SIEMENS

SINUMERIK

SINUMERIK ONE
Create MyVirtual Machine System Manual

System Manual

Valid for:
CNC ShopFloor Management Software
Create MyVirtual Machine V1.1
SINUMERIK ONE
SINUMERIK CNC SW V6.13
SINUMERIK ONE STEP 7 Toolbox V16

12/2019
A5E47496012B AB

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.

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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.

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℗ 12/2019 Subject to change

Preface

SINUMERIK documentation

The SINUMERIK documentation is organized into the following categories:

- General documentation/catalogs
- User documentation
- Manufacturer/service documentation

Additional information

You can find information on the following topics at the following address (https://support.industry.siemens.com/cs/de/en/view/108464614):

- Ordering documentation/overview of documentation
- Additional links to download documents
- Using documentation online (find and search in manuals/information)

If you have any questions regarding the technical documentation (e.g. suggestions, corrections), please send an e-mail to the following address (mailto:docu.motioncontrol@siemens.com).

mySupport/Documentation

At the following address (https://support.industry.siemens.com/My/ww/en/documentation), you can find information on how to create your own individual documentation based on Siemens' content, and adapt it for your own machine documentation.

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At the following address (http://www.siemens.com/sitrain), you can find information about SITRAIN (Siemens training on products, systems and solutions for automation and drives).

FAQs

You can find Frequently Asked Questions in the Service&Support pages under Product Support (https://support.industry.siemens.com/cs/de/en/ps/faq).

SINUMERIK

You can find information about SINUMERIK at the following address (http://www.siemens.com/sinumerik).

Target group

Target group

This documentation is intended for project engineers, programmers and commissioning engineers.

Benefits

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

Note regarding the General Data Protection Regulation

Siemens observes standard data protection principles, in particular the principle of privacy by design. That means that

this product does not process / store any personal data, only technical functional data (e.g. time stamps). If a user links this data with other data (e.g. a shift schedule) or stores personal data on the same storage medium (e.g. hard drive) and thus establishes a link to a person or persons, then the user is responsible for ensuring compliance with the relevant data protection regulations.

Technical Support

Country-specific telephone numbers for technical support are provided on the Internet at the following address (https://support.industry.siemens.com/sc/ww/en/sc/2090) in the "Contact" area.

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

Purpose of this documentation

Description

This documentation describes the fundamentals and the operation of Create MyVirtual Machine.

Table of contents

Fundamental safety instructions

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1.1 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.

1.2 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 specific customer solutions, but are only intended to provide support for 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.

1.3 Industrial security

Note

Industrial security

Siemens provides products and solutions with industrial security 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 security concept. Products and solutions from Siemens 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. using firewalls and/or network segmentation) are in place.

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Industrial security (https://www.siemens.com/industrialsecurity)

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they become available, and that only 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 Security RSS Feed at:

Industrial security (https://www.siemens.com/industrialsecurity)

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 holistic, state-of-the-art industrial security concept for the installation or machine.
- Make sure that you include all installed products into the holistic industrial security concept.
- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.
- On completion of commissioning, check all security-related settings.
- Protect the drive against unauthorized changes by activating the "Know-how protection" converter function.

Introduction

2

2.1 Deployed software

Software requirements

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

2.2 General information

Create MyVirtual Machine

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

With Create MyVirtual Machine, you can develop and test the next control 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.

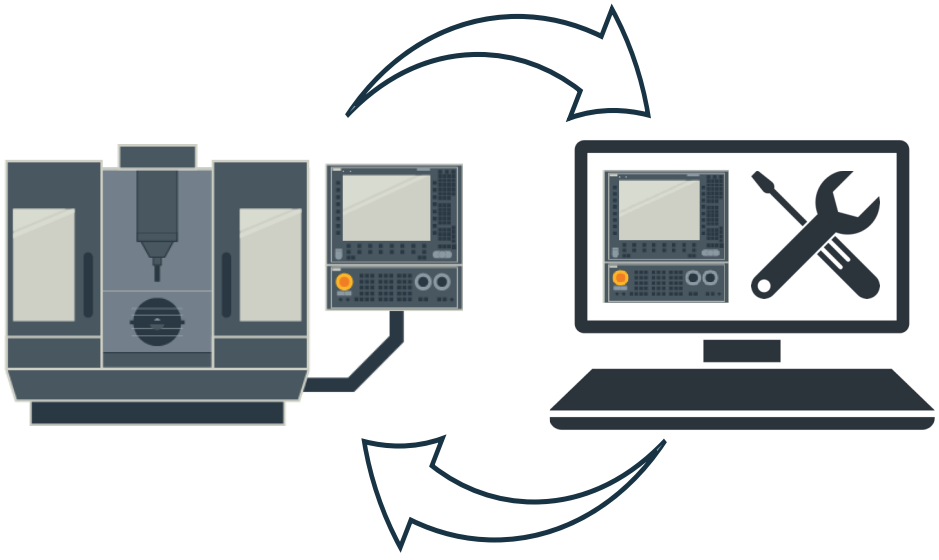


Figure 2-1 Create MyVirtual Machine, virtual commissioning

Create MyVirtual Machine components

- simNCK: Simulation of the NCK
- SIMATIC S7-PLCSIM Advanced: PLC simulation based on S7-1500
- HMI: SINUMERIK Operate with virtual machine control panel
- simDrive (drive simulation): SINAMICS S120 substitute drive component
- Open Interface for integrating external simulation tools
- Integrated peripheral simulation

Product description 3

3.1 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 18) based on S7 PLCSIM Advanced (SIMATIC S7-1500F) including F-capability and communication mechanisms (Page 25)
- NCK simulation simNCK (Page 20)
- HMI user interface SINUMERIK Operate with machine control panel (Page 20)
- simDRIVE substitute drive component (Page 21) to simulate various safety functions
- Peripheral simulation (Page 22)

3.2 Properties

3.2.1 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

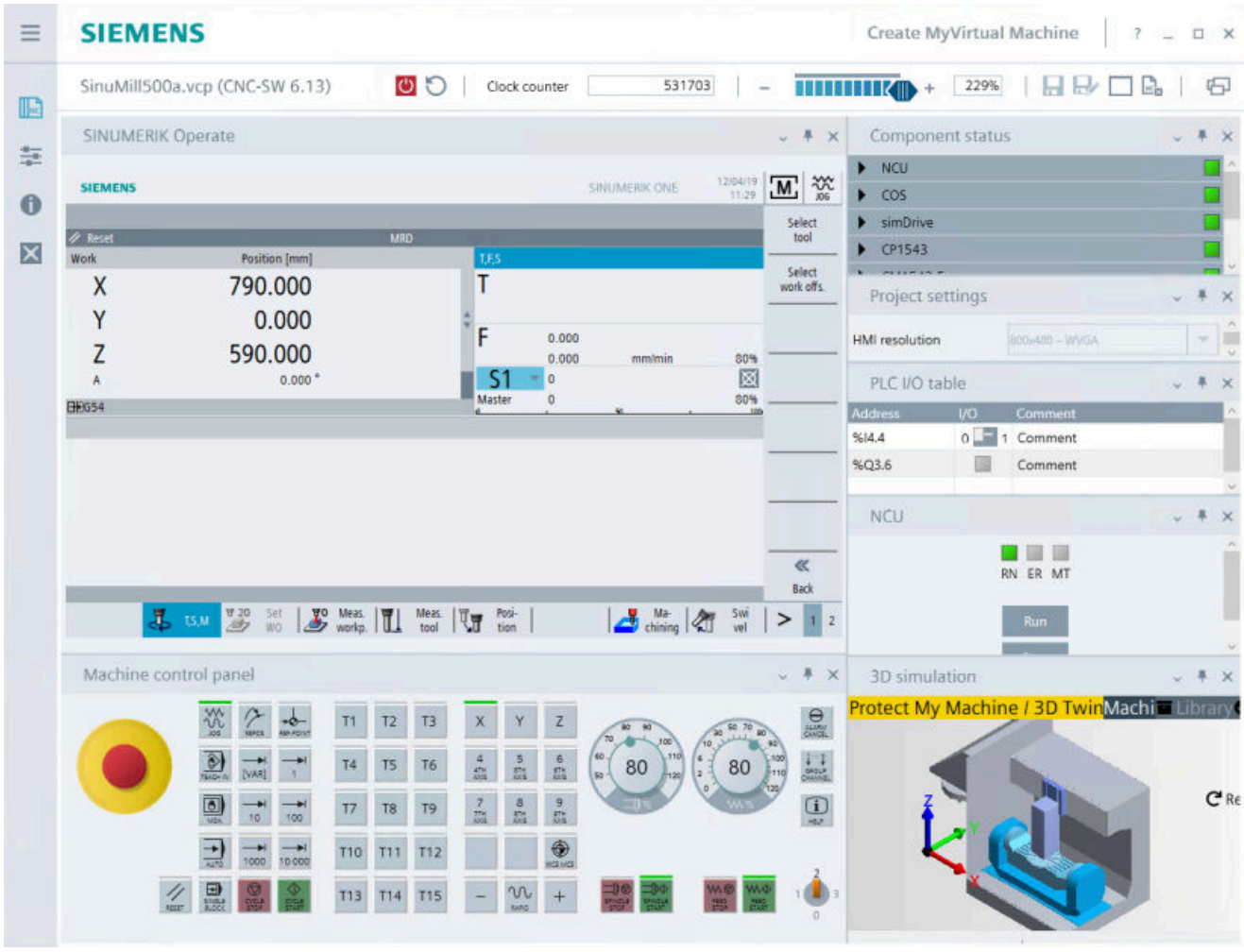


Figure 3-1 Create MyVirtual Machine with a machine project that has started

Functional scope

- Possibility for the use of different machine configurations, e.g. turning machine (with/without Safety Integrated), milling machine (with/without Safety Integrated).
- Manage machine configurations in machine projects (e.g. create, configure, save).
- Machine projects are only compatible if they are using an identical version of the Virtual CNC software, e.g. V6.13.
- 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
- Online help available

Engineering in the TIA Portal

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

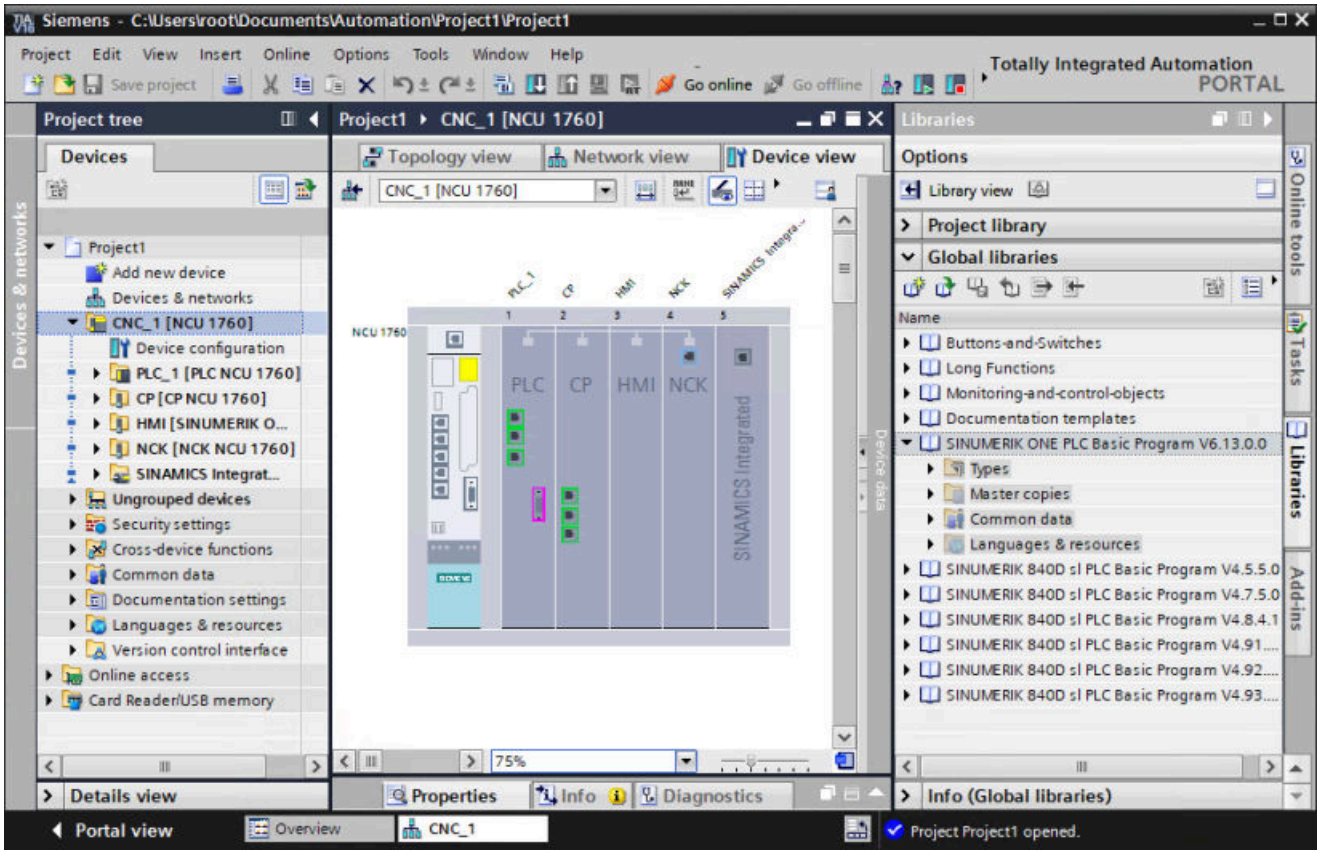


Figure 3-2 Configuration of a SINUMERIK ONE in the TIA Portal

3.2.2 SINUMERIK ONE STEP 7 Toolbox V16

The software component SINUMERIK ONE STEP 7 Toolbox V16 contains the following tools and functions:

- Supplement to the hardware catalog with the following SINUMERIK ONE V6.13 modules:
  - NCU 1750
  - NCU 1760
  - PPU 1740
- The NX15.3 or NX10.3 modules that match the NCU 1750 / NCU 1760 / 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
V6.13	V5.2

- SINUMERIK ONE basic PLC program V6.13
- 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.

3.2.3 PLC simulation

The integrated PLC of Create MyVirtual Machine is a functionally expanded SIMATIC S7-PLCSIM Advanced V3.0.

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 configuration 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 SIMATIC S7-PLCSIM Advanced V3.0 Manual.

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/)

3.2.4 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.

3.2.5 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\".

3.2.6 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

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 (rotary).
- Encoder 2 may be a rotary encoder (gear ratio 1:1 and pitch 10 mm).
- Encoder 2 can also be a linear encoder.

Note

With two encoders, the addresses in MD30110 CRTLOUT_MODULE_NR and MD30220 ENC_MODULE_NR refer to different Motor Modules. Note that the encoder configurations 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

For each drive object, when mechanically simulating linear axes, a fixed spindle pitch (10 mm) with a fixed gear stage (1:1) is simulated. The closed-loop control is realized on the motor encoder.

3.2.7 I/O simulation

Description

The virtual SINUMERIK provides several ways of performing a peripheral simulation.

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

Note

Peripheral simulation and simultaneous machine operation

Create MyVirtual Machine simulates the peripherals 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 peripheral simulation), the integrated machine control panel is no longer operable as expected.

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 ONE (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 peripheral simulation synchronously with the Create MyVirtual Machine simulation

Internal peripheral simulation in Create MyVirtual Machine

Via the internal peripheral simulation, you can read and write peripheral 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.

3.2.8 3D simulation

Create MyVirtual Machine visualizes the machining process using 3D simulation.

Functional scope

- Spatial simulation of machine movements on the basis of a stored kinematic machine model (*.stl geometries and *.xml kinematic description)
- Display of tools from the SINUMERIK tool management based on their geometric values
- Support of various types of tools
- Linking of tool holders (either as *.stl geometry or primitive model) with tools from the SINUMERIK tool management
- Creating, deleting and editing workholders (from *.stl geometries) in a library
- Creating, deleting, editing and managing blanks (from *.stl geometries) in a library
- Parametric changing of the spatial position and orientation of library components
- Creating, deleting and editing of clampings from a maximum of a library component workholder and blank
- Arrangement of library components workholder and blank on SINUMERIK work offsets within a clamping
- Activation of a selected clamping for consideration in the spatial simulation
- Simulation of drilling and milling
  - Simulation of material removal for a single-channel machining process on the basis of the active clamping and tool data
  - A tool in operation
  - 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
- Exporting and importing of library components and clampings

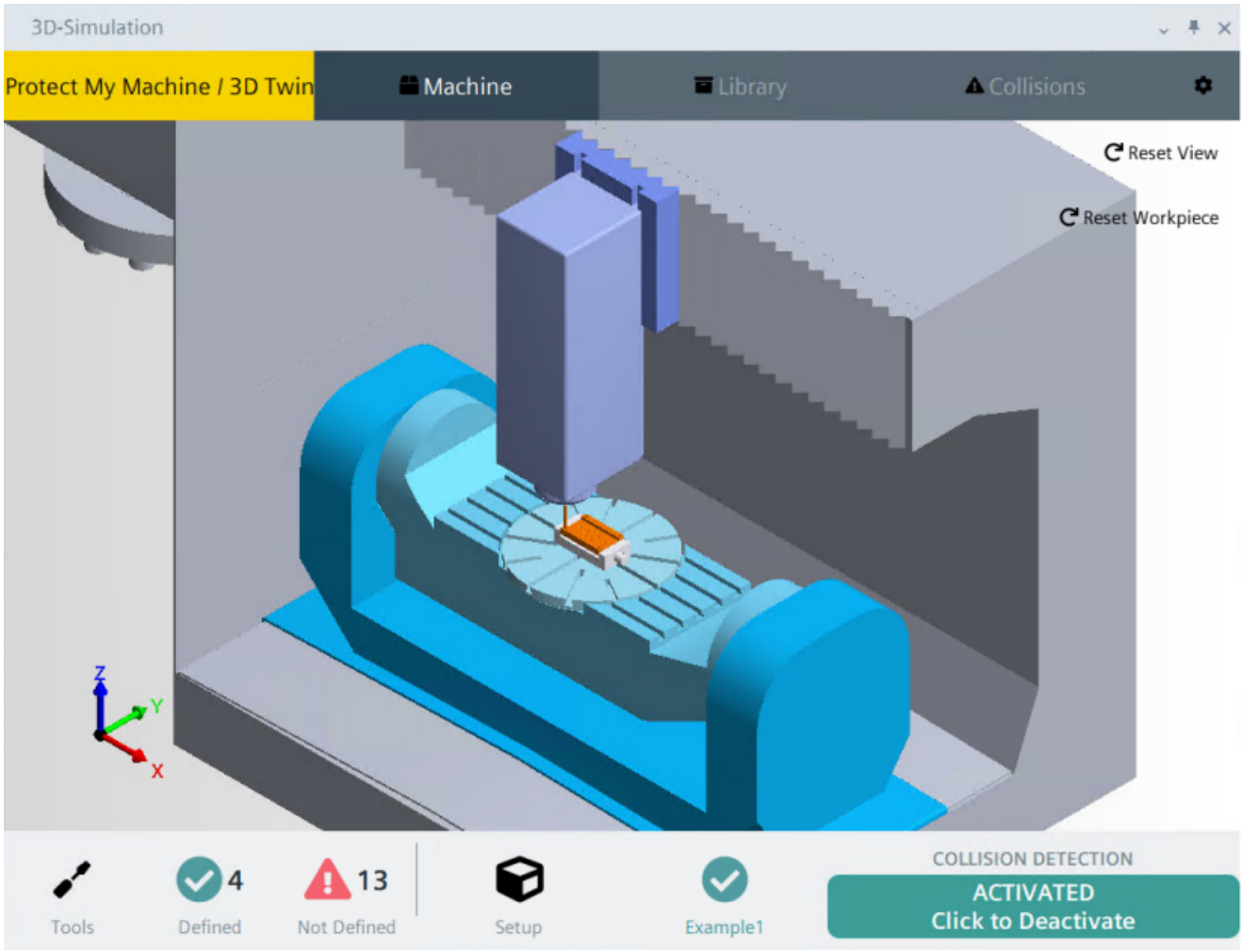


Figure 3-3 3D simulation in Create MyVirtual Machine

3.2.9 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.

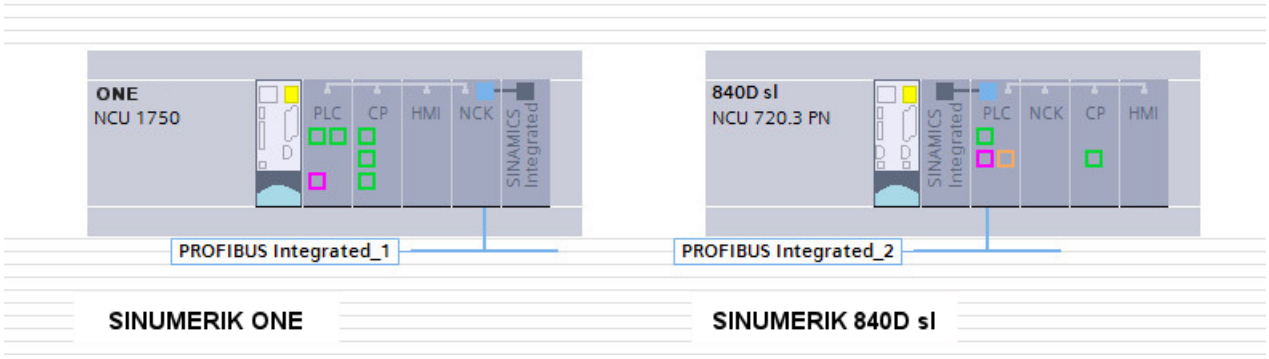


Figure 3-4 Comparison of the configuration (network view): SINUMERIK ONE and SINUMERIK 840D sl

	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.

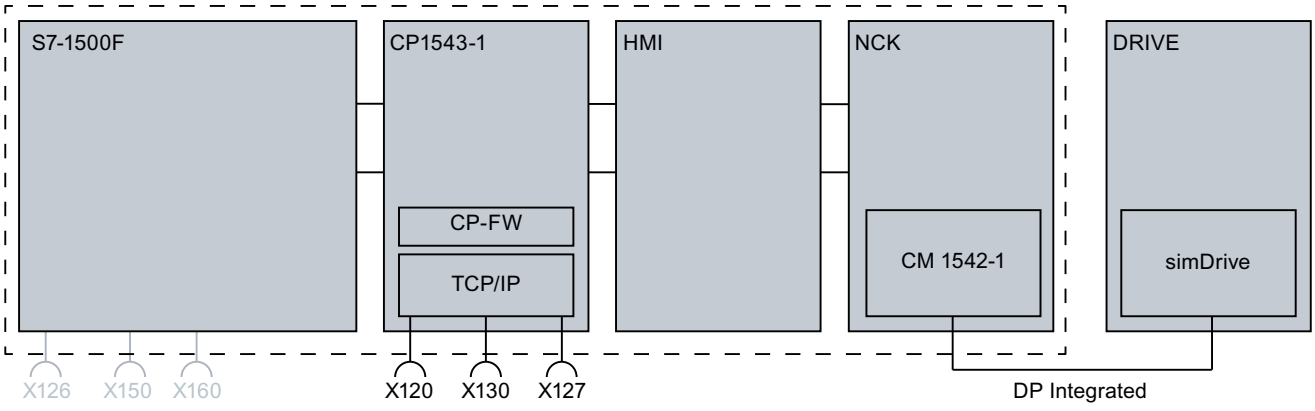


Figure 3-5 Interface overview - the interfaces shown grayed out are not available with the virtual SINUMERIK

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

3.2.10 Safety Integrated

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

Supports F-PLC, F-peripherals 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 supplementary conditions listed in this manual as well as those in the manuals for SINUMERIK ONE Safety Integrated, SIMATIC Safety Advanced V16 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 diagnostic 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.

Additional references

Further information can be found in the *SINUMERIK ONE Safety Integrated* Commissioning Manual.

3.3 Differences compared to the real system

3.3.1 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.

3.3.2 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.
- TIA Portal projects with CNC software < V6.13 cannot be loaded in a machine project with Virtual CNC software V6.13. The TIA Portal project must first be upgraded to version V6.13.
- No simulation in the program editor.
- 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.
- The pause mode (simulation speed 0%) causes a communications failure. The HMI is no longer operable.
- 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.

3.3.3 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

3.3.4 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.
- T blocks (SEND/RECV, CONNECT/DISCONN, STATUS, BSEND/BRECV) are 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 Firewall global 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 access point "SINUERMIK_CP1543" (see also Assign "PG/PC interface").

3.3.5 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 SIMATIC S7-PLCSIM Advanced V3.0 Manual 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.

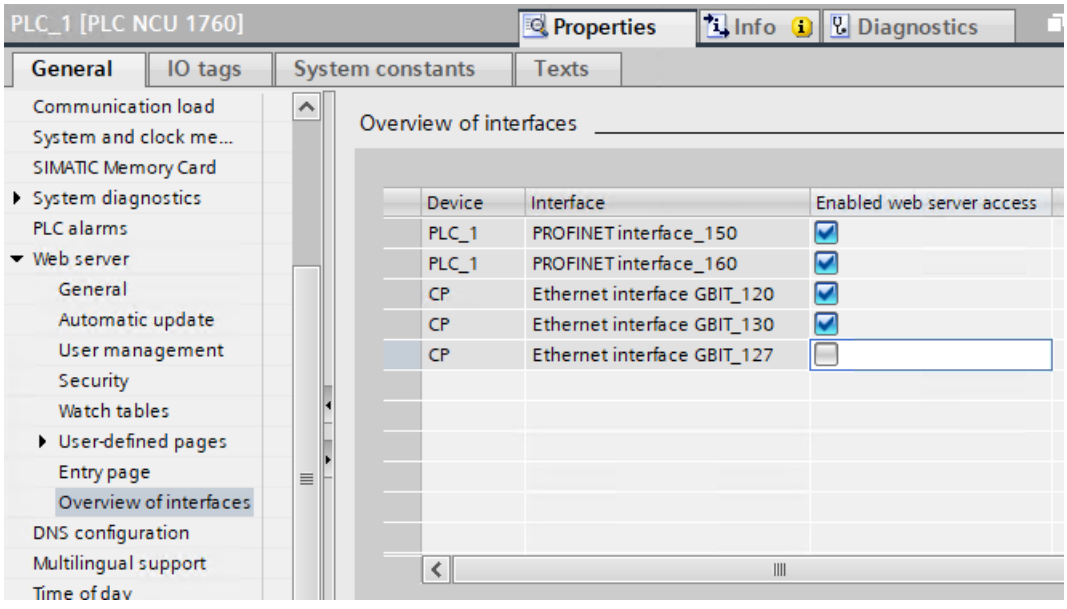


Figure 3-6 Interfaces X120 and X130 activated for web server access

- **Online diagnostic 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.

3.3.6 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 3-1 Differently set machine data

MD	Name	Initial value (remark)	Configurability	Machine data type
MD10162	$MN_COM_TIMING	0 (Response time of the communication)	Customizable	General machine data
MD13060	$MN_DRIVE_TELEGRAM_TYPE	136 (PROFIdrive communication via SIEMENS telegram 136)	Permanently assigned	
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 (Gears are not supported. See "Substitute drive component restrictions (Page 35)")	Permanently assigned	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 35)")	Permanently assigned	
MD34200	$MA_ENC_REFP_MODE	0 (Homing mode absolute encoder)	Customizable	
MD34210	$MA_ENC_REFP_STATE	2 (Absolute encoder is adjusted)	Customizable	

Further information

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

3.3.7 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 permitted, e.g. <block name>.<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)
- 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 diagnostic screens, the various configured machine data as well as information about the DSF archive data in the *Create MyVirtual Machine* System Manual.

3.3.8 3D simulation restrictions

The following functions are explicitly not supported for the 3D simulation:

- Simulation of turning and grinding
- Simulation of parallel or sequential multi-channel machining processes
- Simulation of more than one tool in operation (dual spindle)
- Inclusion of more than one *.stl geometry for a blank and workholder
- Consideration of more than one blank or one workholder library component in a clamping
- Consideration of more than one clamping in the machining simulation
- Consideration of tools deviating from the above-mentioned types (deviating tools are displayed as Type X)
- Saving and exporting the in-process workpiece geometry
- Use of file formats other than *.stl for the import of 3D geometries

3.3.9 Safety Integrated restrictions

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

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 supplementary conditions 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 supported. No cross-data comparison is performed via the parameters of the 1st and 2nd monitoring channels.
- **Alarms and messages**
  Safety messages are not output.
- **Safety Integrated commissioning**
  In the real system, the Safety Integrated commissioning must be activated to change Safety Integrated-relevant data. In the substitute drive component, the Safety Integrated data without Safety Integrated commissioning mode (p10=95) can be changed.
- **SI drive alarms**
  In the substitute drive component, no alarm is output for a safety limit value violation. To do this, the user must evaluate the INT_EVENT bit in the PROFIsafe telegram.
- **SI encoder system**
  Only a 1-encoder safety system is supported in the substitute drive component.
- **Forced dormant error detection (test stop pulse cancellation)**
  Forced dormant error detection can only be configured using SIC/SCC.
- **Scope of the usable safety functions and stop responses**
  - Only those safety functions listed in the overview table are supported.
  - SAM cannot be activated by triggering a stop response by SS1 or SS2.

3.3.10 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.
  - Import or save drive parameters via SINUMERIK archives is not supported.
- **No support for the following drive functions:**
  - Data set switchover
  - Motor switchover
  - Flying measurement
  - Drive-autonomous extended stop and retract
  - Travel to fixed stop
  - Weight counterbalance
  - Torque feedforward control
  - Operating mechanism options
  - Drive OA
  - Function modules
  - Brake test
  - Brake control
  - Gears
  - Sensors
  - Terminals
  - Topology
  - No support for star-delta switchover (FC17)
  - 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
- **Limited support of drive objects and telegram types**
  Only the previously listed drive objects and telegram types are supported.
- **Archive of SINUMERIK 840D sl with drive data**
  No drive parts are adopted during import of a SINUMERIK 840D sl archive in the virtual SINUMERIK. The encoder configuration in particular is set manually in SINUMERIK Operate in the corresponding drive parameters.

See also

Substitute drive components (Page 21)

Design and operation

4

4.1 Introduction

Description

Create MyVirtual Machine comprises a project management for the machine projects and the SINUMERIK Operate user interface with machine simulation. The functional scope of a SINUMERIK control system is covered.

4.2 Manage machine projects

Introduction

The machine projects (*.vcp; **V**irtual **C**ommissioning **P**roject) are managed in the Create MyVirtual Machine project management. 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

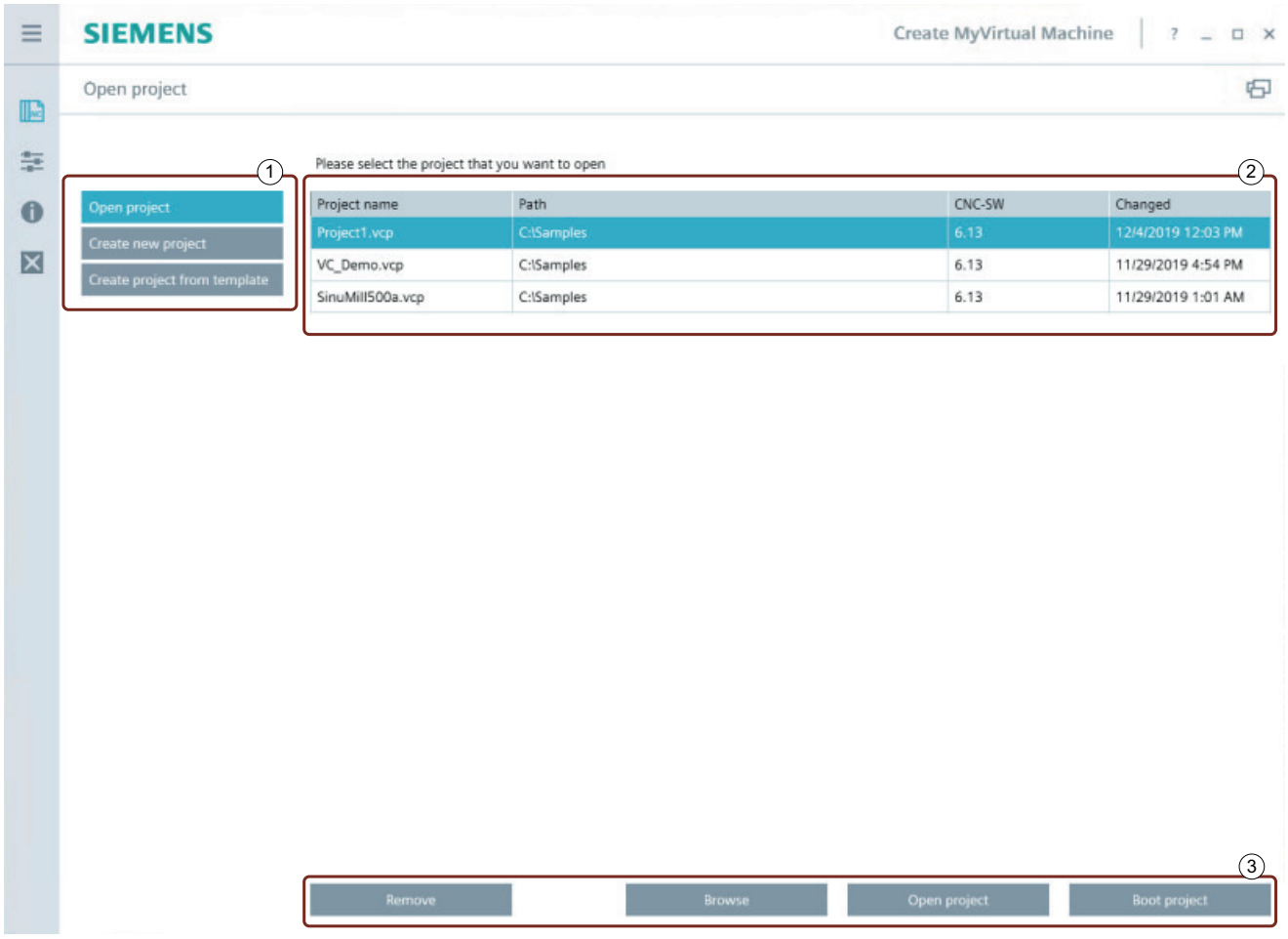
To edit a machine project, the matching version of the CNC software must always be installed on the computer. A machine project can neither be created nor opened without the CNC software being installed. If the version of the CNC software used in the project is not installed, an error message stating 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 management 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 management appears.

Create MyVirtual Machine project management



① **Open project**
Open existing projects from the overview

Create new project
Create new projects

Creating a project from a template
Creating a new project from an existing project template

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

③ **Remove**
Remove projects from the project overview. The machine project is only deleted from the overview, and remains on the data storage medium.

Browse
Search the data storage medium for projects and enter them into the overview.

Open project
Open a selected machine project in the overview.

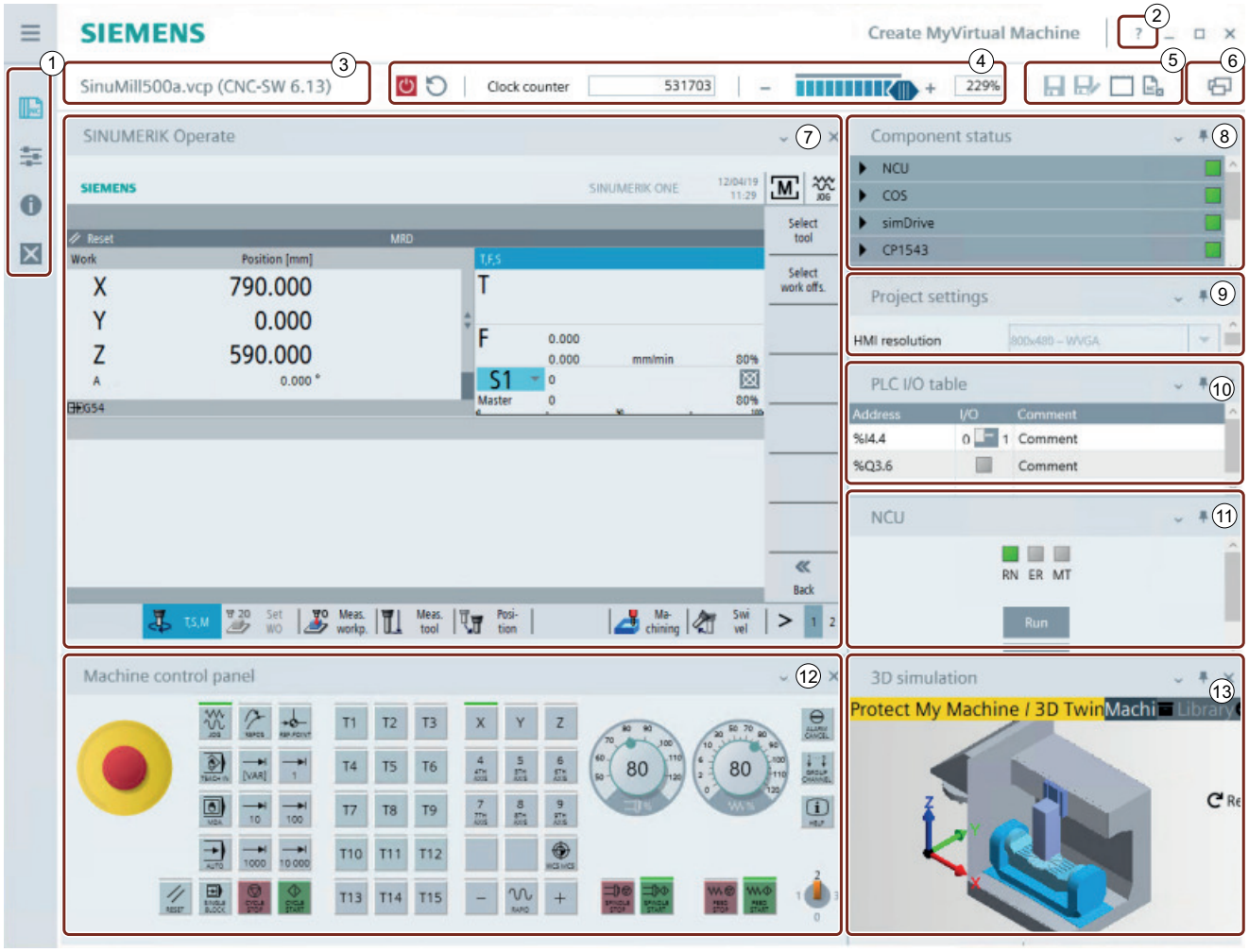
Start the project
Open a selected machine project in the overview and then start the machine.

Figure 4-1 Create MyVirtual Machine project management

4.3 Create MyVirtual Machine 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.



① Basic functions

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

Displays of the project overview

Settings

Open the settings to toggle between languages and manage the window layout.

Info

Displays of the version information

Exit

Exiting Create MyVirtual Machine

② Help

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

③ Title bar

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

④ Simulation control

Start simulation of the machine.

The simulation control cannot be operated during the run-up phase.

Exiting machine simulation.

Clock cycle counter

Display the previous servo clock cycles

Reset

Initiate NCK/PLC warm restart

The simulation speed varies from standstill (pause - system stopped) to the maximum speed.

- In the left (-) position, the simulation is in pause status. Live debugging of the "frozen" edit process can be performed in this status. For values between 0% and 100%, the system runs in "slow motion".
- In the middle setting, 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.

⑤ Management of an open 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 notice is displayed, and you can save the project before exiting.
  Machine projects can be exited only if the machine simulation has been previously exited.

⑥ Display/hide viewlets

You can display/hide the viewlets ⑦ to ⑪ using the button.

You can remove the individual viewlets as windows with the buttons, and dock them at any other position in Create MyVirtual Machine. For example, you can display HMI SINUMERIK Operate in an separate window.

⑦ HMI SINUMERIK Operate

The HMI SINUMERIK Operate viewlet contains the SINUMERIK Operate commissioning and operating software.

⑧ Display 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. After the first ramp up, the shutdown time is still zero.
The clock cycle counters and the 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).

⑨ Project settings

You can adapt the resolution of the SINUMERIK Operate HMI as required.

⑩ PLC I/O table

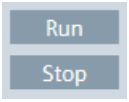
You read and write the PLC inputs and outputs with the integrated peripheral simulation. Outputs with status LEDs and inputs with toggle switches are configured in the table lines of the expandable PLC I/O table.

⑪ NCU

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 selector 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 operating mode, you must trigger a warm start (Reset) so that the components (NCK and PLC) are resynchronized.

⑫ Virtual machine control panel

- EMERGENCY STOP (flashing 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 basic PLC program.

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

⑬ 3D simulation (option)

During execution of an NC program in AUTOMATIC mode, 3D simulation with collision monitoring enables you to check the processing so that any program errors can be detected.

4.4 Working with machine projects

4.4.1 Create 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 "Create new project".
2. Enter a project name.
3. Select the storage path.
4. Select the "CNC SW version". This CNC SW version is used in the project, and corresponds to the version of the SINUMERIK components used in the virtual machines. All installed versions of the CNC software are displayed in the drop down list box.

5. Confirm with "Create project". The project is opened.

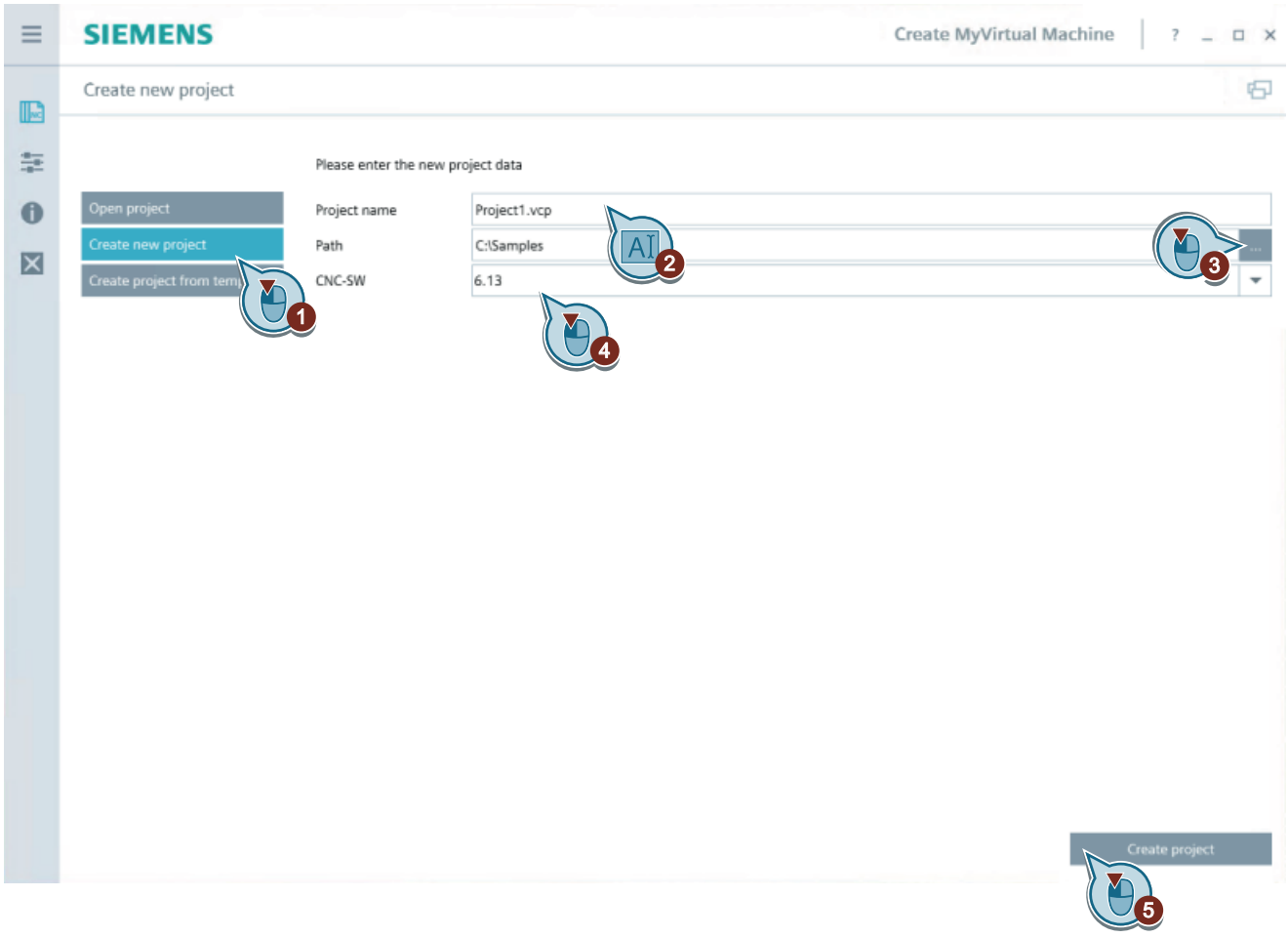


Figure 4-2 Creating a new machine project

6. The Create MyVirtual Machine project view is opened with a standard project, and is initially shown empty. The machine must first be started. This places the machine in simulation mode. The starting corresponds to the switch-on and ramp-up of a real machine.

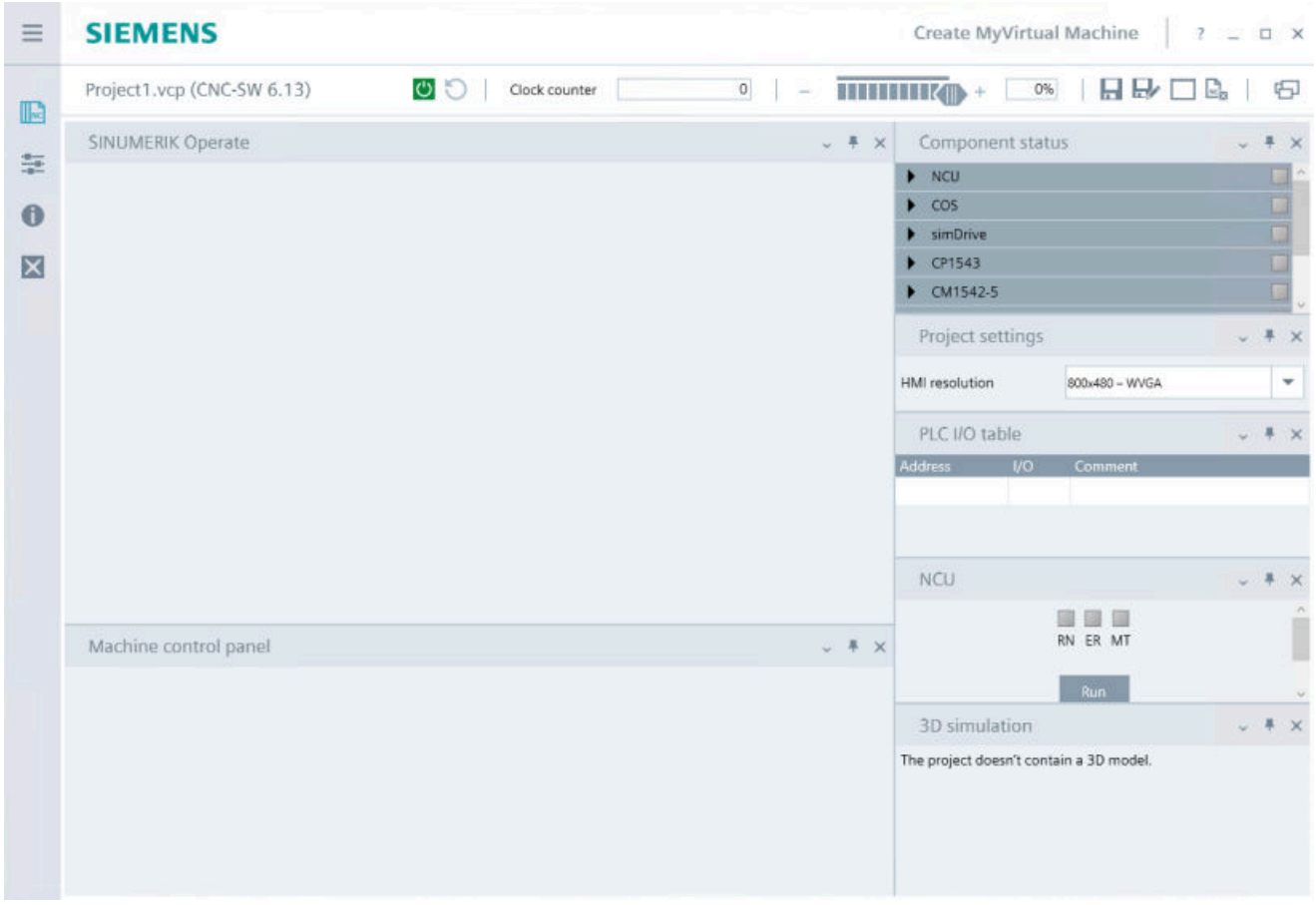


Figure 4-3 Create MyVirtual Machine with an open machine project

7. To do this, 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.

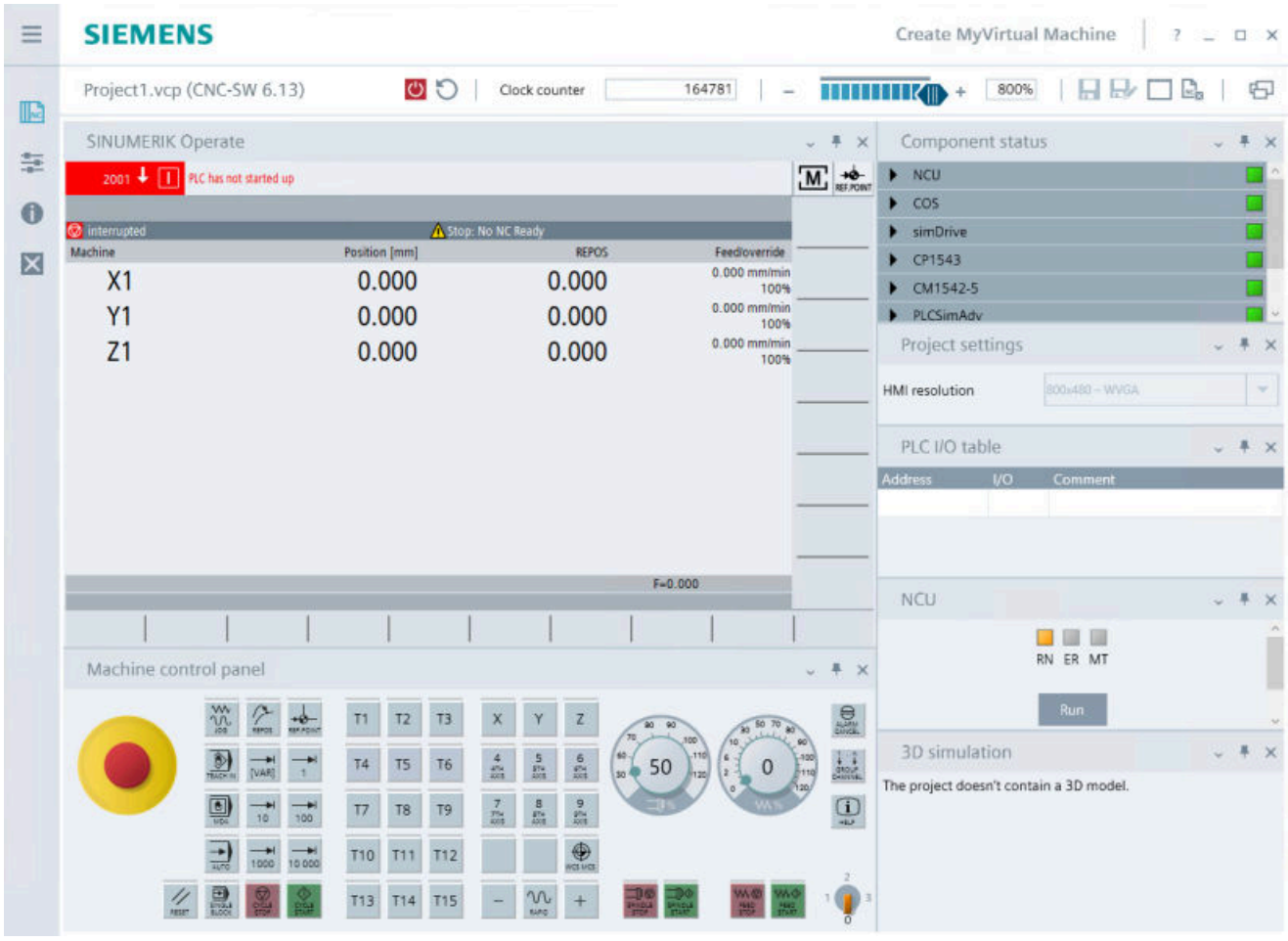


Figure 4-4 Create MyVirtual Machine: Empty, newly created machine project after ramp up

The newly-created machine project has a standard configuration. To adapt this machine, you must commission the machine in an additional step. To do this, import an existing archive of a SINUMERIK control and commission the control (NKC, PLC, HMI).

4.4.2 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. In a project that is created on the basis of a template project, you cannot make any changes to the commissioning data.

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 "Create project from template".

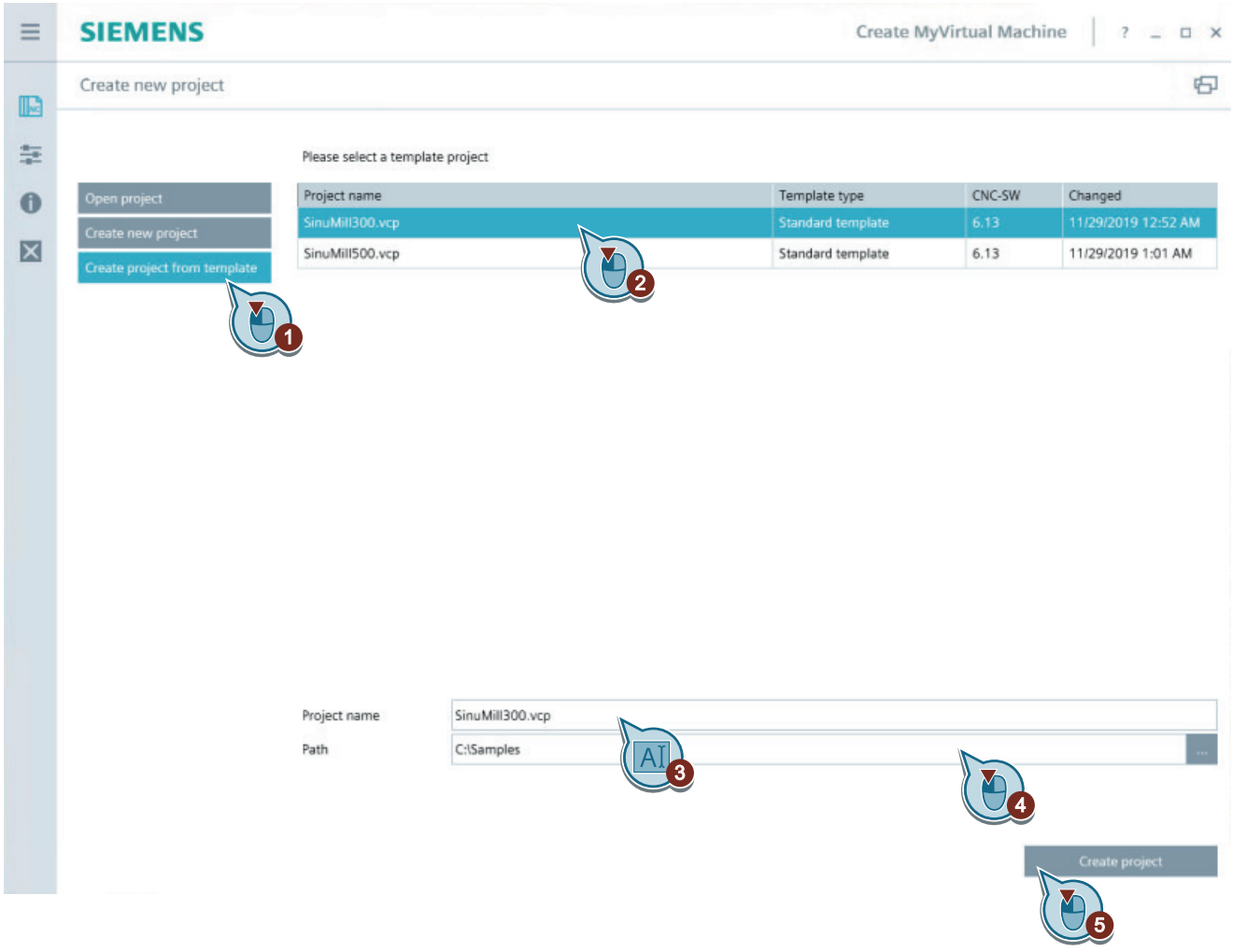


Figure 4-5 Creating a machine project from a project template

2. Select a project template.
3. Enter a project name.
4. Select the storage path.
5. Confirm with "Create project". The project is opened.
6. To do this, click the "Start machine" button in the control area to start the machine.

4.4.3 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.

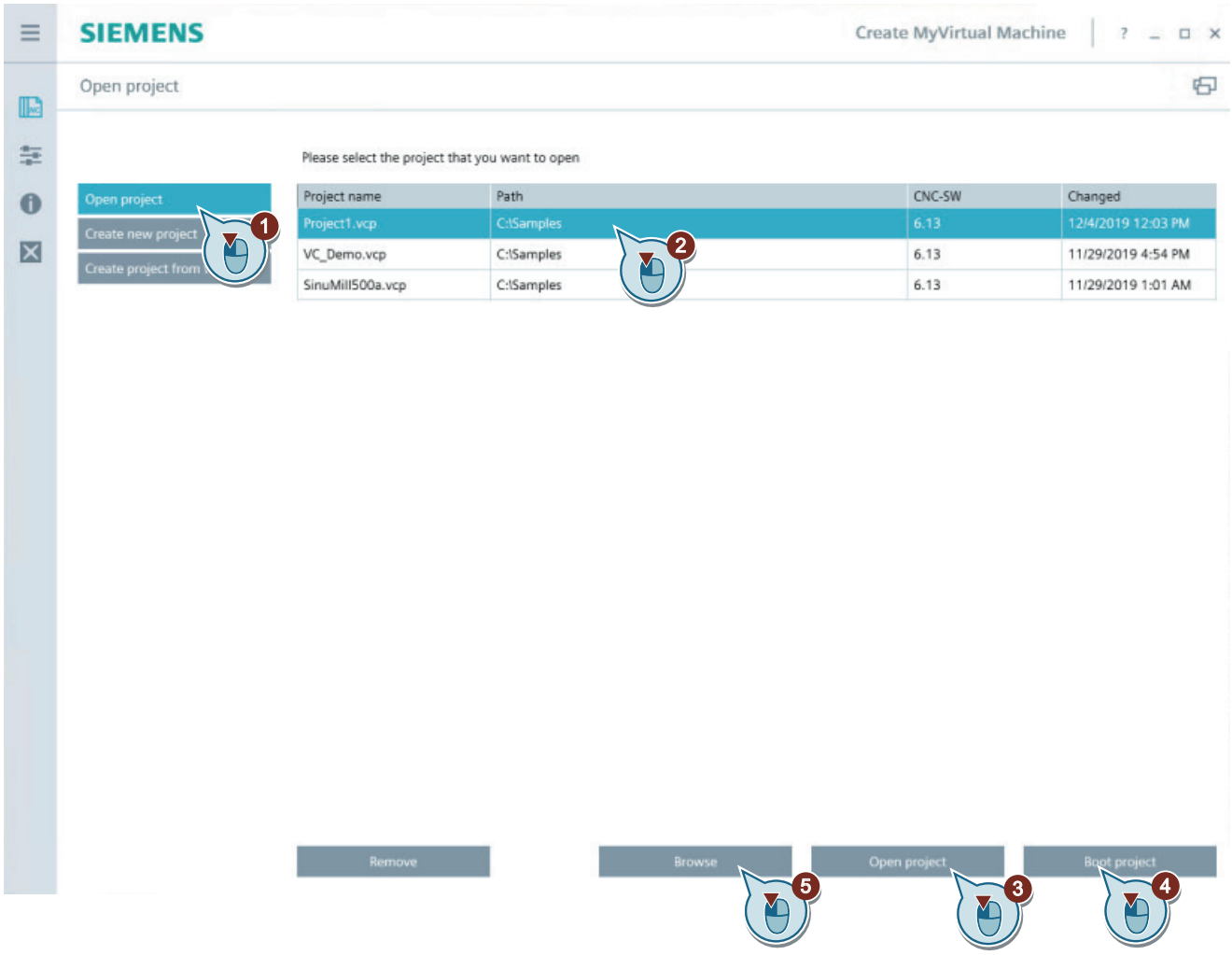


Figure 4-6 Open a project in Create MyVirtual Machine

4. As an alternative to steps 3. and 8., you can click on the "Start project" button. 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. To start the machine project, then click on button "Start machine".

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

4.4.4 Save the machine project and exit

Description

The current status of the machine project is saved when 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.

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 "*.vcp" file extension.

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. Select "Exit" in the program management. The project management and Create MyVirtual Machine are closed.

4.4.5 Cross-version use of machine projects

Note

Using machine projects in another version

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

4.4.6 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.

This is how you 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. 6.13.
   Path example:
   C:\Program Files (x86)\Siemens\Automation\SINUMERIK CNC-SW\SINUMERIK CNC-SW 06.13\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 RunMyVirtual Machine

Protect the project template against unauthorized changes and manipulation. You can find additional information in Section Preparing projects for Run MyVirtual Machine (Page 115).

4.5 Switching over the interface language

You can switch over the user interface to any of the installed languages.

This is how you switch over the user interface language

1. Click on button "Settings".
2. Select the new user interface language.
3. Click on "Apply".
   The language switchover only takes effect after restarting the application.

4.6 Adapting the HMI resolution

When required, you can adapt the resolution of the SINUMERIK Operate HMI.

Requirement

You only change the HMI resolution with the project open in the "Stop the simulation" state.

This is how you adapt the HMI resolution

1. Click on the "Viewlets" button.
2. Select the "HMI resolution" viewlet. The viewlet is displayed.
3. In the open viewlet, select the resolution from the list.

Figure 4-7 Selecting the HMI resolution

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

Note

The HMI resolutions that can be selected depend on the CNC software version.

Virtual commissioning 5

5.1 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.

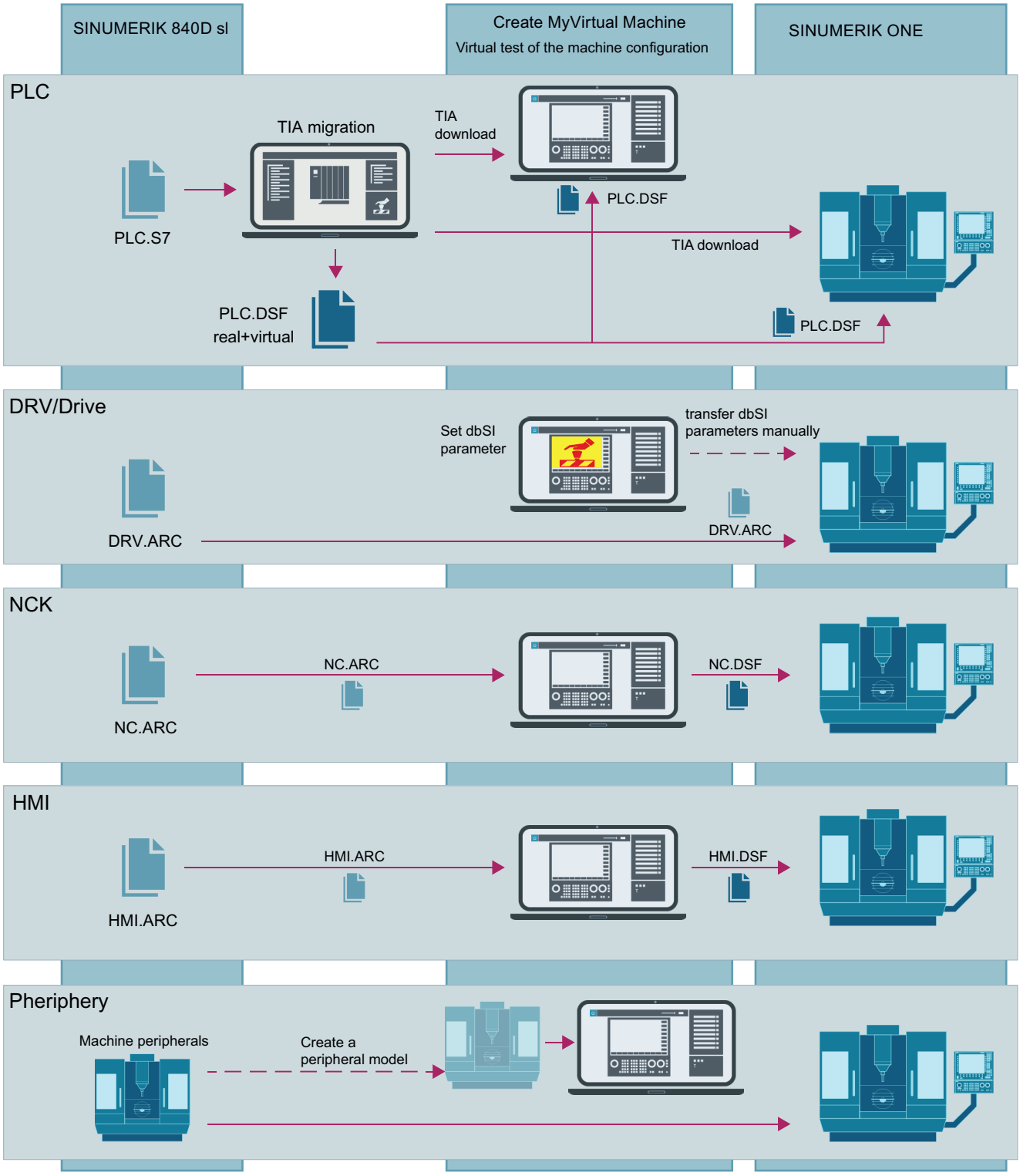


Figure 5-1 Symbolic representation of the data transfer from SINUMERIK 840D sl to SINUMERIK ONE

See also

PLC project (Page 55)
Drive data (Page 56)
NCK configuration (Page 56)
HMI configuration (Page 57)
Machine I/O (Page 58)

5.2 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 53)

5.3 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. Manually transferring the safety-specific drive parameters, checked in Create MyVirtual Machine, to the SINUMERIK ONE

See also

Transition from SINUMERIK 840D sl to SINUMERIK ONE via Create MyVirtual Machine (Page 53)

5.4 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
- MD31050/60 $MA_DRIVE_AX_RATIO
  Create MyVirtual Machine only supports the transformation ratio 1:1
- MD31064/66 $MA_DRIVE_AX_RATIO2
  Create MyVirtual Machine only supports the transformation ratio 1:1 in the reduction gearbox
- MD31070/80 $MA_DRIVE_ENC_RATIO
  Create MyVirtual Machine only supports the transmission ratio 1:1 in the measuring gearbox
- MD32100 $MA_AX_MOTION_DIR
  Create MyVirtual Machine does not support direction reversal

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 53)

5.5 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 53)

5.6 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 53)

5.7 Commissioning

Description

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

Initial commissioning scope

Step	Description	Further information/documentation
1	You first create a new machine project in Create MyVirtual Machine.	Creating a machine project (Page 44)
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 (Page 117)
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 39)
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

Step	Description	Further information/documentation
8	Perform the drive and safety commissioning, as well as further NC functions in Create MyVirtual Machine in SINUMERIK Operate.	Safety Integrated "simDrive Parameters" List Manual
9	In parallel to the commissioning process, test PLC programs and functions in simulation mode.	Open Interface (Page 109) Peripheral simulation (Page 22)

Further information

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

- System Manual Migrating to a SINUMERIK ONE

5.8 Virtual card

Description

As on the real SINUMERIK control, the virtual SINUMERIK ONE also has a memory card (SD card) for data storage and program management. 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.

The structure and the handling of the virtual memory card match 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

Configuring the TIA project settings and loading the project into Create MyVirtual Machine

6

6.1 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 "When compiling blocks that support simulation 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 the simulation-capability of blocks for compilation" option under the "Protection" tab. Confirm with "OK".

6.2 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.

6.3 Setting the IP address in the project

To load the project into Create MyVirtual Machine, you must set the IP address of the CP. Use the IP on which Create MyVirtual Machine is installed as the IP address.

Requirement

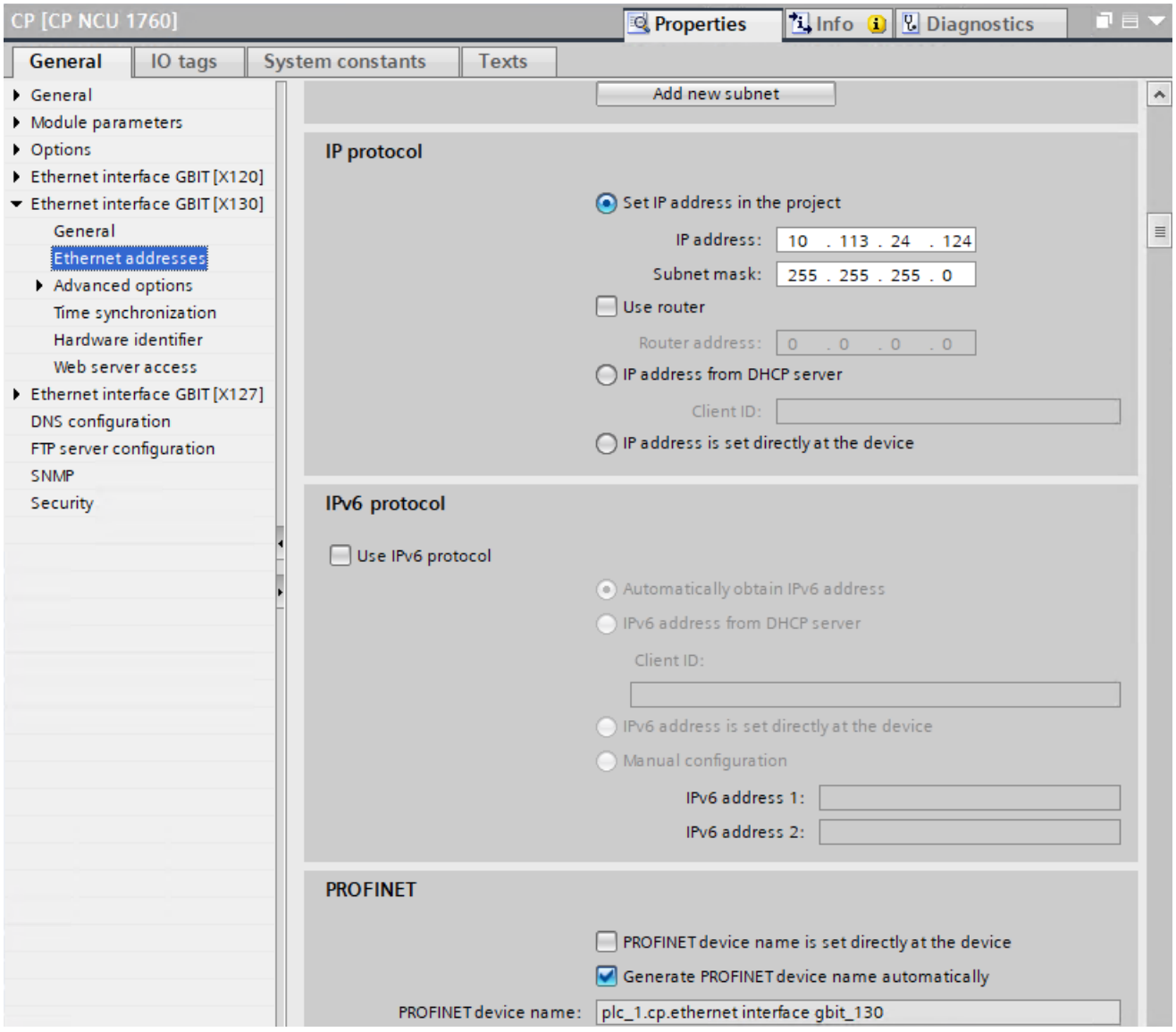
This IP address corresponds to the address of a real network card of the PC, and must be linked to the SINUMERIK_CP1543 at "Control Panel > Set PG/PC interface", e.g. with the following entry: "SINUMERIK_CP1543 (SINUMERIK 17xx) > Intel(R) PRO/1000 MT Network Connection.TCPIP.1".

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.

See also

Configuring the PG/PC interface (Page 67)

Preparing cross-computer communication via Ethernet (Page 69)

6.4 Download the project to the PLC

Requirement

- The simulation-capability of blocks is activated (Page 61).
- 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 configuration is compiled.
- Create MyVirtual Machine has started.
- The machine project is loaded or created, and the machine is started:
  - Create MyVirtual Machine works with "*.vcp" files. They contain the project loaded from the TIA Portal and further settings, e.g. machine data. Before a TIA Portal project can be loaded into Create MyVirtual Machine, such a "*.vcp" file must be opened or newly created When an existing project is opened, it is overwritten during the course of the procedure described below. When a new project is created, a new "*.vcp" file is created, which is populated during the course of the procedure described below.
  - After loading a "*.vcp" file (existing file for overwriting or newly created file), the machine must still 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 configuration with changed Safety Integrated mode, you must perform a general reset of the PLC prior to loading.

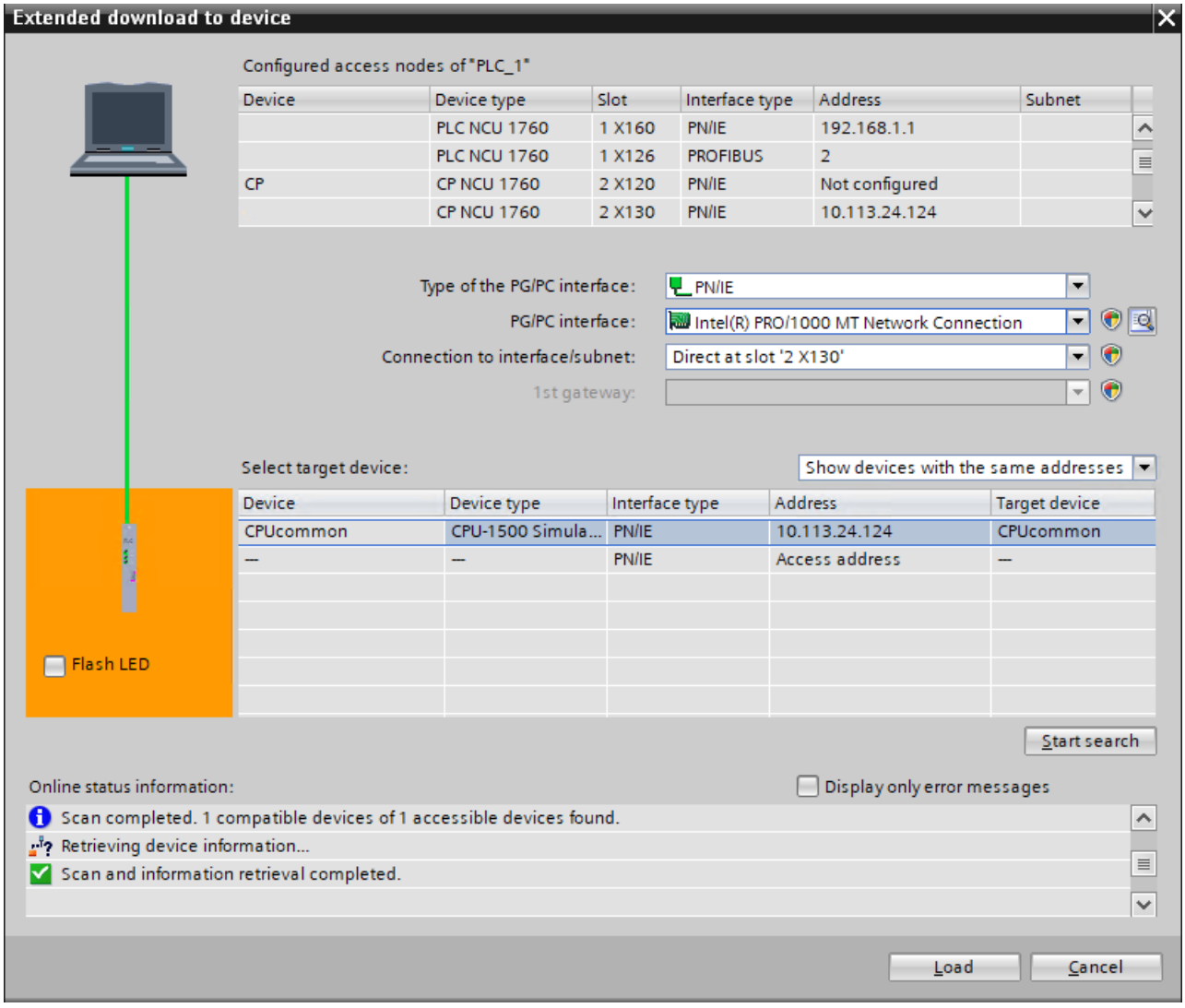
Procedure

To load the hardware and software configurations 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 slot '2 X130'
   - Select target device: "Display devices with the same addresses".

   Alternatively, you can specify an IP address directly in the "Compatible nodes in the target subnet" list in the "Address" column. 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".

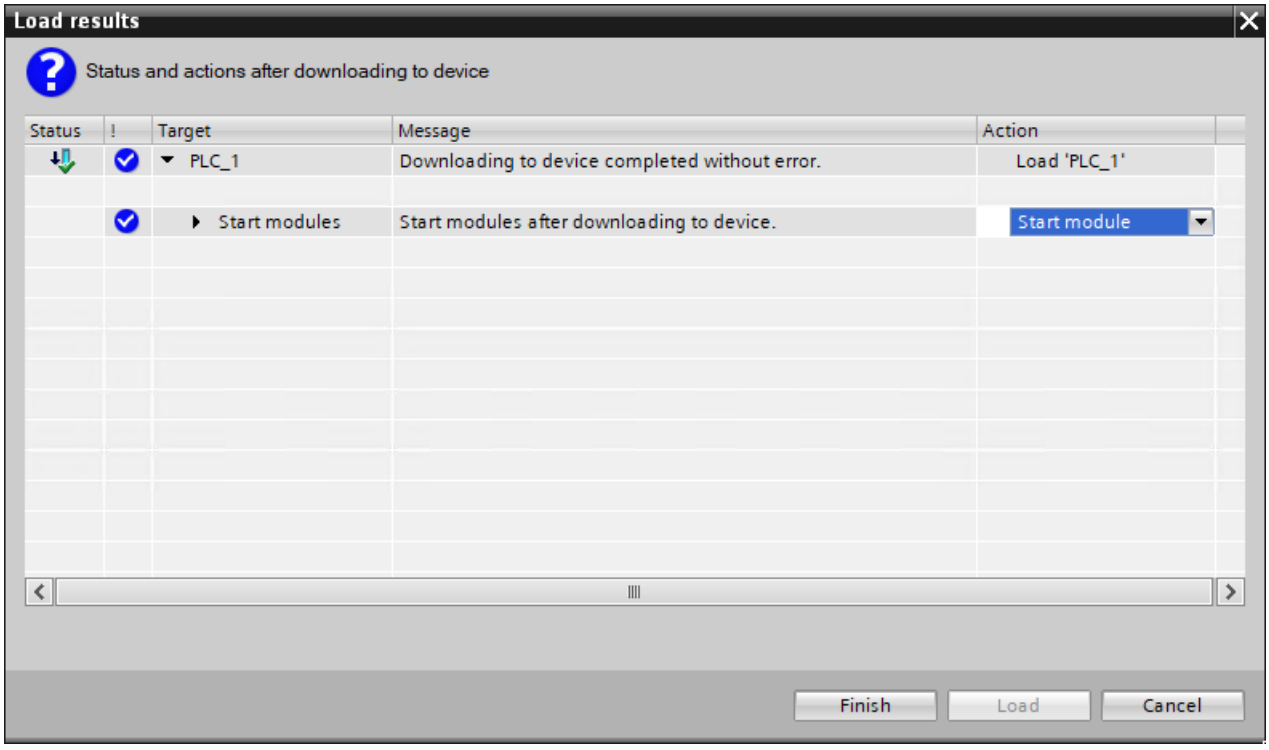


Figure 6-1 Restarting the PLC after a download

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" .

See also

Configuring the PG/PC interface (Page 67)

Preparing cross-computer communication via Ethernet (Page 69)

6.5 Preparing the communications link

6.5.1 Configuring the PG/PC interface

Description

For communication between TIA Portal or HMI and PLCSIM Advanced, you must set the PG/PC interface. Use the applications for the Siemens communication settings for configuring.

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 occurs cross-computer (e.g. SIMATIC STEP 7 Professional on a different computer in the network) and several network cards are available, the network adapter used to connect the computer 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)**.

Requirement

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

This is how you configure the PG/PC interface via "Set PG/PC interface (32-bit)"

1. Enter "Control Panel" in the search field of the Windows taskbar and open the displayed application.
2. Select "All control elements".
3. Click "Set PG/PC interface (32-bit)". The "Set PG/PC interface" window opens.
4. Select the "S7ONLINE (STEP7)" entry at "Access point of the application" on the "Access path" tab.
5. 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.
6. Now select the "SINUMERIK_CP1543 (SINUMERIK 17xx)" entry at "Access point of the application" on the "Access path" tab.
7. In the "Used interface parameter assignment" field, select the entry "<network adapter>.TCPIP.1". <network adapter> is a placeholder for the interface name as used previously.
8. Click "OK" to confirm the settings. The window closes.

This is how you set the PG/PC interface via "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 "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.
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. Select "File > Exit" in the menu to close the window.

Result

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

Further 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 section.

6.5.2 Preparing cross-computer communication via Ethernet

Cross-computer TCP communication

If the TCP communication between MyVirtual Machine products and 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 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

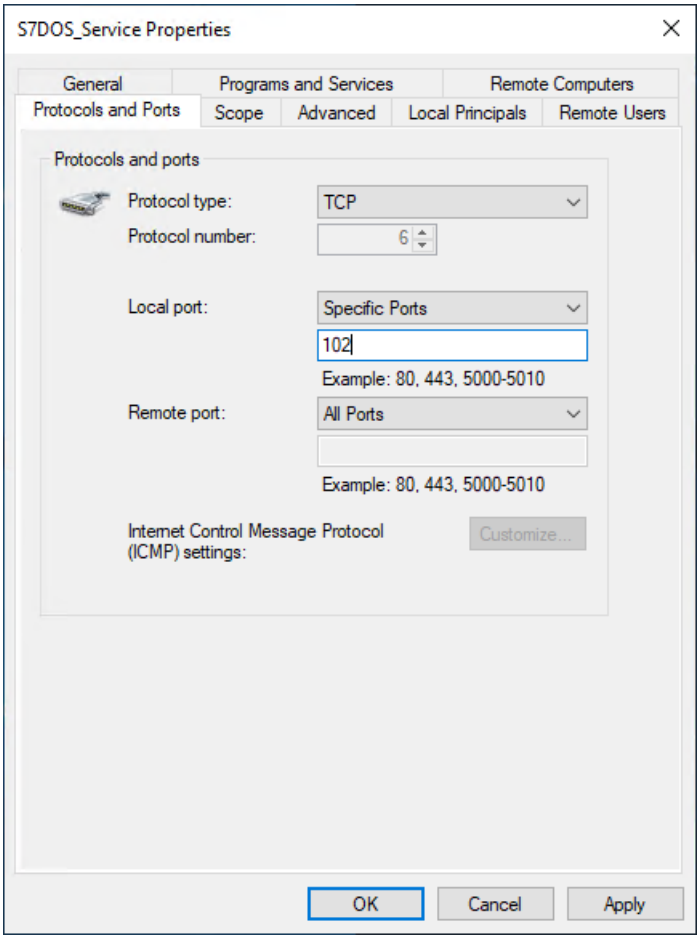


Figure 6-2 Windows Firewall rule: Protocols and ports

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

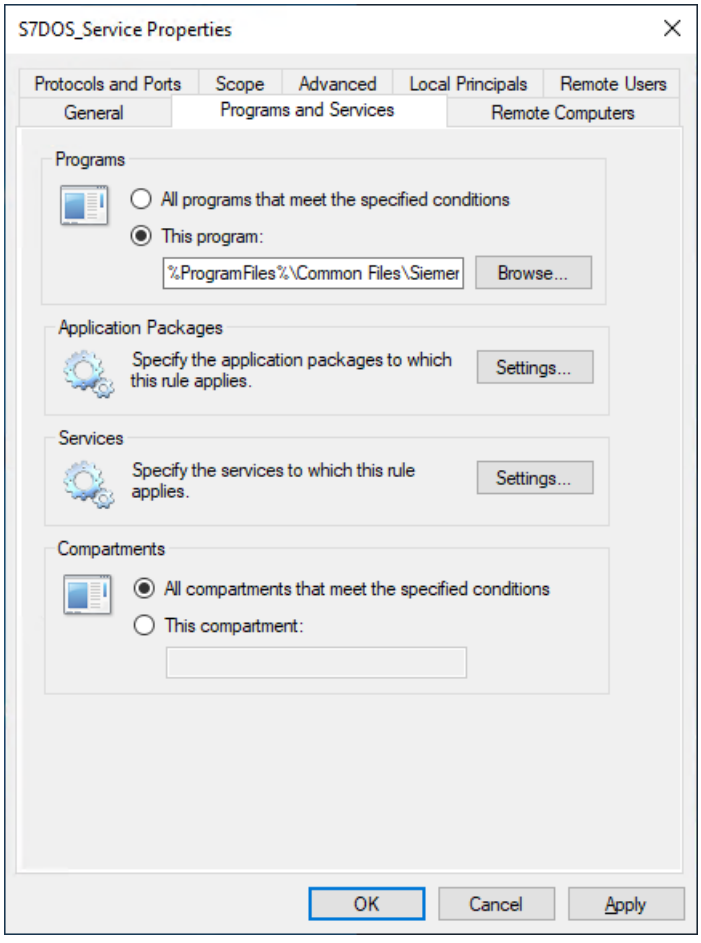


Figure 6-3 Windows Firewall rule: Programs and Services

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

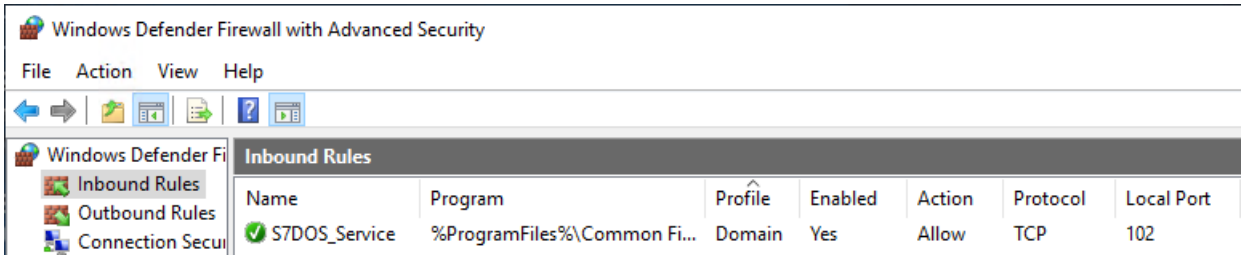


Figure 6-4 Windows Firewall: Inbound rules

Safety Integrated 7

7.1 Activating Safety Integrated in the TIA Portal

Requirement

- The "SIMATIC STEP 7 Safety Advanced" option package has been installed.

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 further 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 (Page 117).

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.

3D simulation (option) 8

8.1 Using 3D simulation

Description

Create MyVirtual Machine visualizes the machining process and machine movements by means of a 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.

The 3D simulation is divided into the following areas:

- Machine
  - Simulation of the machining process and machine movements (Page 88)
  - Defining tools (Page 81)
  - Defining clampings (Page 83)
  - Activating collision monitoring
- Library (Page 78)
  - Fixture (workholder)
  - Blanks
- Collisions (Page 86)
  List of collisions detected during the simulation
- Settings (Page 87)
  - Language selection
  - Toolholder diameter

Note

License

The "Create MyVirtual Machine /3D" license is needed to use the 3D simulation.

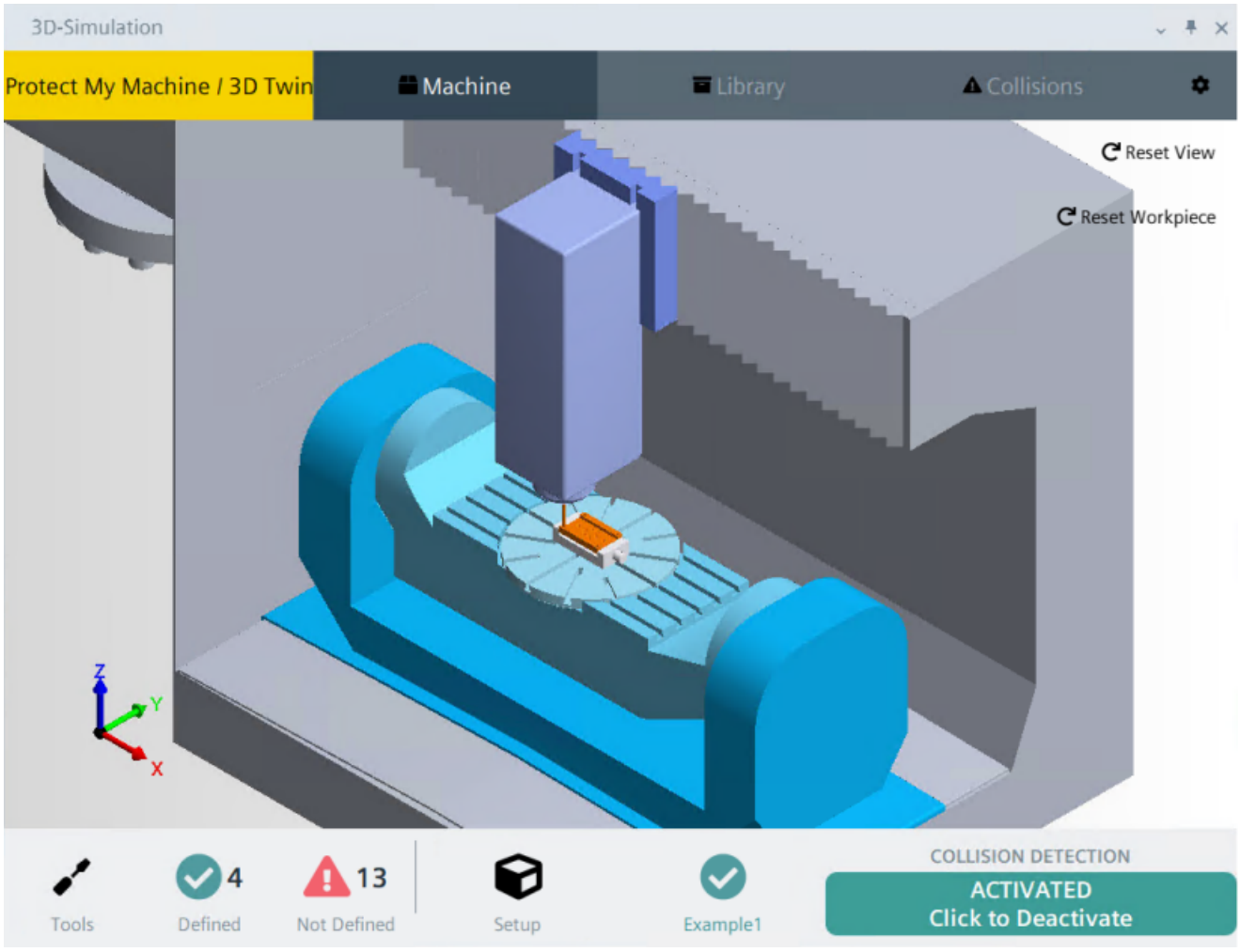


Figure 8-1 3D simulation in Create MyVirtual Machine

Requirements for 3D simulation

Before you can perform a 3D simulation with collision monitoring, the following requirements must have been met.

- The machine model is integrated into the My VirtualMachine project (machine manufacturer) and the project is saved (Page 77)
- The fixture and blank defined in the library
- Clamping that fits the NC program is defined and activated
- The protection functions of the tools used are defined
- Collision monitoring is activated

You can find more detailed information in the following sections.

8.2 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.

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 Collision Avoidance for the configured machine.
   - *.xml kinematic description (oa3d_machine_model.xml)
   - *.stl geometries (e.g. machine table, magazine, enclosure, axes)
3. Copy the created 3D model to the virtual card of the machine project. This is stored in the folder "C:\Users\<username>\AppData\Local\Siemens\Automation\SINUMERIK ONE\ncu\card\oem\sinumerik\3d\model\".
4. Save the complete machine project.
5. With the machine project started, the "3D simulation" window is displayed if the corresponding machine model is integrated.

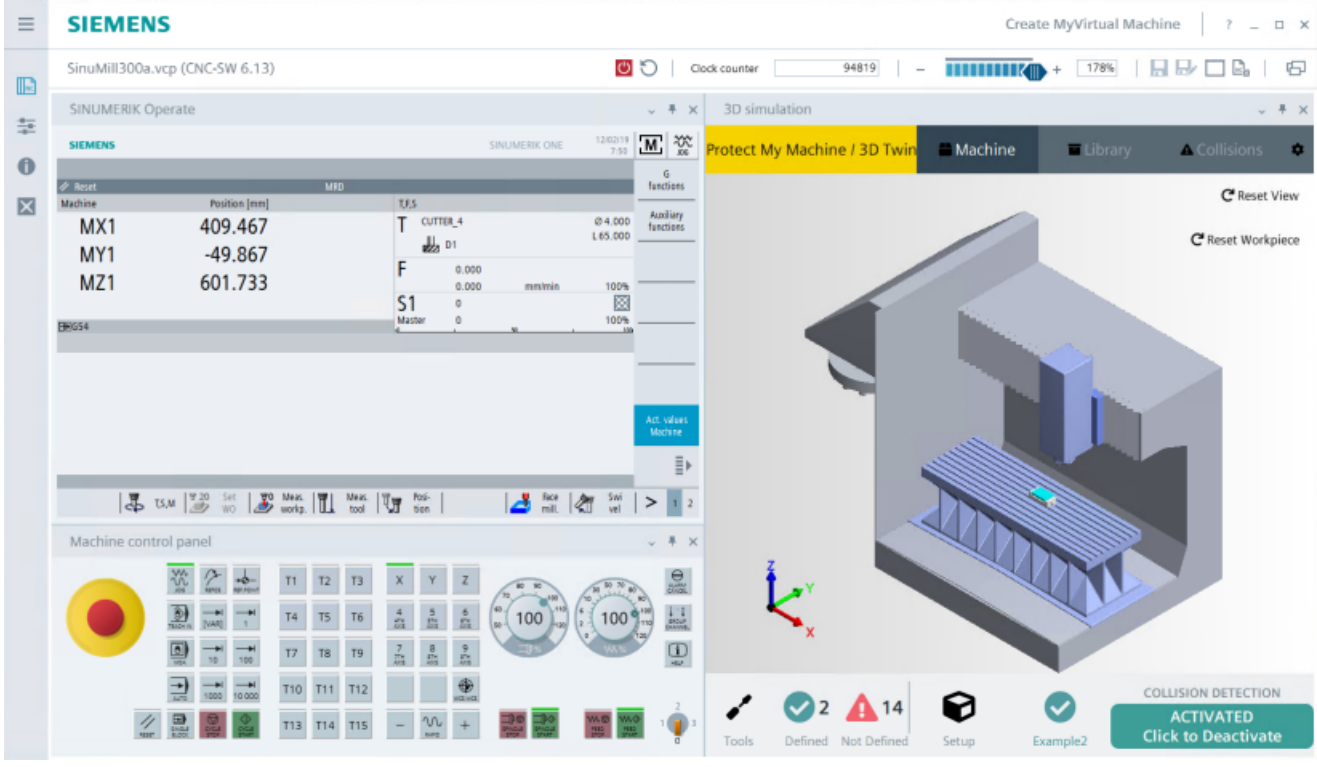


Figure 8-2 Example of 3D simulation of a milling machine in MyVirtual Machine

On the basis of the created machine model, you also define clampings and tools to be used in simulating the machining process.

Note

Support for the 3D machine model

For additional information, service and support issues for the option /3D, contact the official contact person (hotline, Service).

8.3 Fixture and blank

8.3.1 Library

In the library you define the components fixture (workholder) and blank for the 3D simulation. Existing components are displayed and managed in a list.

Definition of components

A component definition has the following parameters:

- Component type
  - Fixture (e.g. workholder, machine vise)
  - Blank (e.g. cuboid)
- Unambiguous component name
  The name can be a maximum of 40 alphanumeric characters long.
- *.stl file of the component (3D model of the component)
  You create the *.stl file with an external program and import it into the library. The *.stl files that are saved in the directory "C:\Users\<username>\AppData\Local\Siemens\Automation \SINUMERIK ONE\ncu\card\user\sinumerik\data\prog\3d\" are available for import.

  Note

  The *.stl files for a clamping (fixture, blank) should be exported with an identical reference point from the design system. Only in this case are the positions workholder, blank and the positioning correct in relation to one another in the machine. If the components have different reference points, rotate or move the component across the transformation matrix until the correct position has been reached.

- Transformation matrix (optional)
  The transformation matrix describes the offset, orientating or rotating of the component. You can transform different parameters depending on the component type.

8.3.2 Creating components

You create the fixtures and blanks in the "library".

How to create components in the library

1. Click the button "Add". A blank component is displayed in the right side of the window.
2. Select the "type" of the component.
   - Fixture
   - Blank
3. Enter a unique "name".
4. Click "Import". A new dialog appears.
5. Select the *.stl file. The selected *.stl file is displayed in the preview window.

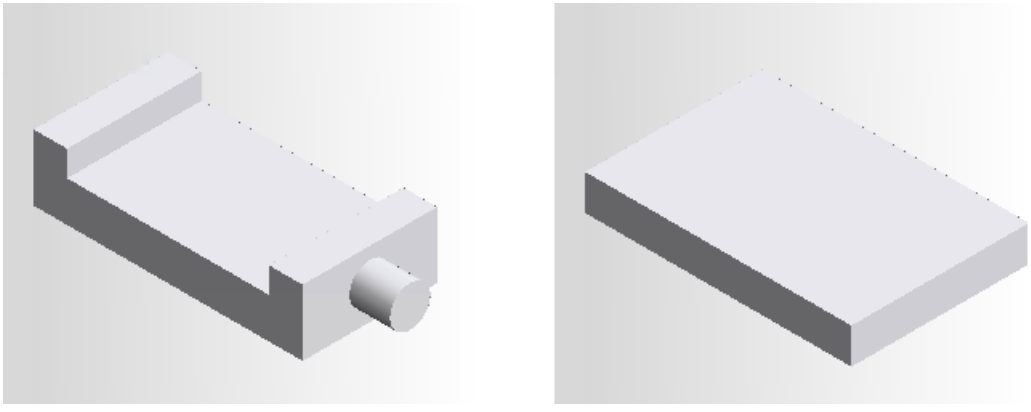


Figure 8-3 Example: preview images of fixture and blank

6. Click "Import". The file is imported and a preview image is displayed.
7. Optionally, you can also define transformations for the *.stl file. You can transform different properties depending on the component.
8. Click on the "+" to insert a new row for a transformation regulation. Click on "-" to delete the selected row.
9. Enter a unique ID and the transformation values.
10. Click "Save". The newly created component is shown in the library.

See also

Transforming components (Page 80)

8.3.3 Transforming components

The transformation matrix describes the offset, orientating or rotating of the component. You can transform different parameters depending on the component type. Use transformations to position the fixture and blank to one another and to the machine model if the components have different reference points.

Functions of the transformation matrix

You can transform the following properties for the clamping fixture and the blank. You can select these via the corresponding tab.

- Connector
- Slots (only clamping fixture)
- Reference points
- Component zero point

Types of transformation

- Offset
  The values ΔX, ΔY and ΔZ define the positions of the components along the X, Y and Z axes. Positive and negative values can be entered for the values ΔX, ΔY and ΔZ.
- Orientation
  I, J and K values are used for aligning the component. 0 or 1 are permissible for the values I, J and K. At least one of them must be 1. The values correspond to a direction vector.
- Rotation
  The roll parameter defines the rotation of the component about the component axis. Numbers between 0° and 360° can be entered. The rotation is executed about the direction vector that was defined beforehand using I, J and K.

When the components are being saved, impermissible or incomplete values for the transformation are detected and a corresponding note is displayed. The component can only be saved after a successful check.

8.4 Tools

8.4.1 Tool manager

Managing tools for the 3D simulation

The tool manager is displayed when you click on the tool icon on the start page of the 3D simulation. All of the tools, with their IDs, tool names and preview image are displayed in a horizontal list. The tool list is synchronized with the tool list in SINUMERIK Operate and contains the tools defined there. If the data of the SINUMERIK Operate tool list changes, it is also updated in the 3D simulation.

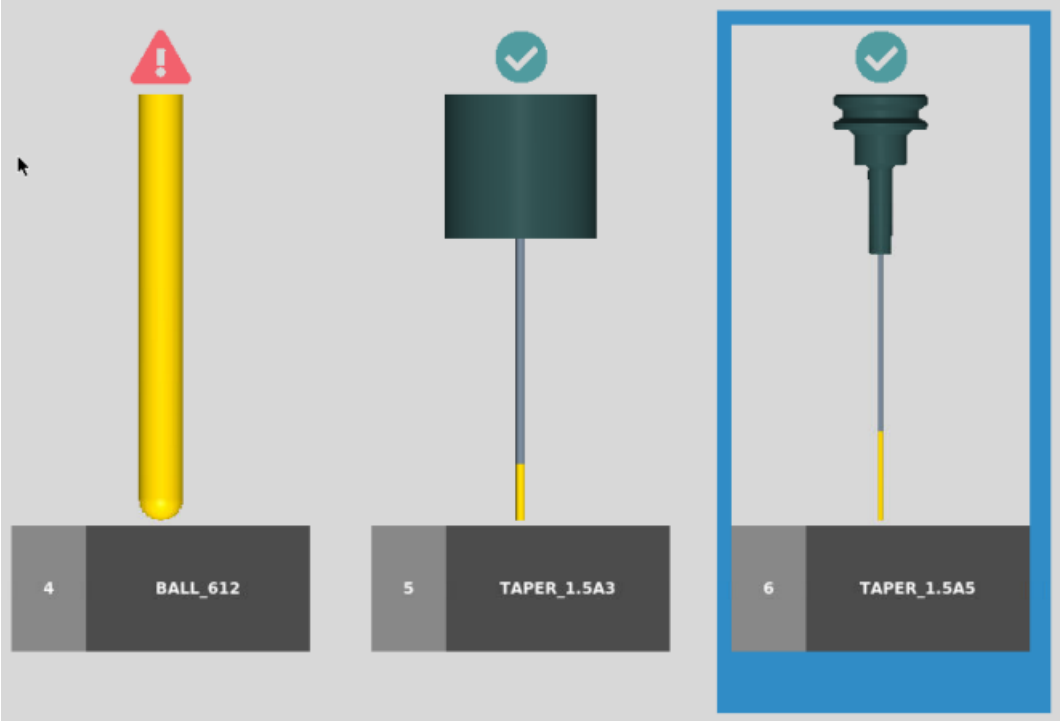


Figure 8-4 Example: Tools with protection functions are marked with a green symbol and displayed with holder

In addition to the geometry data from the SINUMERIK Operate tool list, you also define the holder geometry and the usable length of the cutting edge. As a consequence, a realistic simulation for optimal collision protection can be achieved. You set the additional data before starting the simulation. Changes made during the simulation only take effect when the simulation is restarted.

For the additional data of the tool, select one of the following options:

- Fast protection
- Detailed protection

Fast protection

For fast protection, you define the following additional tool and holder parameters:

- Cutting edge length of the tool (yellow section in the figure)
- Unclamping length/collar length of the tool when used in a holder
  The unclamping length must always be shorter than the tool length stored in SINUMERIK Operate.

Fast Protection allows you to define the cutting edge length and holder for a tool without importing an *.stl file of the tool holder. This option defines a basic holder without geometric details.

For fast protection, the value entered under "Settings" is used as the holder diameter.

Detailed protection

For individual protection, define the following tool and holder parameters:

- Cutting edge length of the tool (yellow section in the figure)
- Tool holder geometry as an *.stl file

The unclamping length is automatically determined on the basis of the holder geometry and the tool length.

The detailed protection function allows you to define the cutting edge length and the tool holder geometry via an *.stl file. The *.stl files that are saved in the directory "C:\Users\<username>\AppData\Local\Siemens\Automation\SINUMERIK ONE\ncu\card\user\sinumerik\data\prog\3d\" are available for import.

8.4.2 Defining protection for tools

You define the protection for tools in the "Machine" tab. The number of defined and non-defined tools is displayed in the footer of the tab. A tool can be protected via the "fast protection" or "detailed protection".

This is how you define a "fast protection" for tools

1. Click the button "Tool"  . A horizontal list of all available tools is displayed.
2. Click on the tool for which you want to define a protection.
3. Click on "Use fast protection". The section is maximized and the fields can be edited.
4. Enter a value in mm for the "Cutting edge length".
5. Enter a value in mm for the "Unclamping length".

6. Click "Save". The values are saved and a preview image with a yellow cutting edge length is displayed.

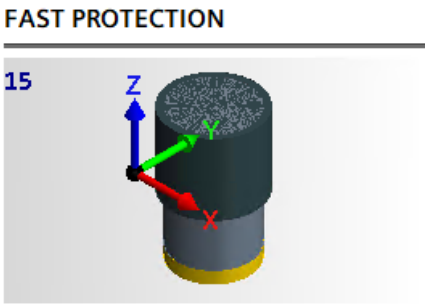


Figure 8-5 Tool: fast protection using a cutter head as an example

7. Repeat the work steps if you want to define more tools.

Click on the "Machine" tab to close the tool manager.

This is how you define an individual "detailed protection" for tools

1. Click the button "Tool" . A horizontal list of all available tools is displayed.
2. Click on the tool for which you want to define a protection function.
3. Click on "Use individual protection". The section is maximized and the fields can be edited.
4. Enter a value in mm for the "Cutting edge length".
5. Click on "Import holder". The selection dialog for the *.stl file of the holder geometry is displayed.
6. Select the *.stl file and click on "Import". The holder geometry is imported.
7. Click "Save". The values are saved.
8. Repeat the work steps if you want to define more tools.

Click on the "Machine" tab to close the tool manager.

8.5 Clampings

8.5.1 Clampings

You define the combination of fixture and blank in the clampings. The clampings are displayed when you click on the clamping icon on the start page of the 3D simulation. All of the available clampings are shown in a tabular overview.

Functions in the "Clamping" tab

- Overview of all clampings
- Identification of the active clamping

- Creating/deleting clampings
- Exporting or importing clampings as a *.zip file
  The transfer directory is "C:\Users\<username>\AppData\Local\Siemens\Automation \SINUMERIK ONE\ncu\card\user\sinumerik\data\prog\3d\"

Definition of clamping

You create the components of a clamping beforehand in the library. A clamping has the following parameters:

- Name of the clamping
  The name can be a maximum of 40 alphanumeric characters long.
- Fixture
- Blank
- Fast Protection Area
  Instead of a fixture, you define a protection area around the blank. To this end, enter a value for the height of the protection area. The effective protection area size is automatically scaled on the basis of the protection area stored in the machine model.
  The maximum height of the protection zone is 999 cm.
- Settable work offsets for fixture and blank
  All of the existing work offsets of SINUMERIK Operate are displayed (e.g. G54-G57). The values of the work offset in SINUMERIK Operate are taken into consideration during the simulation.

8.5.2 Defining clampings

You define the clampings in the "Machine" tab. Before you define clampings, you create the workholders and blanks in the "library".

This is how you define a new clamping

1. Click the button "Clamping"  . The tabular overview of all of the clampings is displayed.
2. Click on "New clamping". A detailed display for the clamping is displayed.
3. Enter a new "Name of the clamping".

4. Select a fixture and a blank respectively from the "Components" list. A preview image of the clamping is displayed.

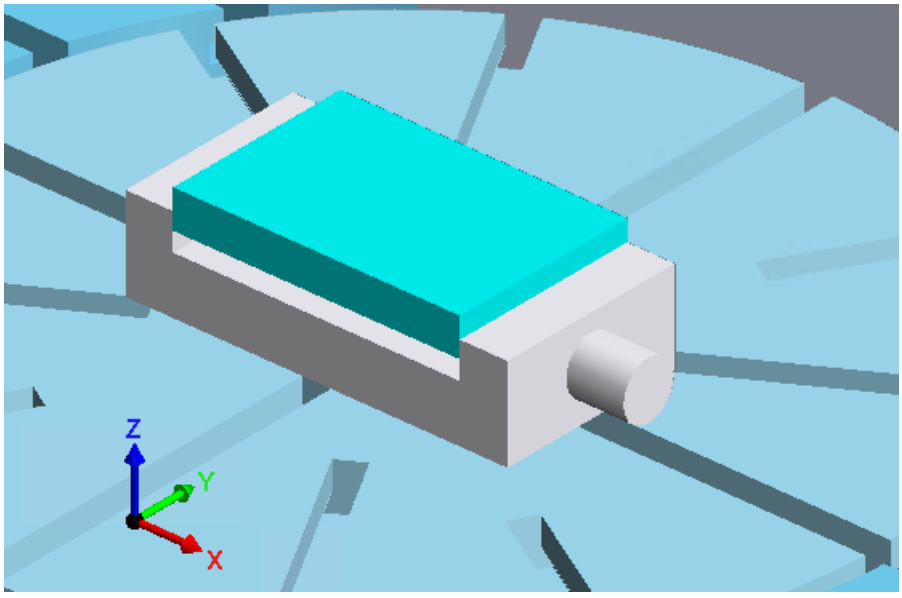


Figure 8-6 Example of a clamping: fixture for machine vise and blank

5. If you do not use a fixture, activate "Fast Protection Area". In this case, you can only select the blank under "Components".
   - Enter a value for the height of the protection area.
   - When the protection area is used, you cannot configure a work offset.
6. Optionally select an active work offset for the fixture and blank.
7. Click "Save".

The newly defined clamping is displayed in the tabular overview and can be activated. Before you start the 3D simulation, first activate a clamping.

8.5.3 Activating a clamping

You activate the clamping in the "Machine" tab.

To activate a clamping

1. Click the button "Clamping" . The tabular overview of all clampings is displayed.
2. Click on the clamping in the "Select" column that you want to activate. A detailed display for the clamping is displayed.
3. In the "Select" column, check the checkbox in front of the desired clamping.
4. Click "Activate".
   The selected clamping is activated. The value "true" is displayed in the "Is active" column. Only one clamping can be active.
5. Click on "Back" to switch to the "Machine" tab.

8.6 Collisions

8.6.1 Collision monitoring

During 3D simulation of the machining process, collisions that occur while collision monitoring is active are logged and visually displayed in the 3D simulation.

Collision log

All of the collisions that occur are displayed in a tabular view with a screenshot in the "Collisions" tab. 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\data\prog\3d\collision.log"

The following data is displayed in the table or saved in the log for each collision:

- Number
  Unique number of the collision
- Collision component
  Which component caused the collision?
- Collision with component
  Which component was involved in the collision?
- Screenshot of the collision
  A 3D image of the collision is displayed in the right section of the tab.

The logged collisions and the saved log can be deleted via the "Delete" button.

Table of the collisions

The collisions that occurred during program processing are listed in a table.

1. Click on the collision in the table for which you want to display the 3D image.
2. The 3D image can be zoomed, rotated and moved in order to better display the details.

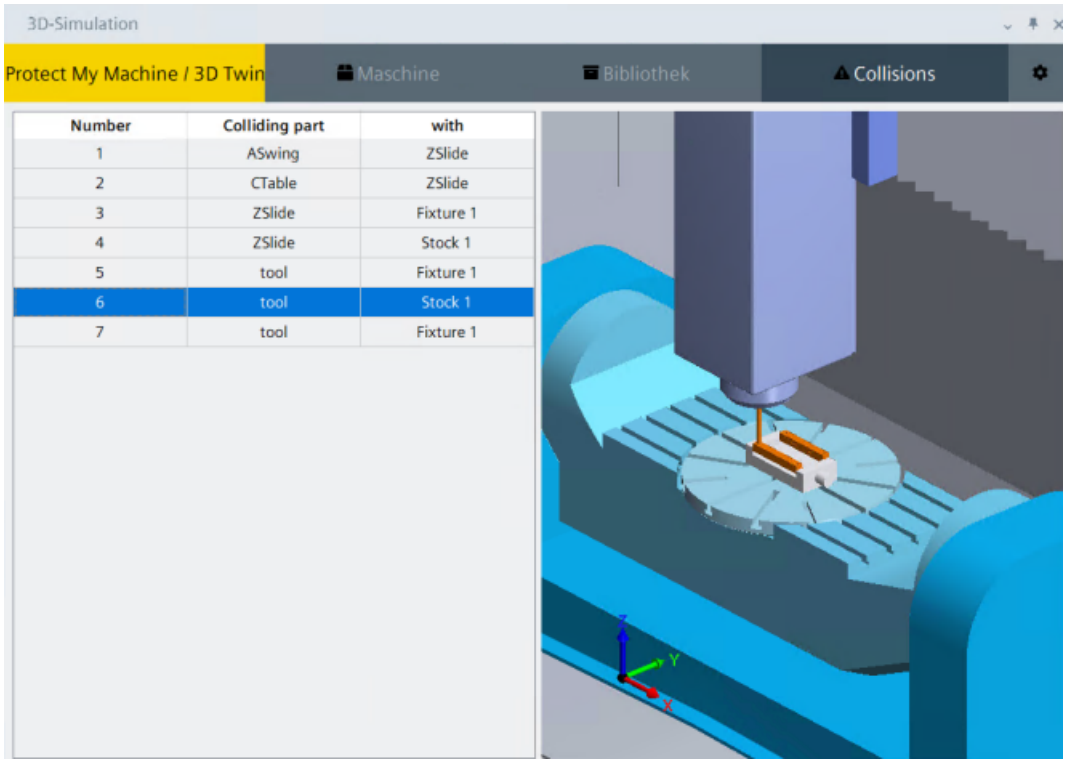


Figure 8-7 Example of a violation of the protection area of the tool with a workpiece (marked in orange)

8.6.2 Activating collision monitoring

Before you start the 3D simulation of the machining process, activate the collision monitoring to ensure that collisions that occur during machining are displayed and logged. Collision monitoring cannot be activated or deactivated during the machining process.

To activate/deactivate collision monitoring

1. Click on the red "Deactivated - Click to activate" button in the "Machine" tab in the right-hand footer of the window.
   The button is displayed in green with the caption "Activated". Collision monitoring is now active.
2. If you want to deactivate collision monitoring again, click again on the button.
   The button is displayed in red and monitoring is deactivated again.

Collisions that occur are logged in the "Collisions" tab.

8.7 Settings

In the "Settings" tab, switch over the user interface language and define a standard diameter for the holder.

Switching over the user interface language

The 3D simulation is available with the user interface languages German and English.

This is how you change the user interface language

1. Select the new user interface language in the "Settings" tab under "Language". The user interface changes to the selected language.
2. Switch back to the "Machine" tab.

Changing the holder diameter

You define a default value for the holder diameter for the 3D simulation. The default value is only used if the protection function "Fast Protection" is defined for the active tool in the simulation.

This is how you change the value for the holder diameter

1. Enter a new value for the "Holder diameter for fast protection" in the "Settings" tab.
2. Click "Save". The new value will enter into effect in the next simulation.
3. Switch back to the "Machine" tab.

8.8 Automatic mode with 3D simulation

During execution of an NC program in AUTOMATIC mode, 3D simulation with collision monitoring enables you to check the processing so that any program errors can be detected.

Requirement

- Requirements for 3D simulation are fulfilled (Page 75)
- 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  "Maximize or minimize the machine view". The view of the machine is maximized or minimized.
2. Click on  "Reset view". The zoomed and moved view of the machine is reset to the default view.
3. Click on  "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 on NC-Start in SINUMERIK Operate. The program is processed and machining of the blank is simulated.

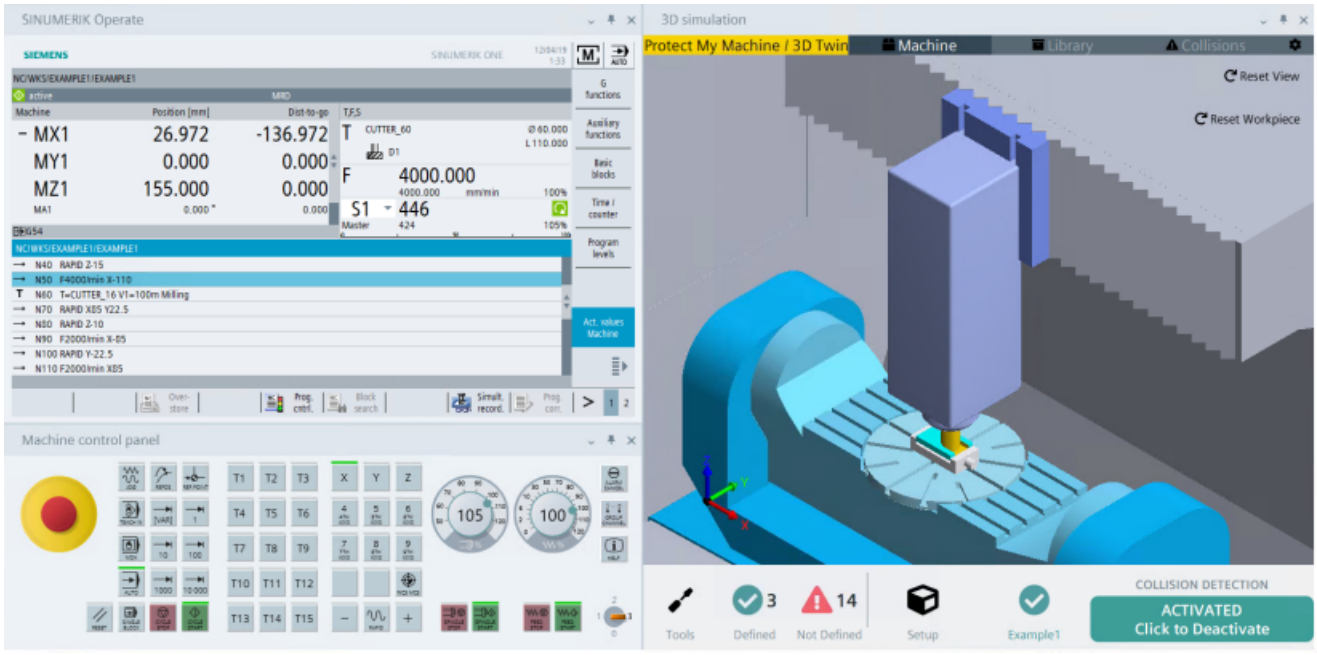


Figure 8-8 Example: simulation of machining process

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
  - Orange: Protection area of the components violated, but no collision yet
  - Red: Collision of the components
- Logging of the collisions
- Zooming and moving the view to better recognize the details
  - Zooming the view: Rotate mouse wheel up/down
  - Rotating the view: Left/center mouse button and move mouse
  - Moving along the axes: Right mouse button and move mouse

Upgrading a project

9

9.1 General information about upgrading projects

When opening the SINUMERIK project from version < V16 of the TIA Portal, you are prompted to upgrade the project. This means that you can continue to use the project in the current version.

In the next chapter, you are given further information about upgrading SINUMERIK projects in the TIA Portal

See also

SINUMERIK ONE Toolbox V15.1 Upd 2 to V16 (Page 91)

9.2 SINUMERIK ONE Toolbox V15.1 Upd 2 to V16

9.2.1 Continued use of TIA Portal projects

In the current version, only TIA Portal projects with the SINUMERIK ONE STEP 7 Toolbox V15.1 Upd 2 with basic PLC program V6.12 Upd 2 can continue to be used. Available projects with older versions of the TIA Portal or of the basic PLC program must first be upgraded to this version.

Installed software requirements

- TIA Portal V16
- SINUMERIK 840D sl STEP 7 Toolbox V16
- SINUMERIK ONE STEP 7 Toolbox V16

Upgrading know-how protected blocks

Know-how protected blocks are bound to the version of the TIA Portal under which the know-how protection was set up. Therefore, they cannot be upgraded for safety reasons. Proceed as follows if you use know-how protected blocks in the project:

- Remove your own blocks before upgrading the know-how protection.
- For third-party blocks, use the appropriate new version of these blocks (e.g. new version of basic PLC program).

After the upgrade, you can set up the know-how protection again.

Further use of TIA Portal projects in V16

To be able to use previous TIA Portal projects in the current version, proceed as follows:

- Upgrade the control system and NX modules to firmware V6.13 via "Device replacement".
- After upgrading the hardware to V6.13, replace the existing basic PLC program in the project with the current version of the basic PLC program V6.13.
- You update instructions used in the project to the latest version of the TIA Portal.

See also

Upgrading hardware (Page 92)

Updating the basic PLC program and data types (Page 94)

Updating instructions in the project (Page 94)

9.2.2 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.

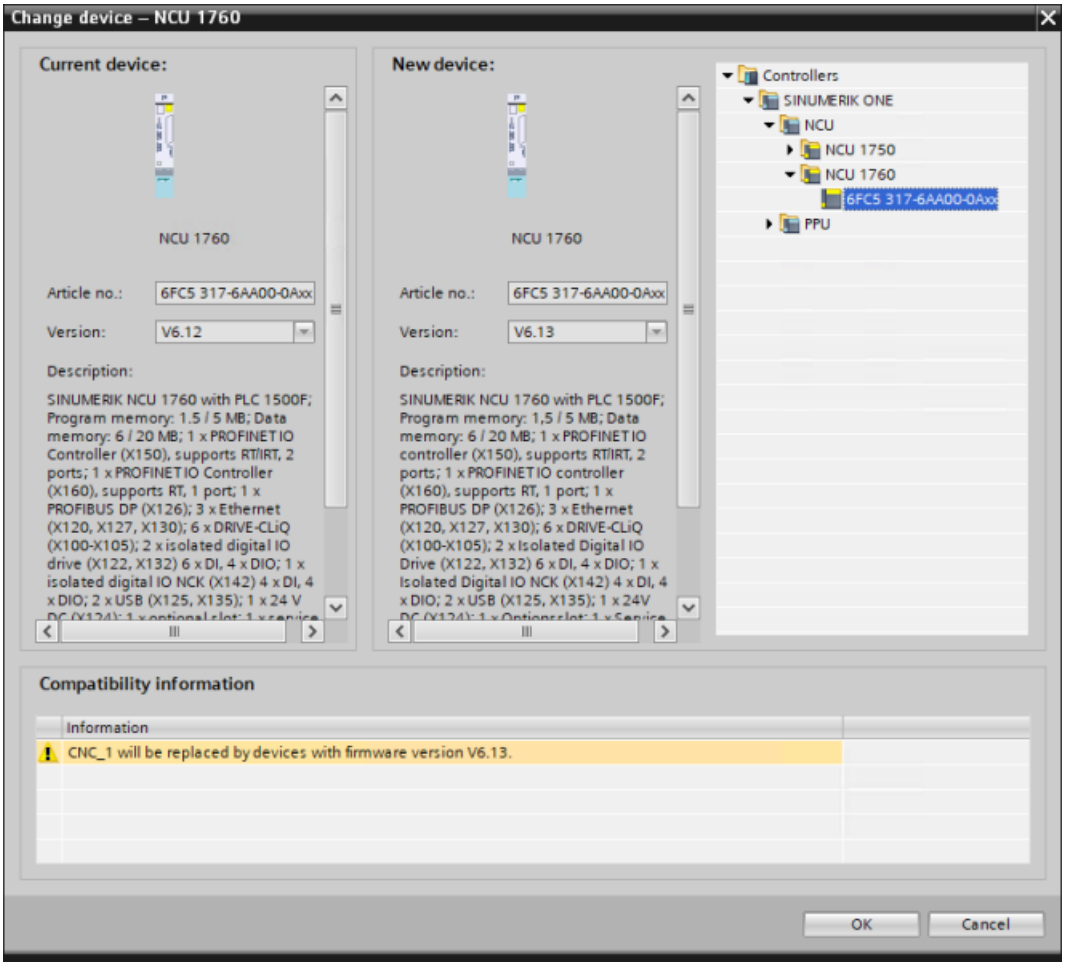


Figure 9-1 Replacement of device for new version

4. Confirm with "OK". The NCU and existing NX modules are upgraded to version V6.13.

In the next step, you upgrade the basic PLC program and the data types to version 6.13.

9.2.3 Updating the basic PLC program and data types

Upgrading the basic PLC program and data types

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

1. Open the "Program blocks" folder in the project navigator.
2. Switch to the "Libraries" task card and open the library "SINUMERIK ONE basic PLC program V6.13".
   You use the variant for the basic PLC 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 basic PLC 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 basic PLC Program (upgrade) > SINUMERIK ONE PLC BP" folder to the "Program Blocks" folder of your project.
   The basic PLC program is updated to the new version.
4. Drag and drop the "Copy Templates > SINUMERIK ONE Basic PLC Program (upgrade) > SINUMERIK ONE PLC BP data types" folder to the "PLC data types" folder of your project.
   The PLC data types are updated.
5. Save and compile the project.

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

9.2.4 Updating instructions in the project

After upgrading the project, instructions used will not be automatically upgraded to the latest version of the TIA Portal. When you compile the project, you receive the following error messages "Library version conflict for Serialize or Deserialize V2.1". The 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

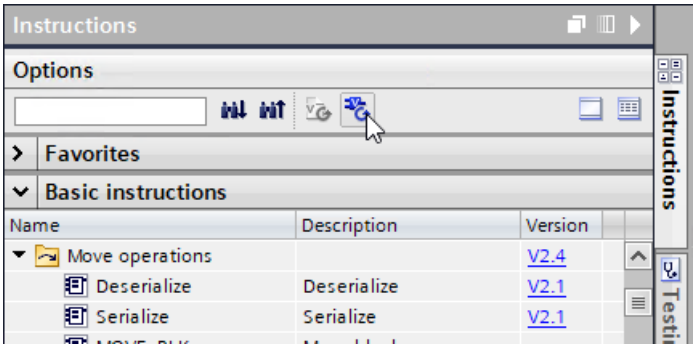


Figure 9-2 Updating instructions to the latest version TIA Portal

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.

9.3 Tips and tricks for upgrading

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

Changes to CNC Software 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.

Creating and importing archives using SINUMERIK Operate

10

10.1 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 commissioning 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 control system).
  - 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]
NC data [1]	Machine data	●	●
	Setting data	●	●
	Option data	●	●
	Global user data (GUD)	●	●
	Tool and magazine data	●	●
	Protection zone data	●	●
	R parameters	●	
	Zero offsets	●	●
	Workpieces, part programs and subprograms	●	
	Manufacturer cycles	●	●
	User cycles	●	
	Definitions and macros	●	●
	Collision avoidance 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 series commisioning file is reloaded into the same control.	●	
	Axis optimization data (AST)	●	●
	Compile cycles	●	●
PLC data	PLC project	●	●
	Remanence data	●	
Drive data	Drive data archiving	●	●
HMI data	User texts, alarm texts	●	●
	Individual templates, workpiece templates	●	●
	HMI applications, OEM applications	●	●
	Engineering data	●	●
	Configurations, incl. display of machine data	●	●
	Help files	●	●
	Version data	●	●
	Error logs	●	●
	Program lists	●	●
	Dictionaries	●	●
	Files located in the data tree of the "System data" in the "HMI data / data backups" directory.	●	●
	Tracking data	●	●

Components	Data	Backup	Setup [2]
System settings	Drive configurations	•	
	TCU settings	•	
	Network settings (for embedded only)	•	
	mmc.ini	•	
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.	•	•

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.

10.2 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
DSF (from real systems)	Virtual	NC, HMI (Linux only)
DSF (from real systems)	Real	NC, PLC, HMI, drives, system settings
DSF (from virtual systems)	Real	NC, HMI (Linux only)

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 target control (e.g. NCU 1750).
- The CNC software in the TIA Portal matches the target control version.

10.3 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

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 control system is generally reset when starting the reading process.

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. In SINUMERIK Operate switch over to the "Commissioning" operating area "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.
4. To import the archive, confirm with "OK".
   The "Import archive" window shows the import process with a progress display.

10.4 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 remanent 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 • 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 NCextend: L • Date (ISO) • Possibly an extension (1, 2, 3, etc.) **Example** Backup_NH_2019-06-03 Backup_NDHSL_2019-06-03_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. In SINUMERIK Operate switch over to the "Commissioning" operating area "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.

Internal peripheral simulation 11

11.1 Internal peripheral simulation

Use the internal peripheral simulation for the simulation of the peripherals (actuators, sensors) in Create MyVirtual Machine. The internal peripheral simulation realizes 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 peripheral simulation is characterized by the manual interaction between operator and control. Therefore it is only suitable for simple, slow running projects.

Functional scope

The internal peripheral 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 peripheral simulation has the following restrictions.

- Only bit values (0/1) are permissible for PLC variables.
- Symbols cannot be used, only direct addresses.

11.2 PLC I/O table

In the PLC I/O table, you configure inputs with switches and outputs with LED displays. To simulate parts of the peripheral, control and monitor the status of the PLC variables in the tabular overview.

Display of the PLC I/O table

You show and hide the PLC I/O table via the menu.

1. Select "View > PLC I/O table" in the menu. The PLC I/O table is displayed.
2. To close the PLC I/O table, click the "Window close button" of the PLC I/O table or select in the menu "View > PLC I/O table" again. The table is closed.

Structure of the PLC I/O table

In the PLC I/O table, you show the PLC variables you want to control or whose values you want to display line by line. The table has three columns and contains one PLC variable per line. You can copy, insert and delete the contents of individual cells.

Address	I/O	Comment
You enter the address of the PLC variable in the "Address" column. Incorrect PLC addresses are marked red. You take the address of the PLC variable from the corresponding programs of the TIA Portal project.	The bit value of the variable is displayed and controlled in the "I/O" column.	You enter an optional comment on the PLC variable in the "Comment" column.
The 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.	

How to create entries in the PLC I/O table

The machine project must be open to edit the PLC I/O table.

1. Show the PLC I/O table.
2. Select the first line of the table.
3. Click the table cell in the "Address" column.

   Note
   Editing a table cell

   The first click selects the cell, and you can edit the selected cell with the second click.

4. Enter the address for the input or output. Depending on the address type, a toggle switch or an LED is displayed in the "I/O" column.
5. Click the "Comment" column and enter an optional comment.
6. Press "Enter" to confirm. A new, empty table call is added.

   Note
   Creating a table cell

   Change to the next table line with the "Enter" key. If the last line of the table is already selected and you press "Enter", a new, empty table cell is added.

7. Select the newly created table line and click the "Address" column.

8. Create any further inputs/outputs that you want to monitor and/or control.

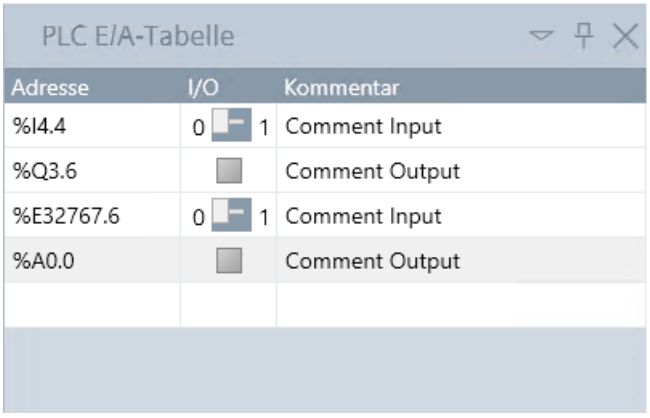


Figure 11-1 Example of PLC I/O table with inputs (switches) and outputs (LED)

9. Select "Project > Save" in the menu.
When the machine project is saved, the PLC I/O table is also saved in the project. If you exit the project without saving, the created PLC I/O table is not backed up and is empty the next time it is opened.

11.3 Working with the internal peripheral simulation

Requirement

To use the peripheral simulation, there must be an executable PLC project in the machine project.

How to work with the internal peripheral simulation

1. Open the previously created PLC I/O table of 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

Monitor the following mode of operation if you work with the internal peripheral simulation.

- The table has a maximum number 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 does not become effective until the second cycle of the PLC.

- 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.
- If a PLC input variable is deleted from the table, the connected PLC input is reset and the value 0 is written.

Open Interface 12

12.1 Overview

Description

The Open Interface of Create MyVirtual Machine allows external applications to control the Create MyVirtual Machine system and to communicate at runtime. Possible applications of the Open Interfaces are:

- Remote control of Create 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 license "Create MyVirtual Machine /Open" is needed to use the Open interface.

12.2 Licensing

An additional license is required to use the Open Interface.

Licensing

The Open Interface requires the "Option MyVirtual Machine /Open" license. The license that 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 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).

Further information

You can find additional information about licensing in:

- Create MyVirtual Machine Installation Instructions

12.3 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 .vcp machine projects

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 these 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

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 112)
- Displaying areas of the standard user interface in separate windows or integrating into other applications (Page 113)

12.4 Programming

Description

The Create 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 MyVirtual Machine application. All other DLLs are loaded from them. The interface functions are described by the associated header files.

Supplementary condition

The client application runs on the same computer as Create 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 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
- > 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 corresponding example project and the appropriate libraries for your 32 or 64-bit application.

The following data are stored in the subfolders.

Folder/file	Description
OpenClientSample.sln and directory OpenClientSample	Reference project "OpenClientSample.sln" in .Net C# Visual Studio 2013. The file can be opened and compiled directly, and shows the basic principles of Open programming. The reference project contains configurations for 32 and 64-bit applications. The libraries appropriate for the configuration are used.
doc	Doxygen-based documentation of the Open Interface functions. It is provided as a PDF on the DVD and in the online help for Create MyVirtual Machine.
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 black box operation.

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 or work with the reference project.

Further information

Reference documentation of the functions and variables can be found via the following link.

Documentation of Open Interface, functions and variables

Note

Opening a reference from the online help

When opening the Open HTML reference help from the Create MyVirtual Machine online help, you must confirm the message via the view of the blocked contents.

12.5 Hiding the user interface (blackbox operation)

Create MyVirtual Machine as control system simulation

As an option, Create MyVirtual Machine can be used without the user interface. This "black box" operation 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 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 MyVirtual Machine is started. The following profiles are contained in the "config" folder:

- Starting with the user interface CMVMStartUpProfile.xml
- Starting in the blackbox mode: CMVMStartUpProfileBlackbox.xml

You save the corresponding run-up profile (*.xml) in the installation path ../Create MyVirtual Machine/Bin.

Further 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 113).

12.6 HMI and MCP in a dedicated window

As an expansion of black box operation, you can integrate specific window components of the standard application into the customized application context.

Note

In the current version, only the window of the SINUMERIK Operate HMI can be used as an embeddable component.

Defining a window in an external application

In order that SINUMERIK Operate HMI can be embedded in an external application, you must provide a host window in the application.

1. Create a host window in the application 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 via the Open interface 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.

Preparing projects for Run MyVirtual Machine 13

13.1 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.

Appendix

A

A.1 Peripheral simulation via the Open Interface

Description

The Open Interfaces allow you to use an external peripheral simulation for Create MyVirtual Machine. A reference for the functions and variables can be found in the following document.

Create MyVirtual Machine reference Open functions, variables

A.2 Standard telegram configuration of a SINUMERIK ONE

A.2.1 PROFIdrive telegrams for standard data

The I/O addresses of standard telegrams are compared to the following telegram configurations in the following:

- SINUMERIK ONE, FW 6.13
- SINUMERIK 840D sl, FW 4.92

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)
DriveAxis01	SIEMENS telegram 136	4100	4100	13050[0]
DriveAxis02	SIEMENS telegram 136	4140	4140	13050[1]
DriveAxis03	SIEMENS telegram 136	4180	4180	13050[2]
DriveAxis04	SIEMENS telegram 136	4220	4220	13050[3]
DriveAxis05	SIEMENS telegram 136	4260	4260	13050[4]
DriveAxis06	SIEMENS telegram 136	4300	4300	13050[5]
DriveCU01	SIEMENS telegram 391	6500	6500	
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)
DriveAxis01	SIEMENS telegram 136	4340	4340	13050[6]
DriveAxis02	SIEMENS telegram 136	4380	4380	13050[7]
DriveAxis03	SIEMENS telegram 136	4420	4420	13050[8]
DriveAxis04	SIEMENS telegram 136	4460	4460	13050[9]

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE)
DriveAxis05	SIEMENS telegram 136	4500	4500	13050[10]
DriveAxis06	SIEMENS telegram 136	4540	4540	13050[11]
DriveCU01	SIEMENS telegram 390	6530	6530	
Infeed01	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)
DriveAxis01	SIEMENS telegram 136	4580	4580	13050[12]
DriveAxis02	SIEMENS telegram 136	4620	4620	13050[13]
DriveAxis03	SIEMENS telegram 136	4660	4660	13050[14]
DriveAxis04	SIEMENS telegram 136	4700	4700	13050[15]
DriveAxis05	SIEMENS telegram 136	4740	4740	13050[16]
DriveAxis06	SIEMENS telegram 136	4780	4780	13050[17]
DriveCU01	SIEMENS telegram 390	6540	6560	
Infeed01	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)
DriveAxis01	SIEMENS telegram 136	4820	4820	13050[18]
DriveAxis02	SIEMENS telegram 136	4860	4860	13050[19]
DriveAxis03	SIEMENS telegram 136	4900	4900	13050[20]
DriveAxis04	SIEMENS telegram 136	4940	4940	13050[21]
DriveAxis05	SIEMENS telegram 136	4980	4980	13050[22]
DriveAxis06	SIEMENS telegram 136	5020	5020	13050[23]
DriveCU01	SIEMENS telegram 390	6550	6590	
Infeed01	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)
DriveAxis01	SIEMENS telegram 136	5060	5060	13050[24]
DriveAxis02	SIEMENS telegram 136	5100	5100	13050[25]
DriveAxis03	SIEMENS telegram 136	5140	5140	13050[26]
DriveAxis04	SIEMENS telegram 136	5180	5180	13050[27]
DriveAxis05	SIEMENS telegram 136	5220	5220	13050[28]
DriveAxis06	SIEMENS telegram 136	5260	5260	13050[29]
DriveCU01	SIEMENS telegram 390	6560	6620	
Infeed01	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)
DriveAxis01	SIEMENS telegram 136	5300	5300	13050[30]
DriveAxis02	SIEMENS telegram 136	5340	5340	
DriveAxis03	SIEMENS telegram 136	5380	5380	
DriveAxis04	SIEMENS telegram 136	5420	5420	
DriveAxis05	SIEMENS telegram 136	5460	5460	
DriveAxis06	SIEMENS telegram 136	5500	5500	
DriveCU01	SIEMENS telegram 390	6570	6650	
Infeed01	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)	MD (ONE)
DriveAxis01	SIEMENS telegram 136	5540	5540	
DriveAxis02	SIEMENS telegram 136	5580	5580	
DriveAxis03	SIEMENS telegram 136	5620	5620	
DriveAxis04	SIEMENS telegram 136	5660	5660	
DriveAxis05	SIEMENS telegram 136	5700	5700	
DriveAxis06	SIEMENS telegram 136	5740	5740	
DriveCU01	SIEMENS telegram 390	6580	6680	
Infeed01	SIEMENS telegram 370	6584	6634	

A.2.2 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, FW 6.13
- SINUMERIK 840D sl, FW 4.92

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. Thus, the corresponding entry in the 840D sl machine data is 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)
DriveAxis01	SIEMENS telegram 903	6700	1008	-
DriveAxis01	SIEMENS telegram 701	5800	5800	13374[0]
DriveAxis02	SIEMENS telegram 903	6716	992	-

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE)
DriveAxis02	SIEMENS telegram 701	5816	5816	13374[1]
DriveAxis03	SIEMENS telegram 903	6732	976	-
DriveAxis03	SIEMENS telegram 701	5832	5832	13374[2]
DriveAxis04	SIEMENS telegram 903	6748	960	-
DriveAxis04	SIEMENS telegram 701	5848	5848	13374[3]
DriveAxis05	SIEMENS telegram 903	6764	944	-
DriveAxis05	SIEMENS telegram 701	5864	5864	13374[4]
DriveAxis06	SIEMENS telegram 903	6780	928	-
DriveAxis06	SIEMENS telegram 701	5880	5880	13374[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)
DriveAxis01	SIEMENS telegram 903	6796	912	-
DriveAxis01	SIEMENS telegram 701	5896	5896	13374[6]
DriveAxis02	SIEMENS telegram 903	6812	896	-
DriveAxis02	SIEMENS telegram 701	5912	5912	13374[7]
DriveAxis03	SIEMENS telegram 903	6828	880	-
DriveAxis03	SIEMENS telegram 701	5928	5928	13374[8]
DriveAxis04	SIEMENS telegram 903	6844	864	-
DriveAxis04	SIEMENS telegram 701	5944	5944	13374[9]
DriveAxis05	SIEMENS telegram 903	6860	848	-
DriveAxis05	SIEMENS telegram 701	5960	5960	13374[10]
DriveAxis06	SIEMENS telegram 903	6876	832	-
DriveAxis06	SIEMENS telegram 701	5976	5976	13374[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)
DriveAxis01	SIEMENS telegram 903	6892	816	-
DriveAxis01	SIEMENS telegram 701	5992	5992	13374[12]
DriveAxis02	SIEMENS telegram 903	6908	800	-
DriveAxis02	SIEMENS telegram 701	6008	6008	13374[13]
DriveAxis03	SIEMENS telegram 903	6924	784	-
DriveAxis03	SIEMENS telegram 701	6024	6024	13374[14]
DriveAxis04	SIEMENS telegram 903	6940	768	-
DriveAxis04	SIEMENS telegram 701	6040	6040	13374[15]
DriveAxis05	SIEMENS telegram 903	6956	752	-
DriveAxis05	SIEMENS telegram 701	6056	6056	13374[16]
DriveAxis06	SIEMENS telegram 903	6972	736	-
DriveAxis06	SIEMENS telegram 701	6072	6072	13374[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)
DriveAxis01	SIEMENS telegram 903	6988	720	-
DriveAxis01	SIEMENS telegram 701	6088	6088	13374[18]
DriveAxis02	SIEMENS telegram 903	7004	704	-
DriveAxis02	SIEMENS telegram 701	6104	6104	13374[19]
DriveAxis03	SIEMENS telegram 903	7020	688	-
DriveAxis03	SIEMENS telegram 701	6120	6120	13374[20]
DriveAxis04	SIEMENS telegram 903	7036	672	-
DriveAxis04	SIEMENS telegram 701	6136	6136	13374[21]
DriveAxis05	SIEMENS telegram 903	7052	656	-
DriveAxis05	SIEMENS telegram 701	6152	6152	13374[22]
DriveAxis06	SIEMENS telegram 903	7068	640	-
DriveAxis06	SIEMENS telegram 701	6168	6168	13374[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)
DriveAxis01	SIEMENS telegram 903	7084	624	-
DriveAxis01	SIEMENS telegram 701	6184	6184	13374[24]
DriveAxis02	SIEMENS telegram 903	7100	608	-
DriveAxis02	SIEMENS telegram 701	6200	6200	13374[25]
DriveAxis03	SIEMENS telegram 903	7116	592	-
DriveAxis03	SIEMENS telegram 701	6216	6216	13374[26]
DriveAxis04	SIEMENS telegram 903	7132	576	-
DriveAxis04	SIEMENS telegram 701	6232	6232	13374[27]
DriveAxis05	SIEMENS telegram 903	7148	560	-
DriveAxis05	SIEMENS telegram 701	6248	6248	13374[28]
DriveAxis06	SIEMENS telegram 903	7164	544	-
DriveAxis06	SIEMENS telegram 701	6264	6264	13374[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)
DriveAxis01	SIEMENS telegram 903	7180	528	-
DriveAxis01	SIEMENS telegram 701	6280	6280	13374[30]
DriveAxis02	SIEMENS telegram 903	7196	512	-
DriveAxis02	SIEMENS telegram 701	6296	6296	
DriveAxis03	SIEMENS telegram 903	7212	496	-
DriveAxis03	SIEMENS telegram 701	6312	6312	

Drive	Telegram type	I/O address (ONE)	I/O address (840D sl)	MD (ONE)
DriveAxis04	SIEMENS telegram 903	7228	480	-
DriveAxis04	SIEMENS telegram 701	6328	6328	
DriveAxis05	SIEMENS telegram 903	7244	464	-
DriveAxis05	SIEMENS telegram 701	6344	6344	
DriveAxis06	SIEMENS telegram 903	7260	448	-
DriveAxis06	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)	MD (ONE)
DriveAxis01	SIEMENS telegram 903	7276	432	-
DriveAxis01	SIEMENS telegram 701	6376	6376	
DriveAxis02	SIEMENS telegram 903	7292	416	-
DriveAxis02	SIEMENS telegram 701	6392	6392	
DriveAxis03	SIEMENS telegram 903	7308	400	-
DriveAxis03	SIEMENS telegram 701	6408	6408	
DriveAxis04	SIEMENS telegram 903	7324	384	-
DriveAxis04	SIEMENS telegram 701	6424	6424	
DriveAxis05	SIEMENS telegram 903	7340	368	-
DriveAxis05	SIEMENS telegram 701	6440	6440	
DriveAxis06	SIEMENS telegram 903	7356	352	-
DriveAxis06	SIEMENS telegram 701	6456	6456	

A.3 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: Configuring
- Manufacturer/Service: Commissioning
- Manufacturer/Service: Functions
- Safety Integrated
- SINUMERIK Integrate / MindApp
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