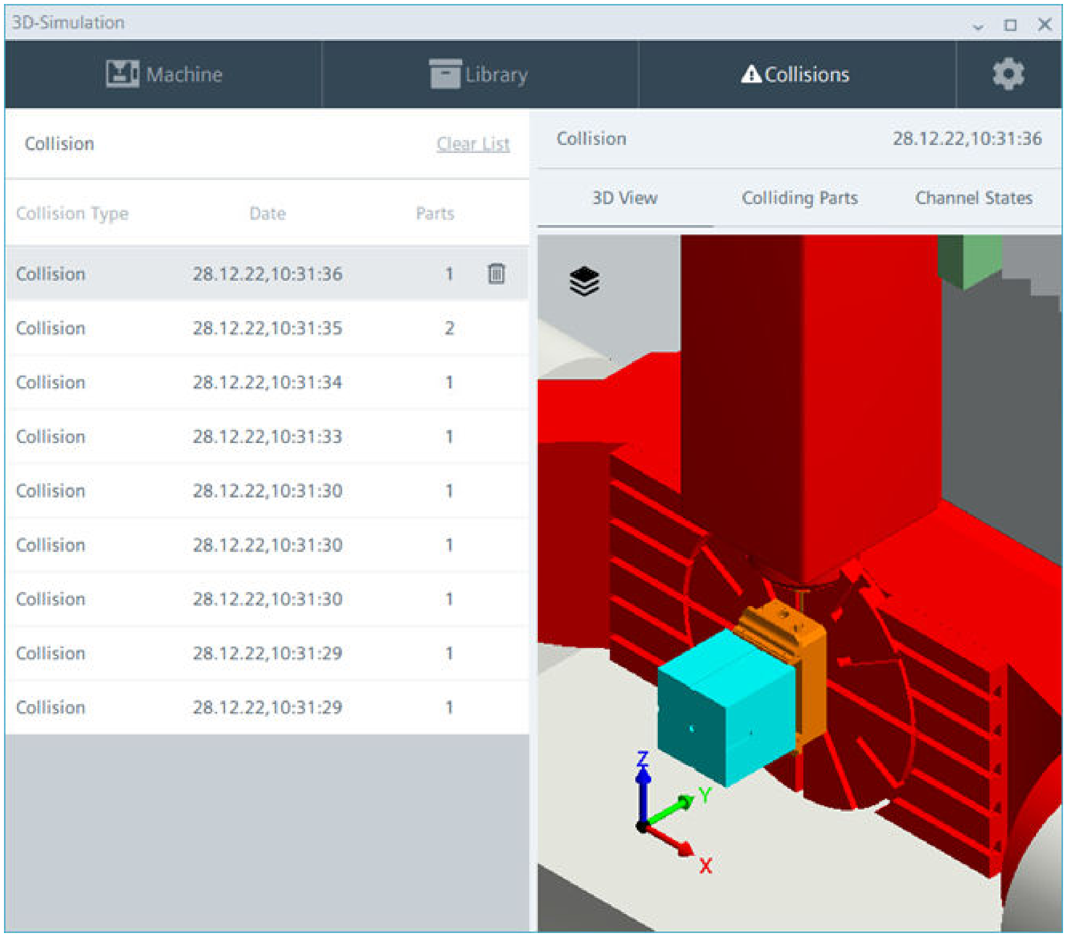
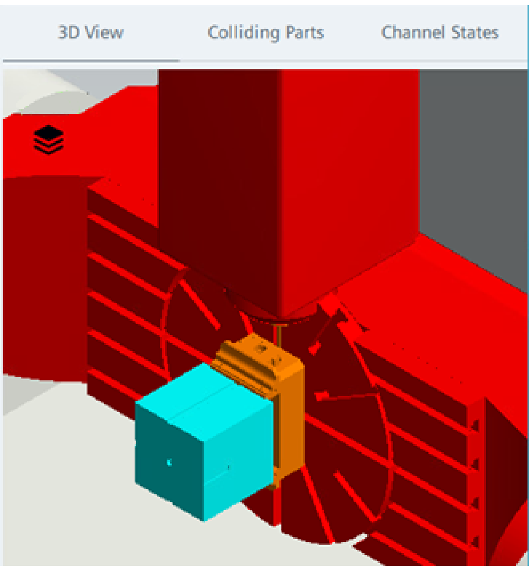
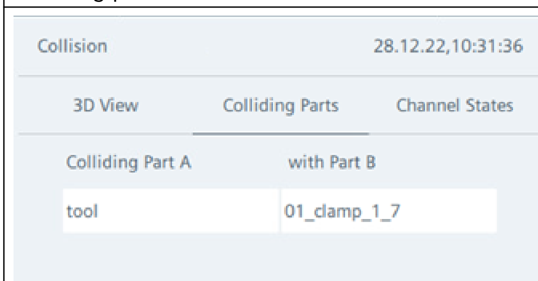
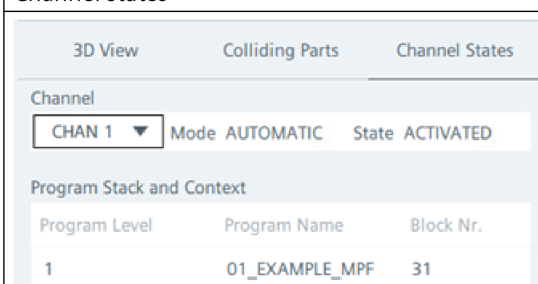


Figure 12-79 Collision screenshot, components involved are shown in color

Collision details

Details on the selected collision are displayed in the table in the tabs.

<table>
<tr><th>Tab</th><th>Meaning</th></tr>
<tr><td colspan="2">3D image of the collision</td></tr>
<tr><td>
</td><td>The 3D image can be zoomed, rotated and moved in order to better display the details.
From the layer menu, you can specifically hide layers, for example the machine housing, in order to better analyze the collision situation.</td></tr>
<tr><td colspan="2">Colliding parts</td></tr>
<tr><td>
</td><td>Which components are involved in the collision, e.g. tool, protection area, machine component</td></tr>
<tr><td colspan="2">Channel states</td></tr>
<tr><td>
</td><td>Channel
Select the channel to display the status of that channel during the collision time. A selection is not possible for single-channel machines.
Mode
Operating mode in which the collision occurred, e.g. JOG, AUTOMATIC.
State
State at the time of collision, e.g. ACTIVATED
Program stack and context
Stack level of the program together with the program name and the line number in which the collision occurred.</td></tr>
</table>

12.8.2 Activating collision detection

Before you start the 3D Simulation of the machining process, activate collision detection so that any collisions that occur during machining are displayed and logged. Collision detection cannot be enabled or disabled during the machining process.

How to activate/deactivate collision detection

1. In the "Machine" tab, click the "Off" button next to "Collision detection" at the bottom of the window.
   The button is displayed in green with the caption "On". Collision detection is now active.
2. If you want to disable the collision detection again, click the button again.
   The button is now red and collision detection is deactivated again.

Collisions that occur are logged on the "Collisions" tab.

12.9 Simulating machining operations and workflows

12.9.1 Measuring processes in the 3D simulation

The 3D simulation simulates and visualizes measuring processes with switching probes. The measuring process is identical to the procedure on a real machine and has the same prerequisites.

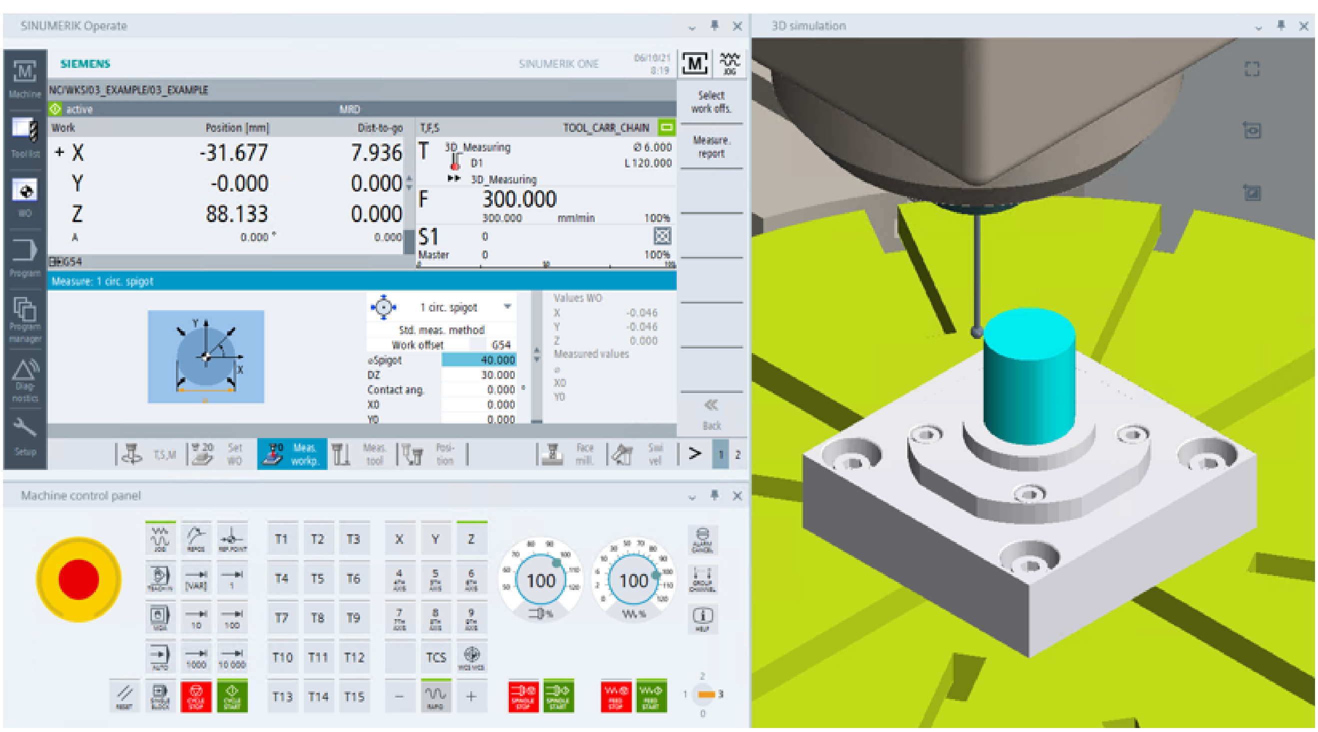


Figure 12-80 Measuring using the example of a measuring cycle in JOG mode

Note

To record the measured values correctly, only real axes may be used, i.e. the axes must be assigned to drives, just as on a real machine. Measuring with virtual axes or in simulation mode does not provide correct results.

Functions

The following functions are supported.

- Measuring the workpiece or clamping
- Use of the workpiece measuring cycles in JOG, MDI and AUTOMATIC
- Support from the first measurement channel
- Contact of the probe with surfaces (e.g. workpiece, clamping) is not evaluated as a collision, but provides the edge for measured signal acquisition.

Restrictions

- No measuring of tools, e.g. with load cells or laser measurement.
- Collisions between the probe (shaft, unclamping) and other collision elements are not permitted.
- Measurements only with probe-tool types that are listed in Section Probe (Page 258).
- Only HighActive probes are supported (no LowActive).

12.9.2 Automatic mode with 3D simulation

During execution of an NC program in AUTOMATIC mode, 3D simulation with collision detection enables you to check the processing so that any program errors can be detected.

Requirement

- Requirements for 3D simulation are fulfilled
- The NC program is loaded in AUTOMATIC mode

How to reset the view

Before starting the simulation, reset the view to the "Machine" tab.

1. Click on button ... "Options" and then "Reset workpiece". The processed workpiece is reset to the blank view.

How to work with the 3D simulation

1. Check whether all of the requirements have been met.
2. Click CYCLE START in SINUMERIK Operate. The program is processed and machining of the blank is simulated.

Figure 12-81 Example: simulation of machining process

The following functions are provided to assist you during the processing and simulation

- Visualization of the workpiece machining and all machine movements
- Visualization of collisions using colored highlighting
- Logging of the collisions
- Zooming and moving the view to better recognize the details

12.9.3 Saving the setup (machining state) in process

You can save the current machining state of the workpiece and the active setup by pressing button "Save in-process setup". This may be necessary, for example, to save the current machining and use it again as a basis for further machining at a later time.

The following components are saved as a copy under an automatically generated name:

- Storage folder:
  - STL file of the machined workpiece
- Library:
  - Machined workpiece
  - Active setup

Constraints

- Only one setup and one workpiece can be saved.
- Saving is only possible during no-load operation (spindle and feedrate stop).

How to save the machining state

1. Stop the spindle and feedrate.
2. In the "Machine" view, click on button ... "Options" and then on "Save in-process set up".
   The workpiece and the setup are saved. A message signals the successful saving process.
3. Start the spindle and feedrate. Machining is continued.

12.10 Option /3D machine model (CMVM)

12.10.1 Integrating 3D simulation into a project

To use the 3D Simulation functions, various data must be provided in the machine project and the project appropriately commissioned. The configured machine project can also be used for Run MyVirtual Machine e.g. to provide customers with a completely configured machine model to simulate NC programs.

The collision avoidance component is a model-based system. It can only determine collisions if the model used for collision detection precisely represents reality. The machine manufacturer must carefully ensure this in order to reduce the risk of any collision. PLC-controlled actuators, FC18 motions, axis couplings and superimposition corrections are not taken into account.

Axes that are not included in the machine model may be asynchronously moved. These are ignored for the collision analysis.

NOTICE
$MA_COLLISION_EXT_AXIS_MASK=0
Please note that $MA_COLLISION_EXT_AXIS_MASK=0 is for axes that are not included in the machine model.

Restrictions

Only one 3D machine model can be used in a machine project ("*.vcp"). If there are several 3D machine models on the virtual memory card in the storage path, then the first 3D machine model found is always used. Additional 3D machine models are ignored.

Note

Only use **one** 3D machine model in a machine project.

How you configure a machine project with 3D machine model

1. Create a machine project in Create MyVirtual Machine with a configured and commissioned machine.
2. Using a suitable software environment, create a 3D machine model with application of the machine manufacturer for the configured machine.
   - Descriptions of kinematics ("*.xml")
   - stl geometries (e.g. machine table, magazine, enclosure, axes)

   Note

   MachineBuilder (ModulWorks) or Create MyVirtual Machine /3D Builder

   You create the machine model (kinematics description and geometries) in the Create MyVirtual Machine /3D Builder or MachineBuilder and export it as "machine container" in the "*.mkc" format, or use the "*.stl" and "*xml" directly.

3. Export the 3D machine model as "*.mkc" or as "*.stl" and "*.xml".
4. Copy the created 3D machine model to the virtual card of the machine project. "C:\Users\<username>\AppData\Local\Siemens\Automation\SINUMERIK ONE\ncu\card\oem\sinumerik\3d\model\".
   - "*.mkc"
     or
   - "*.stl", "*.xml"

5. Save the complete machine project.
6. With the machine project started, the "3D Simulation" window is displayed if the corresponding machine model is integrated and valid.

Figure 12-82 Example of 3D Simulation of a milling machine in MyVirtual Machine

On the basis of the machine model created, you also define setups and tools to be used in simulating the machining process.

Note

Support for the 3D machine model

For more information, service and support issues for the option /3D, contact the official contact person (hotline, Service).

Open interface (option) 13

13.1 Overview

Description

The Open Interface of Create & Run MyVirtual Machine allows external applications to control the Create & Run MyVirtual Machine system and to communicate at runtime. Usually, the Open interface is used by machine manufacturers or simulation software providers. As a machine operator, you are provided with a complete solution by the machine manufacturer.

Possible applications of the Open Interfaces are:

- Remotely controlling Create & Run MyVirtual Machine. An external application starts, operates and exits Create MyVirtual Machine.
- Operation of Create MyVirtual Machine in an external simulation product.
- Connecting to an external peripheral simulation.

Note

License

The "Create MyVirtual Machine /Open" or "Run MyVirtual Machine /Open" license is needed to use the Open interface.

13.2 Licensing

An additional license is required to use the Open Interface.

Licensing

The Open Interface requires the "Create MyVirtual Machine /Open" or "Run MyVirtual Machine / Open" license. The license is provided via a license file (*.lic). A license file can include one or more licenses and is managed via a licensing application. The application is installed automatically when setting up Create & Run MyVirtual Machine.

The license is used as soon as an external Open client connects with the application using "connect". The license is released again if the connection is disconnected using "disconnect". If there is no license, the Open function "connect" returns the error code -1011 (no usable license found).

More information

You can find additional information about licensing in:

- *Create & Run MyVirtual Machine installation instructions*

13.3 Function overview

The Open Interface makes the following functions available for communication between external applications and Create MyVirtual Machine.

Remote control

The Open Interface provides the following functions for remote control:

- Start/exit Create MyVirtual Machine
- Create/open/save/close a machine project
- Start/stop control simulation

Note

Copy machine project "*.vcp"

Machine projects cannot be copied via the Open Interface.

Operation in the external simulation product

Create MyVirtual Machine is controlled by another application, and the external simulation product is integrated in the cyclical operation. Whereby, simNCK data (e.g. axis values) is read in cyclical operation so it can be visualized in a machine model. To simulate actuators and sensors, inputs and outputs of the PLC-IO image are read and written in cyclical operation from (to) SIMATIC S7 PLCSIM Advanced.

The Open interface provides the following additional functions for this purpose:

- Register for cyclical events of the virtual SINUMERIK (OB1 clock cycle of the PLC and/or IPO clock cycle of the NC)
- Read NC data in the IPO clock cycle
- Read PLC outputs in the OB1 clock cycle
- Write PLC inputs in the OB1 clock cycle
- Write PLC inputs via symbols
- Read PLC outputs via symbols
- Read/write channel/axis/tool data
- Read probe signals
- Manage folders, files, NC programs on the NC and virtual memory card
- Select files (e.g. NC programs)
- Execute programs and determine program status
- Exporting/importing project settings

External peripheral simulation

An external simulation application runs in the simulation context of Create MyVirtual Machine to supply the PLC I/O image based on supplied PLC outputs with the appropriate PLC inputs. The external simulation application simulates the peripherals and reads and writes the PLC values via the Open Interface.

Adapting the user interface

You adapt the user interface view of Create MyVirtual Machine corresponding to the particular application via the Open interface.

- Completely hiding the user interface for blackbox operation (Page 331)
- Displaying areas of the standard user interface in separate windows or integrating into other applications (Page 332)

13.4 Programming

Description

The Create & Run MyVirtual Machine Open Interface is provided as a DLL for external software components. The interface functions of the DLL (open.dll) provide the central interface for the Create & Run MyVirtual Machine application. All other DLLs are loaded from them. The interface functions are described by the associated header files.

Constraint

The client application runs on the same computer as Create & Run MyVirtual Machine. Although a cross-computer architecture is not supported, it can be implemented by an appropriate client application.

Characteristic

- Appropriate DLLs are supplied with each version of Create & Run MyVirtual Machine.
- The Open Interface functions are exported as C function calls.
- The calls to the Open Interface are made synchronously, i.e. the call result is supplied immediately with the function return.
- Suitable for 32/64-bit applications.
- The base data types correspond to the base data types of the C programming language, including extensions to the C++11 or C99 standard.
- Strings are always used in Unicode format UTF16. The maximum permissible string length is 256 characters.

Function structure

```
int32 fnName ([<base data type> parName]*)
```

Return values

- = 0 function executed successfully
- < 0 function failed with unambiguous error code
- > 0 function executed with warnings

Using the Open Interface

The DLL with the header files is located on the installation medium in the "oa" subfolder. In each case, use the appropriate libraries for your 32 or 64-bit application.

The following data are stored in the subfolders.

Folder/file	Description
doc	Doxygen-based documentation of the Open Interface functions. Provided as PDF on the installation media and in the Create & Run MyVirtual Machine online help.
h	Contains all header files for the interface functions (required only for C/C++ clients).
bin\x86\Release bin\x64\Release	Contains all DLLs required to run an Open Client application. The "open.dll" program library forms the basis; the other DLLs are loaded from it.
config	Contains the *.xmls of the run-up profiles for blackbox mode.

Preparation for programming the Open application

1. Copy the complete "oa" directory from the installation medium locally to your computer. You can now reference the library in your programming environment.

Programming examples Open API

For a selection of standard cases, you can find further documentation and sample applications based on Visual Studio in Online Support.

>> Open API and sample applications (https://support.industry.siemens.com/cs/ww/en/view/109817568)

Using existing applications with new Open libraries

If you use Open libraries from previous Create & Run MyVirtual Machine versions in an existing Open client application, new Open functions of the latest version cannot be used. The full scope of functions is only available with the current Open libraries.

Note

Compatibility

Current versions of Create & Run MyVirtual Machine or CNC software are not necessarily compatible with older versions of the Open libraries. Replace the Open libraries in your Open Client application with the current version.

More information

Reference documentation for the functions and variables can be found in the following document.

List Manual Create/Run MyVirtual Machine Open Interface (only available in English and German)

Note

Opening a reference from the online help

When opening the Open HTML reference help from the Create & Run MyVirtual Machine online help, you must confirm the message via the view of the blocked contents.

If the Open HTML reference help does not open, you can open the reference help manually:

1. In Windows Explorer, navigate to the help folders: "C:\Program Files (x86)\Siemens\Automation\Create and Run MyVirtual Machine\Help\"
2. Open the appropriate language folder, e.g. "de-DE" for German.
3. Open the "html" folder and double-click on "index.html".
   The Open HTML reference help is displayed in the web browser.

Example path for the English version of the help: "C:\Program Files (x86)\Siemens\Automation\Create and Run MyVirtual Machine\Help\en-US\html\index.html".

13.5 Hiding the user interface (blackbox operation)

Create/Run MyVirtual Machine as control system simulation

As an option, the Create/Run MyVirtual Machine products can be used without user interface. This "blackbox" mode is activated via a corresponding mode when starting the application with the startApplication() function. In this mode, no window is displayed, and another application only uses Create/Run MyVirtual Machine as control system simulation.

Run-up profiles

When starting the application, a run-up profile (*.xml) is used to define in which mode Create/Run MyVirtual Machine is started. The following profiles are contained in the "config" folder:

- Starting with the user interface: CMVMStartUpProfile.xml or RMVMStartUpProfile.xml
- Starting in the blackbox mode: CMVMStartUpProfileBlackbox.xml or RMVMStartUpProfileBlackbox.xml

You save the corresponding run-up profile (*.xml) in the installation path ..\Create and Run MyVirtual Machine\bin\.

More information

In the blackbox mode, you can embed parts of the user interface, e.g. the HMI, in your own application and display. Additional information is provided in the next section (Page 332).

13.6 Areas/viewlets in separate window

As an expansion of blackbox mode, you can integrate specific window components of the standard application into the customized application context.

In the current version, you can display the following window components in a dedicated application:

- SINUMERIK Operate HMI
- MCP
- 3D simulation

SINUMERIK Operate HMI

In order that SINUMERIK Operate HMI can be embedded in an external application, you must provide a host window in the application.

1. In the application, create a host window in which the HMI is embedded.
2. Assign the host window a permanently defined title "Siemens.Automation.Sinumerik.One.VMx.Open.HMI".

When openProject() is called, Create MyVirtual Machine searches for a window with this title, and embeds the HMI in this window. When called from the bootController(), the HMI is opened in the window that was found and displayed.

MCP

In order that the control panel (MCP) can be embedded in an external application, you must provide a host window in the application.

1. In the application, create a host window in which the MCP is embedded.
2. Assign the host window a permanently defined title "Siemens.Automation.Sinumerik.One.VMx.Open.MCP".

When openProject() is called, Create MyVirtual Machine searches for a window with this title. When the project is opened, the MCP is embedded in this window and displayed.

3D simulation

In order that the 3D simulation can be embedded in an external application, you must provide a host window in the application.

1. In the application, create a host window in which the 3D simulation is embedded.
2. Assign the host window a permanently defined title "Siemens.Automation.Sinumerik.One.VMx.Open.3DView".

When openProject() is called, Create MyVirtual Machine searches for a window with this title, and embeds the 3D simulation in this window. When called from the bootController(), the 3D simulation is opened in the window that was found and displayed.

Analyze MyWorkpiece /Toolpath Connector 14

14.1 Analyze MyWorkpiece /Toolpath Connector

Overview

Analyze MyWorkpiece /Toolpath (AMWT) is a software product for visualizing and analyzing NC programs. To perform this analysis, the relevant data (NCK, NCU and PLC variables) from Create & Run MyVirtual Machine are recorded as JSON ("*.zip") when NC programs are executed with the Toolpath Connector plugin activated.

This source format is imported into AMWT in order to simulate and analyze the movements and behavior of the tool. The contour accuracy, surface quality and machining speed are analyzed by evaluating this data.

See also

Recording with the Toolpath Connector (Page 335)

14.2 Recording with the Toolpath Connector

If the "Toolpath Connector" plugin is activated, a "RUN.zip" with relevant data is generated automatically when an NC program is executed, which can be used for further processing in Analyze MyWorkpiece /Toolpath.

Requirement

- An NC program is loaded in SINUMERIK Operate in automatic mode
- The "Toolpath Connector" window is displayed and the plugin can be activated

Activating the Toolpath Connector plugin

1. Click the  button on the Create & Run MyVirtual Machine menu bar.
2. Select the "Toolpath Connector" check box. The window is displayed.
3. Activate the recording "Enable datea recording for AMW /Toolpath Application" in the window that appears.

During the subsequent execution of an NC program, relevant data is recorded for evaluation with AMWT.

Recording data and making it available for AMWT

1. After executing the NC program, the recorded data is stored in the following folder as "RUN.zip":
   C:\Users\<username>\AppData\Roaming\Analyze MyWorkpiece Toolpath\xMVM data (%APPDATA%\Analyze MyWorkpiece Toolpath\xMVM data)
2. Copy the "RUN.zip" file from the directory locally to the hard disk or a network drive in order to back it up.

   Note

   RUN.zip is automatically deleted

   The existing file is automatically deleted when the following events occur:
   - Execution of a new NC program or next NC start
   - Restart of Create & Run MyVirtual Machine

   ---
3. You can use the JSON file "RUN.zip" for analysis via drag & drop or via import in the Analyze MyWorkpiece /Toolpath application.
4. Deactivate the recording of the "Connector Toolpath" if you do not want to analyze any other NC programs.

More information

More information can be found in the *Analyze MyWorkpiece /Toolpath Operating Manual*.

Behavior Model 15

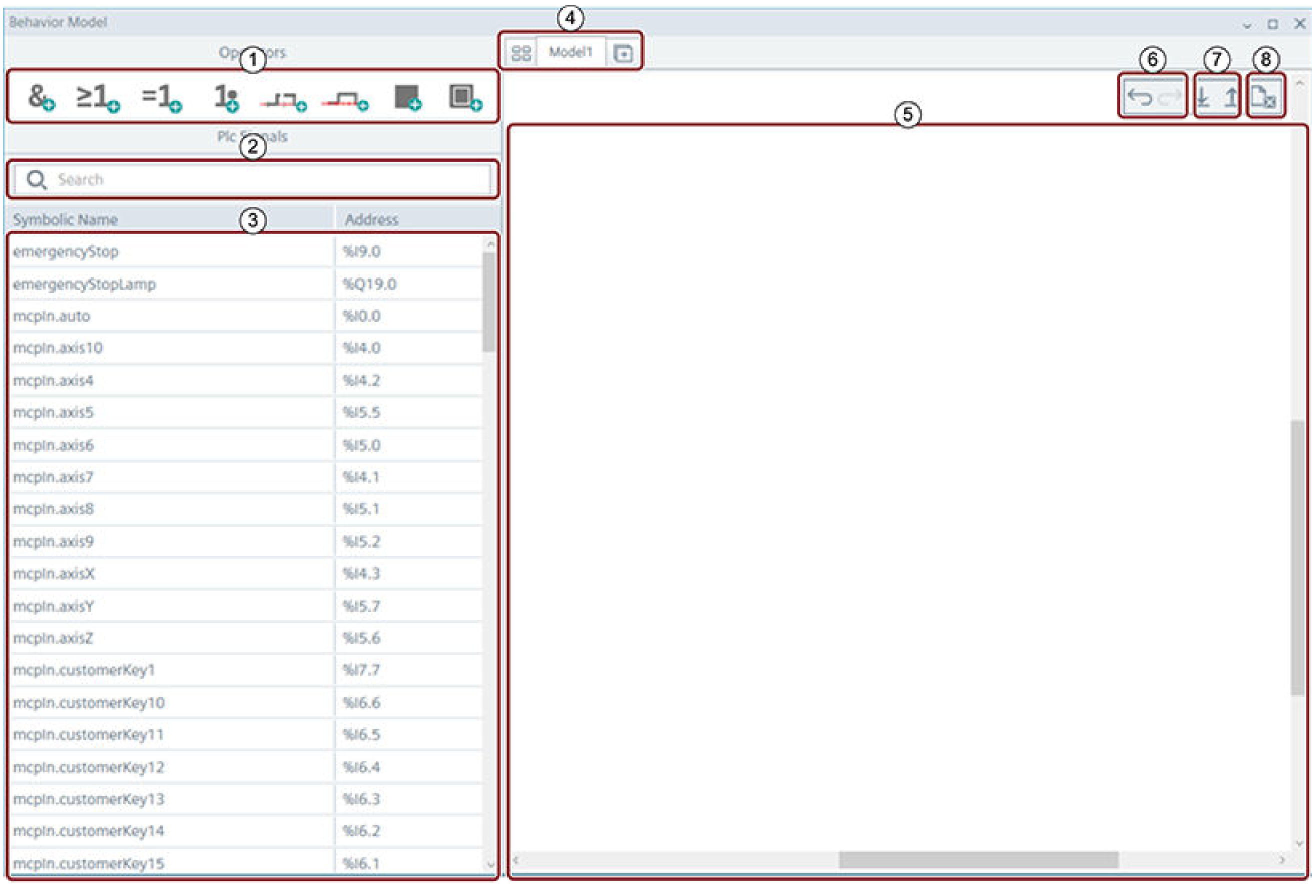
15.1 Overview

Overview

The Behavior Model represents a simulation platform that creates a basic logic design to simulate machine behavior for realistic training environments. It is an add-on to Create MyVirtual Machine (CMVM) or Run MyVirtual Machine (RMVM).

Note

To simulate the machine model, the machine project must be in the RUN state.



① Available operators
Add the operators from the panel via drag & drop to the chart.

② Search bar
Enter the search term. The list of PLC variables is filtered according to the search term.

③ Overview of the PLC signals

④ Model Manager

⑤ Model chart

⑥ Undo and redo buttons

⑦ Import or export the Model (chart) as XML

⑧ Close the active Model

15.2 Features and restrictions

The functionality of the Behavior Model is limited in Run MyVirtual Machine. All functions are only available in Create MyVirtual Machine.

Features and Restrictions for Create & Run MyVirtual Machine

- The simulation of the machine behavior is possible in Create MyVirtual Machine and Run MyVirtual Machine.
- In Create MyVirtual Machine, you use the full range o of Behavior Model functions. You can create and edit models.
- The behavior model is saved in the machine project.
- In Run MyVirtual Machine, you can use only ready-made models. You can only set the value 1 or 0 for the operator SWITCH.

15.3 Activate Behavior Model plugin

To activate the Behavior Model

The plugin is hidden by default. Before you use the Behavior Model, activate the plugin.

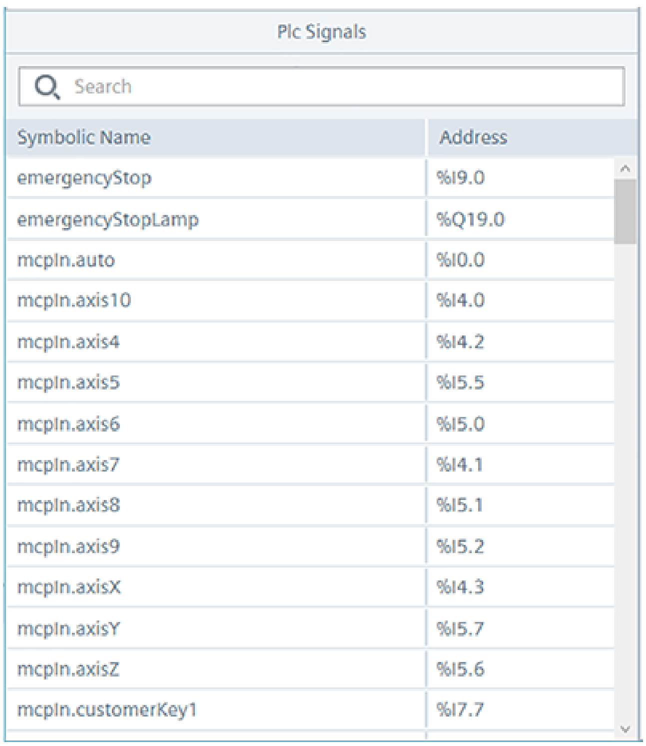
1. Click on the button in the Create & Run MyVirtual Machine menu bar.
2. Activate the "Behavior Model" checkbox. The window is displayed.

15.4 Product description and features

15.4.1 PLC Signals

PLC Signals

All the PLC Signals are listed under the "PLC Signals" panel which shows symbolic names and their PLC addresses.



In the search bar, you can either search for the symbolic name or the address by entering a search term. "Symbolic Name" and "Address" column can be adjusted.

Adding PLC signals

There are two ways to add PLC signals from the panel to the chart:

- Select a row and drag the PLC variable and drop into the chart.
- Double clicking on selected signal, the PLC variable is inserted in the active chart.

Added signal into the chart is not removed from the "PLC Signals" list.

In-/output signals

The PLC signals can be an input or output type. The other options are not available.

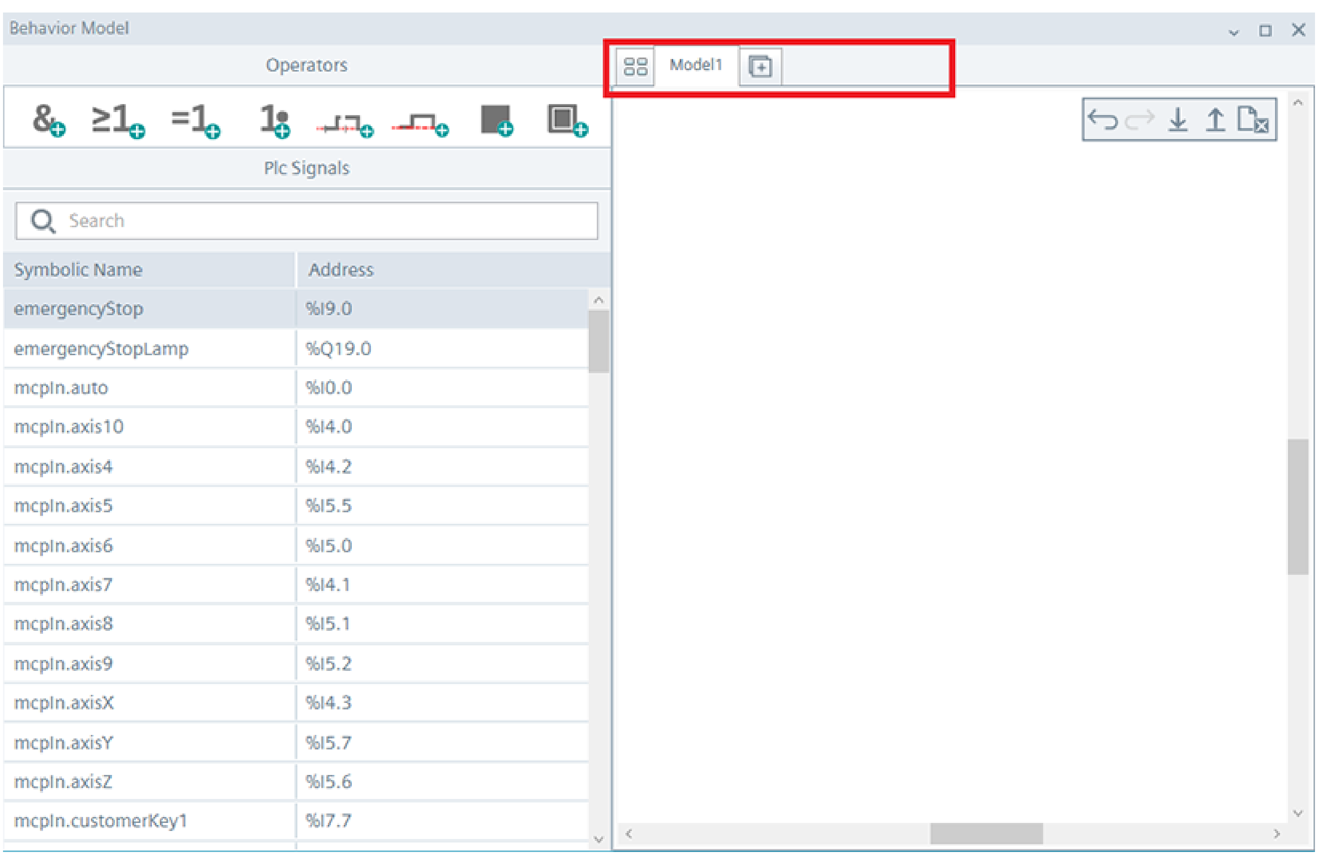
- All the input signal color is red as it is shown at the below.

- All the output signal color is green as it is shown at the below.

15.4.2 Model Manager

Model Manager

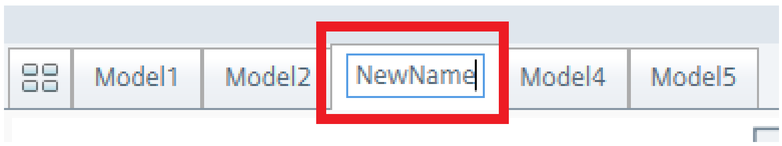
If the virtual commissioning project ("*.vcp") opens in the first time, the chart created automatically.



Create a new model

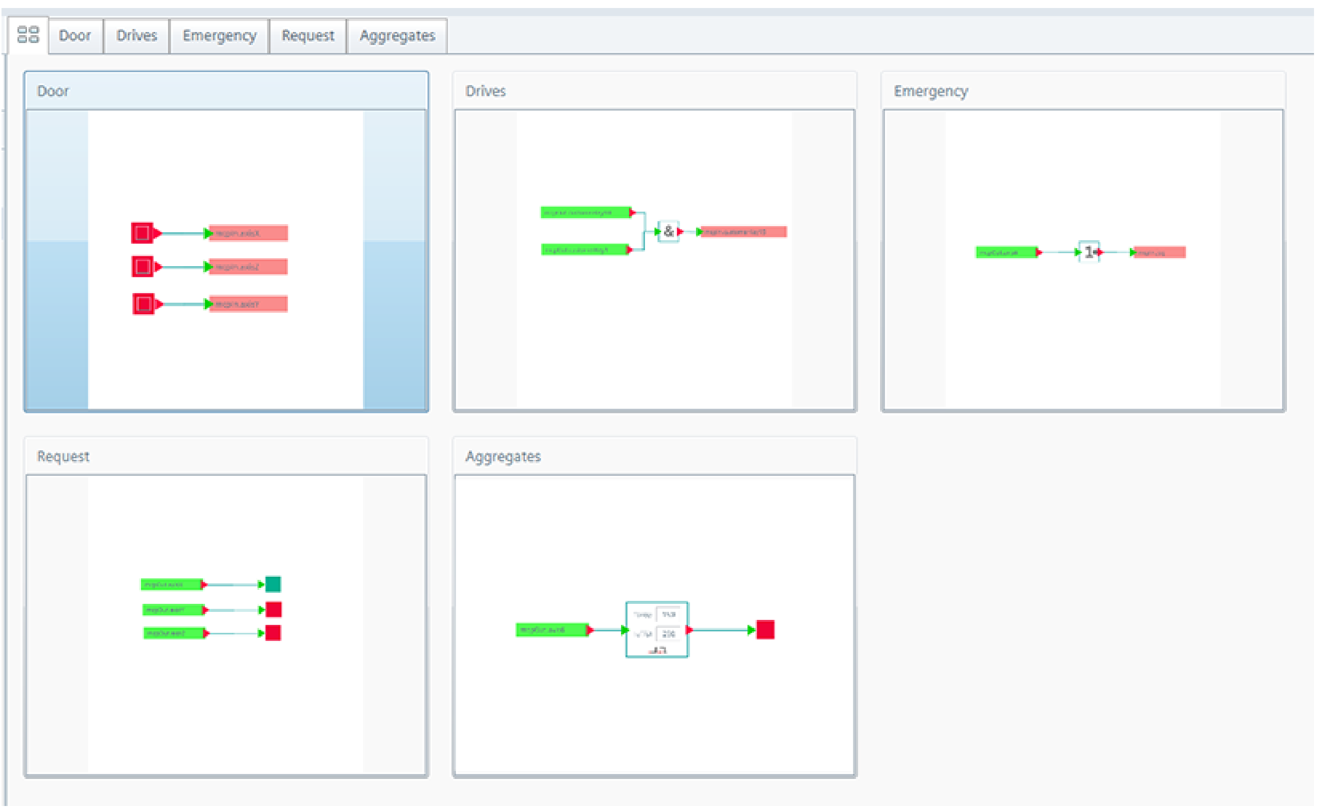
There is a plus icon next to model name. You can use this icon to create a new model. Up to 5 models can be created. When the new model is created, the name sets dynamically.

To change the model name, double click on the existing name.



Manage models

"Model Manager" panel allows to view all the model interface in one window. To open this view, click the navigator icon on the panel.



This navigation bar helps you to quickly find the model you want to work with. Click on the model to display its logical scenarios.

15.4.3 Toolbar

Toolbar

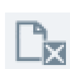
The Toolbar is an assistance tool with buttons for several actions.

The explanation for each button is below:

Undo and redo buttons

Import logical scenarios (model) as a XML

Export logical scenarios (model) as a XML



Closes the active model (register) of the machine project. The model is not saved. Only the displayed models (1 to 5 models) are saved in the machine project.

15.4.4 Load and save operation

Load and save operation

If you want to save the logical scenarios, you must save the machine project "*.vcp". The Behavior Model saves logical scenarios in an XML format. When you open the "*.vcp", the loading mechanism is activated and you see the content in the Behavior Model charts.

The data of the Behavior Model stored under this path:

- C:\Users\<username>\AppData\Local\Siemens\Automation\SINUMERIK ONE\ncu\data\BehaviorModelPlugin

Exchange models between projects

To use Behavior Models in other machine projects, you can export them as "*.XML" and import them into the other machine project.

15.4.5 Relationship between xMVM speed rate and simulation calculation cycle

Relationship between xMVM speed rate and simulation calculation cycle

Behavior Model signalization period is based on simulation time, not real time (wall-clock time). For each simulation cycle in Behavior Model, time is elapsing with the value of NCU clocks period (typically 16ms).

Based on xMVM speed rate, simulation time can be different than real time. For example if xMVM speed rate is 1000 %, 500 ms in simulation time means 50 ms in real-time. As a result, timing operation in Behavior Model (e. g. PULSE or DELAY) can be different than real-time if xMVM speed rate is different than 100 %.

Speed Rate

- If speed rate is 100 %, simulation time and clock time is same
- If speed rate is 500 %, simulation time is 5 times faster than clock time

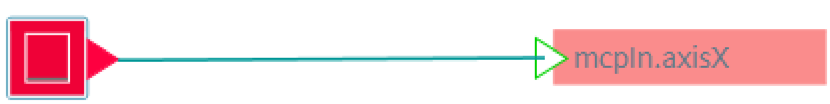
15.4.6 How to create a connection between operators and signals

How to create a connection between operators and signals

Each operator has a shape like a triangle, which can be on the right, left or both sides of the operator. To create a connection, proceed as follows:

1. Click on the triangle node on the switch.

2. Draw the line to target operator or PLC signal triangle node and drop it.



3. The connection is established.

15.4.7 Shortcuts

Shortcuts

Mouse

- **Mouse wheel up**
  Zoom in
- **Mouse wheel down**
  Zoom out
- **Mouse left button**
  Pan

Keyboard

- **Space**
  Make the fit of the view regarding to content of logics
- **Ctrl + Z**
  Trigger the undo mechanism
- **Ctrl + Y**
  Trigger the Redo mechanism
- **Ctrl + A**
  Select all content
- **Delete**
  Selected operators/plc signals remove.
- **-/+**
  Zoom In/Out

Mouse with keyboard

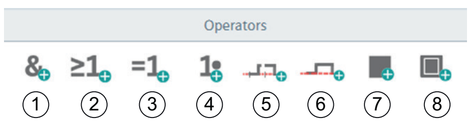
To select a specific area in the model (chart), press the left mouse button and draw a rectangular frame around the corresponding area.

15.5 Operators

15.5.1 Operator overview

Operators overview

There are several operators under the "Operators"-panel. All the operators have unique functionalities.



① AND (Page 346)
② OR (Page 347)
③ XOR (Page 347)
④ NOT (Page 348)
⑤ DELAY (Page 349)
⑥ PULSE (Page 350)
⑦ BINARY DISPLAY (Page 350)
⑧ SWITCH (Page 350)

If you want to add one of the operators from the panel, you must drag & drop the operator to the model chart.

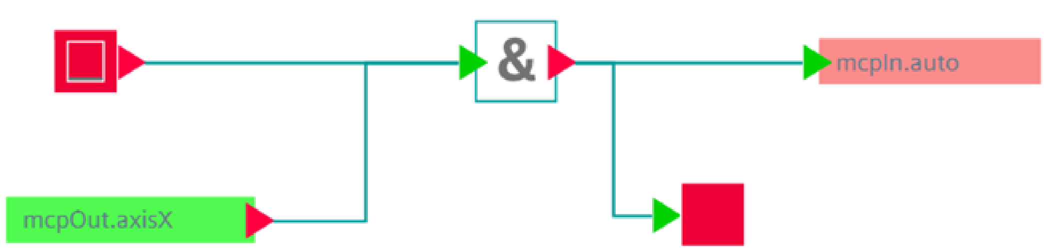
A tooltip describes the function for each operator. You can see the names of the operators when the mouse icon hovers over the operators.

15.5.2 AND

AND operators operate two or more digital signals (input signals) to produce an output value.

In-/outputs and parameters

The AND operator supports multiple inputs and multiple outputs.



Truth table

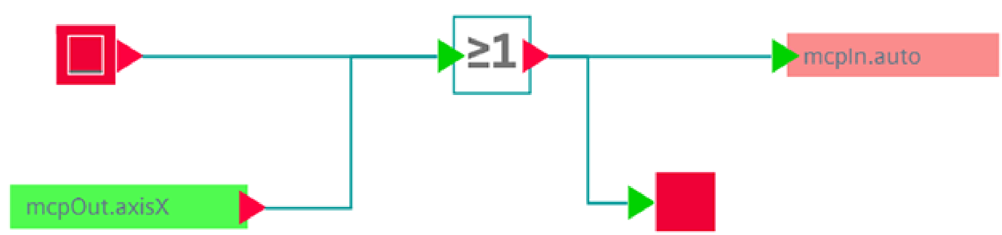
Input 1	Input 2	Output
0	0	0
0	1	0
1	0	0
1	1	1

15.5.3 OR

OR operators operate two or more digital signals(input signals) to produce an output value.

In-/outputs and parameters

The OR operator supports multiple inputs and multiple outputs.



Truth table

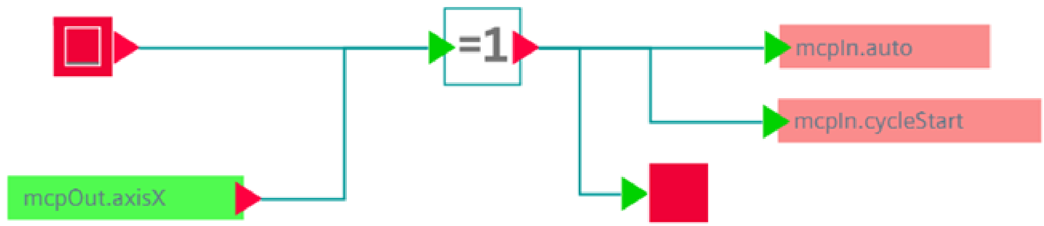
Input 1	Input 2	Output
0	0	0
0	1	1
1	0	1
1	1	1

15.5.4 XOR

XOR operators operate only two signals (input signals) to produce an output value.

In-/outputs and parameters

The XOR operator supports two inputs and multiple outputs.



Truth table

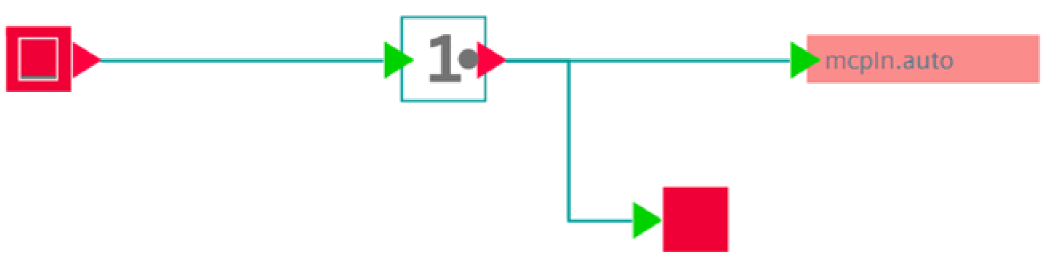
Input 1	Input 2	Output
0	0	0
0	1	1
1	0	1
1	1	0

15.5.5 NOT

NOT operators operate only one signal (input signal) to produce an output value.

In-/outputs and parameters

The NOT operator supports one input and multiple outputs.



Truth table

Input 1	Output
1	0
0	1

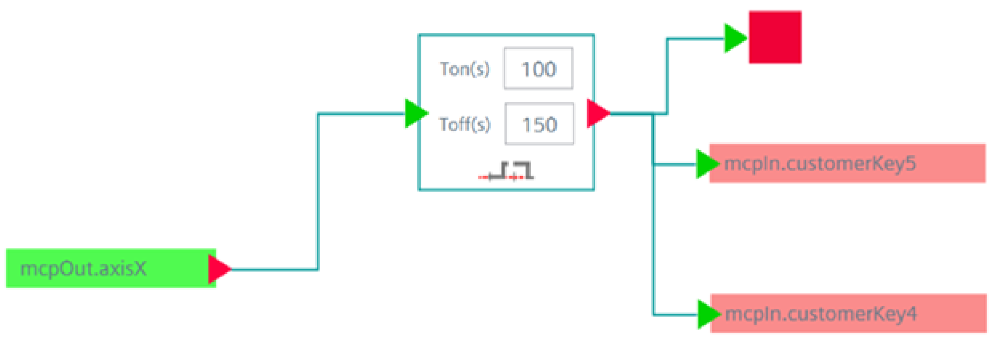
15.5.6 DELAY

If the signal at the input changes from 0 to 1, the output is set to 1 once the ON-delay time T_{ON} has elapsed. If the input signal is reset to 0 before the ON-delay time has elapsed, the output signal remains unchanged at 0.

If the signal at the input changes from 1 to 0, the output is set to 0 once the OFF-delay time T_{OFF} has elapsed. If the output signal is reset to 1 before the OFF-delay time has elapsed, the output signal remains unchanged at 1.

In-/outputs and parameters

The DELAY operator supports one input and multiple outputs.



There are two parameters need to be set:

- T_{ON}
  Given time with T_{ON}, when input value is set as `true`, then output value will be set `true` after T_{ON} time.
- T_{off}
  Given time with T_{ON} , when input value is set as `false`, then output value will be set `false` after T_{OFF} time.

The values for T_{ON} and T_{OFF} are seconds.

Note

In case of that duration time of input value is shorter than given time (T_{ON},T_{OFF}), changes will not be reflected to output signal.

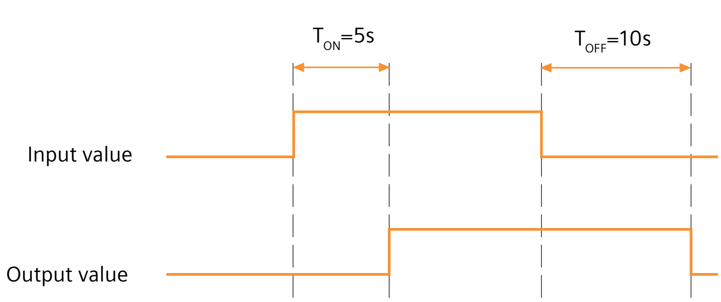
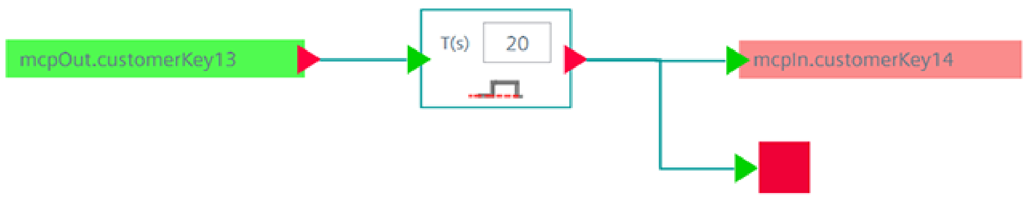


Figure 15-1 Example of a time sequence for the DELAY operator

15.5.7 PULSE

In-/outputs and parameters

The PULSE operator supports one input and multiple outputs.



PULSE operator has only one parameter:

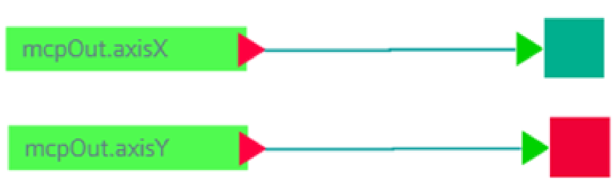
- T
  As long as the input signal has the same value, the output signal has the identical value during the specified time period T in seconds. After T seconds, the output signal is automatically set to `false`.

15.5.8 BINARY DISPLAY

The BINARY DISPLAY operator is used to display a binary value. There are 2 colors can be displayed.

In-/outputs and parameters

- If the result of signal is `true`, the color will be green.
- If the result of signal is `false`, the color will be red.



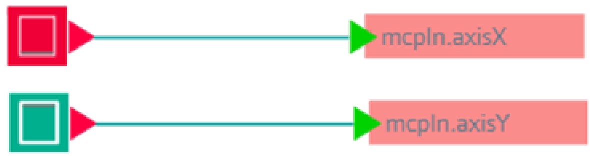
15.5.9 SWITCH

The SWITCH operator is used to switch a binary signal.

In-/outputs and parameters

There are 2 colors can be displayed on SWITCH:

- If the user reset the switch, the color will be red.
- If the user set the switch, the color will be green.



Appendix A

A.1 Standard telegram configuration of a SINUMERIK ONE

A.1.1 SINUMERIK-conformal telegram configuring

Rules for SINUMERIK-conformal telegram configuring of SINAMICS drives

To configure the data exchange between a SINUMERIK 828D, SINUMERIK ONE or SINUMERIK MC and SINAMICS S120 drives, the following rules must be observed for the PROFIBUS/PROFINET configuration of the drives:

- For SINAMICS drive devices (CU3xx) on PROFIBUS/PROFINET, the PROFIBUS/PROFINET configuration must be identical to the standard configuration of the telegrams of the drives on the integrated PROFIBUS (SINAMICS Integrated or NX) of a SINUMERIK 828D or SINUMERIK ONE with regard to the telegrams structure.
- The identical structure of the telegrams refers specifically to the sequence of telegrams for a drive (CU3xx). The telegrams must be configured in the following order:
  - Telegrams for SERVO or HLA drive objects
  - Telegram for the Control Unit drive object
  - Telegram for the infeed drive object
- The following rules must be observed for the telegrams of the individual drive objects:
  - The input and output address of a telegram must have the same value.
    Exception: User-specific telegrams that only have input or output values.
  - The input and output data of a telegram are generally transferred via the same slot. If two different slots are used for data exchange (for PROFIBUS or PROFIBUS Integrated), make sure that the input slot is defined first. The output slot must have the following slot number.

A.1.2 PROFIdrive telegrams for standard data

The I/O addresses of standard telegrams are compared to the following telegram configurations in the following:

- SINUMERIK ONE
- SINUMERIK 840D sl

Table A-1 SINAMICS Integrated: I/O addresses of PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis01	SIEMENS telegram 136	4100	4100	13050[0]	13060[0]
DriveAxis02	SIEMENS telegram 136	4140	4140	13050[1]	13060[1]
DriveAxis03	SIEMENS telegram 136	4180	4180	13050[2]	13060[2]
DriveAxis04	SIEMENS telegram 136	4220	4220	13050[3]	13060[3]
DriveAxis05	SIEMENS telegram 136	4260	4260	13050[4]	13060[4]
DriveAxis06	SIEMENS telegram 136	4300	4300	13050[5]	13060[5]
DriveCU01	SIEMENS telegram 391	6500	6500	13120[0]	-
Infeed01	SIEMENS telegram 370	6514	6514	-	-

Table A-2 NX on DRIVE-CLiQ socket X105; DP address 15: I/O addresses of PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis07	SIEMENS telegram 136	4340	4340	13050[6]	13060[6]
DriveAxis08	SIEMENS telegram 136	4380	4380	13050[7]	13060[7]
DriveAxis09	SIEMENS telegram 136	4420	4420	13050[8]	13060[8]
DriveAxis10	SIEMENS telegram 136	4460	4460	13050[9]	13060[9]
DriveAxis11	SIEMENS telegram 136	4500	4500	13050[10]	13060[10]
DriveAxis12	SIEMENS telegram 136	4540	4540	13050[11]	13060[11]
DriveCU02	SIEMENS telegram 390	6530	6530	-	-
Infeed02	SIEMENS telegram 370	6534	6534	-	-

Table A-3 NX on DRIVE-CLiQ socket X104; DP address 14: I/O addresses of PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis13	SIEMENS telegram 136	4580	4580	13050[12]	13060[12]
DriveAxis14	SIEMENS telegram 136	4620	4620	13050[13]	13060[13]
DriveAxis15	SIEMENS telegram 136	4660	4660	13050[14]	13060[14]
DriveAxis16	SIEMENS telegram 136	4700	4700	13050[15]	13060[15]
DriveAxis17	SIEMENS telegram 136	4740	4740	13050[16]	13060[16]
DriveAxis18	SIEMENS telegram 136	4780	4780	13050[17]	13060[17]
DriveCU03	SIEMENS telegram 390	6540	6560	-	-
Infeed03	SIEMENS telegram 370	6544	6554	-	-

Table A-4 NX on DRIVE-CLiQ socket X103; DP address 13: I/O addresses of PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis19	SIEMENS telegram 136	4820	4820	13050[18]	13060[18]
DriveAxis20	SIEMENS telegram 136	4860	4860	13050[19]	13060[19]
DriveAxis21	SIEMENS telegram 136	4900	4900	13050[20]	13060[20]
DriveAxis22	SIEMENS telegram 136	4940	4940	13050[21]	13060[21]
DriveAxis23	SIEMENS telegram 136	4980	4980	13050[22]	13060[22]
DriveAxis24	SIEMENS telegram 136	5020	5020	13050[23]	13060[23]
DriveCU04	SIEMENS telegram 390	6550	6590	-	-
Infeed04	SIEMENS telegram 370	6554	6574	-	-

Table A-5 NX on DRIVE-CLiQ socket X102; DP address 12: I/O addresses of PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis25	SIEMENS telegram 136	5060	5060	13050[24]	13060[24]
DriveAxis26	SIEMENS telegram 136	5100	5100	13050[25]	13060[25]
DriveAxis27	SIEMENS telegram 136	5140	5140	13050[26]	13060[26]
DriveAxis28	SIEMENS telegram 136	5180	5180	13050[27]	13060[27]
DriveAxis29	SIEMENS telegram 136	5220	5220	13050[28]	13060[28]
DriveAxis30	SIEMENS telegram 136	5260	5260	13050[29]	13060[29]
DriveCU05	SIEMENS telegram 390	6560	6620	-	-
Infeed05	SIEMENS telegram 370	6564	6594	-	-

Table A-6 NX on DRIVE-CLiQ socket X101; DP address 11: I/O addresses of PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis31	SIEMENS telegram 136	5300	5300	13050[30]	13060[30]
DriveAxis32	SIEMENS telegram 136	5340	5340	-	-
DriveAxis33	SIEMENS telegram 136	5380	5380	-	-
DriveAxis34	SIEMENS telegram 136	5420	5420	-	-
DriveAxis35	SIEMENS telegram 136	5460	5460	-	-
DriveAxis36	SIEMENS telegram 136	5500	5500	-	-
DriveCU06	SIEMENS telegram 390	6570	6650	-	-
Infeed06	SIEMENS telegram 370	6574	6614	-	-

Table A-7 NX on DRIVE-CLiQ socket X100; DP address 10: I/O addresses of PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)
DriveAxis37	SIEMENS telegram 136	5540	5540
DriveAxis38	SIEMENS telegram 136	5580	5580
DriveAxis39	SIEMENS telegram 136	5620	5620
DriveAxis40	SIEMENS telegram 136	5660	5660
DriveAxis41	SIEMENS telegram 136	5700	5700
DriveAxis42	SIEMENS telegram 136	5740	5740
DriveCU07	SIEMENS telegram 390	6580	6680
Infeed07	SIEMENS telegram 370	6584	6634

A.1.3 PROFIsafe/PROFIdrive telegrams for Safety Integrated (F-PLC)

The I/O addresses of safety-relevant telegrams are compared to the following telegram configurations in the following:

- SINUMERIK ONE
- SINUMERIK 840D sl

From the firmware versions of SINUMERIK ONE, the I/O addresses of SIEMENS telegram 903 no longer have to be entered in the machine data. The corresponding item in the 840D sl machine data is therefore not imported to the SINUMERIK ONE during the SINUMERIK archive migration.

Table A-8 SINAMICS Integrated: I/O addresses of PROFIsafe/PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis01	SIEMENS telegram 903	6700	1008	-	-
DriveAxis01	SIEMENS telegram 701	5800	5800	13374[0]	13376[0]
DriveAxis02	SIEMENS telegram 903	6716	992	-	-
DriveAxis02	SIEMENS telegram 701	5816	5816	13374[1]	13376[1]
DriveAxis03	SIEMENS telegram 903	6732	976	-	-
DriveAxis03	SIEMENS telegram 701	5832	5832	13374[2]	13376[2]
DriveAxis04	SIEMENS telegram 903	6748	960	-	-
DriveAxis04	SIEMENS telegram 701	5848	5848	13374[3]	13376[3]
DriveAxis05	SIEMENS telegram 903	6764	944	-	-
DriveAxis05	SIEMENS telegram 701	5864	5864	13374[4]	13376[4]
DriveAxis06	SIEMENS telegram 903	6780	928	-	-
DriveAxis06	SIEMENS telegram 701	5880	5880	13374[5]	13376[5]

Table A-9 NX on DRIVE-CLiQ socket X105; DP address 15: I/O addresses of PROFIsafe/PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis07	SIEMENS telegram 903	6796	912	-	-
DriveAxis07	SIEMENS telegram 701	5896	5896	13374[6]	13376[6]
DriveAxis08	SIEMENS telegram 903	6812	896	-	-
DriveAxis08	SIEMENS telegram 701	5912	5912	13374[7]	13376[7]
DriveAxis09	SIEMENS telegram 903	6828	880	-	-
DriveAxis09	SIEMENS telegram 701	5928	5928	13374[8]	13376[8]
DriveAxis10	SIEMENS telegram 903	6844	864	-	-
DriveAxis10	SIEMENS telegram 701	5944	5944	13374[9]	13376[9]
DriveAxis11	SIEMENS telegram 903	6860	848	-	-
DriveAxis11	SIEMENS telegram 701	5960	5960	13374[10]	13376[10]
DriveAxis12	SIEMENS telegram 903	6876	832	-	-
DriveAxis12	SIEMENS telegram 701	5976	5976	13374[11]	13376[11]

Table A-10 NX on DRIVE-CLiQ socket X104; DP address 14: I/O addresses of PROFIsafe/PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis13	SIEMENS telegram 903	6892	816	-	-
DriveAxis13	SIEMENS telegram 701	5992	5992	13374[12]	13376[12]
DriveAxis14	SIEMENS telegram 903	6908	800	-	-
DriveAxis14	SIEMENS telegram 701	6008	6008	13374[13]	13376[13]
DriveAxis15	SIEMENS telegram 903	6924	784	-	-
DriveAxis15	SIEMENS telegram 701	6024	6024	13374[14]	13376[14]
DriveAxis16	SIEMENS telegram 903	6940	768	-	-
DriveAxis16	SIEMENS telegram 701	6040	6040	13374[15]	13376[15]
DriveAxis17	SIEMENS telegram 903	6956	752	-	-
DriveAxis17	SIEMENS telegram 701	6056	6056	13374[16]	13376[16]
DriveAxis18	SIEMENS telegram 903	6972	736	-	-
DriveAxis18	SIEMENS telegram 701	6072	6072	13374[17]	13376[17]

Table A-11 NX on DRIVE-CLiQ socket X103; DP address 13: I/O addresses of PROFIsafe/PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis19	SIEMENS telegram 903	6988	720	-	-
DriveAxis19	SIEMENS telegram 701	6088	6088	13374[18]	13376[18]
DriveAxis20	SIEMENS telegram 903	7004	704	-	-
DriveAxis20	SIEMENS telegram 701	6104	6104	13374[19]	13376[19]
DriveAxis21	SIEMENS telegram 903	7020	688	-	-
DriveAxis21	SIEMENS telegram 701	6120	6120	13374[20]	13376[20]
DriveAxis22	SIEMENS telegram 903	7036	672	-	-
DriveAxis22	SIEMENS telegram 701	6136	6136	13374[21]	13376[21]
DriveAxis23	SIEMENS telegram 903	7052	656	-	-
DriveAxis23	SIEMENS telegram 701	6152	6152	13374[22]	13376[22]
DriveAxis24	SIEMENS telegram 903	7068	640	-	-
DriveAxis24	SIEMENS telegram 701	6168	6168	13374[23]	13376[23]

Table A-12 NX on DRIVE-CLiQ socket X102; DP address 12: I/O addresses of PROFIsafe/PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis25	SIEMENS telegram 903	7084	624	-	-
DriveAxis25	SIEMENS telegram 701	6184	6184	13374[24]	13376[24]
DriveAxis26	SIEMENS telegram 903	7100	608	-	-
DriveAxis26	SIEMENS telegram 701	6200	6200	13374[25]	13376[25]
DriveAxis27	SIEMENS telegram 903	7116	592	-	-
DriveAxis27	SIEMENS telegram 701	6216	6216	13374[26]	13376[26]
DriveAxis28	SIEMENS telegram 903	7132	576	-	-
DriveAxis28	SIEMENS telegram 701	6232	6232	13374[27]	13376[27]
DriveAxis29	SIEMENS telegram 903	7148	560	-	-
DriveAxis29	SIEMENS telegram 701	6248	6248	13374[28]	13376[28]
DriveAxis30	SIEMENS telegram 903	7164	544	-	-
DriveAxis30	SIEMENS telegram 701	6264	6264	13374[29]	13376[29]

Table A-13 NX on DRIVE-CLiQ socket X101; DP address 11: I/O addresses of PROFIsafe/PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE) for IO address	MD (ONE) for telegram type
DriveAxis31	SIEMENS telegram 903	7180	528	-	-
DriveAxis31	SIEMENS telegram 701	6280	6280	13374[30]	13376[30]
DriveAxis32	SIEMENS telegram 903	7196	512	-	-
DriveAxis32	SIEMENS telegram 701	6296	6296	-	-
DriveAxis33	SIEMENS telegram 903	7212	496	-	-
DriveAxis33	SIEMENS telegram 701	6312	6312	-	-
DriveAxis34	SIEMENS telegram 903	7228	480	-	-
DriveAxis34	SIEMENS telegram 701	6328	6328	-	-
DriveAxis35	SIEMENS telegram 903	7244	464	-	-
DriveAxis35	SIEMENS telegram 701	6344	6344	-	-
DriveAxis36	SIEMENS telegram 903	7260	448	-	-
DriveAxis36	SIEMENS telegram 701	6360	6360	-	-

Table A-14 NX on DRIVE-CLiQ socket X100; DP address 10: I/O addresses of PROFIsafe/PROFIdrive telegrams

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)
DriveAxis37	SIEMENS telegram 903	7276	432
DriveAxis37	SIEMENS telegram 701	6376	6376
DriveAxis38	SIEMENS telegram 903	7292	416
DriveAxis38	SIEMENS telegram 701	6392	6392
DriveAxis39	SIEMENS telegram 903	7308	400
DriveAxis39	SIEMENS telegram 701	6408	6408
DriveAxis40	SIEMENS telegram 903	7324	384
DriveAxis40	SIEMENS telegram 701	6424	6424
DriveAxis41	SIEMENS telegram 903	7340	368
DriveAxis41	SIEMENS telegram 701	6440	6440
DriveAxis42	SIEMENS telegram 903	7356	352
DriveAxis42	SIEMENS telegram 701	6456	6456

A.2 Preparing projects for Run MyVirtual Machine

A.2.1 Preparing a machine project

The training software Run MyVirtual Machine simulates a SINUMERIK ONE on your PC using the SINUMERIK Operate user interface, and uses the same machine project as Create MyVirtual Machine. You must prepare the machine project before it is used in Run MyVirtual Machine. The changes involve fundamental security measures against unauthorized access and manipulation of the machine project.

This is how you prepare machine projects for Run MyVirtual Machine

If you transfer Create MyVirtual Machine project files (*.vcp) to end users for use in Run MyVirtual Machine, you must prepare these in the TIA Portal or in Create MyVirtual Machine.

1. In the TIA Portal project, setup know-how protection for the PLC program blocks. Using know-how protection, you password-protect block types OB, FB, FC and global data blocks against unauthorized access.
   After you have activated the know-how protection, load the PLC project into the Create MyVirtual Machine machine project.
2. In "logdrive.ini", remove all access data to manufacture-specific network drives. "logdrive.ini" is on the virtual memory card of the machine project.
3. In SINUMERIK Operate, change the standard passwords, and assign your own passwords for protection levels 0 to 3.
   As default setting, machine projects are delivered with the key-actuated switch set to 0 with protection level 7.
4. Save the machine project after you have modified it. The machine project file (*.vcp) can be opened and started in Run MyVirtual Machine.

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