SIEMENS

Overview of controllers for vendors
of machine tools

SINUMERIK Operate - Milling

SINUMERIK ONE

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SINUMERIK ONE
SINUMERIK Operate - Milling

Overview of controllers for vendors of machine tools

Valid for:

Controller:
SINUMERIK ONE
Software:
CNC software version 6.15

05/2022
A5E51494323B 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.

Proper use of Siemens products

Note the following:

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

Trademarks

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

Disclaimer of Liability

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

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Preface

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Scope of validity

This document provides you with an overview of the range of functions included in the **SINUMERIK ONE V6.15** for milling machines.

The document is focusing on vendors and dealers of machine tools.

Organization of the information

Of the varied functional features of the SINUMERIK products, only those are listed which are of direct value to the machine user. For each function it is indicated whether it is included in the basic scope of SINUMERIK Operate or whether you have to purchase it separately as an option.

All functions contained in the machine's basic configuration will be identified as follows:

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

All functions that you can purchase as additional options are marked as follows:

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
	Option: [Article No. order code]		Option: [Article No. order code]		Option: [Article No. order code]		Option: [Article No. order code]

The options are additionally differentiated as follows:

✔	After purchasing the option, you will receive a license key. By reading in the license key, you activate the function.
⚙	The option requires coordination with the machine manufacturer.

Technical data subject to change.

Contact person at machine manufacturer

Marketing & Sales

Phone:	+49 xxx xxx
Fax:	+49 xxx xxx
E-mail:	xxx@machinemanufacturer.com

Service

Phone:	+49 xxx xxx
Fax:	+49 xxx xxx
E-mail:	xxx@machinemanufacturer.com

Homepage:

http://www.machinemanufacturer.com

SINUMERIK user support worldwide contact

Name	First name	Region	E-mail
Popelka	Jiri	Austria	jiri.popelka@siemens.com
Marino	Gustavo	Brazil	marino.gustavo@siemens.com
Katsarov	Petar	Bulgaria	petar.katsarov@siemens.com
Xu	Zheng Shun	China	zhengshun.xu@siemens.com
Meriaho	Juha	Finland	juha.meriaho@siemens.com
Chevalier	Francois	France	francois.chevalier@siemens.com
Bui	Quang-Minh	Germany	quang-minh.bui@siemens.com
Palla	Csaba	Hungary	csaba.palla@siemens.com
Muthukrishna Pillai	Manish	India	manish.m@siemens.com
Widjayanto	Arif	Indonesia	arif_widjayanto@cncdesign.com.au
Marrelli	Fabio	Italy	fabio.marrelli@siemens.com
Cavazos Valle	Alicia del Carmen	Mexico	alicia.cavazos@siemens.com
Ouwehand	Hans	The Netherlands	hans.ouwehand@siemens.com
Orlik	Piotr	Poland	piotr.orlik@siemens.com
Simzikov	Sergey	Russia	sergey.simzikov@siemens.com
Popelka	Jiri	Slovakia	jiri.popelka@siemens.com
Lee	ByungChan	South Korea	byungchan.lee@siemens.com
Lopez Gomez	Javier	Spain	javier.lopez_gomez@siemens.com
Farger	Alexander	Switzerland	alexander.farger@siemens.com
Tan	Ben	Taiwan	ben.tan@siemens.com
Popelka	Jiri	Czech Republic	jiri.popelka@siemens.com
Dinler	Namik Ozkan	Turkey	ozkan.dinler@siemens.com
Coombes	Mark	United Kingdom	mark.coombes@siemens.com
Pollack	Christopher	USA	chris.pollack@siemens.com
Dat	Nguyen Van	Vietnam	nguyen-van.dat@siemens.com

Homepage:

For further information please visit ...

CNC4you-Portal (http://siemens.com/cnc4you)

Technical online documentation
(https://support.industry.siemens.com/cs/document/109768483)

Compact overview

<div style="text-align: right; font-size: 2em;">2</div>

Siemens Machine Tool Systems - a strong partner for the machine tool world ...

Siemens Machine Tool Systems portfolio

☑ SINUMERIK ONE sets standards in terms of machining speed and quality. The CNC system maximizes the productivity of machine tools through maximum PLC and CNC performance. (Page 15)
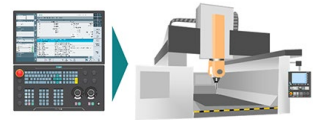
User-friendliness - effective operation like on a PC

☑ SINUMERIK Operate offers a high degree of user-friendliness that is otherwise only expected from personal computers. SINUMERIK Operate thus sets the standard for the efficient operation of machine tools. (Page 25)

Setup functions "Intelligent-JOG"

☑ Functions for setting up the machining process are of central importance in small-batch production with universal milling machines. SINUMERIK Operate sets standards for these "functions of daily life". Thanks to an intelligent JOG mode and intuitive tool management, all of the typical setup functions feature interactive, graphical support. (Page 31)
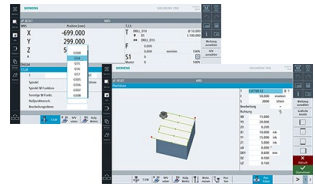
Tool management - powerful but nevertheless easy to use

☑ SINUMERIK ONE offers powerful tool management. Thanks to SINUMERIK Operate, tool management is also "easy to use" for operation sequences in the production of individual parts and small series. (Page 43)
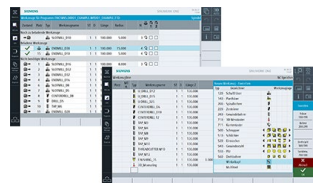
Data management like on a PC

☑ SINUMERIK Operate offers a modern program management system that makes the functions and user-friendliness of PC operating systems available in CNCs for the first time (Page 47)

CNC operation in automatic mode (AUTO)

☑ SINUMERIK Operate offers numerous functions for the AUTO mode - from execution from external memories, block search and program control all the way to logging of measurement results. (Page 49)
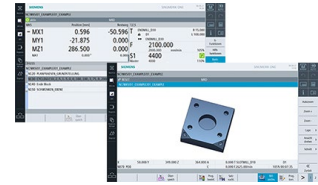
SINUMERIK CNC performance - the benchmark in all aspects

☑ SINUMERIK ONE sets standards in all aspects of machining performance – maximum accuracy while at the same time protecting the mechanical system of the machine. (Page 59)
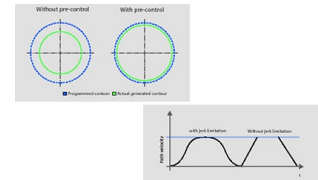
Freeform surface machining - the stress test for every CNC

☑ The machining of freeform surfaces means processing of extremely large quantities of CNC sets in the shortest possible time. Modern CNCs offer special functions to meet this challenge. (Page 71)

CNC programming methods - optimally prepared for all production tasks

☑ A major advantage of SINUMERIK are two CNC programming methods that are well established on the market: AV-based, highly productive DIN/ISO programming as well as a workshop-based workstep programming. This gives you unparalleled flexibility. (Page 77)
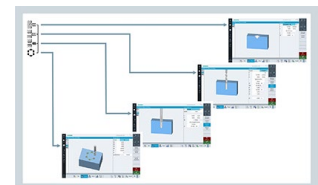
Workpiece visualization - more safety through simple and fast control

☑ Realistic 2D and 3D simulation and the mold-making quick view offer reliability regarding programming and quotation pricing. (Page 87)
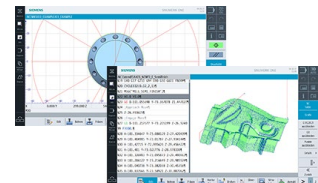
CNC technology cycles - the little helpers for daily CNC programming

☑ Irrespective of whether you use programGUIDE or ShopMill – in either case, the full range of technological cycles, position patterns and geometries is available to you. (Page 91)
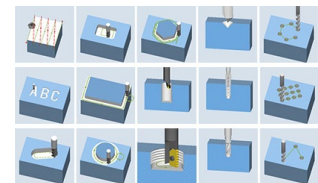
Complete machining - CNC performance in any machining plane, with any tool orientation

☑ Powerful kinematic transformations enable machining in any desired plane or with any tool orientation – without restrictions in the calculation of tool offsets and without compromising on ease of operation and programming. (Page 101)

Automation - the fully automated workpiece flow

☑ Different automation concepts, tailor-made for the respective milling machine concept, automate the workpiece flow and thus increase the economic efficiency in production. (Page 109)
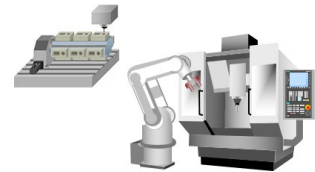
Digitalization on the shop floor

☑ Digitalization is clearly a domain of Siemens, not only with powerful IT solutions for SINUMERIK. The strength of Siemens Digital Industries is the digitalization of the entire shop floor. (Page 111)

Tools and information

☑ More than just useful helpers - DXF Reader and Run MyScreens! On the information platform CNC4you you will find helpful tips & tricks and a download area. (Page 127)
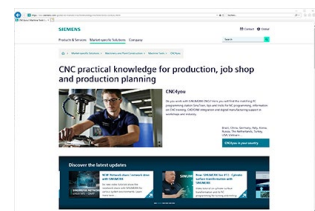
Safety functions

☑ SINUMERIK Safety Integrated permits the unrestricted movement of the machine in set-up mode with open protective doors, thus offering the machine user a significant plus in terms of user friendliness. Collision avoidance functions provide protection against collisions in the workspace. (Page 133)

SINUMERIK Operate - Milling

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System overview

<div style="text-align: right; font-size: 3em;">3</div>
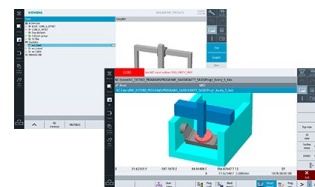
With the SINUMERIK ONE controller, the clear and intuitive SINUMERIK Operate user and programming interface, and the SINUMERIK ONE Dynamics technology packages, you have a tailor-made solution for all CNC milling machines and machining centers used worldwide at your disposal.

SINUMERIK Operate

The characteristic features of SINUMERIK Operate:

- ShopMill and ShopTurn are integrated into the SINUMERIK Operate user interface
- Intuitive and clear operation and programming, including Animated Elements
- Display in the modern Windows style
- Powerful functions covering all aspects of setting up, programming, tool and program management

Two options are available for the **programming**:

- DIN-ISO programming with programGuide (CNC text editor with programGuide cycle support, and DIN-ISO and readable CNC high-level language commands) for mid-sized and large series
- ShopMill machining step programming with graphical interactive CNC machining step editor and CNC programming without DIN-ISO knowledge for small series

SINUMERIK ONE Dynamics technology packages

SINUMERIK ONE Dynamics offers you a series of options for your machine tool with three complementary technology packages:

- **SINUMERIK ONE Dynamics Operate**

  The SINUMERIK ONE Dynamics Operate package comprises convenient functions for efficient operation and programming at the machine. The proven SINUMERIK ShopMill/ShopTurn machining cycles and a high-quality CNC simulation for the milling and turning technologies are included in the package.

  In addition, you are also given a wide range of options for accessing your CNC programs and workpiece documentation on external storage media (EES). This means that the exchange of production data is paperless. The DXF Reader enables rapid transfer of contours and drilling patterns from electronic drawings to the part program, for example.

- **SINUMERIK ONE Dynamics 3-axis milling and SINUMERIK ONE Dynamics 5-axis milling**

  The SINUMERIK ONE Dynamics 3-axis and 5-axis milling packages with their CNC functions Top Surface and Top Speed plus permit excellent motion control and perfect workpiece surfaces. They support the execution of CAM-generated CNC programs for freeform surface machining. Top Surface particularly shows its strengths when milling complex freeform surfaces where the requirements on surface quality, shape accuracy and production efficiency are especially high.

  Top Speed plus ensures a better dynamic response without exciting the natural frequencies of the machine. This ensures both reliable contour accuracy and fast machining. Depending on the specific application, machining times can be shortened by up to 30 percent. In this way, it is possible to reduce the unit costs for milling with CAM-generated CNC programs and increase production efficiency.

		ONE Dynamics Operate	S41	ONE Dynamics 3-axis milling	S42	ONE Dynamics 5-axis milling	S43
ShopTurn/ShopMill	P17	✔		✔		✔	
Residual material detection and machining for Contour pockets and stock removal	P13	✔		✔		✔	
3D simulation 1 (finished part)	P25	✔		✔		✔	
Simultaneous recording (real-time simulation of current machining)	P22	✔		✔		✔	
DXF reader	P56	✔		✔		✔	
Execution From External Storage EES	P75	✔		✔		✔	
TRANSMIT/peripheral surface transformation	M27	✔		✔		✔	
Measuring cycles for drilling/milling and turning	P28			✔		✔	
Advanced Surface	S07			✔		✔	
Top Surface	S17			✔		✔	
Top Speed plus	S62			✔		✔	
HMI user memory additionally on memory card of the NCU	P12			✔		✔	
Measuring the kinematics	P18					✔	
5-axis machining package	M30					✔	
3D tool radius compensation	M48					✔	

3.1 SINUMERIK ONE

SINUMERIK ONE is optimized for performance. The consistent further development of the powerful and proven SINUMERIK CNC system software for state-of-the-art CNC hardware with Multicore µP Technology offers an undreamt-of increase in CNC performance in many areas. The integrated SIMATIC S7-1500F PLC allows cycle times that are up to ten times faster than those of the previous PLC.

With Run MyVirtual Machine, the digital twin of the SINUMERIK ONE for machining, you can always simulate central processes such as programming, work preparation or process optimization on the digital twin first.
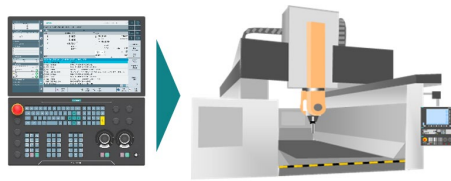
- Drive-based modular CNC & Panel-based compact CNC
- Multi-technology CNC
- Up to 31 axes/spindles
- Up to 10 machining channels
- SIMATIC S7-1500 based PLC

You can find more information in Catalog NC 63

Benefits

- **Increased CNC performance through powerful multi-core µP technology**
- **Significantly shorter idle times and complete integration into the TIA Portal through the integrated SIMATIC S7-1500F PLC**
- **SINUMERIK ONE, suitable for both modular and compact machines**
- **SINUMERIK ONE convinces on the shopfloor with modern usability and smooth operation**
- **Create, verify, and prevent collisions offline with Run MyVirtual Machine NC programs**

3.2 Run MyVirtual Machine (digital twin)

☑ SINUMERIK ONE PPU 1740	☑ SINUMERIK ONE NCU 1740	☑ SINUMERIK ONE NCU 1750	☑ SINUMERIK ONE NCU 1760
✔ Option: via SISW	✔ Option: via SISW	✔ Option: via SISW	✔ Option: via SISW

With Run MyVirtual Machine, the digital twin of the SINUMERIK ONE for machining, offline programming and checking of NC programs is possible without a real machine.

Using SINUMERIK Operate and the original SINUMERIK CNC kernel, all operating processes and NC programming operations can be used and CNC programs executed, without any restrictions. New functions and programming options can thus be learned, tested and demonstrated in a secure environment.

- In work preparation:
  - Higher machine availability through offline CNC programming on the PC during work preparation
  - Verification of CNC programs, regardless of whether they were generated via Run MyVirtual Machine itself or via CAM systems
  - No new operating and programming skills required, since exactly the same scope of CNC language commands, CNC machining cycles as well as ShopMill/ShopTurn work steps is available as in the real CNC
  - To get the best possible match with your real CNC, machine projects (*.vcp) can be loaded to match the respective machine.

    Contact your machine manufacturer for this purpose.

- In training:
  - Easy learning and professional training through pre-configured sample machines and no additional hardware costs
  - Learning as on the CNC, with additional tutorials and programming guides
  - Learning as on the real machine with control functions and machine movements through a complete virtual image of the machine (digital twin)
  - Practicing in the virtual world (incl. measuring, scratching, etc.) without the risk of a machine crash

- For presentation:
  - Showing (new) SINUMERIK functions live instead of slides, always and everywhere
  - Even before the delivery of an ordered machine, you can program and test components and train employees for the new machine.

Additional components:

- Run MyVirtual Machine /Open

  You need Run MyVirtual Machine /Operate to operate an external software application, for example your own machine room simulation.

- Run MyVirtual Machine /3D

  Run MyVirtual Machine /3D extends Run MyVirtual Machine to include integrated 3D machining and material removal simulation. This enables you to evaluate machine movements visually and to check for freedom from collision. The 3D simulation is also ideal for training setup procedures and running in machines on a virtual model without exposure to any risks whatsoever.
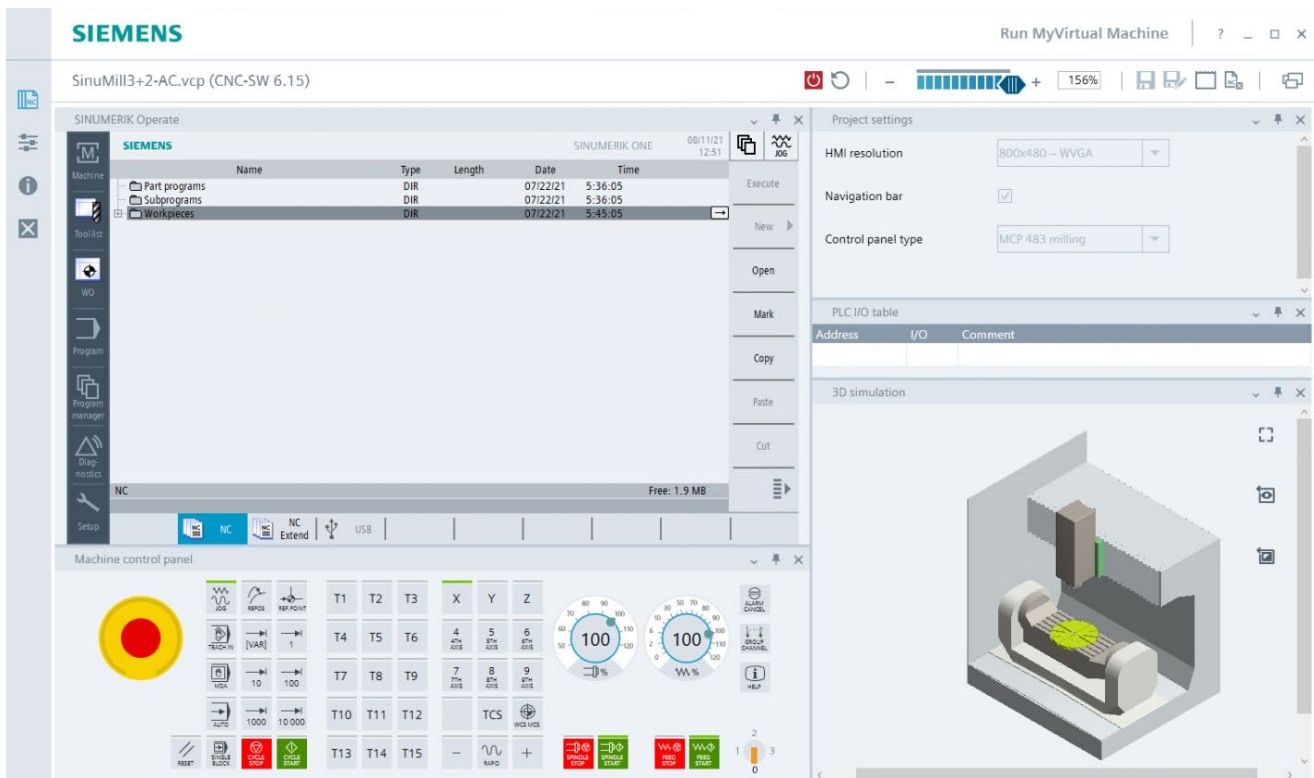
Note

To order Run MyVirtual Machine licenses, contact your regional customer service representative or SIEMENS Industry Software (SISW).

> Contact SISW (https://new.siemens.com/global/en/products/automation/systems/cnc-sinumerik/digitalization/manufacturing.html)
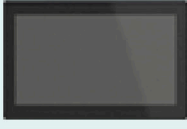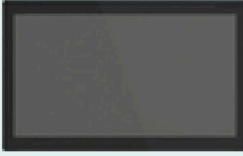
Benefits

- **Run MyVirtual Machine enables the simulation of machining incl. machine and workspace, offline programming and checking of NC programs without a real machine using the digital twin of the SINUMERIK ONE and the machine.**
- **Run MyVirtual Machine is the optimal tool to increase efficiency and process reliability in CNC programming.**

3.3 Innovative hardware

SINUMERIK ONE is available in several control cabinet-based NCU variants as well as in a compact Panel-based PPU variant (Panel Processing Unit). The PPU variant combines the CNC and a 15-inch or 19-inch HMI Panel in one component. This makes SINUMERK ONE suitable for both modular and compact machines.

Modern operation of the machine is easily possible with SINUMERIK ONE: high-resolution multi-touch operator panels offer maximum ease of use. And with the HT 10 hand-held terminal, the machine can be operated consistently in SINUMERIK Operate even on the mobile device.

SINUMERIK blackline plus				
Panel size	15"	19"	22"	24"
Width	398 mm	464 mm	529 mm	585 mm
SIMATIC ITC Industrial Thin Client	X	X	X	(x)*
SIMATIC IFP Industrial Flat Panel (monitor)	X	X	X	X
SIMATIC IPC 477E Industrial PC (Integrated Panel PC)	X	X	X	X
PPU 1740	X	X	--	--
NCU 1740 / 1750 / 1760	X	X	X	X
SINUMERIK MCP 398C + EM				
SINUMERIK ONE MCP	--			
SINUMERIK HT 10				

*) available as a customer-specific version

3.4 Data memory

Internal memory				External storage	
	PPU 1740	NCU 1740 / NCU 1750 / NCU 1760		✔	Execution from external storage devices EES (option P75) Network, USB storage media, compact flashcard
✔	Option P77 + option P12 [1)]	up to 6 GB			
✔	Option P77	100 MB			
✔	CNC user memory (option D00)	10 MB to 28 MB		✔	Execution from the CNC expanded user memory (option P77)
✔	Internal memory can be expanded via option P77 + P12 → 6 GB Internal memory can be expanded via option P77 → 100 MB			✔	External storage can be expanded almost without limit (option P75)

1) Not in combination with SIMATIC IPC for SINUMERIK

CNC operation with SINUMERIK Operate

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4.1   Animated elements

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

To illustrate which parameters affect what in machining operations, SINUMERIK Operate offers a new input support function with animated element sequences. For instance, the difference between chip breakage and chip removal when drilling or the precise probe sequence for a corner measurement can be shown.
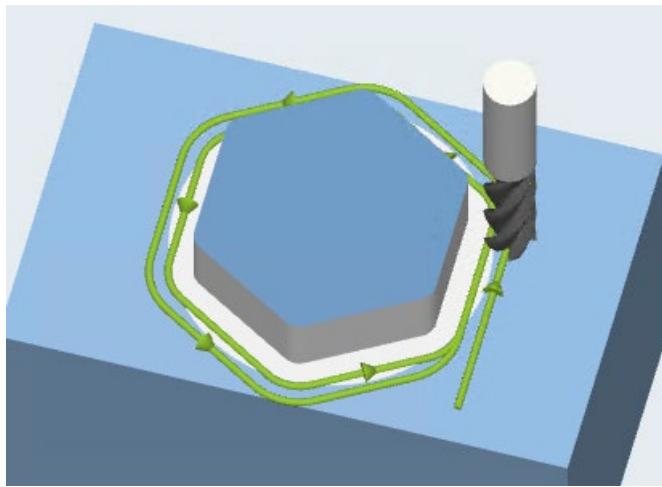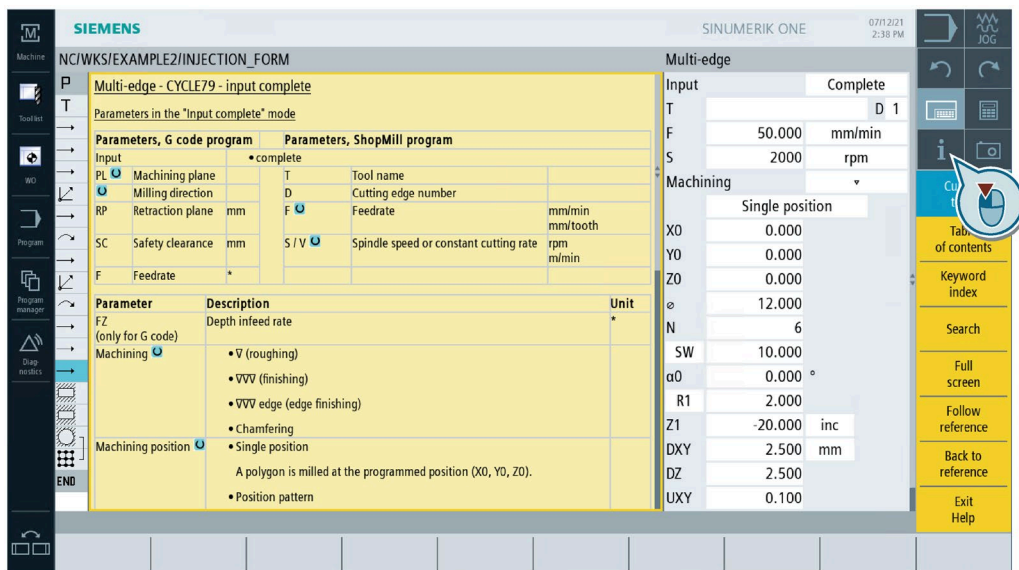

Benefits

- **Process reliability during the setup**
- **Increased reliability during program input by easily understood depiction of selection options**
- **This results in improved efficiency and increased availability of the machine**

4.2 Onboard documentation

✅	SINUMERIK ONE PPU 1740	✅	SINUMERIK ONE NCU 1740	✅	SINUMERIK ONE NCU 1750	✅	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

For each input field in the operating screens, SINUMERIK Operate automatically displays help in the form of a "cursor text". Further information is provided in the form of a complete context-sensitive help system with many useful details and graphics.

Benefits

- **Programming on the machine without a handbook**
- **Help button to toggle between the editor and help screens**

4.3 Multi-touch operation

4.3.1 Multi-touch operation - basic configuration

✅ SINUMERIK ONE PPU 1740	✅ SINUMERIK ONE NCU 1740	✅ SINUMERIK ONE NCU 1750	✅ SINUMERIK ONE NCU 1760
Basic configuration	Basic configuration	Basic configuration	Basic configuration

SINUMERIK Operate is optimized for multi-touch operation. A new easy-to-read font, modern picture elements, and clearly visually distinguishable operating areas support user guidance and convey a positive user experience.

- Intelligent gesture operation with touchpanels, also with work gloves
- Capacitive touch for industrial use
- Palm detection
- Detection of liquids and contaminations
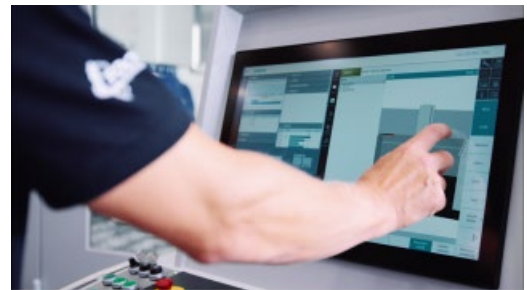
Extract from the multitouch operation gestures:

Tap with two fingers	**Tap and hold**	**Pan**	**Flick with three fingers**	**Spread**
Call the shortcut menu, e.g. copy, paste	Open object to be changed, e.g. NC block	Move graphic contents, e.g. simulation, mold making view	Scroll to the start or end of lists or files	Zoom out graphic contents, e.g. simulation, mold making view

Benefit

- **Modern and efficient gesture operation of SINUMERIK Operate – rugged and reliable, even in harsh industrial environments**

4.3.2 Multi-touch operation with sidescreen

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

With sidescreen you can integrate widgets and pages. The additional windows can be closed and opened and placed either on the left or right side of the screen. The sidescreen can be opened and closed.
You can integrate the following standard widgets and pages:

- NC/PLC variables
- Actual value
- Zero point
- Alarms/messages
- Axis load
- Current tool
- Tool life
- Program runtime
- ABC keyboard as an alternative to the virtual QWERTY keyboard
- Virtual MCP
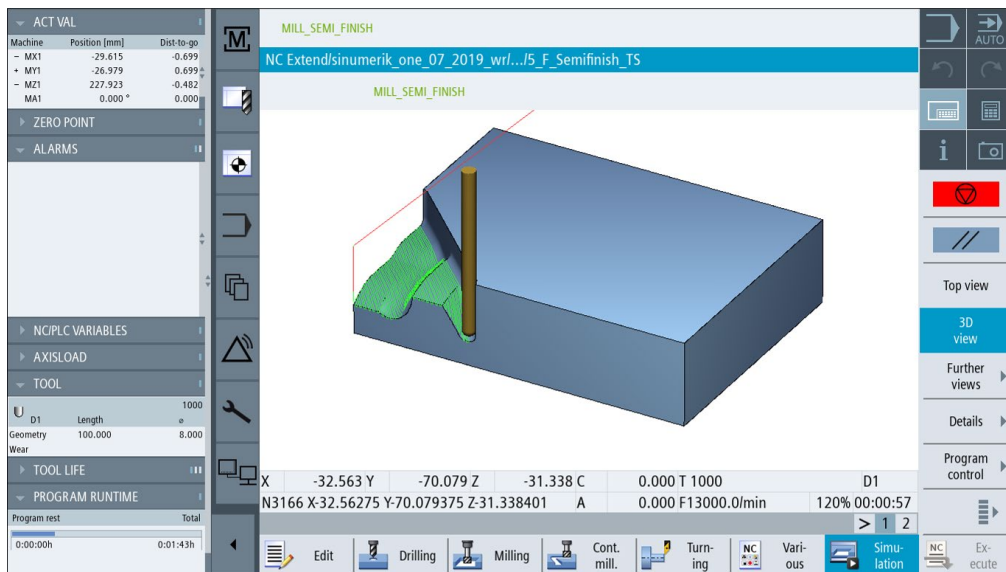
Note

- Available for all SINUMERIK blackline plus Panels from 15" to 24"
- Resolution from 1366x768 - HDREADY up to 22", 1920x1080 - FULLHD from 22" to 24" - "Landscape - horizontal mode"

Benefit

- **All information in view in every operating situation and thus permanent control of the machine status.**

4.3.3 SINUMERIK Operate Display Manager

✅ SINUMERIK ONE PPU 1740		✅ SINUMERIK ONE NCU 1740		✅ SINUMERIK ONE NCU 1750		✅ SINUMERIK ONE NCU 1760	
✔	Option: P81	✔	Option: P81	✔	Option: P81	✔	Option: P81

With the Display Manager, the machine operator has the possibility to individually adapt the user interface to machines and individual requirements.
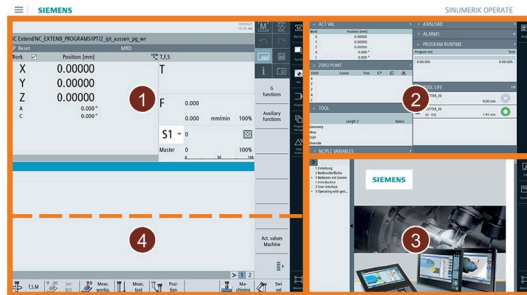
Partitioning of the display area into three or four areas.

Example:

1: SINUMERIK Operate

2: Standard widgets

3: Applications (PDF, keyboard, etc.)

4: Virtual keyboard (optional)

- Direct switching between left and right orientation
- Sidescreen widgets can continue to be used in the Display Manager
- Customized Windows applications
- Machine control panel/virtual keyboard
- Temporarily maximizing the display area

Note

- Available for all SINUMERIK blackline plus Panels from 15" to 24"
- Resolution from 1366x768 - HDREADY up to 22", 1920x1080 - FULLHD from 22" to 24" - "Landscape - horizontal mode"
- For PPU1740 only supported for PPU1740-1900 with 19" FULLHD

Benefit

- **Effective use of large screens with individually configurable contents.**

4.4 Shortcuts

	SINUMERIK ONE PPU 1740		SINUMERIK ONE NCU 1740		SINUMERIK ONE NCU 1750		SINUMERIK ONE NCU 1760
✓	Basic configuration	✓	Basic configuration	✓	Basic configuration	✓	Basic configuration

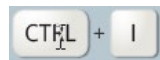Shortcuts are available for many menu operations in SINUMERIK Operate. A small extract follows:

CTRL + A	Select all (editor functionality)
CTRL + C	Copy
CTRL + V	Paste
CTRL + X	Cut
CTRL + I	Calculation of the time from/to line/block
CTRL + L	Language selection
CTRL + M	Maximum simulation speed
CTRL + P	For screenshots (storage location: commissioning (keyword) → System data → HMI data → Logs → Screenshots)

Benefit

- **Shortcuts in SINUMERIK Operate avoid the need for complicated menu operations and provide functions not previously expected from a CNC**

CNC operation in manual mode (JOG)

5.1 TSM universal cycle

✅	SINUMERIK ONE PPU 1740	✅	SINUMERIK ONE NCU 1740	✅	SINUMERIK ONE NCU 1750	✅	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

A universal cycle is available in setup mode for the most commonly used machine functions. These include:

- Tool change, also replacement tools, with direct access via the tool table (T)

- Spindle speed and direction (S)

- M functions (M)

- Activation of work offsets

- Definition of the gearbox stage

- Selection of the machining plane
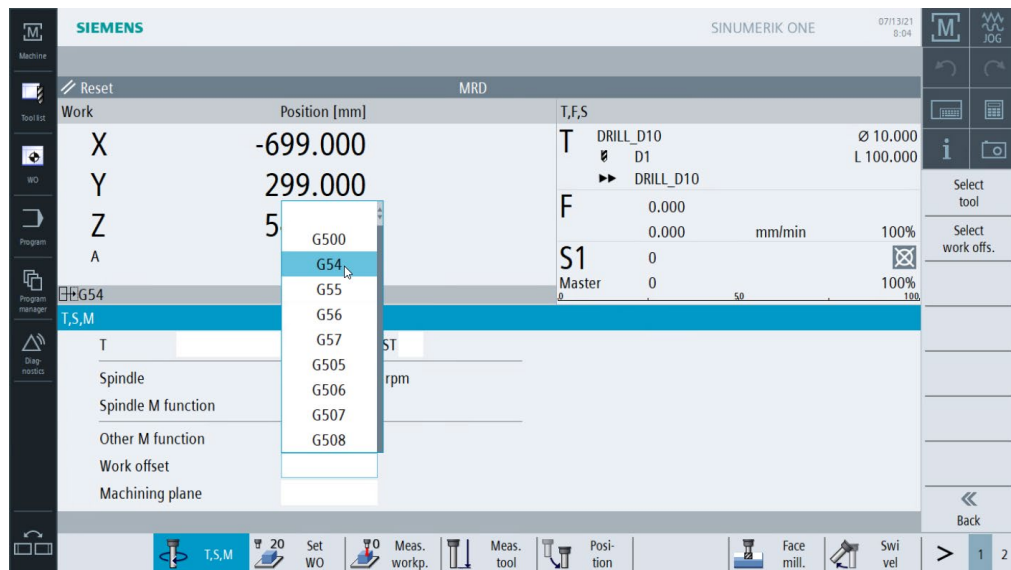
Benefit

- **User-friendly manual input function with dialog prompting**

5.2 Work offsets

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

The following work offsets are possible:

- Settable work offsets:

    It is possible to enter as many as 100 work offsets (G54 to G57, G505 to G599), offset coordinates, angles and

    scaling factors.

- Programmable work offsets:

    The programmable work offsets allow you, for example, to work with different work offsets for repetitive machining operations at different positions on the workpiece.

- External work offsets:

    Axis-related linear work offsets can also be activated via the PLC user software.
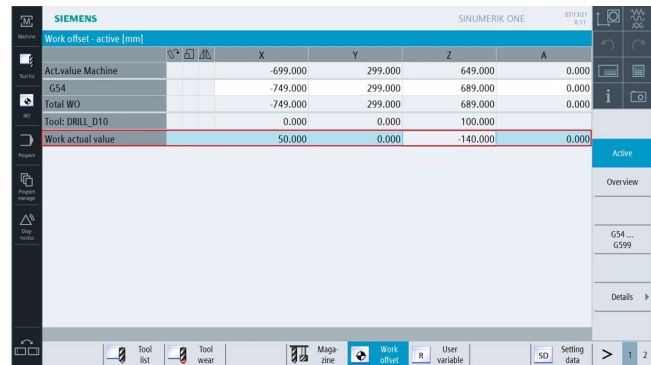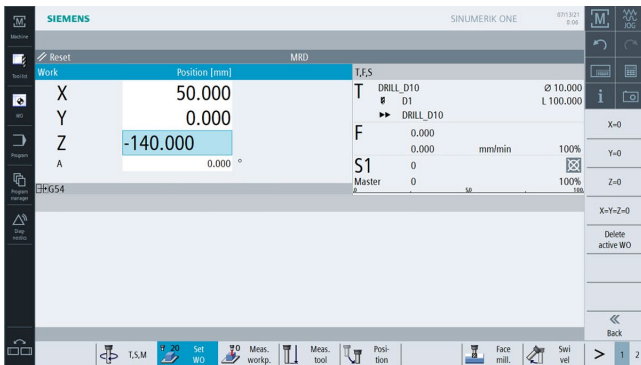
Benefits

- **Flexible machining thanks to a large number of adjustable work offsets**
- **User-conform understandable representation of the number of work offsets**

5.3 Measuring a workpiece

✅	SINUMERIK ONE PPU 1740	✅	SINUMERIK ONE NCU 1740	✅	SINUMERIK ONE NCU 1750	✅	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

The workpieces can be measured as follows:

- Edge finder, dial gauge, reference tool
- 3D switching probe

The following measuring cycles are available:

- Calibrate probe
- Point measurement for edges
- Orienting the edge (angle)
- Inner/outer corner (3 or 4 points)
- Orienting the edge by means of 2 holes/spigots
- Rectangular or circular pockets, rectangular or circular spigots
- Center point of 3 or 4 holes or spigots
- Orienting the plane with three points

The measurement results can be output in a measurement report (see paragraph Logging measurement results in JOG (Page 36)).
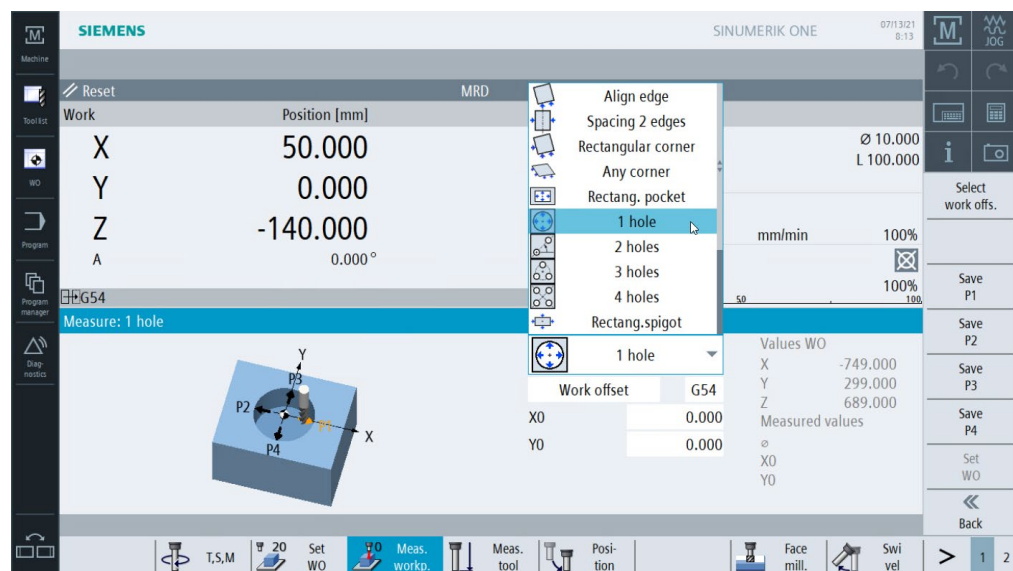
Benefits

- **Time saving due to user-friendly determination of the workpiece's clamping position instead of orienting the workpiece by hand**
- **The measurement results can be output in a measuring log**

5.4 Measuring a tool

☑ **SINUMERIK ONE PPU 1740**	☑ **SINUMERIK ONE NCU 1740**	☑ **SINUMERIK ONE NCU 1750**	☑ **SINUMERIK ONE NCU 1760**
Basic configuration	Basic configuration	Basic configuration	Basic configuration

The tool compensation values can be directly determined in setup mode.

The following variants are supported:

- Manual or switching probe

- Scratching with tool at known workpiece geometry

The measurement results can be output in a measurement report (see paragraph Logging measurement results in JOG (Page 36)).
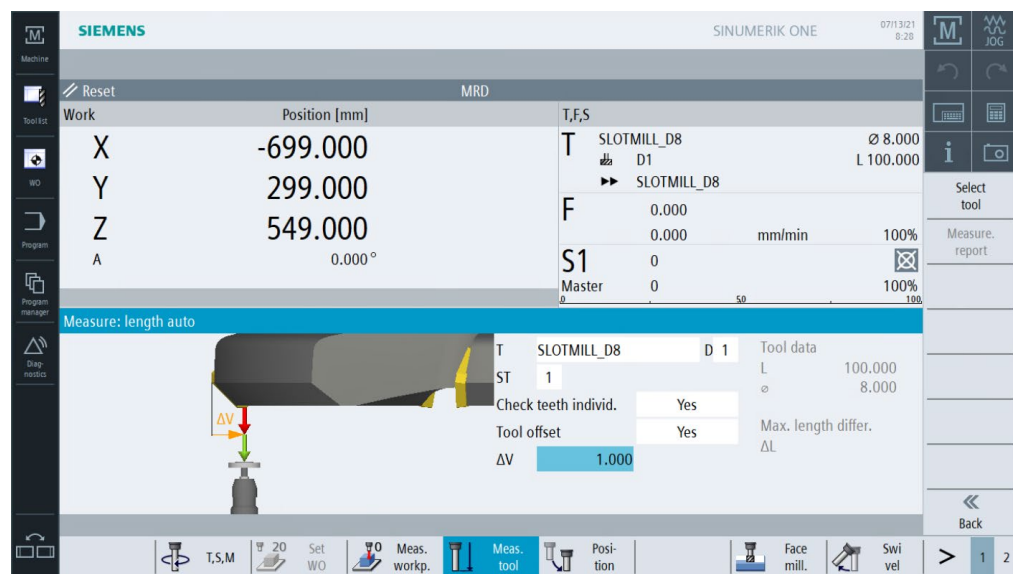
Benefit

- **User-friendly functions for determining the tool dimensions directly in the machine**

5.5 Logging measurement results in JOG

	SINUMERIK ONE PPU 1740		SINUMERIK ONE NCU 1740		SINUMERIK ONE NCU 1750		SINUMERIK ONE NCU 1760
☑		☑		☑		☑	
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

The results for measuring in JOG can be logged. The standard log contains the measurement results of the most recently performed measuring method.

The function is available as milling technology for the workpiece and tool measurement.

Text format or table format can be selected for the output format

The measuring log comprises the following data:

- Date and time when the log was written

- Log name with path details

- Measuring method

- Correction target

- Setpoints, measured values and differences
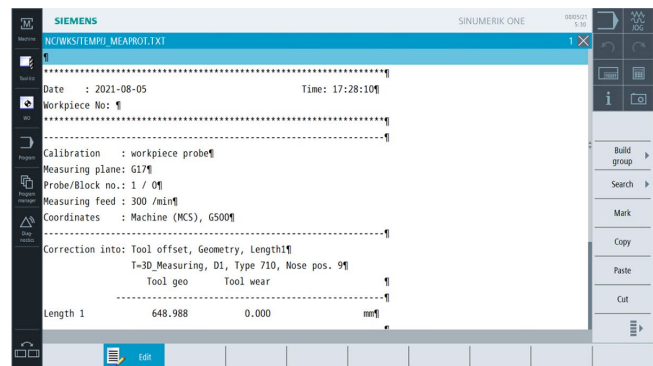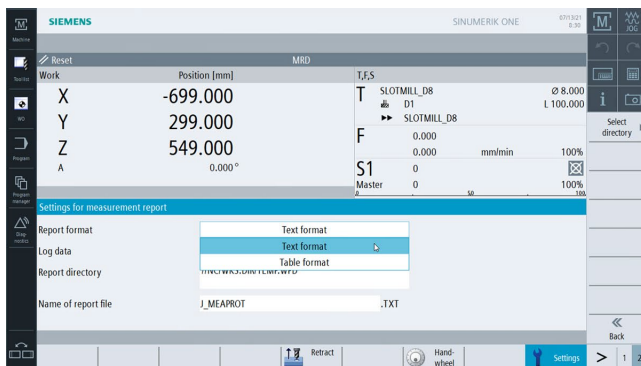
Benefit

- **Simple logging of measured values in log files**

5.6 Face milling cycle

	SINUMERIK ONE PPU 1740		SINUMERIK ONE NCU 1740		SINUMERIK ONE NCU 1750		SINUMERIK ONE NCU 1760
✅		✅		✅		✅	
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

A face milling cycle for preparation of the blank for machining is available directly in setup mode. You can select the tool directly from the list. Input the feedrate and the spindle speed / cutting speed.

You can specify the following parameters:

- Machining strategy and direction
- Machining limitations

The input values are retained even after switching off and on again, so that users can always restart their face milling operation with minimum effort.
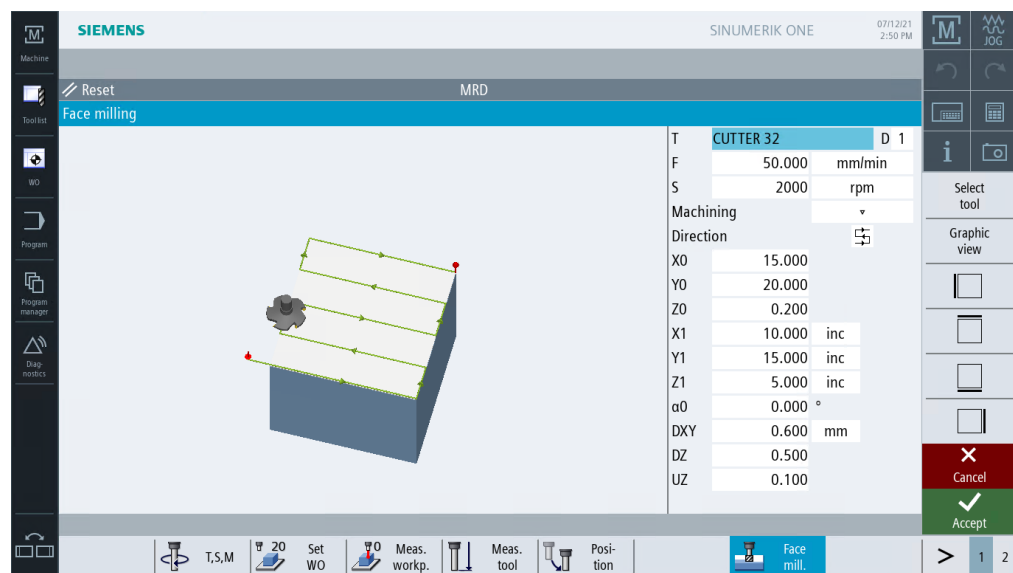
Benefit

- **Preparation of workpiece without having to create a part program**

5.7 Retract

✓	SINUMERIK ONE PPU 1740	✓	SINUMERIK ONE NCU 1740	✓	SINUMERIK ONE NCU 1750	✓	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

The Retract function supports the manual retraction of the tool after an interruption. In the JOG mode, after the interruption, the tool can be retracted from the workpiece in the tool direction.

Typical applications include machining while deploying the CYCLE800 swivel cycle, 5-axis machining with TRAORI as well as tapping without compensating chuck.
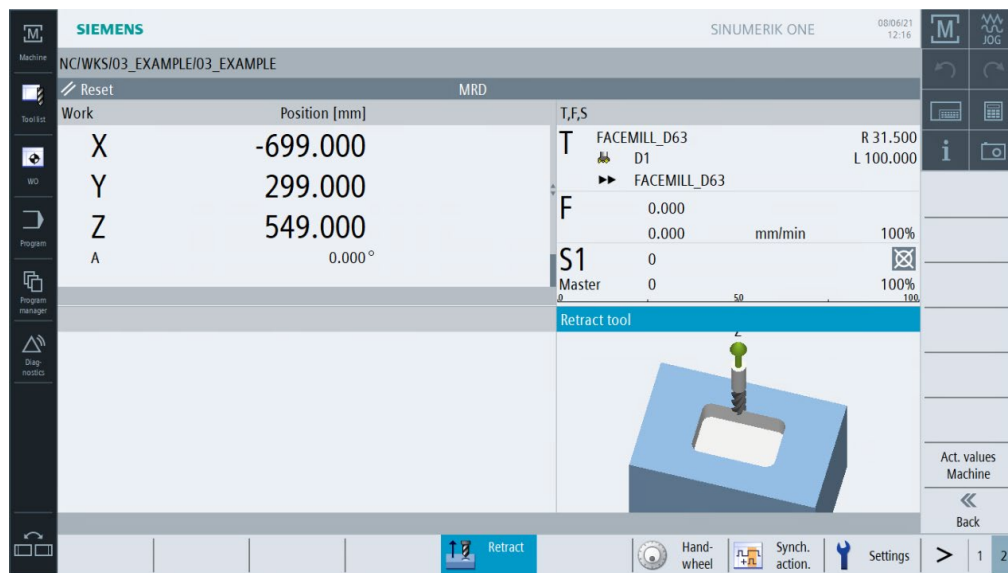
Benefit

- **Machining can be continued at the point of interruption**

5.8 Swiveling in setup mode

✅	SINUMERIK ONE PPU 1740	✅	SINUMERIK ONE NCU 1740	✅	SINUMERIK ONE NCU 1750	✅	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

You can swivel the machining plane to any angle in setup mode:

- Machining inclined surfaces

- Measure with inclined tool or table

The plane can be swiveled directly including rotation of coordinates or axial swiveling. Using the initial setting softkey, you can traverse the rotary axes of the swivel data set to the initial position. Here, you can select between with and without retraction.
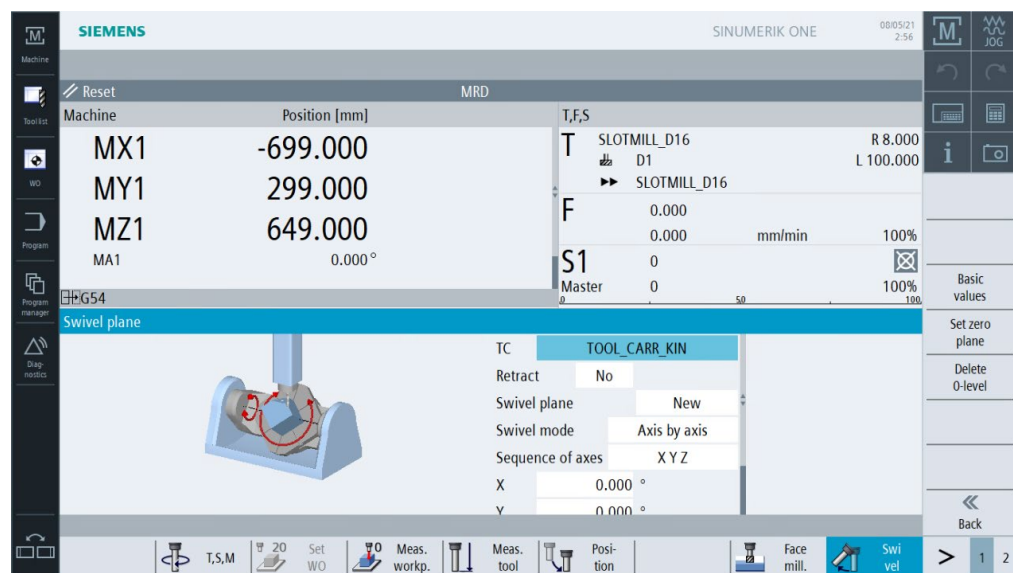
Benefits

- **Swivel the machining plane in setup mode by dialog**
- **Simple setup of the workpiece for machining with swivel axes**

5.9 Manual machine

✓	SINUMERIK ONE PPU 1740	✓	SINUMERIK ONE NCU 1740	✓	SINUMERIK ONE NCU 1750	✓	SINUMERIK ONE NCU 1760
⚙	Option: P17	⚙	Option: P17	⚙	Option: P17	⚙	Option: P17

The Manual machine function is part of the ShopMill/ShopTurn option package. This allows you to perform all important machining operations in the manual machine operating area without needing to create a specific part program.

The following functions are available:

- Measuring a tool
- Traversing axes
- Setting the work offset
- Turning a straight line / circle
- Drilling, including centering, deep-hole drilling, tapping
- Milling, including face milling, pocket, multiple edge spigot
- Milling contours
- Turning
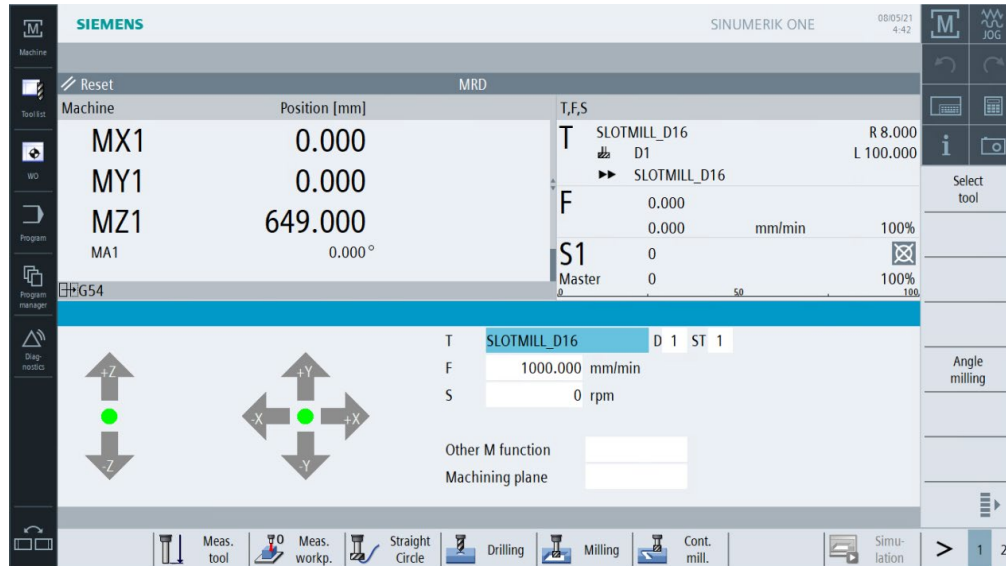
Benefit

- **Simple and intuitive operation of cycle-controlled milling machines**

Tool management 6

6.1 Tool table

✅	SINUMERIK ONE PPU 1740	✅	SINUMERIK ONE NCU 1740	✅	SINUMERIK ONE NCU 1750	✅	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

Tools with their complete operating data can be managed in the tool list.

- Tools are assigned to the desired magazine locations with the load function.
- For each tool, you can store the following data:
  – Tool type: e.g. face milling cutter, taps and 3D probes
  – Clear tool name in plain text, example: CUTTER_HEAD_63MM
  – Max. of 9 cutting edges per tool
  – Tool length and diameter
  – Nose angle for drills or number of teeth for milling tools
  – Spindle direction and coolant (level 1 and 2) and up to four additional functions
- Direct transfer of the tool from the list in the program or for measurement
- You can select multiple tools and load, unload or delete them
- Using the settings, for example, you can activate the graphic magazine display
- Reading tools from a file or archiving to a file
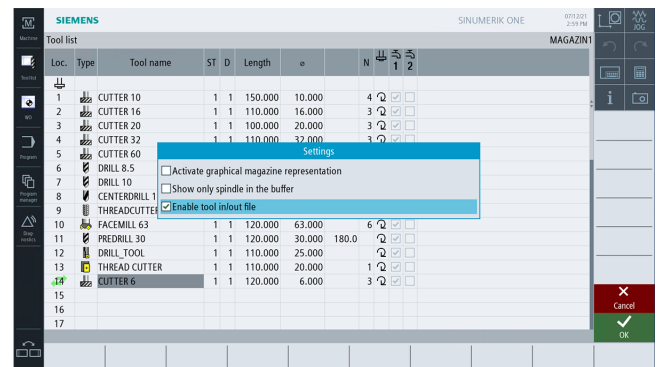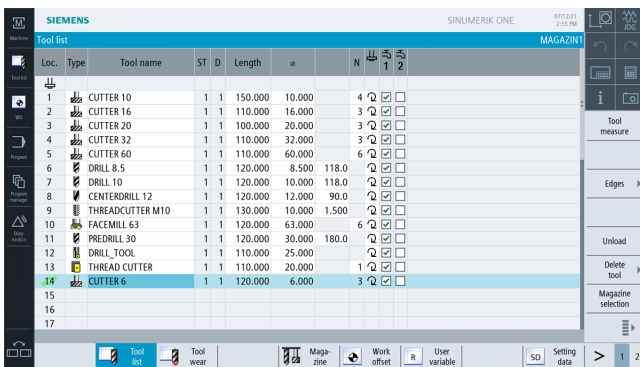
Benefits

- **All tool data at a glance**
- **Simple and secure handling via unmistakable tool names**

6.2 Monitoring of tool life and workpiece count

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

You can use SINUMERIK Operate to monitor the service life of your tools and the number of exchanges. You can give your tools meaningful names instead of cryptic numbers. You will come to appreciate this convenience when you read the CNC program, if not before.

- Monitor cutting time (T) in minutes or number of exchanges (C)

- Prewarning limit for timely preparation of new tools

- Provided the desired tool is not in the magazine, SINUMERIK Operate will request a manual tool change.

Benefits

- **Reduction of machine standstill times via tool monitoring**
- **Support of tool life monitoring or job time monitoring as standard**

6.3 Replacement tools

✅	SINUMERIK ONE PPU 1740	✅	SINUMERIK ONE NCU 1740	✅	SINUMERIK ONE NCU 1750	✅	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

If needed, you can also manage replacement tools with SINUMERIK Operate. Tools with the same name are created as replacement tools. Replacement tools are identified with an increasing number in the ST column.

Benefit

- **Automatic exchange of identical tools for unmanned operation**

6.4 Angle head adapter

| ☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
⚙	Option: M56	⚙	Option: M56	⚙	Option: M56	⚙	Option: M56

With the "Angle head adapter" function, you can describe the angle head and the tool separately and then "marry" them. This also allows any tool type to be used in an angle head.

You can specify the necessary geometric sizes of the angle head in the SINUMERIK Operate user interface and assemble the tool and adapter.

The angle head adapter can be used for all technological functions of SINUMERIK Operate and for the cycles.

Note

Only the tool types < 400 and >= 600 are possible, i.e. no turning or grinding tools.
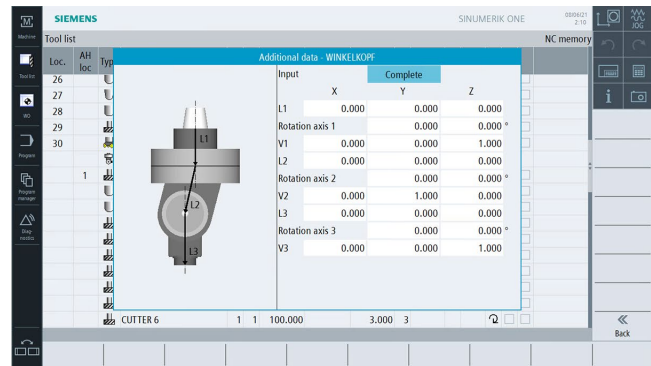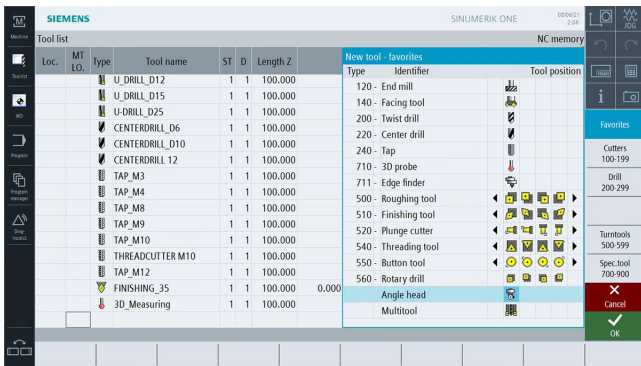
Benefit

- **Simple, intuitive input of data and assembly of tool and adapter.**

Data management

7

7.1 Program manager

	SINUMERIK ONE PPU 1740		SINUMERIK ONE NCU 1740		SINUMERIK ONE NCU 1750		SINUMERIK ONE NCU 1760
✅		✅		✅		✅	
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

The program manager provides an optimum overview of the directories and programs, and very easy-to-use file handling similar to Windows Explorer.

- Plain names with as many as 24 characters for directories and files

- Management of subdirectories on external storage media, local drives, and on the NC

- Store and display files of any type (e.g. *.png, *.pdf, *.dxf, *.xml)

- Manage and open DXF files

- Display all storage media in the program manager (with details of the storage capacity), including the network drives

- Edit part programs on all media
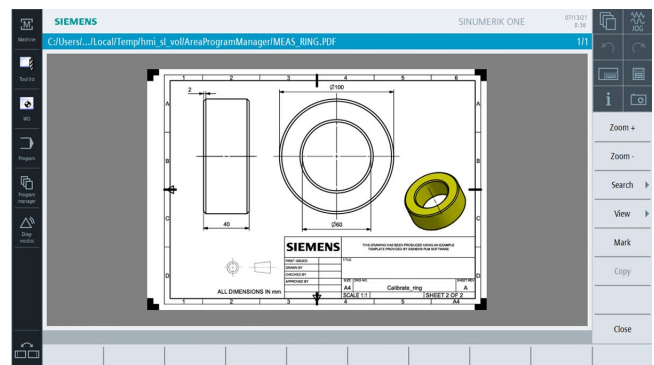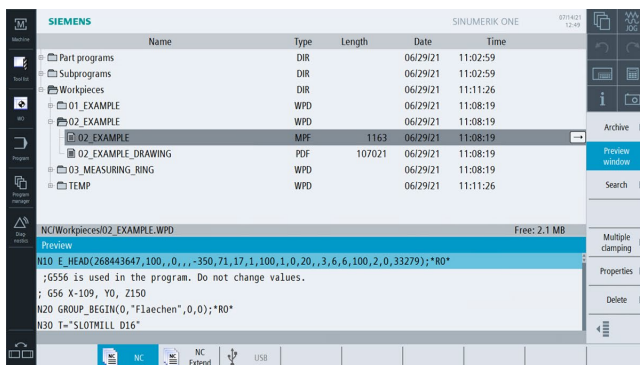
Benefits

✅

- **Easy and open exchange of data between the various storage media and the network**
- **User-friendly data handling in typical PC style with copy, paste, rename, etc.**
- **The preview window allows quick identification of programs without having to open them**

7.2 Ethernet networking

✅ SINUMERIK ONE PPU 1740	✅ SINUMERIK ONE NCU 1740	✅ SINUMERIK ONE NCU 1750	✅ SINUMERIK ONE NCU 1760
Basic configuration	Basic configuration	Basic configuration	Basic configuration

The SINUMERIK ONE is set up for Ethernet (TCP/IP) networking (RJ45 connection).

- The data transfer rate is 10/100/1000 Mbit/s.

- Remote access to the control via the RCS Commander, e.g. for commissioning and remote diagnostics

- Access to the network drives is available directly from the program manager. No additional software is required on the server.

Benefits

- **Easy and economical connection via Ethernet (TCP/IP) to Windows PCs**
- **No software needs to be installed on the servers**

CNC operation in automatic mode (AUTO) 8

8.1 Block search

	SINUMERIK ONE PPU 1740		SINUMERIK ONE NCU 1740		SINUMERIK ONE NCU 1750		SINUMERIK ONE NCU 1760
✅	Basic configuration	✅	Basic configuration	✅	Basic configuration	✅	Basic configuration

A block search may be executed in the Reset machine status, e.g. after a program interruption or to specifically return to machining. The program data is prepared in such a way that all relevant parameters (tool, work offsets, M functions, etc.) are available when accessing the program.

The following search variants are available:

- Specifically to the point of interruption, also possible after "Power Off"
- To any CNC blocks in DIN/ISO programs
- To any subprogram levels in DIN/ISO programs
- In ShopMill machining step programs
- In position patterns for machining step programming
- Block search for drill patterns in programGUIDE
- Accelerated block search in large mold-making programs

You can individually configure the block search:

- With calculation/without calculation
- With approach/without approach

Benefits

✅

- **Time-saving and secure restart at any program point, as no editing of the part program is required**
- **An extremely quick block search is also available for large part programs through the "External block search without calculation" function; overstore, if necessary**

8.2 Program control

✓	SINUMERIK ONE PPU 1740	✓	SINUMERIK ONE NCU 1740	✓	SINUMERIK ONE NCU 1750	✓	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

You can influence the program sequence in the AUTO and MDI modes. The following options are available to do this:

- PRT – no axis motion

  The program is completely executed with the axes stationary, e.g. for the program test.

- DRY – dry run feedrate

  The traversing velocities programmed in conjunction with G1, G2, G3, CIP and CT are replaced by a defined dry run feedrate.

- RG0 – reduced rapid traverse

  You define the reduced rapid traverse in the settings for automatic operation.

- M01 – programmed stop 1

  The processing of the program stops at every block in which supplementary function M01 is programmed. In this way you can check the intermediate result when machining a workpiece.

- DRF – handwheel offset

  This selection allows you to enter an additional incremental work offset while processing in automatic mode with an electronic handwheel.

- SKP

  Skip blocks are skipped during machining.

- MRD

  The display of the measurement result can be enabled or disabled during program execution.

- CST - Configured stop

  Option: see the following description

Configured stop (CST)

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
✔	Option: S24	✔	Option: S24	✔	Option: S24	✔	Option: S24

The Configured stop option offers, beyond the basic scope of program control, the following possibilities:

- Additional single block type with stop and NC start only at specific and/or definable "types" of block ends.

  Freely configurable stop condition such as G1 - G0 transition, subprograms.

- The message can be configured language-independently for the type of "Configured stop".
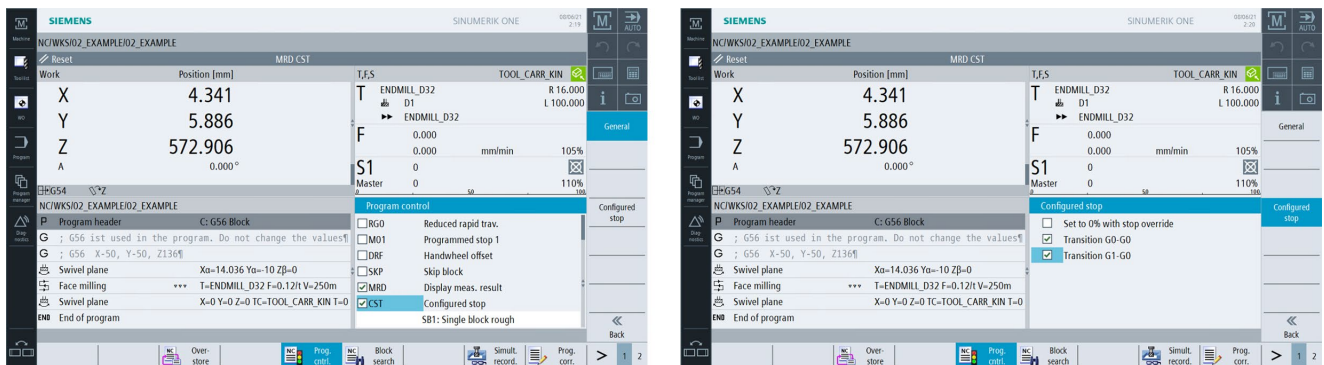
Benefits

- **Secure positioning of new part programs**
- **Continue machining quickly after interruptions**

8.3 Execution from external storage

✓	SINUMERIK ONE PPU 1740	✓	SINUMERIK ONE NCU 1740	✓	SINUMERIK ONE NCU 1750	✓	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

You can select, edit and execute part programs directly on the CF card, USB stick, hard disk or via the network.

Execution from external storage EES

✓	SINUMERIK ONE PPU 1740	✓	SINUMERIK ONE NCU 1740	✓	SINUMERIK ONE NCU 1750	✓	SINUMERIK ONE NCU 1760
✔	Option: P75	✔	Option: P75	✔	Option: P75	✔	Option: P75

The "Execution from external storage (EES)" option provides the following advantages over the basic configuration:

- Uniform syntax for the subprogram call, independent of the storage location of the subprogram. This reduces syntax errors for the subprogram call.

- Part programs can be edited without NC reset.

- The size of the memory available on the machine can be expanded economically with external media. The size of the part programs is limited only by the capacity of the external data storage.

Benefit

- **Quick and easy access to part programs on external storage media - and thus quasi infinite storage space and relief of the internal memory of the SINUMERIK controller**

8.4 Basic block display

☑	**SINUMERIK ONE PPU 1740**	☑	**SINUMERIK ONE NCU 1740**	☑	**SINUMERIK ONE NCU 1750**	☑	**SINUMERIK ONE NCU 1760**
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

The individual traversing blocks are displayed as DIN/ISO commands during execution of machining steps or machining cycles.

The basic block display guarantees an especially high process security while running-in programs in single block mode.

This function is available to you for ShopMill as well as for programGUIDE (figure below).

Benefit

- **Optimal control of the program execution, even in complex sequences or machining cycles, especially in single block mode**

8.5 Simultaneous recording

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
✔	Option: P22	✔	Option: P22	✔	Option: P22	✔	Option: P22

While machining the workpiece the tool paths can be recorded on the screen of the control in the plan view, 3-side view or in 3D view. Workpiece depiction and views correspond to the graphic simulation.
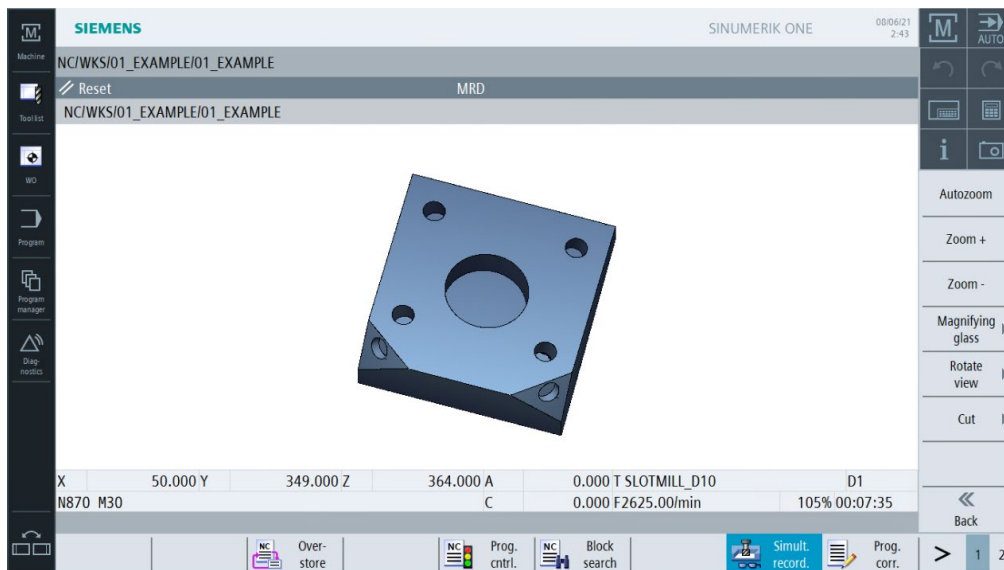
Note: For the topic "Simultaneous recording with a machine model", see section Protect MyMachine /3D Primitives (Page 136).

Benefit

- **Machining can be monitored directly, especially when direct control of the machine room is not possible due to coolants, etc.**

8.6 Identifying tool demand

✅	**SINUMERIK ONE PPU 1740**	✅	**SINUMERIK ONE NCU 1740**	✅	**SINUMERIK ONE NCU 1750**	✅	**SINUMERIK ONE NCU 1760**
✔	Option: M77	✔	Option: M77	✔	Option: M77	✔	Option: M77

When executing and simulating part programs, all required tools are optionally written as well. If you then use the part program again, SINUMERIK Operate can check whether all of the required tools are available. This creates a list of all tools with the following identifiers:

- Tool unknown
- Tool known but not loaded
- Tool known and loaded
- Tool is not used and can be unloaded.

You can load and unload tools directly in the list. In addition, you can create new tools based on the recorded data.

Benefit

- **Quick and simple check whether all machine tools are loaded before starting the program - prevents downtimes during machining**

8.7 Logging measurement results in automatic mode

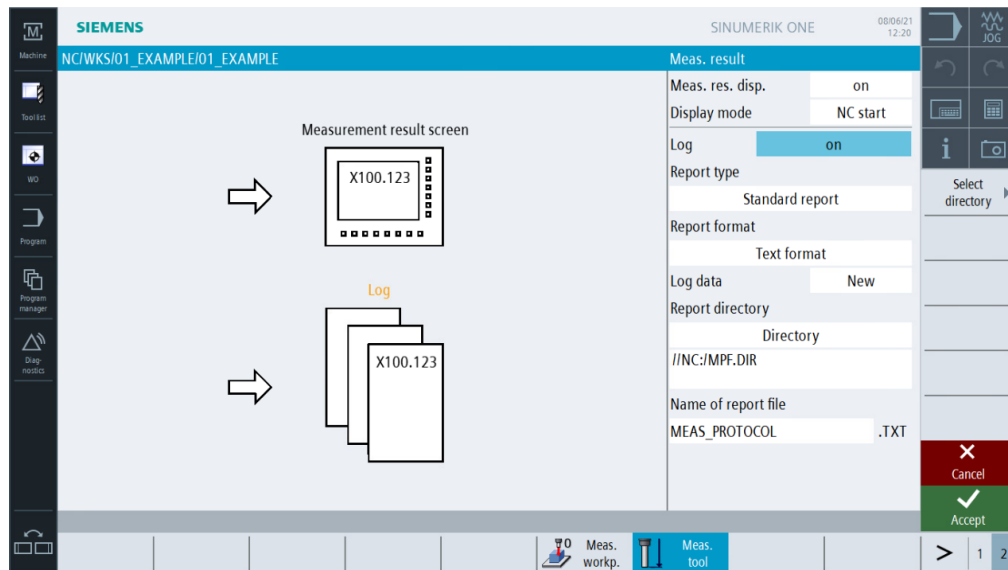| ☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

In automatic operation, you can output the measurement results as measuring log. You can configure the output. The following settings are some of those possible:

- Display mode: autom. 8 s, NC start, for alarm
- Log type: standard log, user log
- Log format: text format (*.txt), table format (*.csv)
- Log data: new (discard old log data), append (append to old log data)
- Log storage: storage directory (complete path)

You can then open the measuring log in the program management at the configured storage path. The measuring log contains data that includes:

- Date and time when the log was written
- Measuring method
- Correction target
- Setpoints, measured values and differences

Note: Irrespective of the user interface language, the measuring logs are output in English.
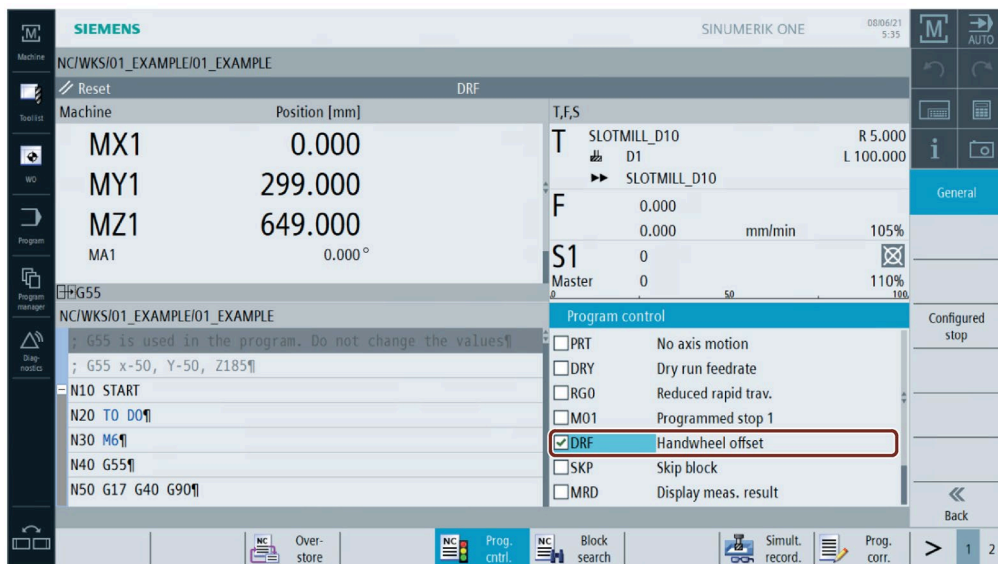

Benefit

- **Simple logging of measured values in log files**

8.8 Handwheel override

✅	SINUMERIK ONE PPU 1740	✅	SINUMERIK ONE NCU 1740	✅	SINUMERIK ONE NCU 1750	✅	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

In the AUTOMATIC mode, while executing a program, small corrections and override feed of the tool in the tool direction are possible using a handwheel. When the orientation of the tool changes, the handwheel override that has been accumulated is also rotated. The manual correction acts in the form of override to the traversing motion from the NC program.

Benefit

- **Small corrections and feeds of the tool in the tool direction are possible using a handwheel.**

CNC functionalities

<div style="text-align: right; font-size: 2em;">9</div>

9.1 80-bit NANO floating-point accuracy

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

The accuracy of the workpiece is determined by more factors than just the mechanical characteristics of the machine. The CNC also contributes to a critical degree towards the precision of the workpieces. SINUMERIK Operate offers many CNC functions for this purpose.

The SINUMERIK controls and the SINAMICS drive calculate with 80-bit NANO floating-point accuracy. This enables a calculation accuracy much less than a nanometer. This exactness is available not only for closed loop position control but also for closed-loop power and speed control and also for sensor evaluation of the drive.
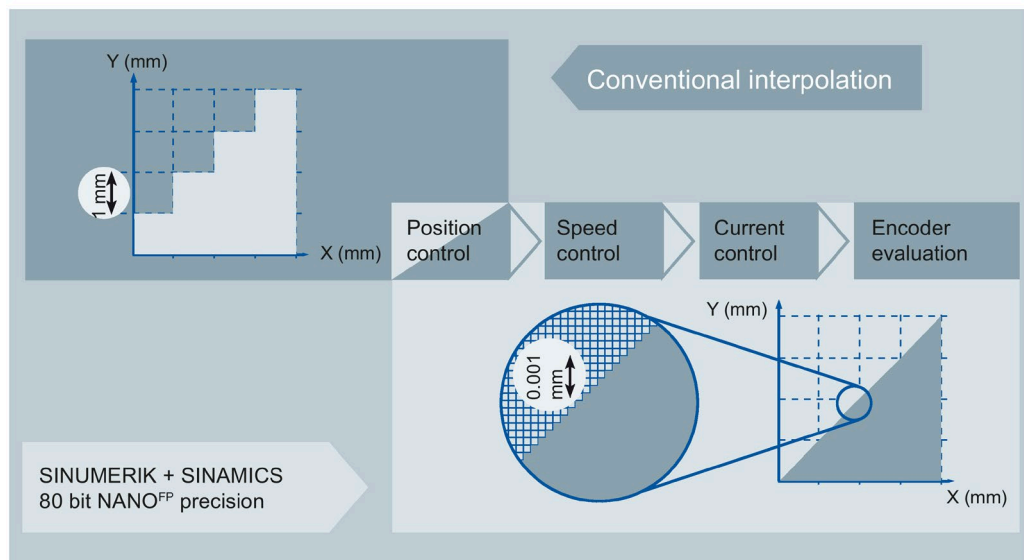
Benefit

- **Maximum precision in the workpiece results due to extremely high calculation accuracy**

9.2   Block change times

	SINUMERIK ONE PPU 1740		SINUMERIK ONE NCU 1740		SINUMERIK ONE NCU 1750		SINUMERIK ONE NCU 1760
☑	Basic configuration	☑	Basic configuration	☑	Basic configuration	☑	Basic configuration

In the following table you can see typical block cycle times (block processing times) as a function of the PPU/NCU being used:

PPU 1740	NCU 1750	NCU 1760
0.7 ms	0.3 ms	0.2 ms

Requirement: use of the compressor

Benefit

☑

- **Minimum block cycle times for the respective performance versions**

9.3 Jerk limitation

✅ SINUMERIK ONE PPU 1740	✅ SINUMERIK ONE NCU 1740	✅ SINUMERIK ONE NCU 1750	✅ SINUMERIK ONE NCU 1760
Basic configuration	Basic configuration	Basic configuration	Basic configuration

The control calculates a steady acceleration profile instead of jumps in acceleration. This enables jerk-free speed characteristics for the involved path axes. The jerk limitation can also be directly activated in the part program with the »SOFT« NC language command.
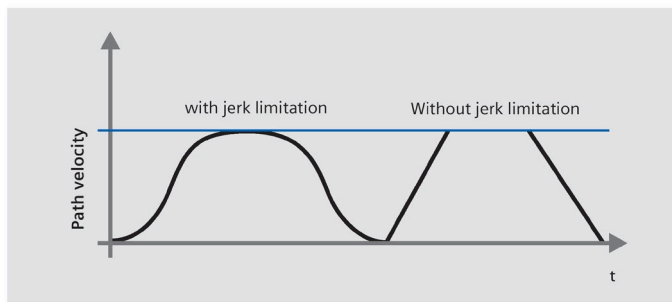
Benefits

✅

- **Longer machine lifespan through protection of the mechanical components**
- **Higher path accuracy through softer acceleration**

9.4 Dynamic feedforward control

✓	SINUMERIK ONE PPU 1740	✓	SINUMERIK ONE NCU 1740	✓	SINUMERIK ONE NCU 1750	✓	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

Inaccuracies in the resulting workpiece contour due to following errors can practically be eliminated using dynamic feedforward control FFWON. The result is excellent machining precision even at high path speeds. This is clarified with a circularity test on the machine.

Example:
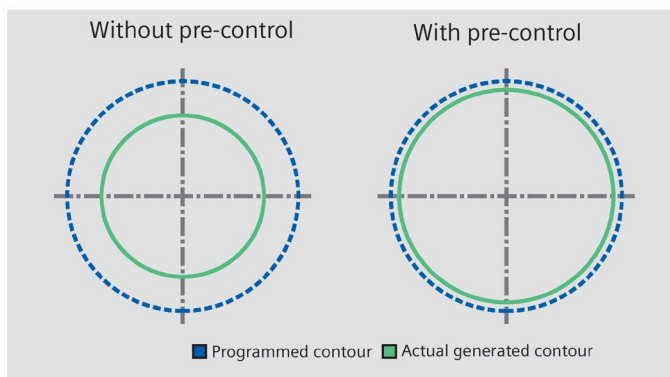
Benefit

- **Higher path accuracy through compensation of contouring errors**

9.5 Friction compensation

✅ SINUMERIK ONE PPU 1740	✅ SINUMERIK ONE NCU 1740	✅ SINUMERIK ONE NCU 1750	✅ SINUMERIK ONE NCU 1760
⚙ Option: S06	⚙ Option: S06	⚙ Option: S06	⚙ Option: S06

The friction compensation (quadrant error compensation) leads to a significant improvement in contour accuracy, especially in circular contour machining operations.

At the quadrant transitions, one axis traverses at maximum path velocity while the second axis is stationary. The different friction conditions can therefore result in contour violations.

Friction compensation reliably compensates for this behavior and produces excellent results, without contour errors, in the very first machining operation.

The intensity of the compensation pulse is set according to the characteristic as a function of the acceleration. This characteristic is determined and parameterized during commissioning with the aid of the circularity test.
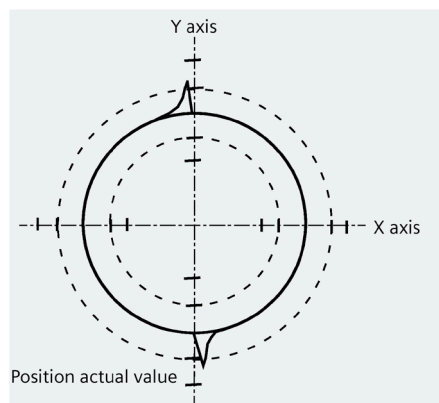
Quadrant transitions without compensation
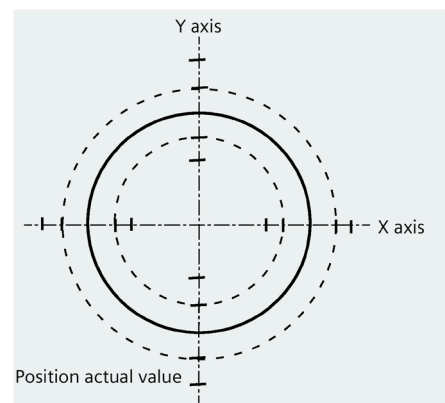
Quadrant transitions with quadrant error compensation

Benefit

- **Considerably higher contour accuracy**

9.6 Nodding compensation

Nodding compensation counteracts dynamic position deviations along linear machine axes that occur due to acceleration processes along this or another linear machine axis.

The position deviation results from the mechanical compliance within the machine.

Nodding compensation ECO

☑ SINUMERIK ONE PPU 1740	☑ SINUMERIK ONE NCU 1740	☑ SINUMERIK ONE NCU 1750	☑ SINUMERIK ONE NCU 1760
Option: S20	Option: S20	Option: S20	Option: S20
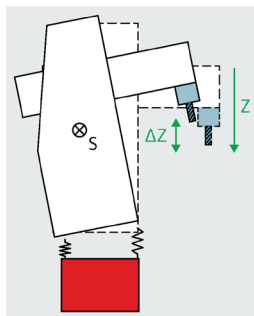
Nodding compensation ECO counteracts the relevant position deviation with correction movements along a machine axis, e.g. compensation of ΔZ.

Nodding compensation ADVANCED

☑ SINUMERIK ONE PPU 1740	☑ SINUMERIK ONE NCU 1740	☑ SINUMERIK ONE NCU 1750	☑ SINUMERIK ONE NCU 1760
⚙ Option: S21	⚙ Option: S21	⚙ Option: S21	⚙ Option: S21
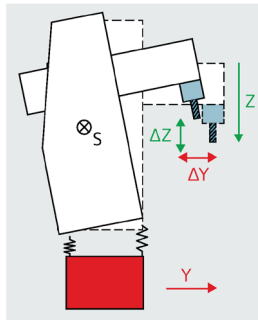
Nodding compensation ADVANCED counteracts multiple deviations with correction movements along multiple machines axes, e.g. compensation of ΔY and ΔZ.

Benefits

- **Improved machining quality with simultaneously increased jerk and acceleration values**
- **Increased productivity can be achieved without costly mechanical reinforcement of the machine**
- **Saves costs because often more cost-effective than mechanical measures to increase stiffness**
- **Can be used, for milling, multitasking, tapping, and laser and water jet machining, for example**

9.7 Intelligent Load Control (ILC)

✅	**SINUMERIK ONE PPU 1740**	✅	**SINUMERIK ONE NCU 1740**	✅	**SINUMERIK ONE NCU 1750**	✅	**SINUMERIK ONE NCU 1760**
🔧	Option: S11	🔧	Option: S11	🔧	Option: S11	🔧	Option: S11

The "Intelligent load adjustment" function is used to optimize the following characteristics of a machine tool by adapting dynamic response and control parameters:

- Shorter machining times

- Increased dynamic response

- Greater accuracy

- Higher accuracy

The clamping and the weight of the workpiece influence the dynamic response of the machine due to their moment of inertia. During axis movements, inaccuracies in workpiece machining can arise. Using cycle CYCLE782, you can automatically adapt the controller settings of the drive or the dynamic response parameters of the axes to a specific situation. The following axes are supported:

- Rotary table for holding a workpiece

- Linear axes

- Spindles

- Other rotary axis (e.g. A axis for the rocker)

Benefits

- **You achieve faster and more accurate machining on the workpiece.**

9.8 Involute interpolation

☑ **SINUMERIK ONE PPU 1740**	☑ **SINUMERIK ONE NCU 1740**	☑ **SINUMERIK ONE NCU 1750**	☑ **SINUMERIK ONE NCU 1760**
✔ Option: M21	✔ Option: M21	✔ Option: M21	✔ Option: M21

Using involute interpolation, you can program a spiral contour in the shape of a circular involute in one CNC block.

The exact mathematical description of the contour enables a higher path velocity to be achieved, together with a shorter machining time. Undesirable facets, which could result from coarse polygon functions, are thus avoided.

Furthermore, with involute interpolation, the end point need not lie exactly on the involute defined by the starting point. You can enter a maximum permissible deviation via machine data.
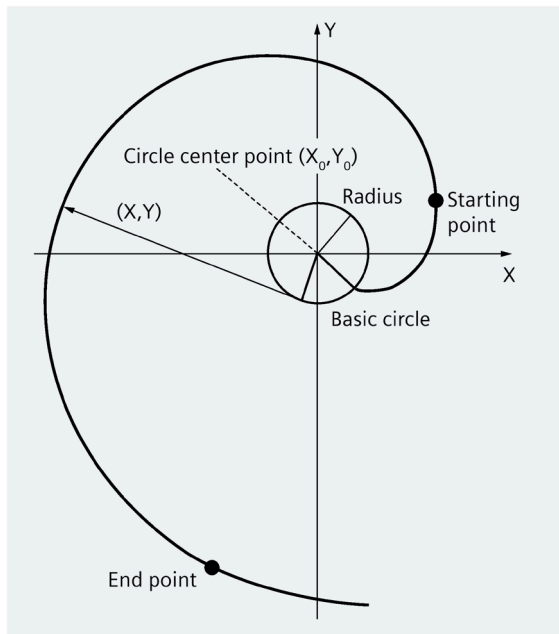
Benefit

- **Simple programming of complex spiral movements or contours.**

9.9 Measurement level 2

✅ **SINUMERIK ONE PPU 1740**	✅ **SINUMERIK ONE NCU 1740**	✅ **SINUMERIK ONE NCU 1750**	✅ **SINUMERIK ONE NCU 1760**
Option: M32	Option: M32	Option: M32	Option: M32

With axis-specific measuring, activation of the measuring process can take place in the part program or in synchronous actions. If two measuring systems are available for the axis, you can use both for the measurement.

The following measuring methods are available:

- Measuring with delete distance-to-go (MEASA) and measuring without delete distance-to-go (MEAWA)

  With MEASA or MEAWA for the programmed axis, up to four measured values are acquired for each measurement and are then saved in system variables in accordance with the trigger event.

- Continuous measurement without delete distance-to-go (MEAC)

  With continuous measurement with MEAC, the measurement results are stored in FIFO variables.

The measurement results can be logged in a file. You can structure the log as required.

Benefits

- **Influencing the process during machining**
- **Ensuring machining precision**
- **Logging of the measurement results**

9.10 Synchronized actions stage 2

✅ **SINUMERIK ONE PPU 1740**	✅ **SINUMERIK ONE NCU 1740**	✅ **SINUMERIK ONE NCU 1750**	✅ **SINUMERIK ONE NCU 1760**
✔ Option: M36	✔ Option: M36	✔ Option: M36	✔ Option: M36

More than 24 synchronized actions can be active in the CNC block. As many as 255 parallel actions can be programmed in each channel. Using the Synchronized actions stage 2 option, you can group technology cycles together as programs. Thus it is possible, for example, to start axis programs in the same IPO cycle by scanning digital inputs.

Benefits

- **Transfer of auxiliary functions M and H to the PLC user software and machine responses derived from this**
- **Fast, axis-specific deletion of the distance-to-go in response to input signals**
- **Manipulation of the read-in disable for the CNC block using external signals**
- **Monitoring of system variables such as velocity, power and torque**
- **Control of process variables such as velocity, speed and distance**

9.11 Analysis of internal drive values

☑ SINUMERIK ONE PPU 1740	☑ SINUMERIK ONE NCU 1740	☑ SINUMERIK ONE NCU 1750	☑ SINUMERIK ONE NCU 1760
✔ Option: M41	✔ Option: M41	✔ Option: M41	✔ Option: M41

The analysis of internal drive values can be used to control a second process variable depending on a measured process variable. You can, for example, influence the path-specific or axis-specific feedrate depending on the measured spindle current.

Analysis of internal drive values is a requirement for implementing Adaptive Control. You can parameterize the Adaptive Control within the part program as follows:

- Additive control

  Programmed value (F word) is corrected by adding

- Multiplicative control

  F word is multiplied by a factor (override)

The following real-time variables can be evaluated as internal drive variables:

- $AA_LOAD drive utilization as a %
- $AA_POWER drive active power in W
- $AA_TORQUE drive torque setpoint in Nm
- $AA_CURR actual axis/spindle current in A

Benefits

- **Protecting machines and tools against overload**
- **Shorter machining times**
- **A superior surface quality of the workpieces can be achieved**

Tool and mold making

<div style="text-align: right; font-size: 3em;">10</div>

10.1 High Speed Settings

	SINUMERIK ONE PPU 1740		SINUMERIK ONE NCU 1740		SINUMERIK ONE NCU 1750		SINUMERIK ONE NCU 1760
✅		✅		✅		✅	
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

The High Speed settings cycle enables easy parameterization of the optimum motion control in relation to the machining type and the part program contour tolerance band.

The high-speed setting cycle sets automatically the associated optimum combination of accuracy, speed and surface quality – for 3-axis and 5-axis machining of free form surfaces.

The cycle is called within the DIN/ISO editor or in ShopMill. Calling this function activates **Advanced Surface** and/or **Top Surface** depending on the options and the configuration. The best available mold making function is automatically used.

The following settings are possible:

- Machining type
  - Roughing
  - Rough-finishing
  - Finishing
- Tolerance
- Multiple axis program yes/no
- Orientation tolerance and rotary axis tolerance
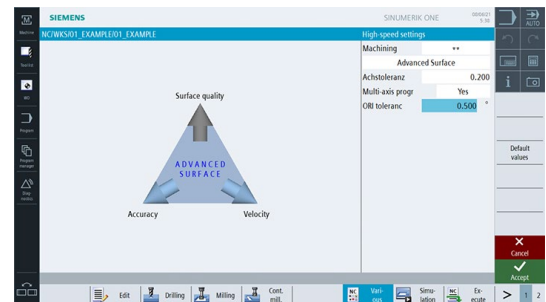
Benefit

- **Simple and easily understandable parameterization of the required machining type (roughing, pre-finishing or finishing) with an interactive screen**

10.2 Advanced Surface and Top Surface

Machining of free-form surfaces involves high requirements regarding speed, precision and surface quality. The "High Speed Settings" cycle simplifies the parameterization of mold making applications.

The "Advanced Surface" and "Top Surface" options allow the manufacturing of high-quality mold making workpieces.

Conventional CNC   **with Advanced Surface and Top Surface**

Perfect surface

SINUMERIK Operate can even cope with inadequate CNC block sequences in mold making programs: New forward-thinking, mathematical algorithms perform fully identical calculations for the movement paths in forward and reverse directions. This means that reverse paths on molds yield mirror-finish workpiece surfaces.
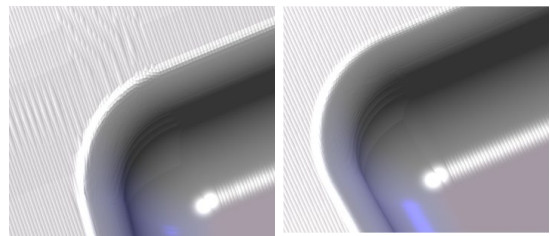
Minimum machining time

In addition, Advanced Surface and Top Surface ensure shortest machining times. A brand new type of motion control calculates an ideally smooth surface, for which it keeps the tool within the optimum speed range at all times.

One-off optimizing

The Advanced Surface and Top Surface algorithms guarantee optimum workpiece surfaces and shortest machining times after just a single optimization of the system.

Machining time: 281 sec   Machining time: 231 sec
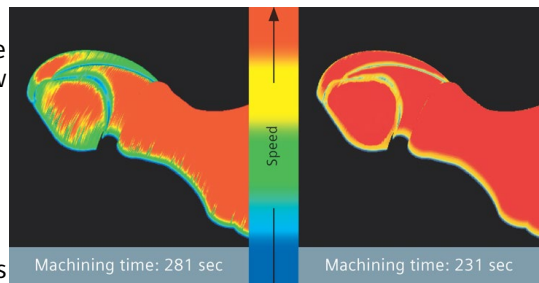
Benefit

- **Advanced Surface and Top Surface are synonyms for milling at physical machine limits; coupled with maximum speed, accuracy and best surface quality, not only for mold making**

10.2.1   Advanced Surface

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
🔗	Option: S07	🔗	Option: S07	🔗	Option: S07	🔗	Option: S07

With Advanced Surface you can easily parameterize optimum speed control depending on the machining type (roughing, rough-finishing, finishing).

Enter the following settings for Advanced Surface:

- Tolerance of the machining axes
- Machining type
  - Finishing
  - Rough-finishing
  - Roughing
  - Deselection
- Multiple axis program yes/no
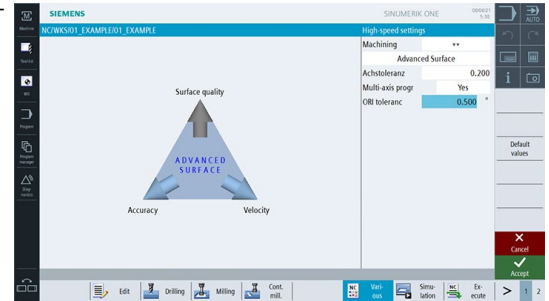
Benefit

- **Advanced Surface permits maximum productivity coupled with simple process parameterization – from 3-axis multipass milling through to dynamic 5-axis machining**

10.2.2 Top Surface

✅	**SINUMERIK ONE PPU 1740**	✅	**SINUMERIK ONE NCU 1740**	✅	**SINUMERIK ONE NCU 1750**	✅	**SINUMERIK ONE NCU 1760**
⚙	Option: S17	⚙	Option: S17	⚙	Option: S17	⚙	Option: S17

The High Speed Settings cycle, Top Surface option ensures a significantly improved workpiece surface for inclined multipass finishing programs, even for poor data quality and/or irregular point distribution in NC programs from the CAD/CAM system.

The dynamic response is also optimized:

- Improved observance of the acceleration and jerk limits

- Lower vibration excitation of the machine

In addition to selecting the machining types (finishing, rough-finishing, roughing), the following settings are possible:

- Smoothing yes/no

- Multiple axis program yes/no

- Contour and orientation tolerance
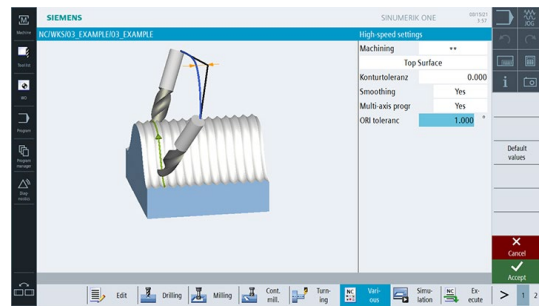
The contour tolerance is shown as magnifying glass.
Standard values:

- Roughing 0.1

- Rough-finishing 0.05

- Finishing 0.01

The smoothing is also shown in the magnifying glass:
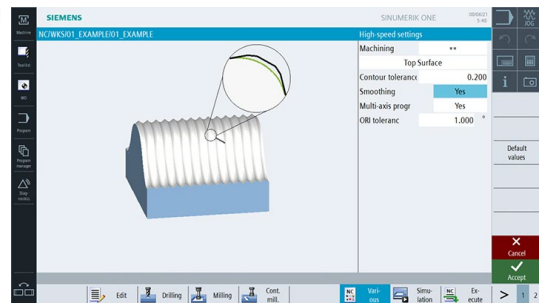
- Smoothing adds shine to the surface.

- Without smoothing, high-precision contours appear perfectly.

Benefits

- **Perfect surface quality - Correction of irregularities from the CAD/CAM data, direction-independent identical smoothing of the milling paths**

- **High accuracy**

- **Stable milling machine - significantly smoother machine running, less wear, long-term availability**

- **Perfect usability - simple and graphical operator screens, optimum surface quality, even with the default setting, for most programs**

10.2.3 Top Speed Plus

☑ SINUMERIK ONE PPU 1740	☑ SINUMERIK ONE NCU 1740	☑ SINUMERIK ONE NCU 1750	☑ SINUMERIK ONE NCU 1760
Option: S62	Option: S62	Option: S62	Option: S62

Top Speed Plus and Top Surface are used together in the processing of CAM-generated 3/5-axis simultaneous machining operations, for example in tool and mold making. The innovative filter technology ensures that the highest motion dynamics of the individual machine axes can be set, while at the same time providing improved surface quality and high contour accuracy.

Benefits

- **When using Top Speed Plus, the restrictions that all axes must be operated with the same filter and jerk limitation values no longer apply**

10.3 Look Ahead

✓ SINUMERIK ONE PPU 1740	✓ SINUMERIK ONE NCU 1740	✓ SINUMERIK ONE NCU 1750	✓ SINUMERIK ONE NCU 1760
Basic configuration	Basic configuration	Basic configuration	Basic configuration

The Look Ahead function (the function is part of Advanced Surface) achieves an optimum machining speed by looking ahead over a parameterized number of traversing blocks. With tangential block transitions, the axis is accelerated and decelerated beyond block boundaries, so that no drops in speed occur.
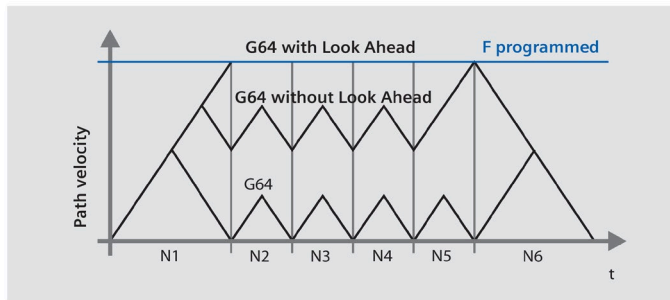
Benefit

- **Shorter machining times through optimum speed control**

CNC programming methods

<div style="text-align: right; font-size: 3em; font-weight: bold;">11</div>

SINUMERIK Operate provides the following programming methods for selection:

DIN-ISO programming with programGUIDE

CNC text editor with programGuide cycle support, and DIN-ISO and readable CNC high-level language commands for mid-sized and large series

The wide choice of technology cycles and the ease of parameterization allows you to reduce the programming time.

ShopMill machining step programming

with graphical interactive CNC machining step editor and CNC programming without DIN-ISO knowledge for small series.

Machining operations such as traversing movements, drilling or pocket milling are shown in ShopMill in the form of machining steps. This means that CNC programs are very compact and are easy to generate and read – even for complex machining operations. Associated sequences are automatically interlinked and can be assigned any position patterns.

Benefit

- **Whether you use programGUIDE or ShopMill – in either case the full range of technological cycles, position patterns and geometries is available to you**

11.1 DIN-ISO programming with programGUIDE

11.1.1 Introduction

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

Below is an overview of the characteristic functions of programGUIDE and SINUMERIK CNC programming. This includes:

- DIN/ISO editor
- Languages
- programGUIDE input support

These functions belong to the basic configuration of SINUMERIK Operate.

11.1.2 Program editor

A line-oriented program editor is available to you for DIN/ISO programming. The editor enables you to input CNC language commands directly or to edit them. Thereby, the complete range of CNC functions is available for the most complex machining.

The following functions are included in the program editor:

- Contour calculator

- Tool selection directly from tool list

- Support screens for standard machining and measuring cycles

- "Copy", "Paste" and "Cut" block

- "Find", "Replace" and "Replace All" character string

- The syntax is highlighted in various colors (comments, NC blocks, etc.)

- Renumbering a program

- Direct execution from any NC program block (block search)

- Jump to program start or program end
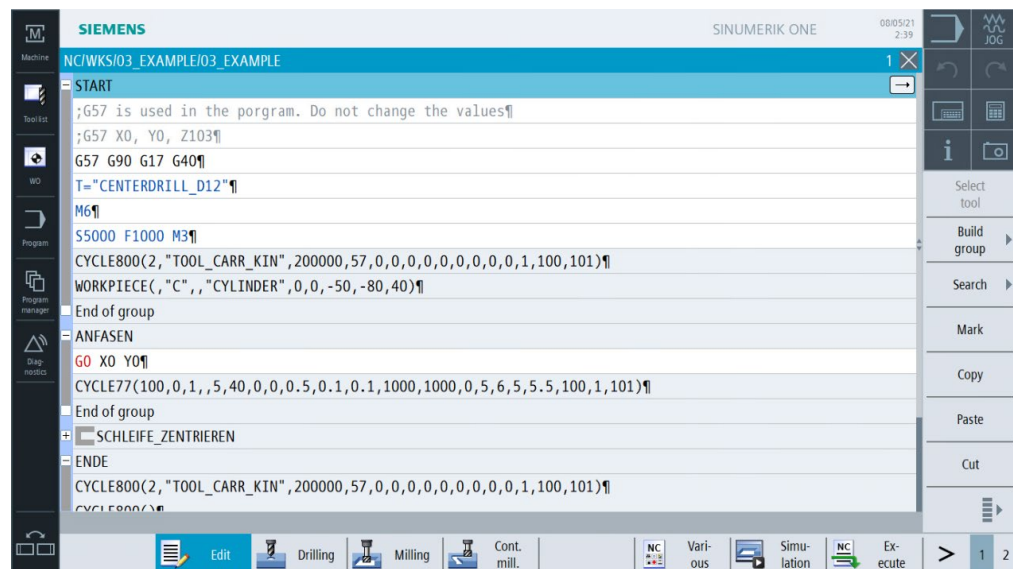
Benefits

- **Time saving by using a powerful editor when programming**
- **Even large part programs (many MB large) can be edited extremely fast**

11.1.3   Languages

The CNC interpreter of the SINUMERIK ONE can also process more complex CNC commands, in addition to DIN 66025 standard commands. The commands are presented in clearly readable form.

The following commands are available:

- **G-code**
  G-code in accordance with DIN 66025 and in ISO dialect mode

- **G functions**
  G0, G1, G2, G71 ...

- **Language commands (extended G functions)**
  CIP, SOFT, BRISK, FFWON ...

- **Frame operations (programmable work offsets)**
  The workpiece coordinate system can be shifted, scaled, mirrored or rotated with the commands TRANS, SCALE, MIRROR, ROT.

- **R parameters (arithmetic parameters)**
  300 predefined R parameters are available as arithmetic parameters (floating-point format).

- **User variables**
  Users can define their own variables by name and type.

- **System variables**
  System variables can be read/written in all programs. They enable access to work offsets, tool offsets, axis positions, measurement values, control conditions etc.

- **Arithmetic operations**
  The following arithmetic operations are available to combine the variables:
  arithmetic operations + - * / sin, cos, exp, etc.
  logical operations == <> >=, etc.

- **Program control structures**
  BASIC-style language commands are available for flexible programming of the user cycles:
  IF-ELSE-ENDIF, FOR, CASE ...

Benefits

- **Established programming according to DIN 66025**
- **Unbeatable range of commands for flexibility and time saving while programming**

11.1.4   programGUIDE input support

The cycle support is an extension of the highly flexible DIN/ISO programming. The input screens are based on the ShopMill cycles input screens, so as to ensure optimum consistency.

The calls for tool, feedrate and spindle speed can of course also be input in the DIN/ISO editor.
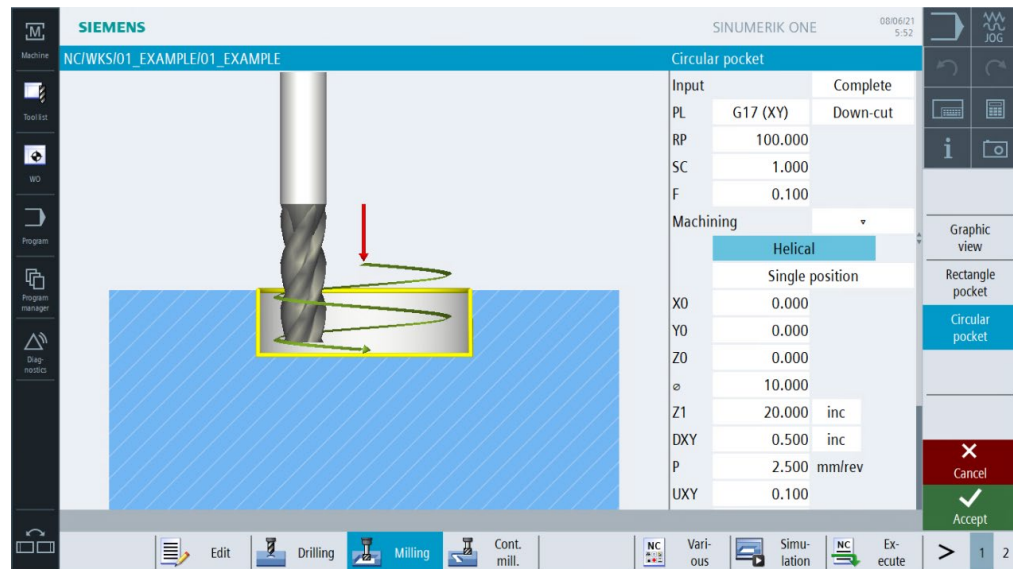
Benefits

- **Existing DIN/ISO part programs with cycles can continue to be used**
- **Minimum learning requirements due to the consistency of the input support**

11.2 ShopMill machining step programming

11.2.1 Introduction

✅	**SINUMERIK ONE PPU 1740**	✅	**SINUMERIK ONE NCU 1740**	✅	**SINUMERIK ONE NCU 1750**	✅	**SINUMERIK ONE NCU 1760**
⚙	Option: P17	⚙	Option: P17	⚙	Option: P17	⚙	Option: P17

The following information provides you with an overview of the characteristic functions of ShopMill. This includes:

- Sequence editor
- Interlinking of sequences
- Broken-line graphics

These functions are part of the machining step programming options package in ShopMill.

11.2.2 Sequence editor

The graphical programming is performed via a graphic interactive sequence editor. Each program line represents a technological sequence (such as: face milling, centering, drilling, tapping) or geometric data required for the sequences (position patterns or contours). Graphical programming offers, in comparison to DIN/ISO programming, a compact and comprehensible program overview.

Entering individual sequences requires no knowledge of DIN/ISO. All required technological and geometric parameters are entered in screen forms. Simple, intuitive programming with sequences can always be expanded very flexibly by inputting DIN/ISO blocks and control functions.
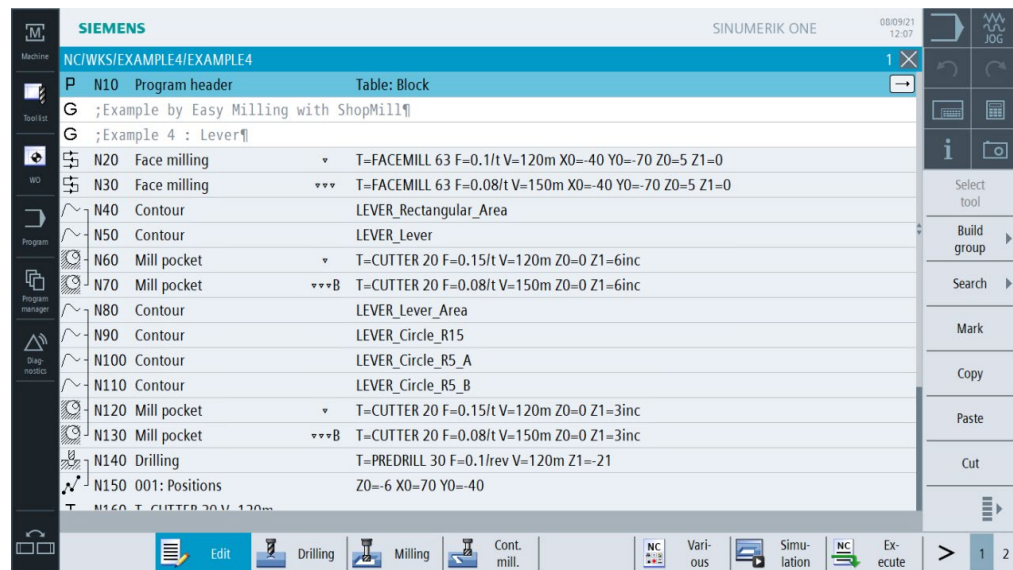
Benefits

- **Intuitive program input, without knowledge of DIN/ISO and the Operating Manual**
- **Compact, clearly arranged machining programs**
- **Reducing the programming time by graphical input masks and copying/pasting machining steps**

11.2.3 Interlinking of sequences

In ShopMill, associated sequences are interlinked with each other. The interlinked sequences are performed consecutively at the appropriate contours or pattern positions.

In the following example, the sequences centering, deep-hole drilling and tapping are applied to 6 holes on the pitch circle pattern position.
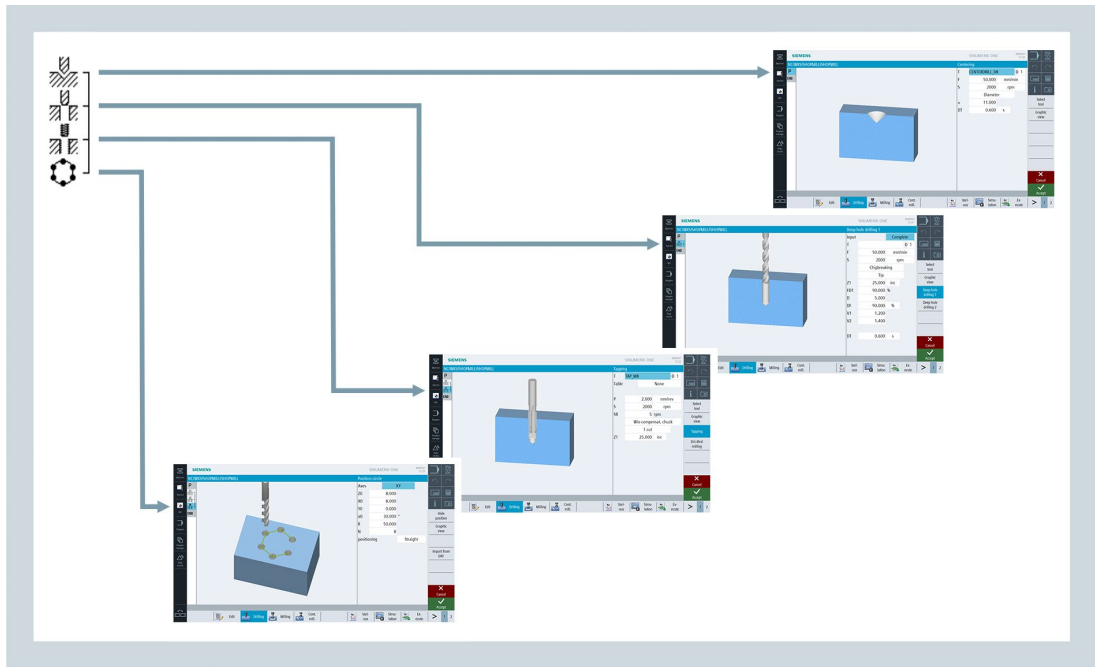
Benefit

- **Reduced programming time due to linking of machining steps**

11.2.4   Graphic view

While programming, the previously entered sequences will be continuously displayed to scale. A simulation is not required for this. The switching between the machining step program and the broken-line graphics is performed with the "Graphics View" softkey or the "Ctrl+G" shortcut.

*   Plan view of workpiece

*   Front view of drilling operations
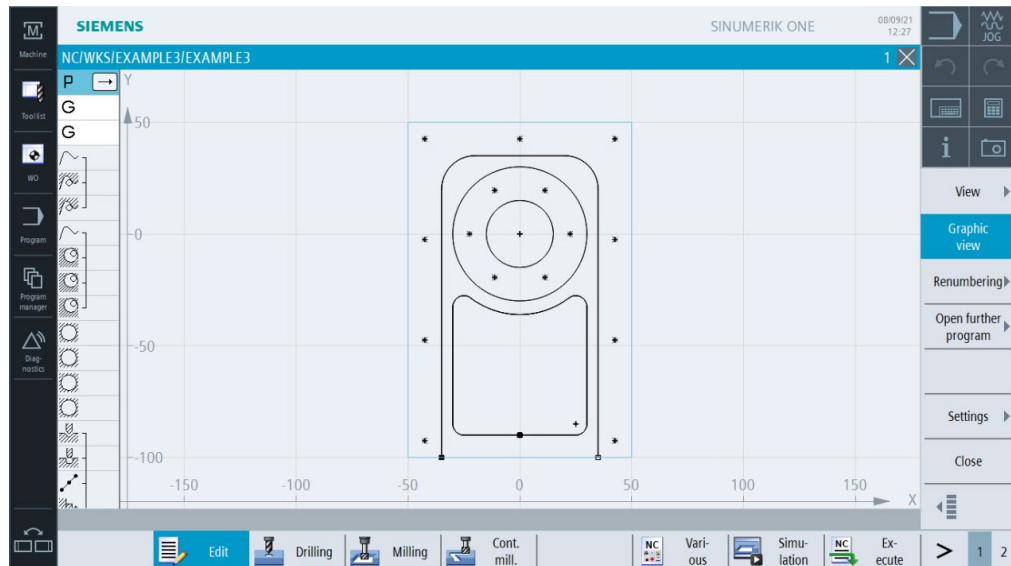
Benefit

*   **Increased reliability at program input by quickly checking the contour, without having to start a simulation run**

Workpiece visualization

<div style="text-align: right; font-size: 3em;">12</div>

12.1 2D simulation

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

SINUMERIK Operate offers with 2D simulation the facility to make optimum and reliable preparations for machining workpieces, such as by detecting collisions. Calculating the machining time also supports optimum calculation of tooling costs.

- Use of the real geometry values of the tools mounted in the machine
- Simulation in plan view and side view
- Simulation can be interrupted at any time, and the speed is controllable
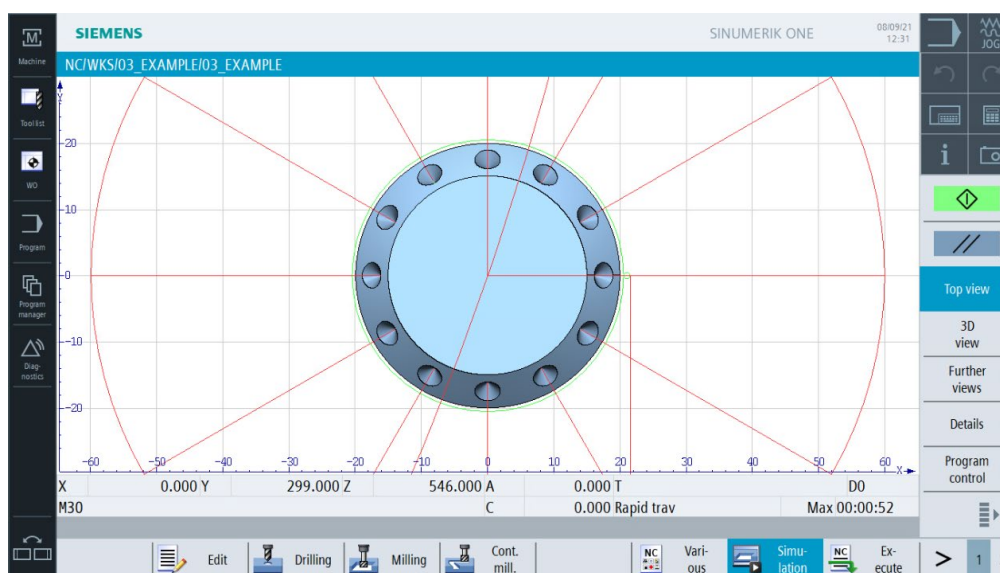
Benefits

- **Maximum process reliability through simulation using real geometry values**
- **Perfect clarity by showing the workpiece dimensions with a scale**
- **Parallel simulation (background simulation), i.e. simulation of a part program while another part program is currently being run**

12.2 3D Simulation

✅	**SINUMERIK ONE PPU 1740**	✅	**SINUMERIK ONE NCU 1740**	✅	**SINUMERIK ONE NCU 1750**	✅	**SINUMERIK ONE NCU 1760**
✔	Option: P25	✔	Option: P25	✔	Option: P25	✔	Option: P25

SINUMERIK 3D workpiece simulation offers you optimum assistance and reliability in programming and in quotation costing.

- Reliability:
  3 viewing planes and solid model of the finished part, with zoom to details and free rotation of the viewing angle

- Support:
  - Simulation speed controllable by override
  - Single block operation and start/stop available at any time

- Checking:
  Automatic calculation of machining time
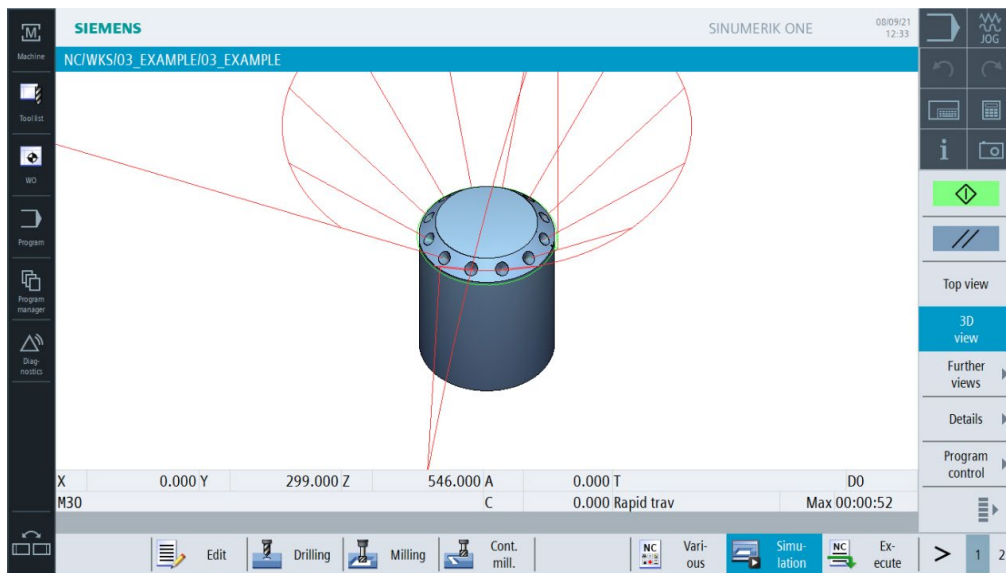
Benefits

- **Particularly realistic simulation through representation of the tool**
- **Optimum help and reliability in programming and in quotation costing**
- **Parallel simulation (background simulation), i.e. simulation of a part program while another part program is currently being run**

12.3 Mold making quick view

✅	SINUMERIK ONE PPU 1740	✅	SINUMERIK ONE NCU 1740	✅	SINUMERIK ONE NCU 1750	✅	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

The mold making fast view is available, in particular for large part programs.

- Fast view of G0, G1, G2, G3 blocks, VECTORS using the 3D mold building model

- Fast identification of part programs where simulation would take a long time

- Displaying/hiding G0, G1, G2, G3 lines and points

- In addition to the classic view, for mold making programs, you can also display the rotary axis vectors and grid mesh (surface, mesh), for example.
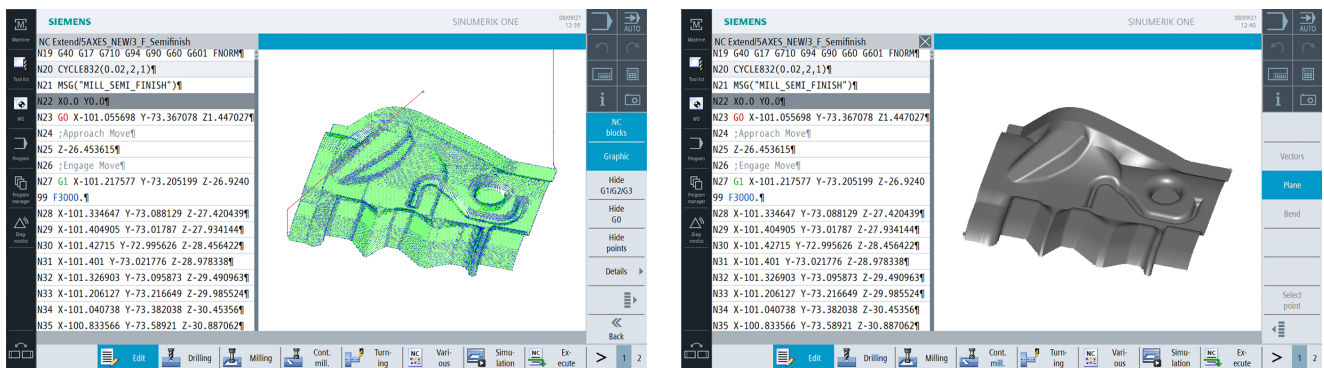
Benefit

- **More safety when handling mold making programs**

CNC technology cycles

<div style="text-align: right; font-size: 3em;">13</div>

Irrespective of whether you use programGUIDE or ShopMill – in either case, the full range of technological cycles, position patterns and geometries is available to you.

Benefits

- **Significant simplification of programming, even for complex jobs, using CNC technology cycles**
- **Consistency of cycles for programGUIDE and ShopMill**

13.1 Highlights of machining cycles

For frequently repeated machining tasks, machining cycles are available for the drilling, milling and turning technologies.

- Drilling technology:

  Drilling/centering, drilling/counterboring, deep-hole drilling, tapping with and without compensating chuck, boring 1 ... 5, row of holes, circle of holes, grid of holes, machining on inclined surfaces

- Milling technology:

  Thread milling, elongated holes in a circle, grooves in a circle, circumferential groove, rectangular/circular pocket, face milling, path milling, rectangular/circular spigot, machining on inclined surfaces, high-speed settings for optimized HSC machining, engraving cycle

- Turning technology:

  Groove, undercut, cutting with relief cut, thread undercut, thread cutting, chaining of threads, thread recutting

A selection of machining cycles is explained in more detail below.

13.1.1 Engraving cycle

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

The engraving cycle is used to engrave a text on a workpiece along a line or arc. You can enter the text as fixed text or assign it via a variable as variable text.

Examples of variable texts:

- Date and time
  The values for the date and time are read from the CNC.

- Quantity
  The "Quantity" variable is available as a pre-defined user variable

- Numbers
  When outputting numbers (e.g. measurement results), you can select the output format (digits before and after the point) of the number to be engraved.

- Text
  Instead of entering a fixed text in the engraving text field, you can specify the text to be engraved via a text variable (e.g., _VAR_TEXT="ABC123").
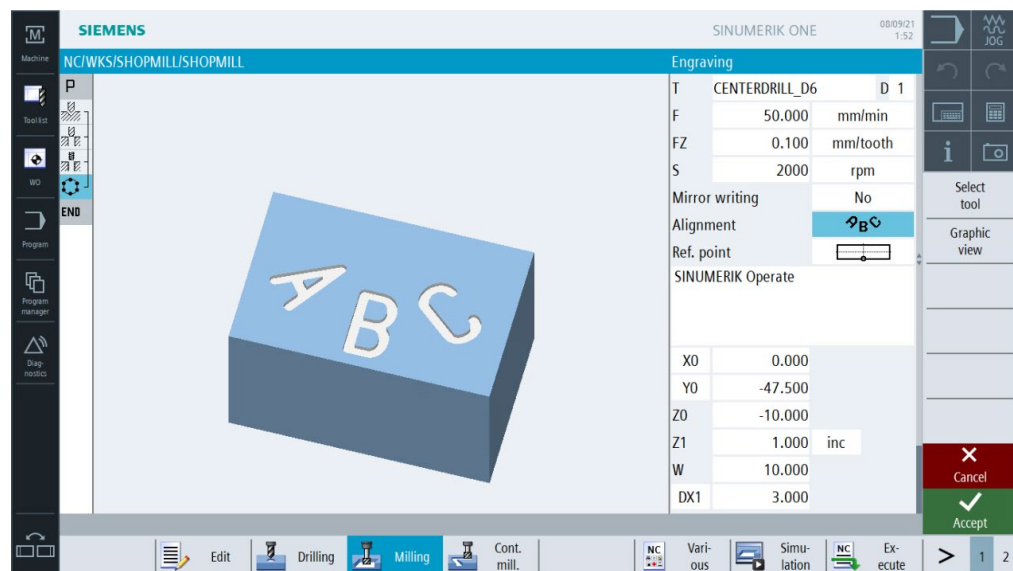
Benefits

- **Reduction of set-up times by complete machining on one machine**
- **Simple program input of engraving**

13.1.2 Trochoidal milling

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

Vortex milling (trochoidal milling) of open slots is available as a milling strategy directly on the controller, i.e. NC programs for path motions do not have to be generated by CAM systems as previously.

- It is the preferred strategy for HSC roughing, the tool is never fully inserted and tool paths are smooth and round

- Simple parameterizing per dialog: Roughing, pre-finishing, finish milling, finishing floor and edge

- You can select as milling direction synchronous operation, reverse rotation, and for maximum cutting volume during roughing the combination reverse rotation and synchronous operation
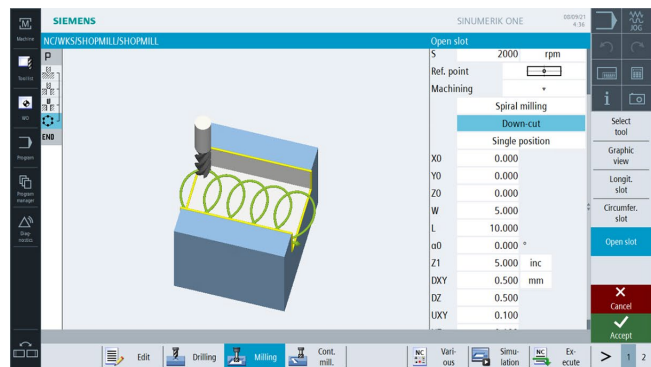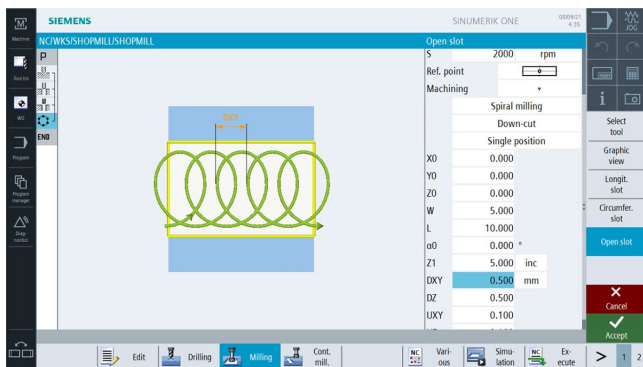
Benefits

- **Innovative CAM function now available directly on the controller**
- **Reduction in the machining time for slot milling by up to 50%**

13.1.3 Plunge cutting

✅	**SINUMERIK ONE PPU 1740**	✅	**SINUMERIK ONE NCU 1740**	✅	**SINUMERIK ONE NCU 1750**	✅	**SINUMERIK ONE NCU 1760**
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

For machining deep pockets and slots in thin-walled workpieces, the plunge cutting cycle is available for open slots.

- As types of machining you can select roughing, pre-finishing and finishing of the edge and/or floor

- Essentially, forces apply only along the main spindle axis, therefore, hardly any distortion of the tool occurs.
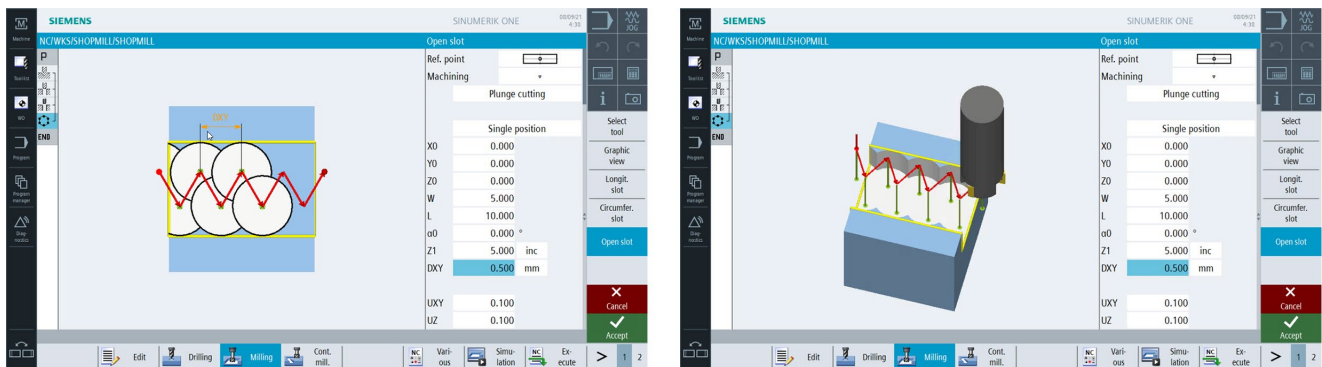
Benefits

- **Less vibrations and deeper cutting depth thanks to the new machining strategy plunge cutting**
- **Reduced cutting pressure and distortion enable higher productivity when machining thin-walled workpieces**

13.1.4 Deep-hole drilling

	SINUMERIK ONE PPU 1740		SINUMERIK ONE NCU 1740		SINUMERIK ONE NCU 1750		SINUMERIK ONE NCU 1760
✅		✅		✅		✅	
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

Easy-to-use cycles for deep-hole drilling are available in SINUMERIK Operate.

The tool drills at the programmed spindle speed and feedrate to the entered final drilling depth.

Deep hole drilling is performed with a depth infeed of a maximum definable depth executed several times, increasing gradually until the final drilling depth is reached.

For example, the drilling machine can be retracted after each infeed depth either to the piloting depth + safety clearance for chip removal or by the length of the programmed retraction path for chip breakage.

You can also choose between the following drilling strategies:

- None / with spot drilling
- With or without pilot hole
- Soft first cut yes/no
- Chip breaking/removal
- Chip breaking and swarf removal
- 1 cut - drill in one step to the end depth
- Swarf removal to the piloting depth / safety clearance
- Retraction to the piloting depth / retraction plane
- Position pattern
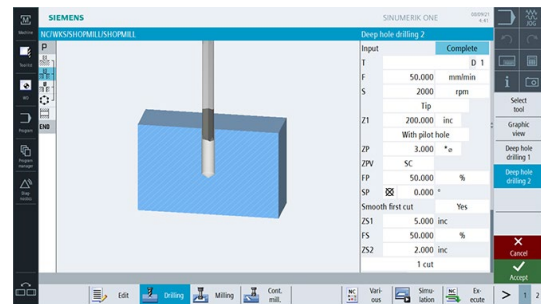
Benefit

- **Generate drill holes with more than one feed to any positions**

13.2 Residual material detection for contour cycles

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
✔	Option: P13	✔	Option: P13	✔	Option: P13	✔	Option: P13

Contour ranges which do not permit milling with large diameters are automatically identified in the cycle for contour pockets and contour spigots. These areas can be selectively machined with a suitable smaller tool, rather than having to use this tool for the entire contour pocket or spigot.

If you mill several pockets and wish to avoid unnecessary tool changeovers, remove stock from all the pockets first and then remove the residual material. In this case, you must enter the tool used for removing the residual material from the pocket in the "TR reference tool" parameter.
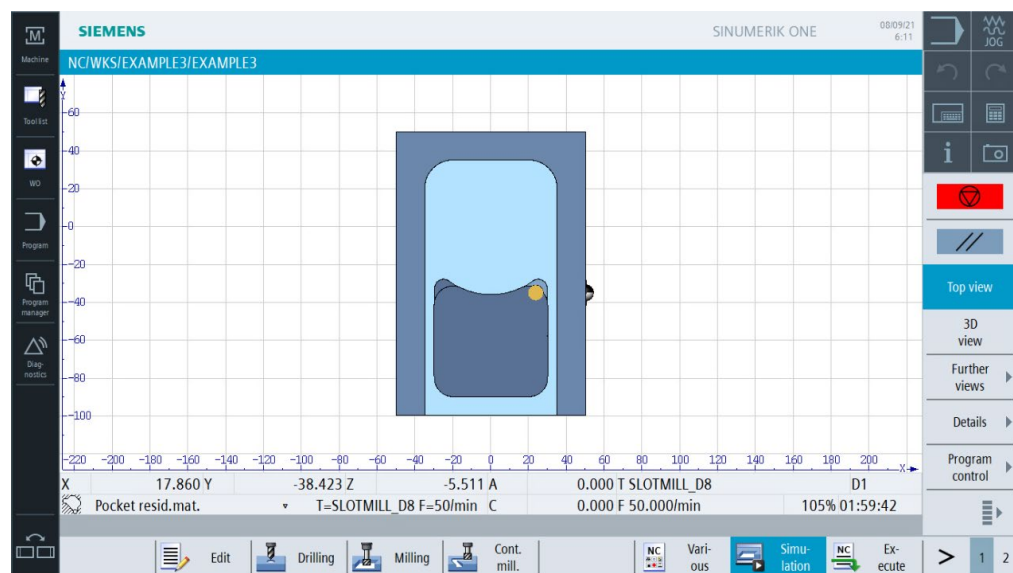
Benefits

- **Shorter machining times through the use of a large tool for the substantial part of the stock removal and a smaller tool for the remaining residual material**
- **Avoidance of non-cutting movements while achieving extremely simple programming**

13.3 In-process measurements for the workpiece and tool

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
⚙	Option: P28	⚙	Option: P28	⚙	Option: P28	⚙	Option: P28

For measuring tasks in the automatic mode, powerful measuring cycles are available both under ShopMill as well as under programGUIDE. Input screens with dynamic help displays are used for convenient entry of the measuring parameters.
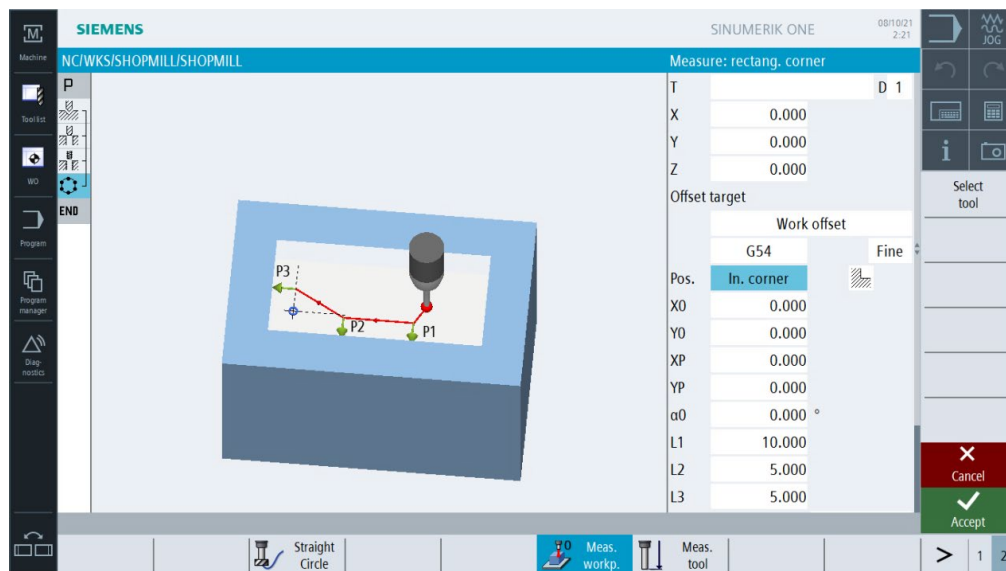
You can perform the following measuring tasks:

- Workpiece measurement: Correction of work offsets, correction of tool geometry or only measuring

- Tool measurement: Correction of tool geometries

- Display of measurement results

- Logging of measurement results

The following workpiece measuring versions are available:
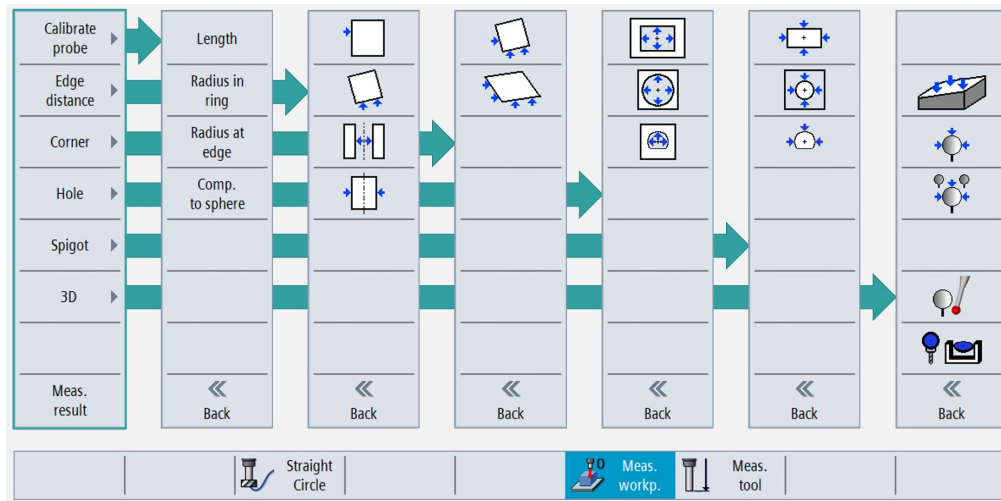
- Calibrate – length, radius in ring, radius at edge, calibration at ball

- Measure edge – edge, align edge, groove, web

- Measure corner - rectangular corner with 3 points or any corner with 4 points at the inside/outside corner

- Measure holes - over 4 or 3 points on a segment of a circle/drill hole/rectangular pocket

- Measure spigots - over 4 or 3 points on rectangular/circular spigot and segment of a circle outside

- 3D measuring – align plane, ball, 3 balls, angular displacement of spindle, kinematics

Benefits

- **Reliable quality of the manufactured parts by automatic measurement in the machine**
- **Fast programming for complex measuring tasks thanks to input screens with graphic support**
- **Measuring cycles are now also available for ShopMill sequence programs**

13.4 Measuring multi-axis kinematics

✅ **SINUMERIK ONE PPU 1740**	✅ **SINUMERIK ONE NCU 1740**	✅ **SINUMERIK ONE NCU 1750**	✅ **SINUMERIK ONE NCU 1760**
⚙️ Option: P18	⚙️ Option: P18	⚙️ Option: P18	⚙️ Option: P18

CYCLE9960 corrects or checks the geometric vectors for defining the kinematic 5-axis transformation. With only one call of the cycle, the kinematics are measured, and the determined values and deviations are represented in the measurement result screen.

For the measurement, up to twelve positions of a measuring sphere on each rotary axis are sensed using workpiece probes. The ball positions are defined in a specified rotary axis area in accordance with the geometric ratios on the machine. The ball position is set via the automatic repositioning of each rotary axis to be measured.

With CYCLE9960, it is also possible to measure the deviation on the tool tip (TCP) with active transformation for various rotary axis positions, after the measurement and compensation of the kinematics. These deviations can be compensated with the VCS (Volumetric Compensation System).

Possible fields of application:

- Check and correct the machine kinematics, e.g. during the machining process or for collision.
- Measure and adapt the reference, e.g. for kinematics with changeable heads.
- Measure and correct interpolation points, e.g. for compensation of the TCP via VCS Rotary.
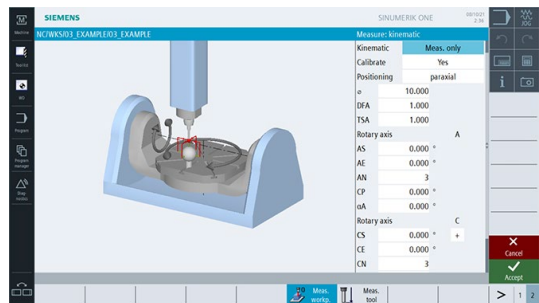
Benefits

- **Complete measurement with one cycle call possible**
- **Improved machine accuracy through automatic probe calibration**

Complete machining

14.1   Cylinder surface transformation (TRACYL)

✅ **SINUMERIK ONE PPU 1740**	✅ **SINUMERIK ONE NCU 1740**	✅ **SINUMERIK ONE NCU 1750**	✅ **SINUMERIK ONE NCU 1760**
⚙ Option: M27	⚙ Option: M27	⚙ Option: M27	⚙ Option: M27

Peripheral surface machining can be executed on machines with an additional part apparatus. It is typically handled with an A axis.
Peripheral surface machining offers a series of additional functions in comparison to simple positioning along the A axis.

Programming in the run-off

The axis behaves like a Y axis while programming in the run-off. All plane machining can also be executed in the run-off.

- Drilling operations at any position patterns

- Milling (pockets, contour pockets)

The Y values are converted while machining along the A axis rotation. The Y axis of the machine does not move.

Milling grooves with parallel walls

Peripheral surface machining offers the possibility of milling grooves on parallel walls with and without groove side offset. This is also possible when the diameter of the milling cutter is smaller than the groove width. In this case, the cutter radius compensation may be used. The required Y axis compensating movements are automatically calculated by the controller.
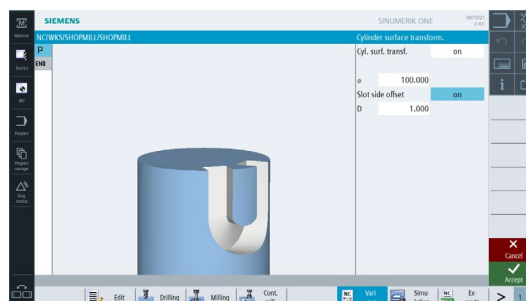
Benefits

✅

- **Additional business through expansion of workpiece spectrum**
- **Reduction of set-up times by complete machining on one machine**

14.2 Swivel plane (CYCLE800)

	SINUMERIK ONE PPU 1740		SINUMERIK ONE NCU 1740		SINUMERIK ONE NCU 1750		SINUMERIK ONE NCU 1760
✅		✅		✅		✅	
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

Multi-face machining saves setup times and increases the precision of finished adjoining sides because the part must not be reclamped. The swivel cycle is used for easy input of parameters for automatic machining and measuring on the various planes.

- A prerequisite is that the machine is equipped with additional rotary axes (swivel head and/or swivel table).

- The swivel cycle is available in the ShopMill machining step - as well as in programGUIDE DIN/ISO programming.

- The planes can be swiveled not only by direct swiveling with rotation of coordinates and swiveling about the axes, but also by specifying a projection or spatial angle for swiveling.

- Flexible combination of shift - swivel - shift.

- Turning or moving are not machine-specific, as they are based on the workpiece coordinate system X, Y and Z.

- Fixed relief positions available
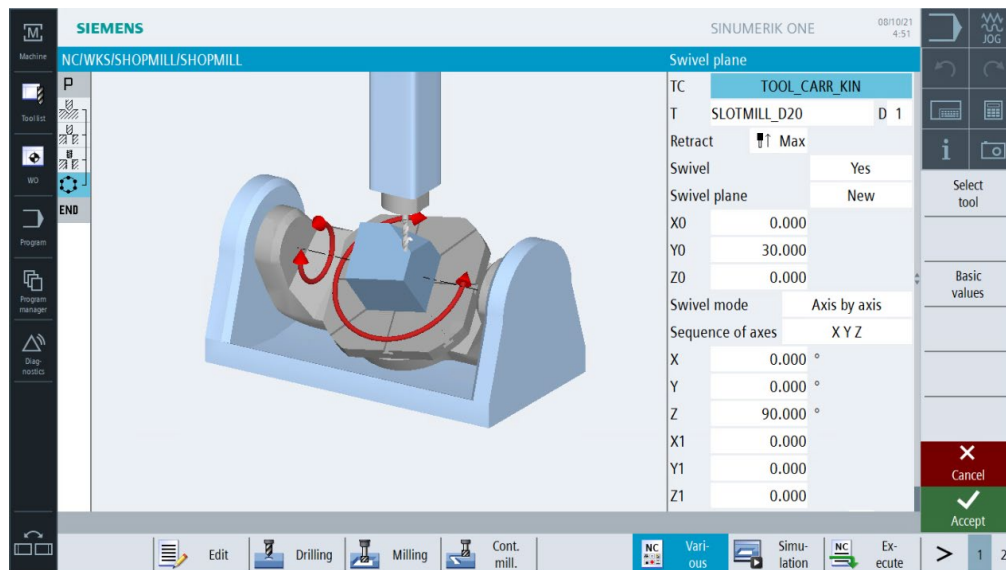
Benefit

- **Programming with standard cycles and easy transformation on the inclined plane through the swivel cycle**

14.3 5-axis machining package (TRAORI)

☑ **SINUMERIK ONE PPU 1740**	☑ **SINUMERIK ONE NCU 1740**	☑ **SINUMERIK ONE NCU 1750**	☑ **SINUMERIK ONE NCU 1760**
Option: S43 (package)	Option: S43 (package)	Option: S43 (package)	Option: S43 (package)

In contrast to static transformations (swiveling) in which the tool is perpendicular to the machining plane, the 5-axis machining package TRAORI allows the dynamic coupled motion of a tool along the workpiece surface. It is used for 5-axis mold making applications and in the aviation industry, for example.

- Any tool orientation
- Remote Tool Center Point function (RTCP)
- Part programs not dependant on kinematics (vector programming)
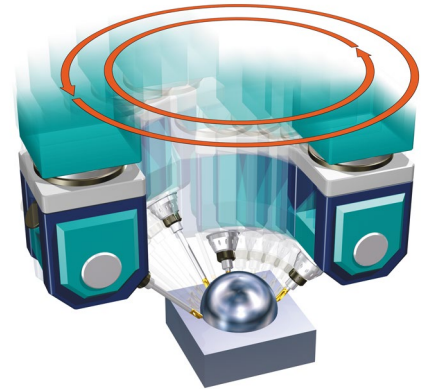
Benefits

- **Programming the tooltip in workpiece coordinates**
- **Programmed speed with reference to the tooltip**
- **Programming the tool orientation independent of the machine kinematics**

14.4 Mill-turning

14.4.1 Introduction

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
	Basic configuration		Basic configuration		Basic configuration		Basic configuration

The milling technology in ShopMill and programGUIDE provides comprehensive technology cycles for turning and contour turning.

Among others, the following functions are available for milling-turning:

- TSM mode
- Tool measurement
- Face milling / stock removal
- Turning cycles for stock removal, grooving, undercutting, threading and tapping
- Contour turning cycles for stock removal / residual stock removal, plunge cutting / residual plunge cutting, plunge turning / residual plunge turning
- Swivel tool

You can check the programming result, even for milling-turning, with the Simulation function.

Benefits

- **Consistent look-and-feel for turning and milling permits a high degree of consistency in the operation and programming for milling-turning**
- **Consistent technology cycles for milling, turning and measuring tasks**
- **Powerful tool management for milling-turning, including multitools**
- **Simulation permits a high degree of process reliability**

14.4.2   Tool management

For multitasking machines – for milling-turning or turning-milling – you are provided with an extended tool management for turning and milling tools.

The turning tools are displayed automatically in the milling-turning technology. In the "Extended data" dialog, you can enter the tool-specific basic rotation for the turning tools.

In addition to turning and milling tools, you can also deploy complex tools, such as multitools. There are additional parameters for multitools, e.g. distance definition using the location number or angle – and different tool types for each location. All tools are shown as icons
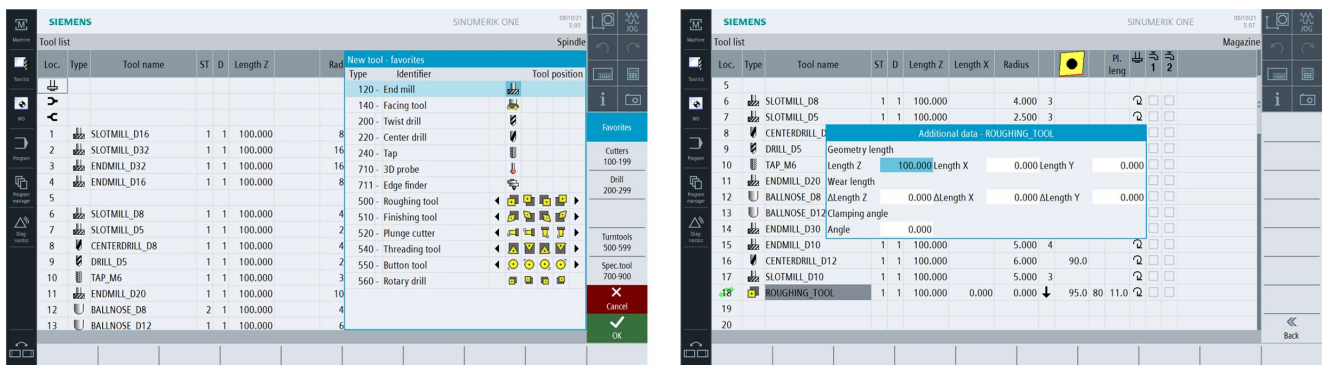
Benefits

- **One tool management for turning and milling tools – including support for multitools**
- **All tools are displayed as symbols**
- **Tool name in plain text**

14.4.3 Programming

For milling-turning machining, programGUIDE and ShopMill provide not only standard cycles, but also turning cycles and contour cycles. You are supported with the appropriate cycles for turning machining as well as turning contour machining and aligning the turning tool.
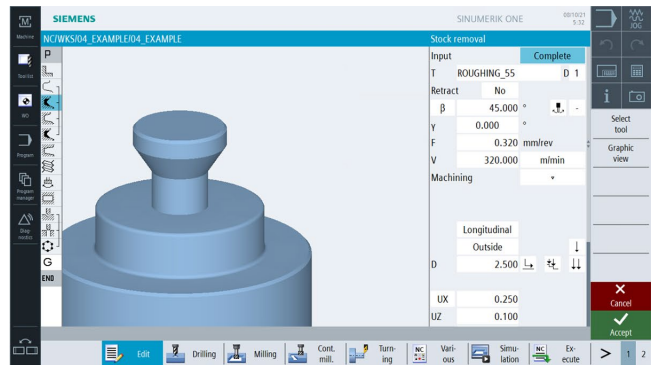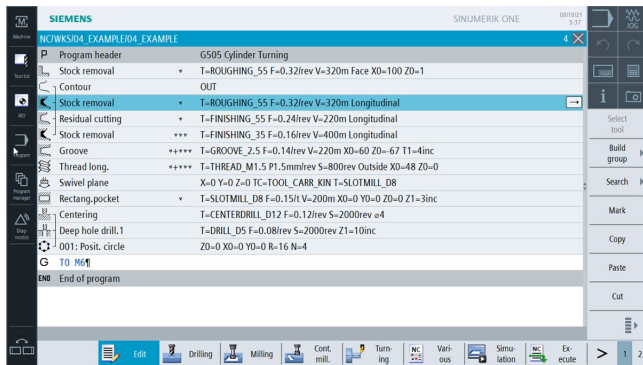
Benefit

- **Turning cycles for programGUIDE and ShopMill as for SINUMERIK Operate turning technology**

14.4.4 Simulation

Also for milling-turning, the usual views are available to simulate the workpiece.
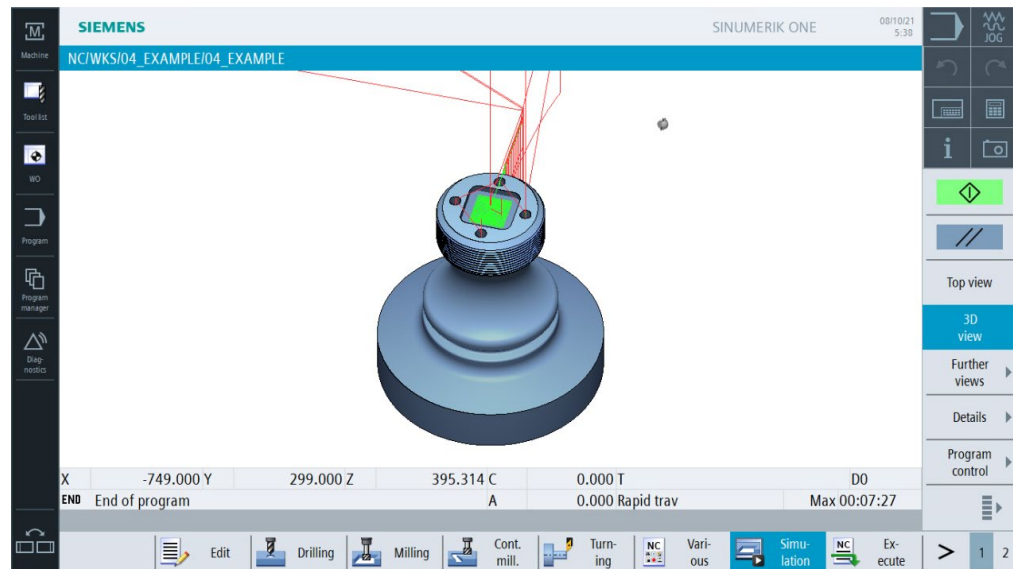
Benefit

- **Maximum process reliability through simulation using real geometry values**

14.5 Interpolation turning

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
⚙	Option: P57	⚙	Option: P57	⚙	Option: P57	⚙	Option: P57

For interpolation turning, the CNC guides the turning tool in a position-controlled way around a fixed workpiece. For this purpose, the main spindle of the machining center is switched to position-controlled mode (also called axis mode). The feed axes interpolate in a spiral/circular arrangement in the x-y/x-y-z plane, while at the same time the main spindle with the turning tool tracks the feed axes.

Application examples: Stock removal (longitudinal/face turning and contour turning), recessing, grooving on cubic workpieces produced on milling machines

Examples for workpieces: Sealing surfaces for master brake cylinder, brake caliper, hydraulic valve housing, pivot bearing, or gearbox housing
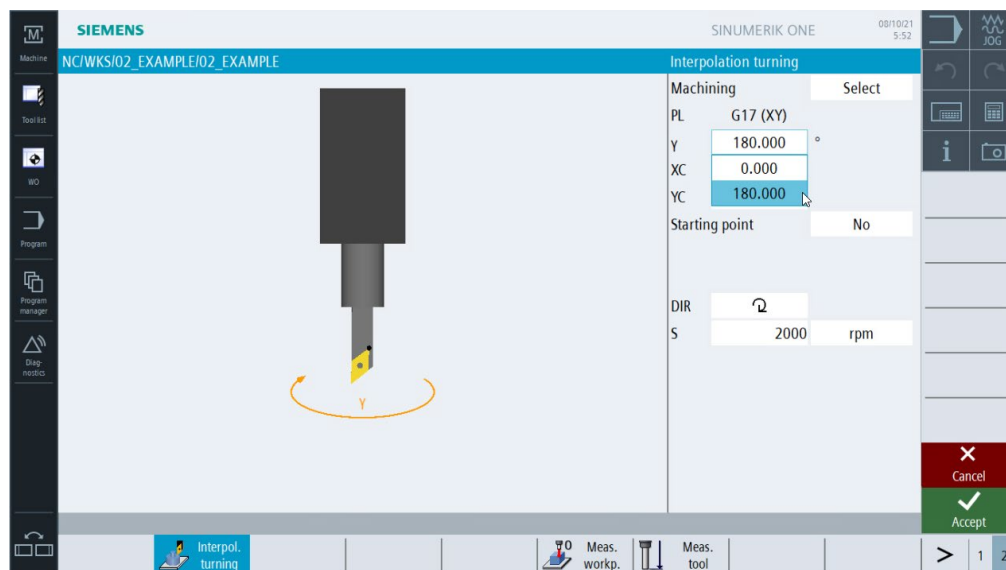
Benefits

- **Off-center turning on machining centers (milling machines) and turning machines with a B axis with reduced machining time because machining operations are completed in one clamping operation**
- **Reduced investment costs**

Automation

<div style="text-align: right; font-size: 3em;">15</div>

15.1 SINUMERIK Run MyRobot /Direct Handling

☑ **SINUMERIK ONE PPU 1740**	☑ **SINUMERIK ONE NCU 1740**	☑ **SINUMERIK ONE NCU 1750**	☑ **SINUMERIK ONE NCU 1760**
⚙ Option: P84	⚙ Option: P84	⚙ Option: P84	⚙ Option: P84

The Run MyRobot /Direct Handling option is a tailor-made package for the integration of handling robots into the SINUMERIK control system:

The package includes all the necessary options for operating a handling robot with a special axis:

- No separate robot control necessary since the robot arm is controlled directly by the CNC
- Programming is done via G-code
- No training overhead since operation is entirely via SINUMERIK Operate

Benefit

☑

- **Run MyRobot /Direct Handling gives you the option to increase the spindle times of the machines.**
- **Robot automation made easy, especially for flexible production.**

15.2 Multiple clamping

☑	**SINUMERIK ONE PPU 1740**	☑	**SINUMERIK ONE NCU 1740**	☑	**SINUMERIK ONE NCU 1750**	☑	**SINUMERIK ONE NCU 1760**
⚙	Option: P17	⚙	Option: P17	⚙	Option: P17	⚙	Option: P17

With the Multiple clamping function, you can optimize identical or different workpiece programs for multiple clamping at the push of a button.

The necessary programs for each individual workpiece are created with ShopMill. The Multiple clamping function automatically generates a new "multiple clamping program" from these programs. In this program, the order of all tools used is rearranged for all workpieces, i.e. the number of tool changes will be reduced significantly, thus increasing the productivity. The flow pattern continues for all used tools of all workpieces.

Without the use of the multiple clamping function, the control system would process the workpiece programs sequentially, i.e. the same tools would be used and substituted several times, thus leading to loss of time.
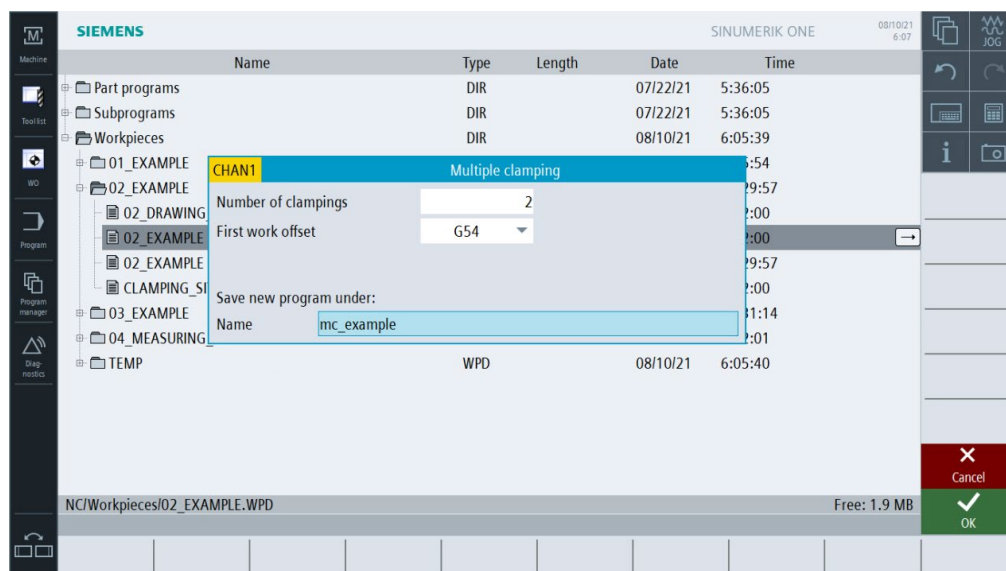
Benefits

- **When machining different workpieces, the Multiple clamping function minimizes the number of tool changes to a minimum and thus ensures a decisive increase in productivity.**

Digitalization

<div style="text-align: right; font-size: 3em; font-weight: bold;">16</div>

The portfolio of the Siemens CNC Shopfloor Management Software covers the entire value chain in production – from product design all the way to actual production and service.

Digitalization offers a wide range of opportunities to increase productivity, reduce costs, and improve quality.

You can optimize your production in four specific areas – even with a full-fledged hardware and software landscape.

- Order preparation and execution
  - Manage MyResources /Tools (Page 112)
  - Manage MyResources /Programs (Page 113)
- Efficiency and flexibility in production
  - Analyze MyPerformance (in line) (Page 114)
  - Analyze MyPerformance /OEE Monitor (MindSphere) (Page 115)
  - Analyze MyPerformance /OEE Tuning (MindSphere) (Page 116)
  - Manage MyMachines (Page 117)
  - Manage MyMachines /Remote (Page 118)
- Machine availability
  - Analyze MyMachine /Condition (Industrial Edge for Machine Tools) (Page 125)
  - Optimize MyMachining /Trochoidal (Industrial Edge for Machine Tools) (Page 122)
  - Optimize MyMachining /Adaptive Control (Page 119)
- Improved machining processes
  - Industrial Edge for Machine Tools (Page 121)
  - Analyze My Workpiece /Capture (Industrial Edge for Machine Tools) (Page 123)
  - Analyze My Workpiece /Monitor (Industrial Edge for Machine Tools) (Page 124)
  - Analyze My Workpiece /Toolpath (Industrial Edge for Machine Tools) (Page 126)

Note

If you have any questions about the applications, please contact our CNC digitalization experts at SIEMENS Industry Software (SISW). You will receive information about which apps you can use to optimize your manufacturing processes and information about the ordering process and licensing.

> Contact (https://new.siemens.com/de/de/produkte/automatisierung/systeme/cnc-sinumerik/digitalisierung/produktionsoptimierung.html)

16.1 Manage MyResources /Tools

✅ **SINUMERIK ONE PPU 1740**	✅ **SINUMERIK ONE NCU 1740**	✅ **SINUMERIK ONE NCU 1750**	✅ **SINUMERIK ONE NCU 1760**
⚙️ Option: via SISW	⚙️ Option: via SISW	⚙️ Option: via SISW	⚙️ Option: via SISW

Manage MyResources /Tools permits centralized management of tools.

- Factory-wide management of tools:

  Tool planning and stock management for tools and components

- Tool stock during magazine assignment:

  Overview of the current tool data, setup dialog for loading and unloading the physical tool

- Data exchange and evaluation:

  Standard interface to measuring devices for tool presetting, provision of tool history

Benefit

- **Increased transparency through cross-machine availability of tool information**
- **Increased efficiency through identification of optimization potentials**

16.2 Manage MyResources /Programs

☑	**SINUMERIK ONE PPU 1740**	☑	**SINUMERIK ONE NCU 1740**	☑	**SINUMERIK ONE NCU 1750**	☑	**SINUMERIK ONE NCU 1760**
⚙	Option: via SISW	⚙	Option: via SISW	⚙	Option: via SISW	⚙	Option: via SISW

The Manage MyResources /Programs application ensures centralized management as well as efficient and secure provision of NC programs. This is an important step toward paperless manufacturing and increases the clarity and transparency of NC program management.

- Secure data transmission to and from the machine, i.e. no manual data handling for the machine operator

- Package life cycle management

- Restoring of older revisions

Benefit

- **Secure handling of data**
- **Transparency of NC program management**

16.3 Analyze MyPerformance (in line)

☑ SINUMERIK ONE PPU 1740	☑ SINUMERIK ONE NCU 1740	☑ SINUMERIK ONE NCU 1750	☑ SINUMERIK ONE NCU 1760
⚙ Option: via SISW	⚙ Option: via SISW	⚙ Option: via SISW	⚙ Option: via SISW

Analyze MyPerformance enables a targeted analysis of weak points and thus the optimization of production.

- Acquisition of machine data to calculate key parameters:

  Key parameters provide information about the state of the plant and allow optimization potential to be identified.

- Acquisition of alarms/messages:

  Avoiding disruptions to production by supporting maintenance and deriving preventive maintenance measures.

- Provision of the widest range of evaluations and analyses:

  – Display of the average duration of disturbances and their percentage of the planned machine usage time.

  – Weak point analysis by showing the effects on upstream and downstream stations.

Benefits

- **Improved productivity**
- **Increased machine availability**
- **Enhanced transparency of the production status**

16.4 Analyze MyPerformance /OEE Monitor (MindSphere)

✓ SINUMERIK ONE PPU 1740	✓ SINUMERIK ONE NCU 1740	✓ SINUMERIK ONE NCU 1750	✓ SINUMERIK ONE NCU 1760
Option: via SISW	Option: via SISW	Option: via SISW	Option: via SISW

Analyze MyPerformance /OEE Monitor for analyzing performance in production with machine tools:

- Analyze MyPerformance /OEE Monitor creates maximum transparency of machine states and production data, thus enabling maximum productivity in the production environment.

- Analyze MyPerformance /OEE Monitor calculates the overall equipment efficiency (OEE) and provides important indicators for measures to increase efficiency.

- By automatically acquiring machine data and providing a user dialog for planning machine utilization and adding quality data, Analyze MyPerformance /OEE Monitor provides all the information required to optimize production.

Benefits

- **Improved productivity**
- **Reduction of production costs**
- **Enhanced transparency of the production status**

16.5 Analyze MyPerformance /OEE Tuning (MindSphere)

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
⚙	Option: via SISW	⚙	Option: via SISW	⚙	Option: via SISW	⚙	Option: via SISW

With Analyze MyPerformance /OEE Tuning on MindSphere, you can increase productivity and reduce production costs:

- Analyze MyPerformance /OEE Tuning creates maximum transparency of machine states and production data, thus enabling maximum productivity in the production environment.

- Analyze MyPerformance /OEE Tuning calculates the overall equipment efficiency (OEE) and provides important indicators for measures to increase efficiency.

- By automatically acquiring machine data and providing a user dialog for planning machine utilization and adding quality data, Analyze MyPerformance /OEE Tuning provides all the information required to optimize production.

Benefits

- **Reduction of production costs based on insights into machine performance**
- **Optimized planning to ensure delivery reliability**
- **High transparency of machine utilization**

16.6   Manage MyMachines

☑ **SINUMERIK ONE PPU 1740**	☑ **SINUMERIK ONE NCU 1740**	☑ **SINUMERIK ONE NCU 1750**	☑ **SINUMERIK ONE NCU 1760**
⚙ Option: via SISW	⚙ Option: via SISW	⚙ Option: via SISW	⚙ Option: via SISW

Manage MyMachines visualizes numerous operating and plant-specific data of machine tools or individual machine components for production, as well as service and maintenance.

- Possibility to combine critical machine data for a meaningful analysis

- Data acquisition from time series and easy creation of rules and threshold values

- Determination of the machine utilization

Benefit

☑

- **Increased availability, utilization and efficiency of machine tools.**

16.7 Manage MyMachines /Remote

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
⚙	Option: via SISW	⚙	Option: via SISW	⚙	Option: via SISW	⚙	Option: via SISW

Manage MyMachines /Remote permits global and secure remote control and monitoring of machine tools connected to MindSphere via Manage MyMachines.

- For critical situations and preventive maintenance, OEM service organizations have immediate access to a comprehensive toolbox for remote diagnostics and troubleshooting.

- If you need support from service specialists such as internal experts or the machine manufacturer, you can provide real-time access to your HMI. All connections to and from a machine tool via the Internet are encrypted.

- Manage MyMachines /Remote meets all security guidelines for remote access to industrial machines.

Benefits

- **Faster problem solving and higher machine availability**
- **Improved service response time and quality**

16.8 Optimize MyMachining /Adaptive Control

✅ **SINUMERIK ONE PPU 1740**	✅ **SINUMERIK ONE NCU 1740**	✅ **SINUMERIK ONE NCU 1750**	✅ **SINUMERIK ONE NCU 1760**
⚙️ Option: via SISW	⚙️ Option: via SISW	⚙️ Option: via SISW	⚙️ Option: via SISW

Optimize MyMachining /Adaptive Control monitors the current cutting conditions in real-time and automatically adjusts the feedrate to the optimum speed.

- If an overload is detected, Optimize MyMachining /Adaptive Control reduces the feedrate and can trigger an alarm to stop the machine.

- Detection of tool breakage to prevent consequential damage.
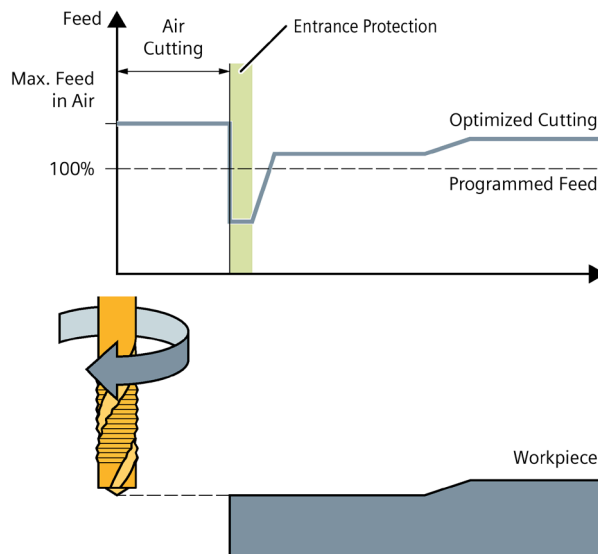
The solution consists of two main components:

- Real-time component:

  Compile Cycle Run MyCC /IMD to access the necessary data

- HMI component:

  SINUMERIK Operate, based on Run MyHMI /3GL

Optional: With the "Cross-operational actions" option, the synchronous action between the compile cycle and the HMI is executed automatically.

Note

Contact SIEMENS Industry Software (SISW) for further questions regarding the products and licenses.

> Contact SISW (https://new.siemens.com/global/en/products/automation/systems/cnc-sinumerik/digitalization/manufacturing.html)

Benefit

- **Optimize MyMachining /Adaptive Control boosts productivity, extends the machine and tool life, and ensures a stable production process.**

16.9 Industrial Edge for Machine Tools & Applications

16.9.1 Industrial Edge for Machine Tools

☑ **SINUMERIK ONE PPU 1740**	☑ **SINUMERIK ONE NCU 1740**	☑ **SINUMERIK ONE NCU 1750**	☑ **SINUMERIK ONE NCU 1760**
⚙ Option: via SISW	⚙ Option: via SISW	⚙ Option: via SISW	⚙ Option: via SISW

Industrial Edge for Machine Tools enables new capabilities for the machine tool, for immediate processing of high-frequency data volumes – directly where they arise.

By decoupling data processing tasks and automation, safe machine operation is always guaranteed. At the same time, customer-specific applications run on Industrial Edge for Machine Tools – for example to ensure workpiece quality and increase machine availability and machine productivity.

The cloud-based services of Industrial Edge for Machine Tools make it possible to distribute updates and new applications within a very short time. Entire machine parks can thus follow shorter innovation cycles – with maximum efficiency.

Benefits

- **Enables the storage and transmission of high-frequency data**
- **Reaction-free: no load on the NCU**
- **Use and development of further applications on Industrial Edge for Machine Tools**

16.9.2 Optimize MyMachining /Trochoidal

✅ **SINUMERIK ONE PPU 1740**	✅ **SINUMERIK ONE NCU 1740**	✅ **SINUMERIK ONE NCU 1750**	✅ **SINUMERIK ONE NCU 1760**
⚙ Option: via SISW	⚙ Option: via SISW	⚙ Option: via SISW	⚙ Option: via SISW

Optimize MyMachining /Trochoidal extends the existing vortex milling functionality by using the most advanced algorithms running on Industrial Edge for Machine Tools.

Based on the best possible optimized tool path and dynamic machine data, Optimize MyMachining /Trochoidal adapts programs – for more productive and tool-friendly machining of grooves [as well as pockets in the future].

The application for optimizing the NC programs is accessed directly on the controller. Its use is therefore particularly intuitive.

Benefits

- **Extends tool life and increases productivity**
- **Extension of the productive use of older machines – due to reduced mechanical load (e.g. bearings)**
- **Optimized process operations**

16.9.3 Analyze MyWorkpiece /Capture

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
⚙	Option: via SISW	⚙	Option: via SISW	⚙	Option: via SISW	⚙	Option: via SISW

Measurement data from SINUMERIK are stored in a structured way using Analyze MyWorkpiece /Capture:

- Generic acquisition of high-frequency data, storage in protected file

- Access to stored data via Siemens applications such as Analyze MyWorkpiece /Toolpath

- Access to data from different Edge devices as well as different programs via one instance of Analyze MyWorkpiece /Toolpath

Benefit

☑

- **Analyze MyWorkpiece /Capture provides high-frequency data as the basis for a variety of use cases**

16.9.4 Analyze MyWorkpiece /Monitor

☑ SINUMERIK ONE PPU 1740	☑ SINUMERIK ONE NCU 1740	☑ SINUMERIK ONE NCU 1750	☑ SINUMERIK ONE NCU 1760
⚙ Option: via SISW	⚙ Option: via SISW	⚙ Option: via SISW	⚙ Option: via SISW

Analyze MyWorkpiece /Monitor provides you with the following functions:

- Monitoring of process tags and comparison against the reference model

- Provision of information on the quality produced

- Flexible and job-based monitoring, e.g. for selected NC programs/tools

- Feedback on quality and traceability documentation for each workpiece, e.g. based on KPIs as indicators

Benefit

- **Documentation of workpiece and process quality**

16.9.5 Analyze MyMachine /Condition

☑	SINUMERIK ONE PPU 1740	☑	SINUMERIK ONE NCU 1740	☑	SINUMERIK ONE NCU 1750	☑	SINUMERIK ONE NCU 1760
🔧	Option: via SISW	🔧	Option: via SISW	🔧	Option: via SISW	🔧	Option: via SISW

Analyze MyMachine /Condition enables users to generate a machine tool's mechanical fingerprint so that potential deviations can be identified at an early stage, machine failures prevented, and machine operation optimized.

Various parameters can be recorded with the aid of flexibly configurable measurement series:

- Stiffness
- Friction/friction distribution
- Backlash
- Quadrant error
- Signature
- Down-cut
- Frequency response

The measurement results can be visualized and compared to reference values.

Benefits

- **Basis for condition-based maintenance**
- **Documentation and comparison of machine conditions**
- **Improved machine utilization through optimization of settings**

16.9.6 Analyze MyWorkpiece /Toolpath

✅ SINUMERIK ONE PPU 1740	✅ SINUMERIK ONE NCU 1740	✅ SINUMERIK ONE NCU 1750	✅ SINUMERIK ONE NCU 1760
⚙ Option: via SISW	⚙ Option: via SISW	⚙ Option: via SISW	⚙ Option: via SISW

Analyze MyWorkpiece /Toolpath can be used in various production stages:

- Analysis of the part program/dynamic files (trace) before starting machining.
- Analysis of dynamic files (trace) after machining with a real machine

Analyze MyWorkpiece /Toolpath provides various analysis functions:

- Analysis of the NC code
- Comparison of different versions of the optimization
- Checking the alignment of the tool
- Checking the dynamic tool paths

Benefits

✅
- **Quick localization of errors/tool paths in the NC program**
- **Comparison of programmed and real NC paths**

Tools and information

17

17.1   DXF reader

☑ SINUMERIK ONE PPU 1740		☑ SINUMERIK ONE NCU 1740		☑ SINUMERIK ONE NCU 1750		☑ SINUMERIK ONE NCU 1760	
✔	Option: P56	✔	Option: P56	✔	Option: P56	✔	Option: P56

The integrated DXF Reader allows you to accept and extract contours and positions from DXF files.

- **DXF Reader in the Program Manager**

  With the Program Manager, you can open DXF files in the DXF Reader. You can either clean DXF data automatically
  or select the desired layer yourself.

- **Import DXF data in the contour calculator**

  You can either clean the imported DXF data automatically or select the desired layer yourself.

  Cleaned DXF data can be buffered as new DXF file.

- **Import DXF data in position patterns**

  You can import the positions from a DXF file for position patterns for the associated technologies.
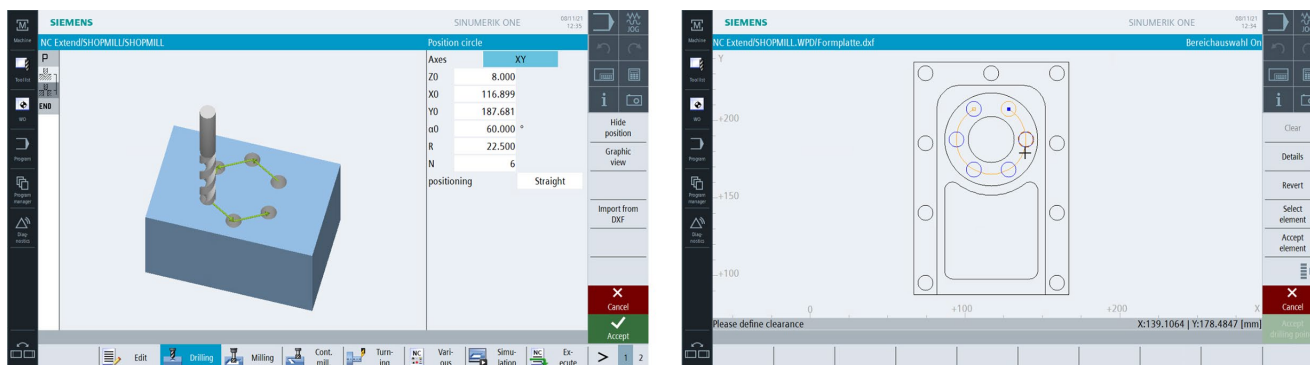
Benefits

- **Time saving for generating the production data**
- **Avoidance of mistakes and inaccuracies**
- **Higher workpiece quality**

17.2   Run MyScreens

✓	SINUMERIK ONE PPU 1740	✓	SINUMERIK ONE NCU 1740	✓	SINUMERIK ONE NCU 1750	✓	SINUMERIK ONE NCU 1760
✔	Option: P64	✔	Option: P64	✔	Option: P64	✔	Option: P64

With "Run MyScreens" you can design your own operating screens and implement user-specific function extensions. You can also implement your own cycle screen forms that can also be called from the part program editor.

Configuring examples for new screen forms, which can also be used as the basis for the user's own new screen forms, can be found in the supplied toolbox.

"Run MyScreens" is configured using ASCII files and then interprets them. The ASCII files contain the descriptions for the layout of interactive screen forms, softkey functions, and texts and images to be displayed. These configuring files are created with the ASCII editor, taking into account certain special rules of syntax.

Benefit

- **Configuration language with simplified syntax, including do-while loops, string and file functions (reading and writing text file and drive data, string processing, password function)**
- **Integration of 3D-animated graphics with animated elements**

17.3 CNC4you

On the CNC4you portal, SINUMERIK users can find helpful tips & tricks, SinuTrain downloads, tutorials and more.

CNC4you portal:
http://www.siemens.de/cnc4you

17.4 Video tutorials

Below you will find selected video tutorials.

- **SINUMERIK live Milling of freeform surfaces**

  Milling of freeform surfaces using 3-axis milling machines

  ▶ Video tutorial (https://youtu.be/l7Ywm6jVf8k)

- **SINUMERIK live Dynamic 5-axis machining with SINUMERIK Operate**

  Programming dynamic 5-axis machining directly in SINUMERIK Operate – Basics, possibilities, and limits

  ▶ Video tutorial (https://youtu.be/0YVqEm7CIUU)

- **SINUMERIK live Machine-integrated workpiece measurement / 3-axis milling**

  Machine-integrated workpiece measurement for 3-axis milling – Principle and application with SINUMERIK Operate

  ▶ Video tutorial (https://youtu.be/BR4cnKy0TjI)

- **SINUMERIK live Cylinder surface transformation**

  Cylinder surface transformation (TRACYL) with SINUMERIK

  ▶ Video tutorial (https://youtu.be/gHcD51oBjhs)

- **SINUMERIK live - Multi-sided machining milling (3+2 axes)**

  Basics of milling and 3+2 axis milling with SINUMERIK Operate

  ▶ Video tutorial (https://youtu.be/uPX1SiVDNdQ)

- **Interpolation turning**

  With the help of the technology cycle (CYCLE959) "Interpolation turning", it is possible to perform turning processes on milling machines without rotary axes. Corners on external and internal contours can thus be beveled longitudinally and flat.

  Note: Video tutorial in English only

  ▶ Video tutorial (https://youtu.be/zt6qug4SnCY)

- **SINUMERIK live Effective multiple clamping**

  Effective multiple clamping – Principle and application with SINUMERIK Operate

  ▶ Video tutorial (https://youtu.be/nzUnDInd-ZE)

- **Managing tools with Manage MyTools**

  If you want to operate multiple machines efficiently, you need to manage the required tools. SINUMERIK Integrate for production Manage MyTools www.siemens.com/sinumerik-integrate provides centralized tool data management, presetter connectivity, tool planning, and (utilization) statistics. Access is possible both on the server and in SINUMERIK.

  ▶ Video tutorial (https://youtu.be/-IK1SFm-nos)

- **Tool and program management for the shopfloor with Manage MyResources**

  ↗ Introduction and video tutorials for Manage MyResources
  (https://new.siemens.com/global/en/markets/machinebuilding/machine-tools/cnc4you/cnc4you-videos/ttt-gen/manage-myresourses-tutorials.html)

- **Managing NC programs with Manage MyPrograms**

  If you have to manage many part programs and versions before production, you need an efficient tool to organize and distribute files to machines. SINUMERIK Integrate for production Manage MyPrograms www.siemens.com/sinumerik-integrate enables paperless manufacturing by allowing you to easily transfer programs and production information to machines.

  ▶ Video tutorial (https://youtu.be/MUvNBap7Sns)

- **Industrial Edge for machine tools**

  With Industrial Edge for machine tools, the high-frequency data streams generated during manufacturing in the CNC are analyzed and processed in an application-specific manner.

  ↗ Tutorials on Edge Computing on machine tools
  (https://new.siemens.com/global/en/markets/machinebuilding/machine-tools/cnc4you/)

- **Unique 3D tool path analysis with Analyze MyWorkpiece /Toolpath**

  The PC-based software Analyze MyWorkpiece /Toolpath helps increase productivity and part quality by analyzing and optimizing NC programs and SINUMERIK trace data with modern 3D visualization. This allows errors in the NC program to be detected at an early stage and non-optimal retraction movements of the machine to be detected.

  ▶ Video tutorial (https://youtu.be/sHWR8t9NohY)

- **SINUMERIK live – Use of DXF for CNC programming**

  "In the SINUMERIK live video series, we present application technology, explained in an easy and understandable way. You are introduced to the productive and professional use of SINUMERIK control functions using theoretical and practical examples. We will start with the topic "DXF application: Faster from the drawing to the component – Possibilities and limits".

  ▶ Video tutorial (https://youtu.be/XGXqqJtFYNs)

Safety functions

<div style="text-align: right; font-size: 3em; font-weight: bold;">18</div>

18.1 SINUMERIK Safety Integrated

✅ SINUMERIK ONE PPU 1740	✅ SINUMERIK ONE NCU 1740	✅ SINUMERIK ONE NCU 1750	✅ SINUMERIK ONE NCU 1760
⚙ Option: refer to the catalog	⚙ Option: refer to the catalog	⚙ Option: refer to the catalog	⚙ Option: refer to the catalog

SINUMERIK Safety Integrated provides integrated safety functions that support the implementation of highly effective personnel and machine protection.

"Safety Integrated" with the safety-relevant components "F-PLC" and "SINAMICS Integrated" can be used up to the following safety requirements:

- SINAMICS Safety Integrated functions:
    - SIL2 - safety class (Safety Integrity Level) according to IEC 61508
    - Performance level (PL) d according to DIN EN ISO 13849-1
    - Category 3 according to DIN EN ISO 13849-1
- F-PLC:
    - SIL3 - safety class (Safety Integrity Level) according to IEC 61508

As a consequence, the essential requirements concerning the functional safety can be implemented simply and cost-effectively.

The functional safety for machine tools covers:

- Functions for reliable monitoring of velocity and standstill
- Functions for establishing safe boundaries in work spaces and protected spaces, and for range recognition
- Functions for the safe activation and testing of holding brakes
- Direct connection of all safety-related sensors/actuators and their internal logic combination

Benefits

- **High level of flexibility: Supports the implementation of practical safety and operating concepts**
- **High level of security: Complete implementation of the safety functions in Category 3/SIL 2**
- **Increased availability: Absence of interference-susceptible electromechanical switching elements**
- **High degree of cost effectiveness: Reduction of the hardware and installation costs; simple commissioning and acceptance**

18.2 Collision avoidance

Machine tools are becoming ever faster and more complex. This is also placing more challenging demands on machine operators and programmers.

Operating errors often cause collisions and the associated production outages. This results in standstill times and high repair costs.

Whatever moves in space has the potential to collide. The collision avoidance options ensure optimum protection of moving and static machine components against collisions and prevent major damage.

Note

- The use of collision monitoring requires the availability of the relevant machine data and the associated visualization.

- The options for collision avoidance demand machine-specific enabling. Please contact your sales representative.

18.2.1 Protect MyMachine /3D Primitives

✅	SINUMERIK ONE PPU 1740	✅	SINUMERIK ONE NCU 1740	✅	SINUMERIK ONE NCU 1750	✅	SINUMERIK ONE NCU 1760
⚙	Option: S03	⚙	Option: S03	⚙	Option: S03	⚙	Option: S03

With the Protect MyMachine /3D Primitives option (previously Collision avoidance ECO option), you can monitor the minimum clearance between protection areas. The geometry of the protection areas is defined using protection area elements.

- Up to 64 protection areas
- Up to 64 protection area elements/Primitive
- Up to 20 collision pairs
- Block, cylinder, ball, or truncated cone
- In the modes JOG, MDI, Automatic
- Single-channel, multi-channel
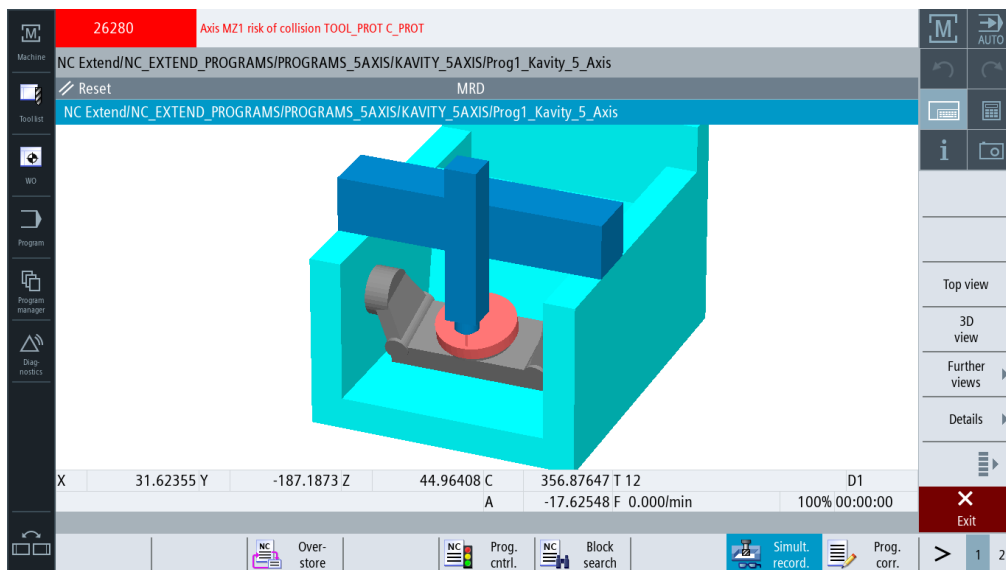
Benefits

- **Low-cost entry into the protection of the machine.**
- **Reduced CPU load of the CNC.**

18.2.2   Protect MyMachine /3D STL

☑ SINUMERIK ONE PPU 1740	☑ SINUMERIK ONE NCU 1740	☑ SINUMERIK ONE NCU 1750	☑ SINUMERIK ONE NCU 1760
⚙ Option: S02*	⚙ Option: S02*	⚙ Option: S02*	⚙ Option: S02*

* with constraints

With the Protect MyMachine /3D STL option (previously Collision Avoidance option), you can monitor the minimum clearance between protection areas. The geometry of the protection areas is defined using protection area elements.

- Such as Protect MyMachine /3D Primitives
- Max. number of protection area facets/up to 5000 triangles
- In the modes JOG, MDI, Automatic

Benefit

- **Machine-oriented mapping of complex protection areas possible.**

18.2.3 Protect MyMachine /Open

✅ SINUMERIK ONE PPU 1740	✅ SINUMERIK ONE NCU 1740	✅ SINUMERIK ONE NCU 1750	✅ SINUMERIK ONE NCU 1760
⚙ Option: S04	⚙ Option: S04	⚙ Option: S04	⚙ Option: S04

The Protect MyMachine /Open option (previously: Collision Avoidance ADVANCED) provides the following functions:
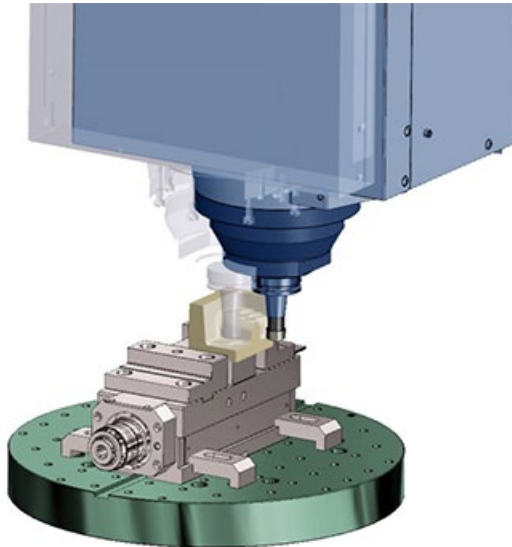
- Data interface for the integration of the Collision Avoidance system from ModuleWorks
- Inclusion of the entire machine model (3D machining area) in collision avoidance
- Collision protection even when using cycles and transformations
- Import/modification of the 3D models of tool, tool holder, clamping device, workpiece and tool adapter (angular head) directly from the CAD/CAM system
- Color highlighting in case of danger of collision enables quick identification of the collision location
- Real-time simulation of material removal
- Predictive collision detection by the CAS system enables controlled stopping or braking of the axes
- Collision detection using the look-ahead function
- JOG, MDI, Automatic modes

Benefit

✅

- **Collision monitoring also possible for complex machining operations, such as 5-axis simultaneous milling or turning with B axis.**

## 18.2.4 Protect MyMachine /3D Twin

✅ **SINUMERIK ONE PPU 1740**	✅ **SINUMERIK ONE NCU 1740**	✅ **SINUMERIK ONE NCU 1750**	✅ **SINUMERIK ONE NCU 1760**
🔧 Option: via SISW*	🔧 Option: via SISW*	🔧 Option: via SISW*	🔧 Option: via SISW*

* In addition, you need the options Industrial Edge for Machine Tools (via SISW) and Protect MyMachine /Open (option S04)

Protect MyMachine /3D Twin visually displays the machining process and machine movements using 3D Simulation, calculates potential collisions in advance, and stops machining when they are detected. Collision avoidance is based on a machine model of the real machine. This model also describes the protection areas of the machine and is provided by the machine manufacturer. In Protect MyMachine /3D Twin, you define the variable protection areas such as tools with holders, blanks and clamping operations.

- Import tool and clamping components as 3D model (*.stl) or redefine via fast protection

- Tool geometries and work offset data are continuously retrieved from NC and updated in the app

- Material removal simulation based on future positions (800 ms Ghost image) and actual axis positions

- Operating modes: AUTOMATIC, MDI, JOG
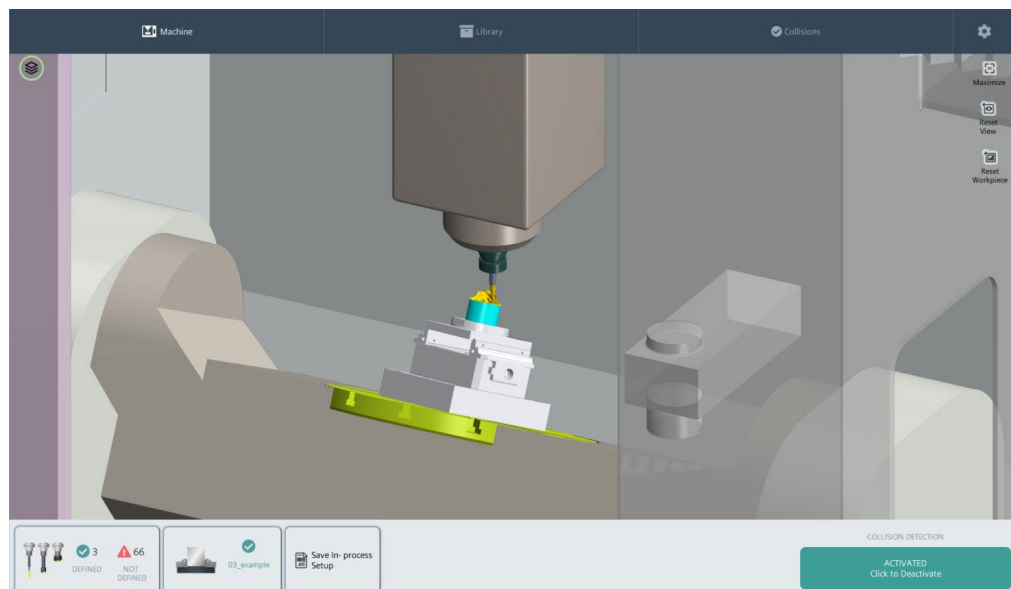
Benefit

- **Complete collision detection without compromising control performance.**
- **High usability through automatic updating of tool and offset data**

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