SIEMENS

SINUMERIK

SINUMERIK ONE
SINUMERIK Machining Technology Extensions

Function Manual

Valid for control:
SINUMERIK ONE

Valid for CNC software from version:
6.15 SP1

07/2022
A5E51733733B 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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Ⓟ 07/2022 Subject to change

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1.1 About SINUMERIK

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

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

1.2 About this documentation

Function Manual "SINUMERIK Machining Technology Extensions"

This manual describes the machining technologies that can be imported into a SINUMERIK control system to extend the scope of functions subsequently.

For each of these subsequently loadable machining technologies named "SINUMERIK Machining Technology Extensions (SMTE)", there is a separate chapter with all pertinent information about the functionality, commissioning, operation and programming of this application.

The target group is configuring engineers, technologists, commissioning engineers, machine operators and programmers.

Overview of contents

You will find on the title page an overview of all the SINUMERIK Machining Technology Extensions described.

Validity

The title page also contains all data about the validity, i.e. for which SINUMERIK control this manual is valid and from which CNC software version subsequent loading of SINUMERIK Machining Technology Extensions is supported.

Standard scope

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

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

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

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

Websites of third-party companies

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

1.3 Documentation on the internet

1.3.1 Documentation overview SINUMERIK ONE

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

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

The documentation is divided into the following categories:

- User: Operating
- User: Programming
- Manufacturer/Service: Functions
- Manufacturer/Service: Hardware

- Manufacturer/Service: Configuration/Setup
- Manufacturer/Service: Safety Integrated
- Information and training
- Manufacturer/Service: SINAMICS

1.3.2 Documentation overview SINUMERIK operator components

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

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

The documentation is divided into the following categories:

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

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

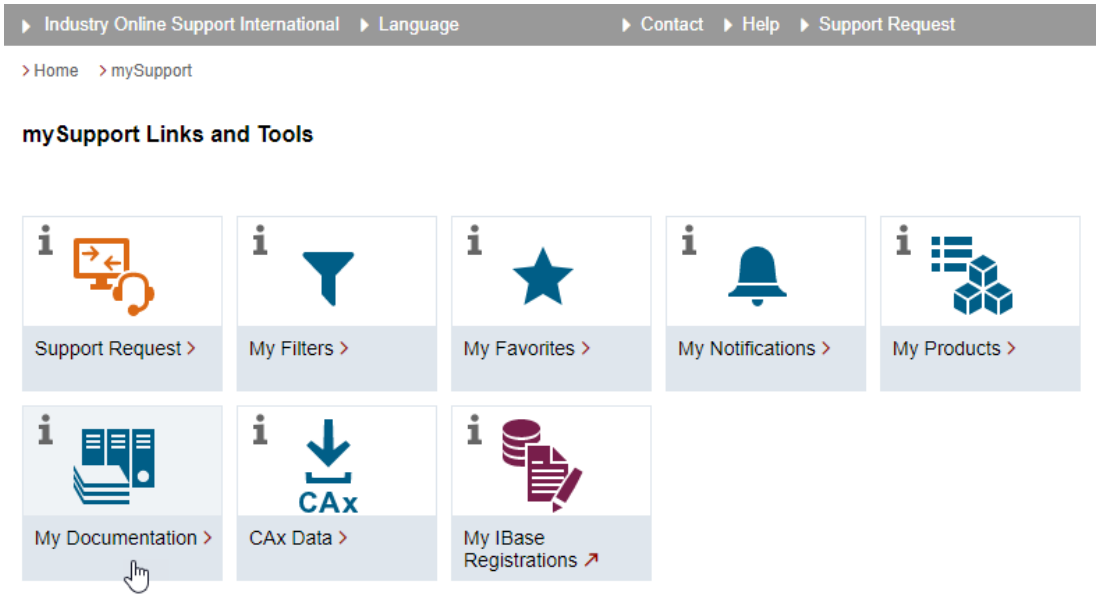
1.4 Feedback on the technical documentation

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

1.5 mySupport documentation

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

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



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

Note

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

1.6 Service and Support

Product support

You can find more information about products on the internet:

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

The following is provided at this address:

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

Technical support

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

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

Training

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

Siemens support on the go

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

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

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

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

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

Data matrix code on the nameplate

The data matrix code on the nameplate contains the specific device data. This code can be read with a smartphone and technical information about the device displayed via the "Industry Online Support" mobile app.

1.7 Important product information

Using OpenSSL

This product can contain the following software:

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

You can find more information on the internet:

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

Compliance with the General Data Protection Regulation

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

For this product, this means:

The product does not process or store any personal data, only technical function data (e.g. time stamps). If the user links this data with other data (e.g. shift plans) or if he/she stores person-related data on the same data medium (e.g. hard disk), thus personalizing this data, he/she must ensure compliance with the applicable data protection stipulations.

Fundamental safety instructions 2

2.1 General safety instructions

⚠ WARNING

Danger to life if the safety instructions and residual risks are not observed

If the safety instructions and residual risks in the associated hardware documentation are not observed, accidents involving severe injuries or death can occur.

- Observe the safety instructions given in the hardware documentation.
- Consider the residual risks for the risk evaluation.

⚠ WARNING

Malfunctions of the machine as a result of incorrect or changed parameter settings

As a result of incorrect or changed parameterization, machines can malfunction, which in turn can lead to injuries or death.

- Protect the parameterization against unauthorized access.
- Handle possible malfunctions by taking suitable measures, e.g. emergency stop or emergency off.

2.2 Warranty and liability for application examples

Application examples are not binding and do not claim to be complete regarding configuration, equipment or any eventuality which may arise. Application examples do not represent specific customer solutions, but are only intended to provide support for typical tasks.

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

2.3 Security information

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

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

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to

an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit
https://www.siemens.com/industrialsecurity (https://www.siemens.com/industrialsecurity).

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

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under
https://www.siemens.com/cert (https://www.siemens.com/cert).

Further information is provided on the Internet:

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

⚠ WARNING

Unsafe operating states resulting from software manipulation

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

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

General information, preconditions and settings 3

3.1 Definition

"SINUMERIK **M**achining **T**echnology **E**xtensions (SMTE)" are subsequently loadable machining technologies for extending the scope of functions of an SINUMERIK control system.

3.2 Terminology

For the sake of simplicity, "SINUMERIK Machining Technology Extensions" are referred to as "SMTE applications" in this document.

3.3 Availability

SMTE applications are software options that require licenses. To be able to use them, they must be allocated to the hardware via the license management.

3.4 Provision

The SMTE applications are provided in software packages that integrate themselves into the system independently. A subsequently loadable package consists of various components.

A programming interface in the form of a user interface is part of a package.

3.5 Memory usage

The SMTE applications generate part programs, some of which have a memory requirement of several megabytes. The storage capacity of the internal NC memory is not sufficient for this.

It is therefore advisable to execute the programs from an external program memory (NC Extend, network drive, statically included USB drive) using the function EES (Execution from External Storage). The following preconditions must be fulfilled:

- The "Expanded CNC user memory" or "Execute from external storage (EES)" licensed option must be set.
- The drives that are used as external memory on the control must be configured as a logical drives.

More information:

- On the EES function:
  → Function Manual Basic Functions
- On setting up drives:
  → Operating Manual

3.6 Setting up a drive

A symbolic name (LOCAL_DRIVE / CF_CARD / SYS_DRIVE) must be assigned to the local drive "NC Extend".

More information:

- On setting up drives:
  → Operating Manual

3.7 Data backup

SMTE applications are part of the SINUMERIK backup and are also stored when SINUMERIK data are archived.

Cone turning

4

4.1 Requirements

The following preconditions apply when using the SMTE "Cone Turning" application:

Licensing

The "SMTE Cone Turning" option requiring a license (article number: 6FC5800-0BR52-0YB0) must be set.

Note

If the license is only activated after the SMTE application has been installed, a restart of the system is required for the license verification.

Memory usage

→ See Chapter "General information, preconditions and settings (Page 13)".

Setting up a drive

→ See Chapter "General information, preconditions and settings (Page 13)".

Machine kinematics

The machine tool must have the following kinematics:

1. One positionable rotary axis
2. One linear axis, collinear to the rotary axis (feed motion)
3. One linear axis, radial to the rotary axis (infeed motion)

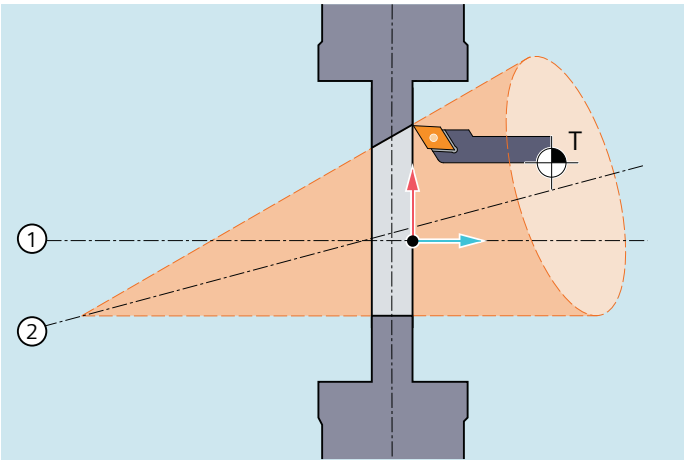
4.2 Function

The SMTE application "Cone Turning" is used for the production of non-rotation-symmetrical conical contours that have to meet the highest demands on accuracy and surface quality.

A function-specific input screen on the user interface supports the user in entering the required parameters. Based on these parameters, the cycle for producing the conical contour is created automatically.

Properties of the programmed cone

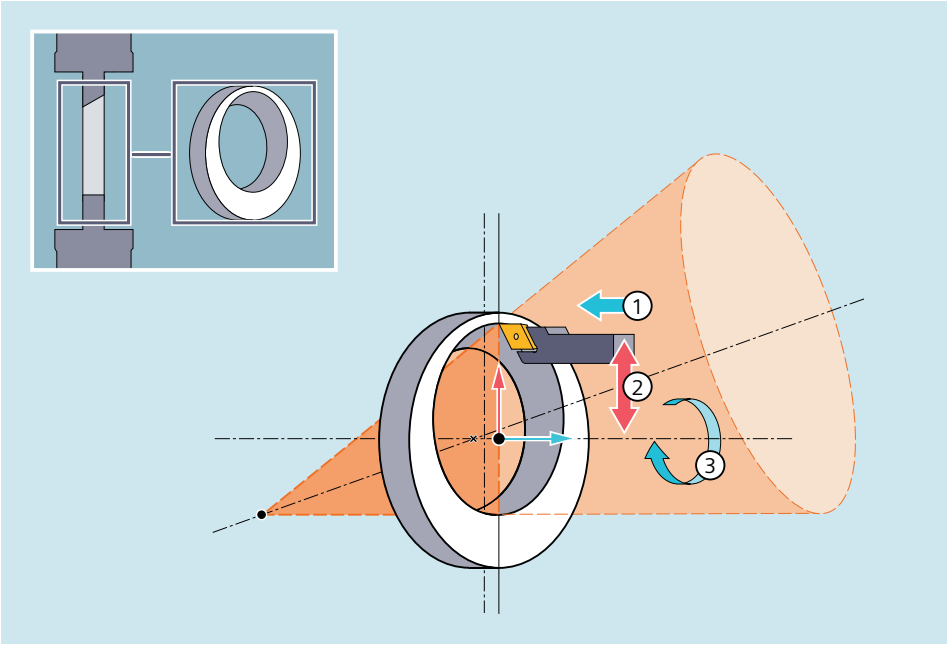
The orientation of the centerline of the cone deviates from the workpiece axis. The cut between the cone and the workpiece results in a non-rotation-symmetrical truncated cone and thus enables the production of a non-circular cone surface. Depending on the position and shape of the cone, the non-circular cone surface is either inside or outside the workpiece (internal or external processing). The following figure illustrates the principle using the example of internal processing:



① Workpiece axis
② Cone centerline

Compensating movements of the linear axes

During program execution, the workpiece rotates about its own axis. In order to be able to produce the non-circular cone surface, compensating movements of the tool take place in two linear axes:



① Feed motion of the tool
② Infeed motion of the tool
③ Rotation of the workpiece

The rotary axis rotates constantly at a fixed, defined speed. The maximum speed depends on the upper dynamic limits of the linear axes and can be limited by them.

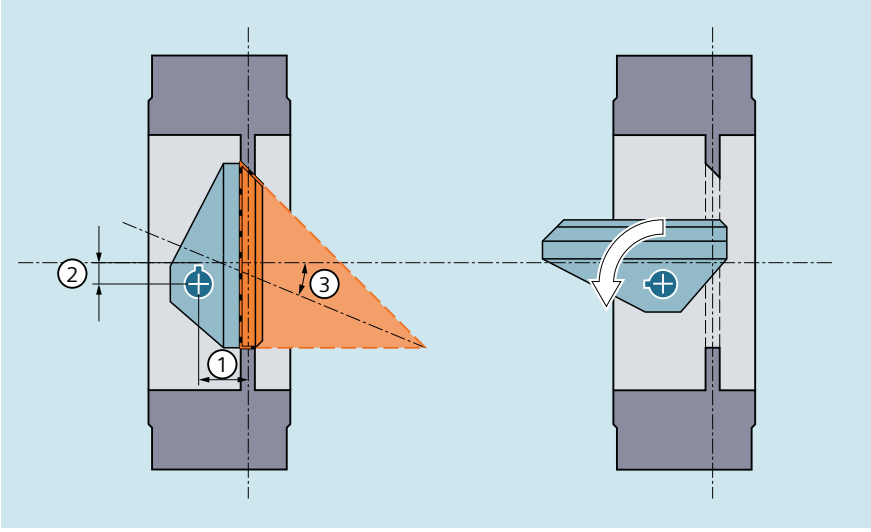
Note

Compensating movement for two linear axes

A compensating movement with only two linear axes results in a limitation in the eccentricity that can be produced, since in extreme cases the turning tool flank could collide with the component.

Application example

A typical application example of "Cone Turning" is producing a triple eccentric butterfly valve and its valve body:



① First eccentricity: offset between the center of the valve spindle and the centerline of the seat sealing surface

② Second eccentricity: offset between the center of the valve spindle and the centerline of the valve bore

③ Third eccentricity: angular offset between the centerline of the cone and the centerline of the valve bore

4.3 Setup

4.3.1 Importing the archive data

Requirement

To install the SMTE application "Cone Turning", it is necessary to log on as manufacturer.

Installation file

The data package provided by Siemens for installation of the SMTE application "Cone Turning" is the archive file "smte_cone.arc".

Installation

Start installation by importing the archive file "smte_cone.arc". The components contained in the archive file then integrate themselves independently into your system.

Procedure

1. Copy the file "smte_cone.arc" to an external storage medium to transfer the file to the SINUMERIK control system via the USB interface.
   - OR -
   Connect to the SINUMERIK control system to gain access to the SD Card of the NCU.
2. Copy the file "smte_cone.arc" to your control system.
3. Select the file "smte_cone.arc" in the program manager and then press the "Read in" softkey.
4. To complete installation, restart the SINUMERIK control system.

After the installation

After successful installation, all components required for the application to work are present on your system.

Storage location: .../oem/sinumerik/hmi/smte_cone

You can now continue with parameterization (Page 19) to complete commissioning of the SMTE application "Cone Turning".

Note

Uninstallation

If necessary, the SMTE application "Cone Turning" can easily be uninstalled again. You only have to delete the directory "smte_cone" completely.

4.3.2 Parameterization

4.3.2.1 Machine data

Channel-specific machine data

For cone turning, the following channel-specific machine data must be set in the machining channel:

MD28540 $MC_MM_ARCLENGTH_SEGMENTS

Function:	Number of storage elements for the arc length function for parameterization of polynomials
Recommended setting:	To obtain a smoother progression of the path velocity during cone turning, MD28450 must be set to at least the value "10": MD28540 $MC_MM_ARCLENGTH_SEGMENTS ≥ 10

MD20262 $MC_SPLINE_FEED_PRECISION

Function:	Tolerance factor that determines the permissible deviation of the path velocity or spindle speed for spline interpolations, compressor functions and polynomial interpolations.
Recommended setting:	MD20262 $MC_SPLINE_FEED_PRECISION = 0.001 (≙ default value) With this setting, for example, with a programmed spindle speed of 100 rpm only spindle speed deviations within the tolerance range of 99.9 rpm to 100.1 rpm are permissible.

MD22430 $MC_FGROUP_PATH_MODE

Function:	Path velocity response in singular situations
Recommended setting:	To avoid abrupt transitions during cone turning, the machine data must be set to the following value: MD22430 $MC_FGROUP_PATH_MODE = 3

Axis/spindle-specific machine data

For cone turning, the following axis/spindle-specific machine data must be set for the rotary axis in which the workpiece is clamped:

MD30455 $MA_MISC_FUNCTION_MASK

Function:	Axis functions
Recommended setting:	For the rotary axis, modulo and axis programming must be active. I.e., programmed positions that are outside the modulo range must be converted to modulo internally. To achieve this, the following bit must be set for this rotary axis in MD30455: MD30455 $MA_MISC_FUNCTION_MASK, bit 0 = 1

4.4 Operation and programming

4.4.1 SMTE application "Cone Turning"

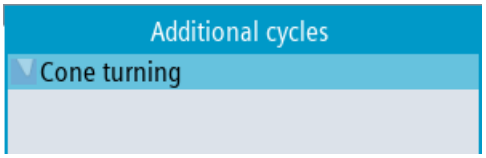
The part program to be edited has been created and you are in the editor.

Now call the SMTE application "Cone Turning".

Procedure

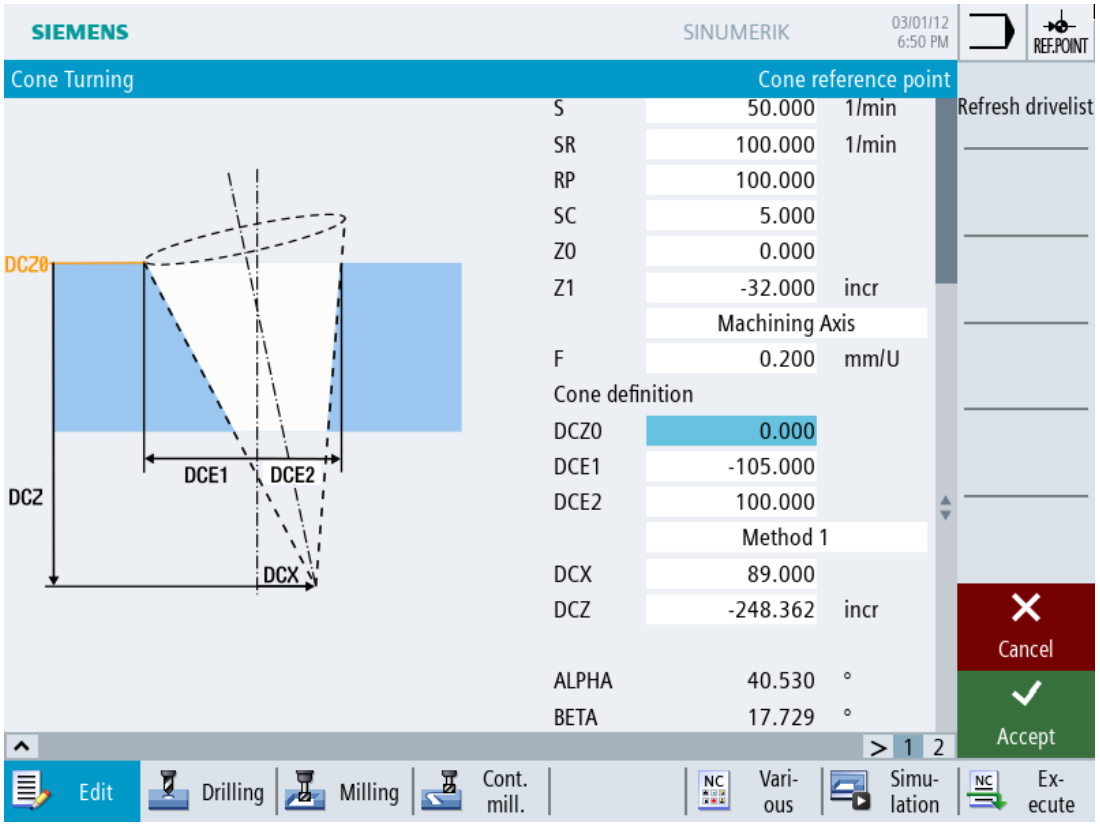
1. Press the menu forward key > and then the "Addition" softkey:

A selection list with all SMTE applications installed on your system opens:



2. Select "Cone Turning" and click "OK" to confirm.

The "Cone Turning" input window opens:



4.4.2 Setting parameters

You will find explanations of the parameters from the "cone turning" input window in the following table:

Parameters	Meaning		Unit [1)]
PRG	Program name Name of the program to be generated		
Drives	Drive selection list Drive on which the program to be generated will be saved. **Note:** Update the drive drop-down list with the "Refresh drivelist" softkey if new storage media are added or inserted during parameter assignment.		
RAX	Rotary axis Rotary axis on which the workpiece is clamped.		
IAX	Infeed axis Linear axis which radially maps the eccentric compensating movement to the center of rotation.		
MAX	Machining axis Linear axis which represents the infeed motion along the conical surface (revolutional feed rate).		
Contour relation	The contour reference can be defined with this parameter:		
	inside	Machining takes place within the defined cone, typically for the housing.	
	outside	Machining takes place outside the defined cone, typically for the valve.	
Machining	Machining direction Specifies the direction in which the rotary axis (RAX) rotates. This should be selected appropriately for the alignment of the turning tool.		
S	Machining speed		rpm
SR	Reduced speed for approaching		rpm
RP	Retraction plane (absolute) During machining the tool traverses in rapid traverse mode from the tool change point to the retraction plane and then to the safety distance. The machining feedrate is activated at this height. When the machining operation has finished, the tool traverses at the machining feedrate away from the workpiece to the safety distance height. It traverses from the safety distance to the retraction plane and then to the tool change point in rapid traverse mode. The retraction plane is entered as an absolute value. Normally, reference point DCZ0 and retraction plane RP have different values. The cycle assumes that the retraction plane is in front of the reference point.		mm
SC	Safety clearance (incremental) In the safety distance you define the distance to the material that is no longer moved in rapid traverse mode. The cycle automatically determines the effective direction of the safety clearance. Generally, the safety distance is effective in several directions. The safety distance is entered as an unsigned incremental value.		mm

Parameters	Meaning		Unit [1]
Z0	Reference point Z (absolute) Z position at the start of machining. → More information: Chapter "Setting a Z0 position (Page 26)".		mm
Z1	End depth (incremental) Depth referred to Z0.		mm
Feedrate reference	You can use this parameter to define the reference of the set feedrate:		
	Machining axis	The set feedrate refers to the machining axis. This results in a constant, helical motion of the machining axis.	
	Contour	The set feedrate is referred to the contour. This results in a compensation motion of the machining axis.	
	→ More information: Chapter "Setting the feedrate reference (Page 28)".		
F	Machining feedrate This parameter describes the feedrate per revolution.		mm/rev
Cone definition			
DCZ0	Cone reference point (absolute)		mm
DCE1	Distance of the cone edge in the negative direction of the infeed axis, starting from the center of rotation (incremental)		mm
DCE2	Distance of the cone edge in the positive direction of the infeed axis, starting from the center of rotation (incremental)		mm
Method	Method of cone definition		
	1	Cone definition via parameters DCX and DCZ	
	2	Cone definition via parameters ALPHA and BETA	
DCX	Distance to the cone apex in the infeed axis, starting from the center of rotation (incremental)		mm
DCZ	Distance to cone apex in the machining axis, starting from the cone reference point (incremental)		mm
DIR	Position of the cone apex relative to DCZ0		
	-	Cone apex is in the negative Z direction	
	+	Cone apex is in the positive Z direction	
ALPHA	Angle of aperture of the cone		Degrees
BETA	Angle of inclination of the cone		Degrees
→ More information for cone definition: Chapter "Defining cones (Page 22)".			
[1] The dimensions are interpreted exclusively in the metric system.			

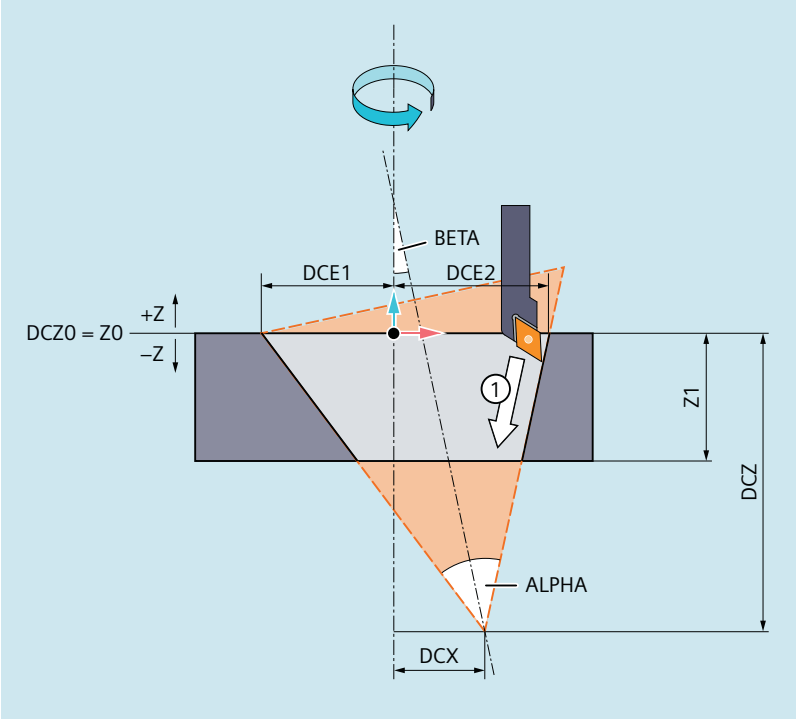
4.4.2.1 Defining cones

With the parameters for cone description, you can defined the shape and position of the cone according to the requirements.

Depending on the selected method, not only the cone reference point DCZ0 and the cone edge distances DCE1 and DCE2 must be entered for this but also either the distances of the cone apex DCX and DCZ (method 1) or the cone angles ALPHA and BETA and the position of the cone apex DIR (method 2).

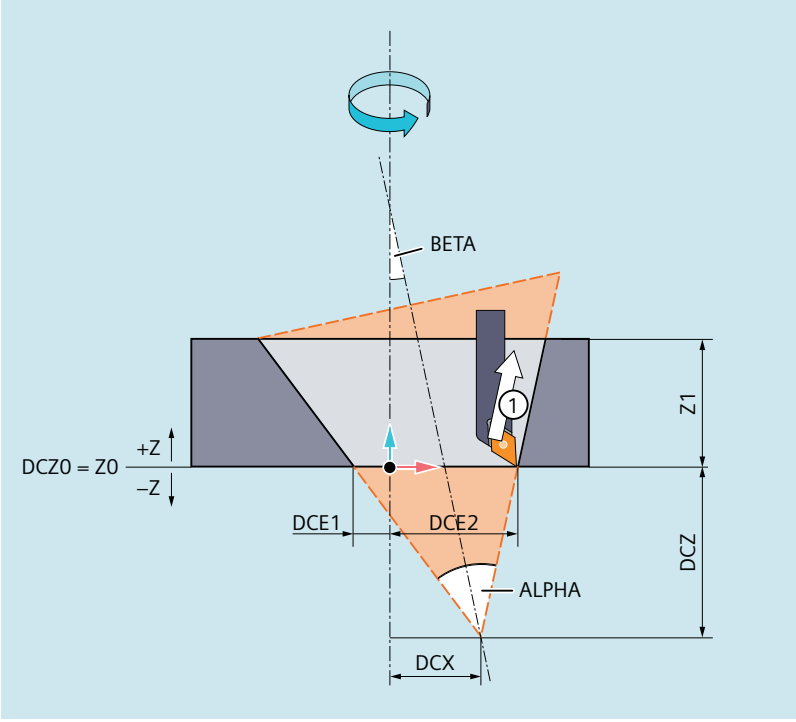
The following figures, which show selected cone positions and machining directions, are intended to illustrate and interpret these parameters.

Example 1



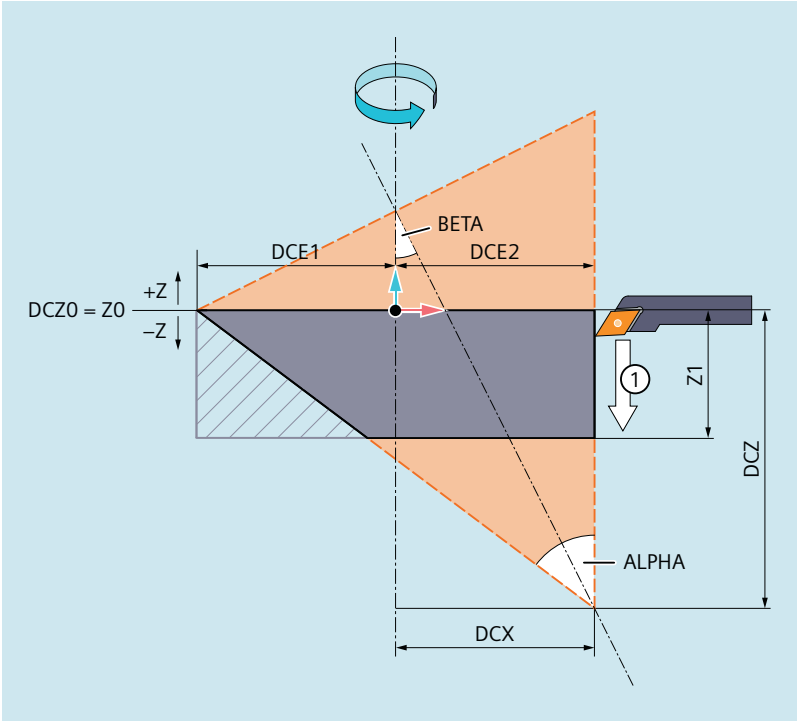
①	Machining direction
DCZ0	Cone reference point
Z0	Z position at the start of machining (in this case: identical to DCZ0)
Z1	End depth relative to Z0 (here with **negative** sign)
DCE1	Distance of the cone edge in the negative direction of the infeed axis, starting from the center of rotation
DCE2	Distance of the cone edge in the positive direction of the infeed axis, starting from the center of rotation
DCX	Distance to the cone apex in the infeed axis, starting from the center of rotation
DCZ	Distance to cone apex in the machining axis, starting from the cone reference point (in this case with **negative** sign)
ALPHA	Angle of aperture of the cone
BETA	Angle of inclination of the cone

Example 2



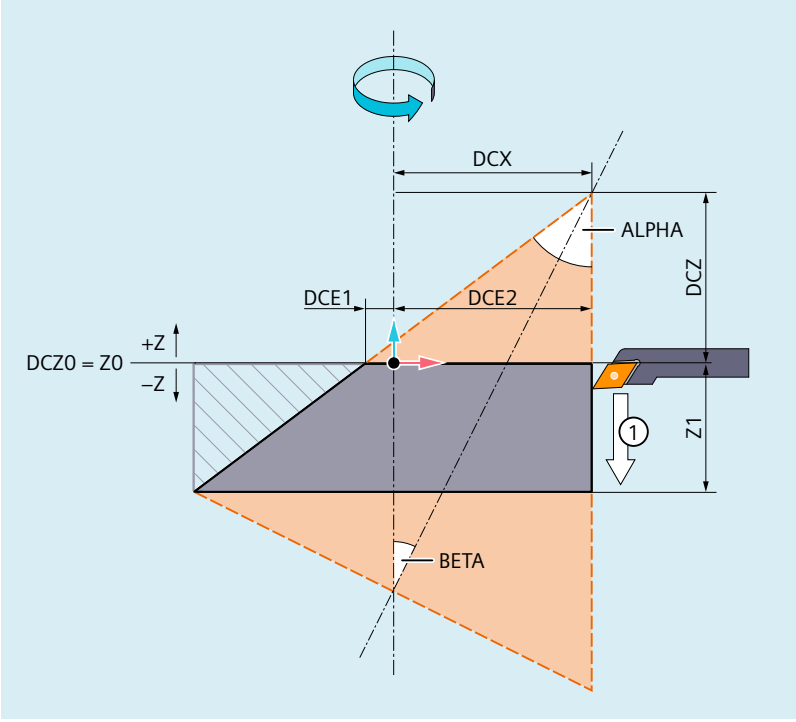
①	Machining direction
DCZ0	Cone reference point
Z0	Z position at the start of machining (in this case: identical to DCZ0)
Z1	End depth referred to Z0 (here with **positive** sign)
DCE1	Distance of the cone edge in the negative direction of the infeed axis, starting from the center of rotation
DCE2	Distance of the cone edge in the positive direction of the infeed axis, starting from the center of rotation
DCX	Distance to the cone apex in the infeed axis, starting from the center of rotation
DCZ	Distance to cone apex in the machining axis, starting from the cone reference point (in this case with **negative** sign)
ALPHA	Angle of aperture of the cone
BETA	Angle of inclination of the cone

Example 3



①	Machining direction
DCZ0	Cone reference point
Z0	Z position at the start of machining (in this case: identical to DCZ0)
Z1	End depth relative to Z0 (here with **negative** sign)
DCE1	Distance of the cone edge in the negative direction of the infeed axis, starting from the center of rotation
DCE2	Distance of the cone edge in the positive direction of the infeed axis, starting from the center of rotation
DCX	Distance to the cone apex in the infeed axis, starting from the center of rotation
DCZ	Distance to cone apex in the machining axis, starting from the cone reference point (in this case with **negative** sign)
ALPHA	Angle of aperture of the cone
BETA	Angle of inclination of the cone

Example 4



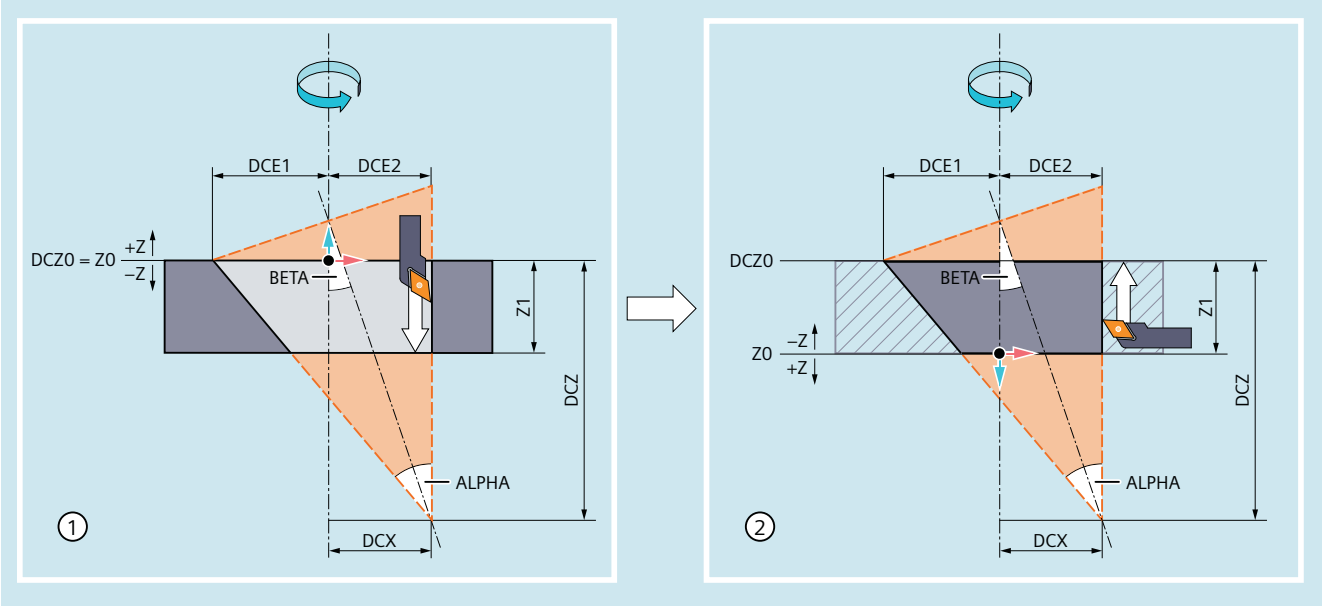
①	Machining direction
DCZ0	Cone reference point
Z0	Z position at the start of machining (in this case: identical to DCZ0)
Z1	End depth relative to Z0 (here with **negative** sign)
DCE1	Distance of the cone edge in the negative direction of the infeed axis, starting from the center of rotation
DCE2	Distance of the cone edge in the positive direction of the infeed axis, starting from the center of rotation
DCX	Distance to the cone apex in the infeed axis, starting from the center of rotation
DCZ	Distance to cone apex in the machining axis, starting from the cone reference point (in this case with **positive** sign)
ALPHA	Angle of aperture of the cone
BETA	Angle of inclination of the cone

4.4.2.2 Setting a Z0 position

With parameter Z0, enter the Z position at which machining is to start.

With the setting option of Z0 and DCZ0, you can adapt your machining to the machining tasks in a fast and uncomplicated way.

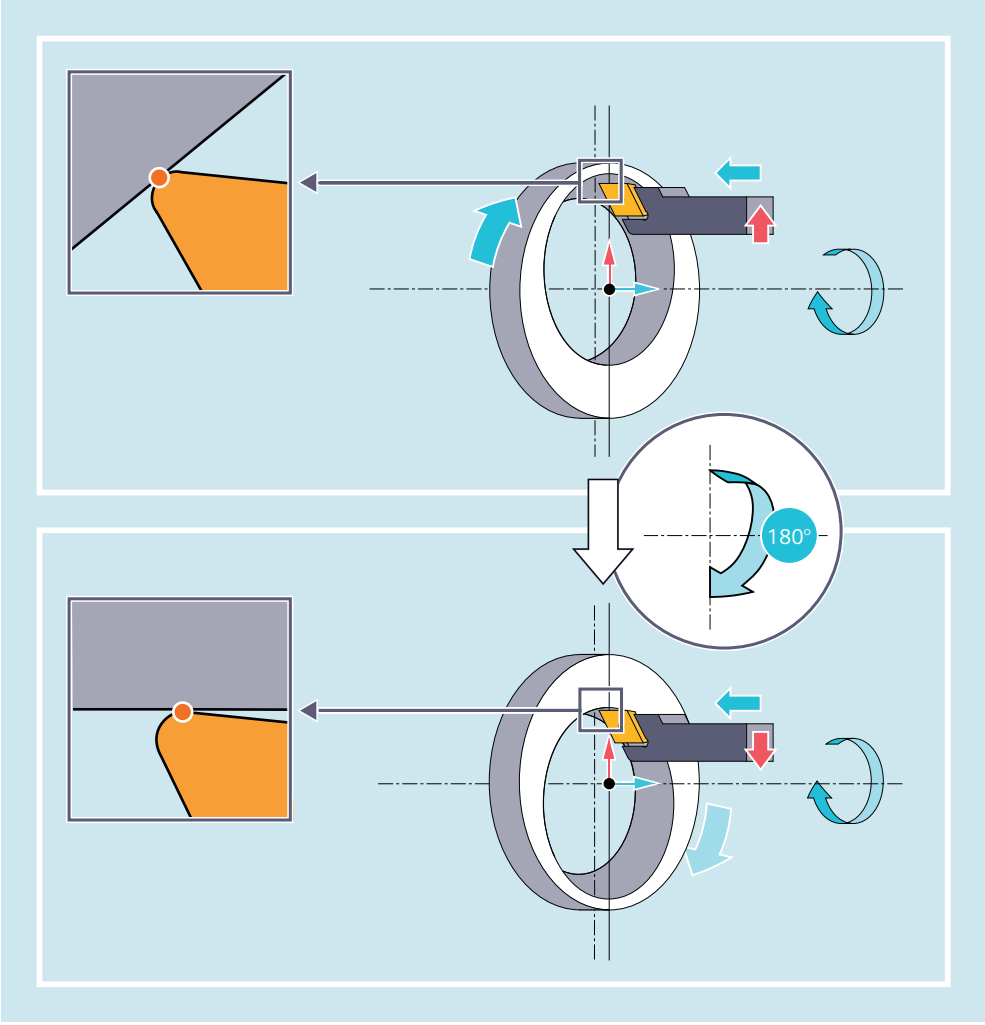
The following example is intended to illustrate this:



①	Definition of a cone for internal machining (e.g. for producing the body of an eccentric butterfly valve). In the example, the value for the cone reference point (DCZ0) and for the Z position at the start of machining (Z0) are initially identical: DCZ0 = Z0
②	To use the defined cone for external machining than (e.g. to produce the eccentric butterfly valve to fit the valve body), the Z0 value must be adapted accordingly.
DCZ0	Cone reference point
Z0	Z position at the start of machining
Z1	Final depth referred to Z0
DCE1	Distance of the cone edge in the negative direction of the infeed axis, starting from the center of rotation
DCE2	Distance of the cone edge in the positive direction of the infeed axis, starting from the center of rotation
DCX	Distance to the cone apex in the infeed axis, starting from the center of rotation
DCZ	Distance to cone apex in the machining axis, starting from the cone reference point
ALPHA	Angle of aperture of the cone
BETA	Angle of inclination of the cone

4.4.2.3 Setting the feedrate reference

Due to the dynamically changing pitch of the cone, the contact point between the tool and workpiece is shifted in the case of one rotation of the workpiece:



This leads to modified feedrate values on the workpiece surface and to deviations in surface quality.

For that reason, set the "feedrate reference" parameter according to your needs:

- Machining axis
  The set feedrate refers to the machining axis. No correction is calculated for the point of contact with the contour. This results in a constant, helical motion of the machining axis. With this setting the machining axis does not change direction during processing. This can be advantageous for high-mass axes and has no negative effect on contour accuracy.
- Contour
  The set feedrate is referred to the contour. This results in a compensation motion of the machining axis. The cycle corrects the changing contact point dynamically. This can result in the machining axis having to change direction on each revolution of the workpiece. The set feedrate is reproduced exactly on the workpiece surface.

4.4.3 Permissible tool types

The SMTE application "Cone Turning" allows the use of the following tool types:

- Ball end mill (type 110)
- Roughing tool (type 500)
- Finishing tool (type 510)

4.5 External programming

4.5.1 Programming CYCLE_CONE externally

Note

Cone turning with CYCLE_CONE is an option that requires a license!

Syntax

```
CYCLE_CONE(<_DRIVENAME>, <_PRGNAME>, <S_WRK>, <S_INSIDE>, <S_CCW>,
<_F>, <_RP>, <_Z0>, <_SC>, <_Z1>, <_SV1>, <_SV2>, <S_DCX>, <S_DCZ>,
<S_DCE1>, <S_DCE2>, <S_ROT_AX>, <S_INF_AX>, < S_MACH_AX>,
<S_DRVLST>, <S_DCZ0>, <S_ALPHA>, <S_BETA>, <S_DIR>, <S_MOD>)
```

Parameters

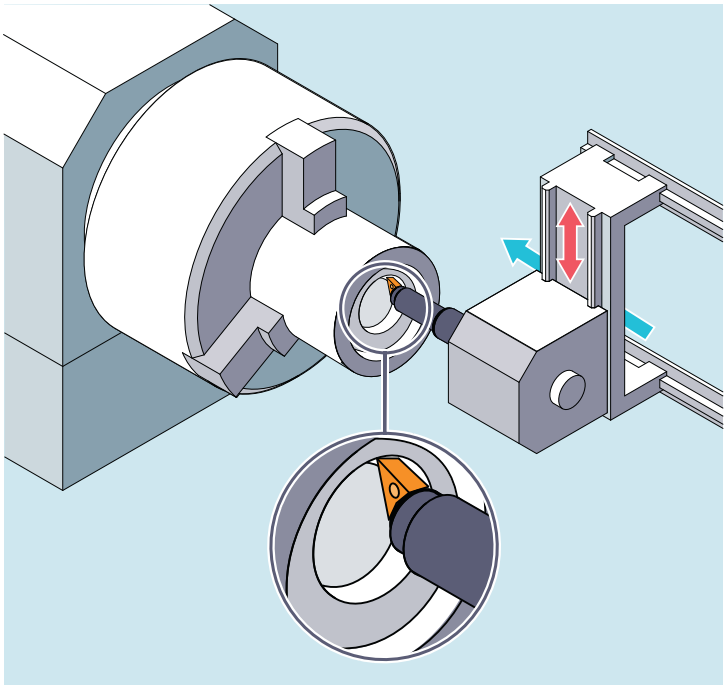
No.	Parameter Mask	Parameter Inside	Data type	Meaning	
1		<_DRIVENAME>	STRING[100]	Drive on which the program to be generated will be saved	
2	PRG	<_PRGNAME>	STRING[100]	Name of the program to be generated	
3		<S_WRK>	INT	Feedrate reference	
				0	Machining axis
				1	Contour
4		<S_INSIDE>	INT	Contour relation	
				0	External cone
				1	Internal cone
5		<S_CCW>	INT	Direction of rotation for machining	
				0	Clockwise (M4)
				1	Counterclockwise (M3)
6	F	<_F>	REAL	Feedrate in mm/rev	
7	RP	<_RP>	REAL	Retraction plane (absolute)	
8	Z0	<_Z0>	REAL	Reference point Z (absolute)	

9	SC	<_SC>	REAL	Safety clearance (incremental)	
10	Z1	<_Z1>	REAL	End depth (incremental) Sign determines the machining direction	
11	S	<_SV1>	REAL	Machining speed rpm	
12	SR	<_SV2>	REAL	Reduced starting speed rpm	
13	DCX	<S_DCX>	REAL	Distance to the cone apex in the infeed axis, starting from the center of rotation (incremental)	
14	DCZ	<S_DCZ>	REAL	Distance to cone apex in the machining axis, starting from the cone reference point (incremental)	
15	DCE1	<S_DCE1>	REAL	Distance of the cone edge in the negative direction of the infeed axis, starting from the center of rotation (incremental)	
16	DCE2	<S_DCE2>	REAL	Distance of the cone edge in the positive direction of the infeed axis, starting from the center of rotation (incremental)	
17	RAX	<S_ROT_AX>	STRING[10]	Selection of the rotary axis on which the workpiece is clamped	
18	IAX	<S_INF_AX>	STRING[10]	Identifier of the infeed axis	
19	MAX	<S_MACH_AX>	STRING[10]	Identifier of the machining axis	
20		<S_DRVLST>	INT	Flag for surface programming, has no effect on the cycle	
21	DCZ0	<S_DCZ0>	REAL	Cone reference point (absolute)	
22	ALPHA	<S_ALPHA>	REAL	Angle of aperture of the cone	
23	BETA	<S_BETA>	REAL	Angle of inclination of the cone	
24	DIR	<S_DIR>	INT	Position of the cone apex relative to DCZ0	
				-	Cone apex is in the negative Z direction
				+	Cone apex is in the positive Z direction
25		<S_MOD>	INT	Method of cone definition	
				0	Cone definition via parameters DCX and DCZ
				1	Cone definition via parameters ALPHA, BETA and DIR

4.6 Example

In this example, you create a non-rotation-symmetrical conical contour on the inner side of a workpiece. The workpiece is clamped centrally on the rotary axis or on the spindle, as in the following example machine.

Example machine



Tool

Processing should be performed with a roughing tool.

Creating a tool

1. Create the following tool in the tool management:

Type	Designation	Name	Cutting edge position
500	Roughing tool	SCHRUPPER_08	

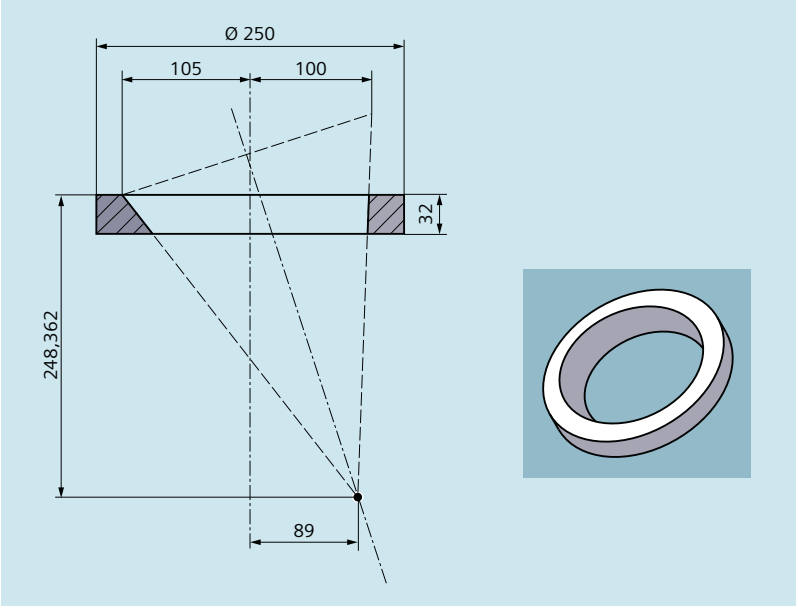
2. Enter the values for the following parameters in the tool list:
   - Lengths
   - Radius
   - Cutting tip angle, tool cutting edge angle
   - Reference direction
3. Adapt the cutting data to the tools used and the specific rated conditions in the NC program.

Blank

The blank is a pipe with the following dimensions:

Outer diameter	250 mm
Inner diameter	175 mm
Height	32 mm

Dimension drawing of the workpiece



Programming a workpiece

To program the workpiece, carry out the following steps:

1. Create the program.
2. Specify the work offset.
3. Blank input for visualization.
4. If necessary, add additional parameters.

Calling a tool

You are in the part program. Call the roughing tool before the SMTE application "Cone Turning".

Procedure

1. Press the "Select tool" softkey.
   The "Tool selection" window is opened.
2. Position the cursor on the required tool.

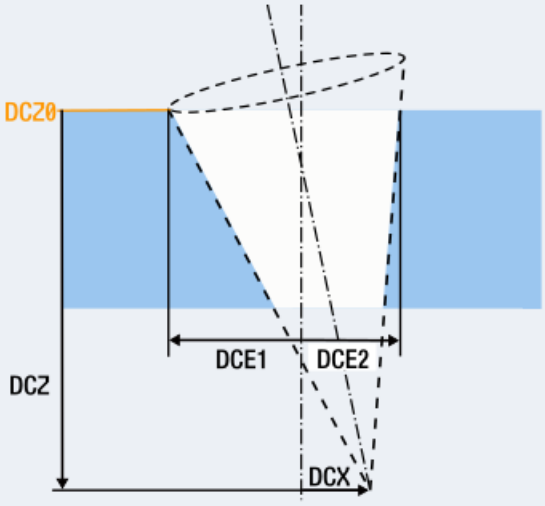
3. Press the "Accept" softkey.

   The selected tool is loaded into the G code editor. The corresponding text, e.g. T="SCHRUPPER_08", is displayed at the current cursor position in the G code editor.
4. Program the tool change (M6).
5. Define the following parameters:
   - Spindle speed (S...)
   - Direction of spindle rotation (M3)
   - Cooling (M8), if applicable

Programming cycle for cone turning

Procedure

1. Call the SMTE application "Cone Turning".
   → See Chapter "Operation and programming (Page 20)".
2. Enter the following parameter values in the "Cone Turning" input window:



PRG	generatedCone	
	Local drive	
RAX	c	
IAX	x	
MAX	z	
	inside	
	M4	
S	50.000	1/min
SR	100.000	1/min
RP	100.000	
SC	5.000	
Z0	0.000	
Z1	-32.000	incr
	Machining Axis	
F	0.200	mm/U
Cone definition		
DCZ0	0.000	
DCE1	-105.000	
DCE2	100.000	
	Method 1	
DCX	89.000	
DCZ	-248.362	incr
ALPHA	40.530	°
BETA	17.729	°

Part program

After the parameters entered have been transferred, the program line with the cycle for producing the conical contour is generated in the part program:

Program code

```
T="SCHRUPPER_08"
M6
G510
WORKPIECE(, "C", , "PIPE", 256, 0, -32, -80, 400, 200)
```

```
Program code
G0 Z100
G0 Y0 C0 X80
CYCLE_CONE("\\LOCAL_DRIVE:\", "generatedCone.mpf", 0, 1, 0, 0.2, 100, 0.5, -32, 50,
100, 89, -248.362, -105, 100, "c", "x", "z", 2, 0, 40.53002, 17.72902, 1, 0).
M30
```

4.7 Data lists

4.7.1 Alarms

The SMTE application "Cone Turning" includes alarms that are not SINUMERIK standard alarms.

In case of an error, the corresponding alarm message is displayed in the header of the user interface.

The following alarms are part of the package:

Alarm: "Cone too small"	
Explanation:	The cone portion to be machined can be smaller than Z1 due to the tool radius compensation. - Or - Z1 is too large.
Response:	Alarm display. NC stop on alarm.
Remedy:	Check parameterization of Z1.
Program continuation:	Delete alarm message using the Reset button. Restart the part program.

Alarm: "Cone radius too small"	
Explanation:	Cone radius was parameterized too small.
Response:	Alarm display. NC stop on alarm.
Remedy:	Enlarge cone radius.
Program continuation:	Delete alarm message using the Reset button. Restart the part program.

Alarm: "After taking into account the tool radius compensation, the cone radius is too small"	
Explanation:	The cone radius becomes too small with radius correction of the tool.
Response:	Alarm display. NC stop on alarm.

Alarm: "After taking into account the tool radius compensation, the cone radius is too small"	
Remedy:	Increase cone radius or reduce tool radius.
Program continuation:	Delete alarm message using the Reset button. Restart the part program.

Engraving

5

5.1 Requirements

The following preconditions apply when using the SMTE application "Engraving":

Licensing

The "SMTE engraving" option that requires a license (article number: 6FC5800-0BR54-0Yx0) must be set.

Note

If the license is only activated after the SMTE application has been installed, a restart of the system is required for the license verification.

Memory usage

→ See Chapter "General information, preconditions and settings (Page 13)".

Setting up a drive

→ See Chapter "General information, preconditions and settings (Page 13)".

Machine kinematics

The machine tool must have the following kinematics:

1. At least three linear axes
2. One spindle

5.2 Function

The SMTE application "Engraving" is used to make engravings in the form of texts, numerical strings or other character combinations. The font can be selected. All characters from the character set of the selected font can be combined as required.

A function-specific input screen on the user interface supports the user when entering all the required parameters.

Based on these parameters, the cycle for engraving the character string is automatically generated.

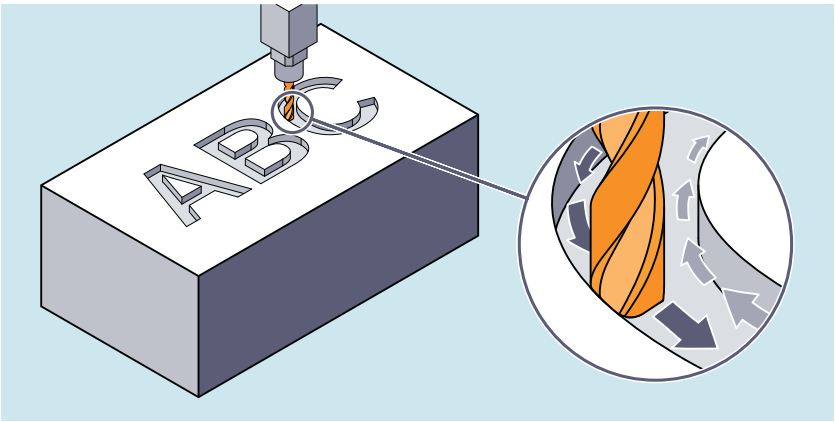
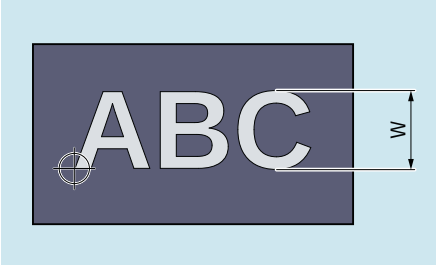


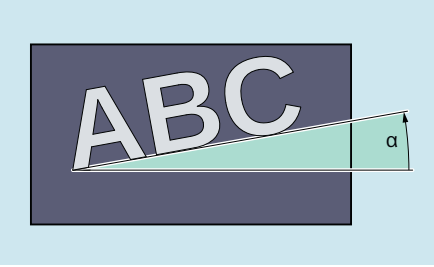
Figure 5-1 Engraving the text

Properties of the character string to be engraved

The character string to be engraved is parameterized with a start point (X0, Y0), an angle (α) and a character height (W). The character string length is obtained depending on the selected font and the entered character height. The start point is permanently referred to the lower left-hand corner of the character string. The text alignment is defined by the angle between the base line and the 1st geometry axis of the plane.



Start point and character height character string to be engraved



Angle between the base line and 1st geometry axis

Fonts

The following fonts are included in the scope of delivery of the SMTE application "Engraving":

- Arimo (Bold, BoldItalic, Italic, Regular)
- Cousine (Bold, BoldItalic, Italic, Regular)
- DancingScript (Bold, Regular)
- NotoSansSC (Bold, Regular)
- RobotoSlab (Bold, Light, Regular)
- Tinos (Bold, BoldItalic, Italic, Regular)
- Yellowtail (Regular)

When required, machine OEMs can add additional fonts.

→ Chapter "Installing additional fonts (Page 41)"

Application example

A typical application example includes milling part numbers or company names.

5.3 Commissioning

5.3.1 Importing the archive data

Requirement

To install the SMTE application "Engraving" it is necessary to log on as manufacturer.

Installation file

The data package provided by Siemens to install the SMTE application "Engraving" is the archive file "smte_engrave.arc".

Installation

Start installation by importing the archive file "smte_engrave.arc". The components contained in the archive file then integrate themselves independently into your system.

Procedure

1. Copy the "smte_engrave.arc" file to an external storage medium to transfer the file to the SINUMERIK control system via the USB interface.
   - OR -
   Connect to the SINUMERIK control system to access the NC memory.
2. Copy the "smte_engrave.arc" file to your control system.
3. Select file "smte_engrave.arc" in the program manager and then press the "Read in" softkey.
4. To complete installation, restart the SINUMERIK control system.

After the installation

After successful installation, all components required for the application to work are present on your system.

Storage location: .../oem/sinumerik/hmi/smte_engrave

The next commissioning step is to set the function-relevant system data: → Chapter "Parameterization (Page 40)".

Note

Uninstallation

If necessary, the SMTE application "Engraving " can be easily uninstalled again. You only have to delete the directory "smte_engrave" completely.

5.3.2 Parameterization

5.3.2.1 Machine data

Channel-specific machine data

The following channel-specific machine data must be set in the machining channel for the SMTE application "Engraving":

MD28540 $MC_MM_ARCLENGTH_SEGMENTS

Function:	Number of storage elements for the arc length function for parameterization of polynomials
Recommended setting:	To obtain a smoother path velocity characteristic, MD28450 must be set to at least the value "10": MD28540 $MC_MM_ARCLENGTH_SEGMENTS ≥ 10

MD20262 $MC_SPLINE_FEED_PRECISION

Function:	Tolerance factor that determines the permissible deviation of the path velocity or spindle speed for spline interpolations, compressor functions and polynomial interpolations.
Recommended setting:	MD20262 $MC_SPLINE_FEED_PRECISION = 0.001 (≙ default value) With this setting, for example, with a programmed spindle speed of 100 rpm only spindle speed deviations within the tolerance range of 99.9 rpm to 100.1 rpm are permissible.

MD22430 $MC_FGROUP_PATH_MODE

Function:	Path velocity response in singular situations
Recommended setting:	The machine data must be set to the following value to avoid abrupt transitions: MD22430 $MC_FGROUP_PATH_MODE = 3

5.3.3 Installing additional fonts

Requirement

To install additional fonts it is necessary to log on as manufacturer.

Installation

The selection of fonts provided can be extended as required.

The following file formats are permitted:

- *.otf
- *.ttf

Procedure

1. Copy the font files to be added to an external storage medium to transfer them to the SINUMERIK control system via the USB interface.
   - OR -
   Connect to the SINUMERIK control system to access the NC memory.
2. Copy the font files to the following directory in your control system:
   .../oem/sinumerik/hmi/smte_engrave/fonts
3. In order that the names of the fonts to be newly added are displayed in the drop-down list in the "Engraving" input window, you must appropriately extend file "fonts.ini":
   - Open file ".../oem/sinumerik/hmi/smte_engrave/fonts/**fonts.ini**".
   - You can find parameter "fontnumber" under the key [CONTROL]. Its value specifies the number of available fonts. Now increase this value by the number of fonts that have been added.
   - Then extend the list of fonts by adding lines with the required information for each of the fonts that has been newly added.

Example

You wish to add the "OEM-Font" font included in the scope of delivery. To do this, you copy the font to directory ".../oem/sinumerik/hmi/smte_engrave/fonts", and then adapt file "fonts.ini" as follows:

[CONTROL]
fontnumber = **8**

[FONT1]
...
[FONT2]
...
...
...
[FONT8]

fontname = OEM-FONT
typenumber = 2
typename1 = Regular
typefile1 = OemFont-Regular.otf
typename2 = Bold
typefile2 = OemFont-Bold.otf

After the installation

After successful installation, the added fonts are available for selection in the input window "Engraving" via parameter "Font".

5.4 Operation and programming

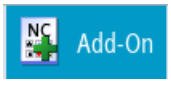
5.4.1 Calling the SMTE application "Engraving"

The part program to be edited has been created and you are in the editor.

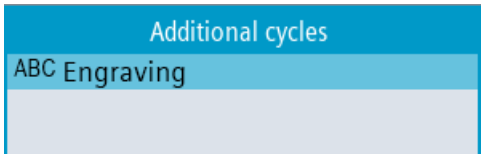
Now call the SMTE application "Engraving".

Procedure

1. Press the menu forward key > and then the "Addition" softkey:

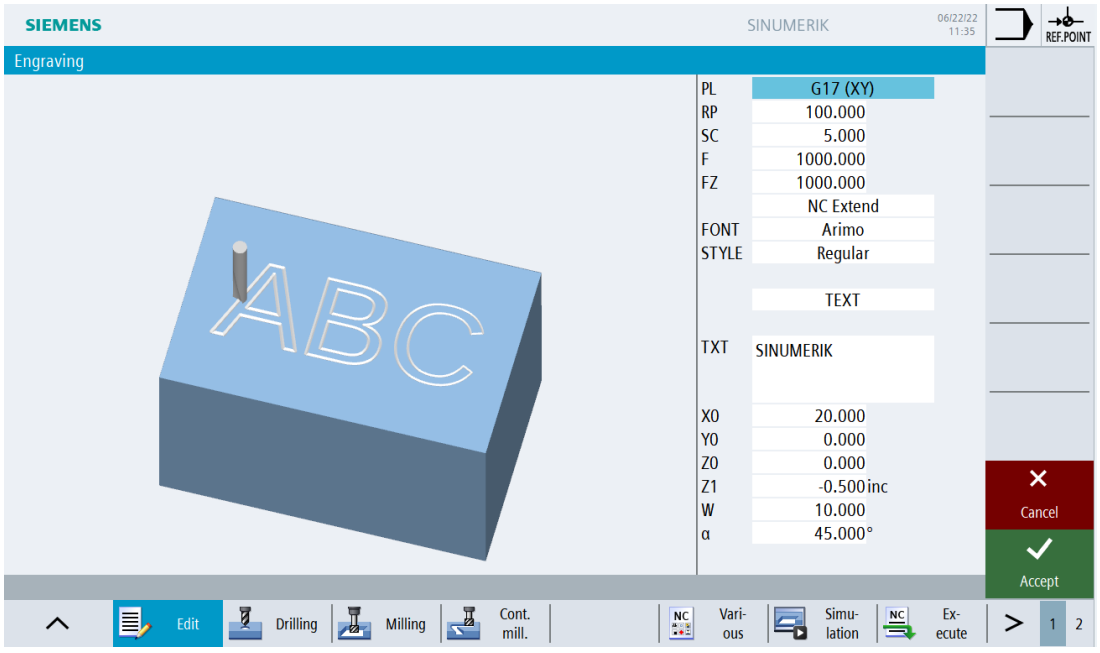


A drop-down list with all SMTE applications installed on your system opens:



2. Select entry "Engraving" and click "OK" to confirm.

The "Engraving" input window opens.



5.4.2 Setting parameters

Information on the parameters from input window "Engraving" is provided in the following table:

Parameters	Meaning	Unit [1)]
PL	Machining plane	
RP	Retraction plane	mm; inch
SC	Safety clearance (incremental) In the safety clearance you define the distance to the material that is no longer moved in rapid traverse mode. The cycle automatically determines the effective direction of the safety clearance. Generally, the safety clearance is effective in several directions. The safety clearance is entered as an unsigned incremental value.	mm; inch
F	Machining feedrate in the plane This parameter defines the linear feedrate in the plane.	mm/min; inch/mm
FZ	Machining feedrate in the infeed axis This parameter defines the linear feedrate in the infeed axis.	mm/min; inch/mm

Parameters	Meaning		Unit [1]
FONT	List of all available fonts		
	User defined	You can also select your own fonts using the list entry "User defined" The following preconditions must be fulfilled: • The font file format must be either *.otf or *.ttf. • The font file must lie in the current work directory. **Procedure:** 1. Select list entry "User defined". An entry field is displayed. 2. Enter the name of the font file in the entry field, e.g. "UserFont.ttf".	
Variable	Variable defined in the execution program that contains the character string to be engraved		
TXT	Character string to be engraved **Note:** To exclude errors in the "reverse translation" of the character string to be engraved, the following characters should not be included: • Comma • Inverted comma • Spaces • Parentheses • Semicolon Should an engraving nevertheless contain one or more of these characters, a variable defined in the execution program must be used instead of the "TXT" parameter for inputting the character string.		
X0	Reference point for X		mm; inch
Y0	Reference point for Y		mm; inch
Z0	Reference point Z (absolute) Z position at the start of machining.		mm; inch
Z1	End depth (incremental) Depth referred to Z0.		mm; inch
W	Width or height of the text		mm; inch
ALPHA	Angle between the 1st geometry axis and the character string to be engraved		Degrees
[1] The dimensions are interpreted in mm or inches depending on the selected base system.			

5.4.3 Permissible tool types

The SMTE application "Engraving" allows the use of the following tool types:

- All milling tools (types 100-199)
- Centering tool (type 220)
- Countersink (type 230)

5.5 External programming

5.5.1 CYCLE_ENGRAVE - external programming

Note

Engraving CYCLE_ENGRAVE is an option that requires a license!

Syntax

```
CYCLE_ENGRAVE(<_DRIVENAME>, <_PRGNAME>, <_TEXT>, <_FONT>, <_RTP>,
<_RFP>, <_SDIS>, <_DP>, <_PA>, <_PO>, <_STA>, <_CP1>, <_CP2>,
<_WID>, <_DF>, <_FFD>, <_FFP1>, <_VARI>, <_CODEP>, <_UMODE>,
<_GMODE>, <_DMODEZ>, <_DMODEE>, <_AMODE>, <_FONTLIST>, <_TYPELIST>,
<_DRVLST>, <_VARIABLE>)
```

Parameters

No.	Parameter Mask	Parameter Inside	Data type	Meaning
1		<_DRIVENAME>	STRING[100]	Drive on which the program to be generated will be saved
2	PRG	<_PRGNAME>	STRING[100]	Name of the program to be generated
3	TXT	<_TEXT>	STRING[200]	Character string to be engraved (max. 200 characters)
4	FONT	<_FONT>	STRING[150]	File name of the font to be used
5	RP	<_RTP>	REAL	Retraction plane (absolute)
6	Z0	<_RFP>	REAL	Reference point Z (absolute)
7	SC	<_SDIS>	REAL	Safety clearance (incremental)
8	Z1	<_DP>	REAL	Depth (incremental)
9	X0	<_PA>	REAL	Reference point 1st axis of the plane (absolute)
10	Y0	<_PO>	REAL	Reference point 2nd axis of the plane (absolute)
11	ALPHA	<_STA>	REAL	Text alignment, angle of the base line with respect to the 1st axis
12		<_CP1>	REAL	Reserved
13		<_CP2>	REAL	Reserved
14	W	<_WID>	REAL	Character height
15		<_DF>	REAL	Reserved
16	FZ	<_FFD>	REAL	Infeed rate, depth
17	F	<_FFP1>	REAL	Feedrate for surface machining
18		<_VARI>	INT	Reserved
19		<_CODEP>	INT	Reserved
20		<_UMODE>	INT	Reserved
21		<_GMODE>	INT	Reserved

22		<_DMODEZ>	INT	TENS display mode	
				1	Character string to be engraved from parameter <_TEXT>
				2	Character string to be engraved from parameter <_VARIABLE>
23		<_DMODEE>	INT	ONES display mode	
				0	Compatibility (→ the plane effective before the cycle call remains active)
				1	G17 (only active in the cycle)
				2	G18 (only active in the cycle)
				3	G19 (only active in the cycle)
24		<_AMODE>	INT	Reserved	
25		<_FONTLIST>	INT	Reserved	
26		<_TYPELIST>	INT	Reserved	
27		<_DRVLST>	INT	Reserved	
28	VAR	<_VARIABLE>	STRING[200]	Variable with the character string to be engraved	

5.6 Example

In this example, you engrave text "SINUMERIK Engrave" in two lines on a cuboidal blank.

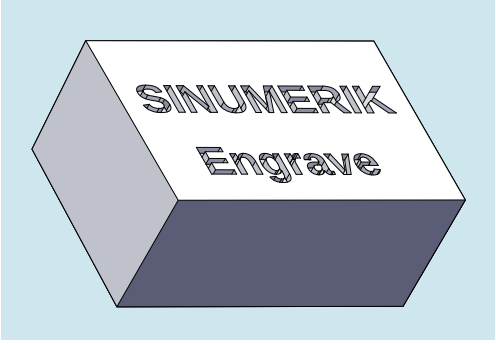


Figure 5-2 Preview

Tool

A ballnose cutter should be used for machining.

Creating a tool

1. Create the following tool in the tool management:

Type	Designation	Name	Cutting edge position
110	Ballnose cylindrical	BALLNOSE_D4	

2. Enter the values for the following parameters in the tool list:
   - Lengths
   - Radius
3. Adapt the cutting data to the tools used and the specific rated conditions in the NC program.

Blank

The blank is a cuboid with the following dimensions:

Length	200 mm
Width	150 mm
Height	10 mm

Dimension drawing of the workpiece

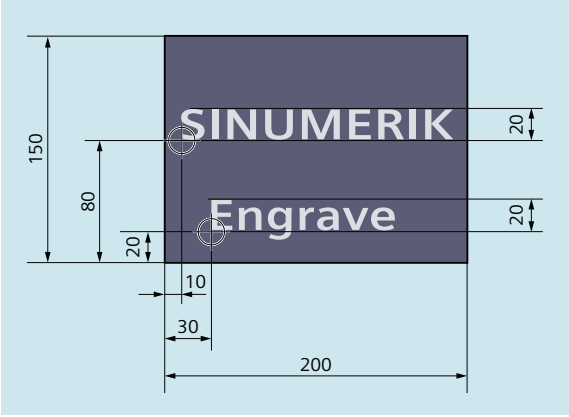


Figure 5-3 Dimension drawing with marking of the two start points

Programming a workpiece

To program the workpiece, carry out the following steps:

1. Create the program.
2. Specify the work offset.
3. Blank input for visualization.
4. Add additional parameters if required.

Calling a tool

You are in the part program. Call the milling tool before calling the SMTE application "Engraving".

Procedure

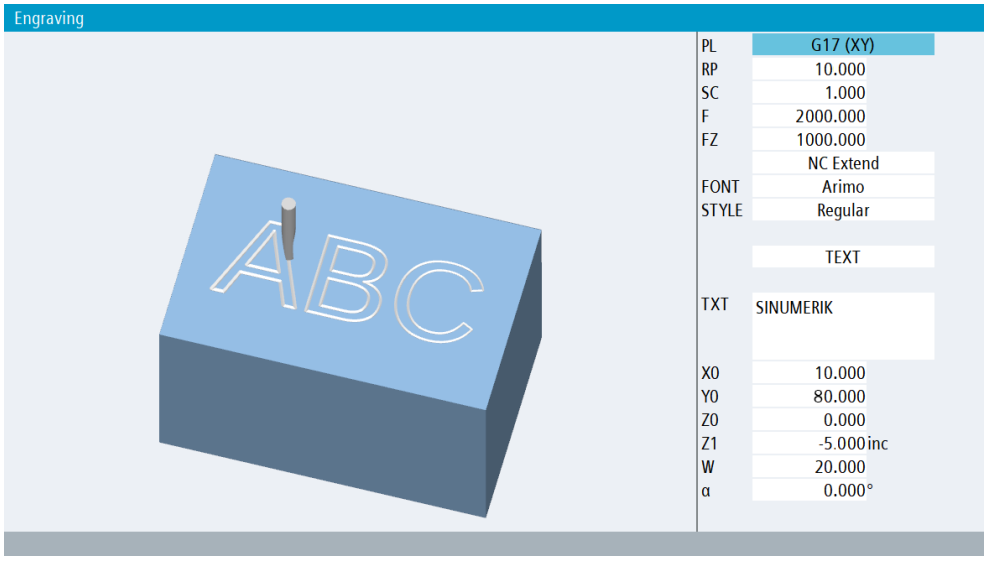
1. Press the "Select tool" softkey.
   The "Tool selection" window is opened.
2. Position the cursor on the required tool.

3. Press the "Accept" softkey.
   The selected tool is loaded into the G code editor. The corresponding text, e.g. T="BALLNOSE_D4", is displayed at the current cursor position in the G code editor.
4. Program the tool change (M6).
5. Define the following parameters:
   - Spindle speed (S...)
   - Direction of spindle rotation (M3)
   - Cooling (M8), if applicable

Programming engraving cycles

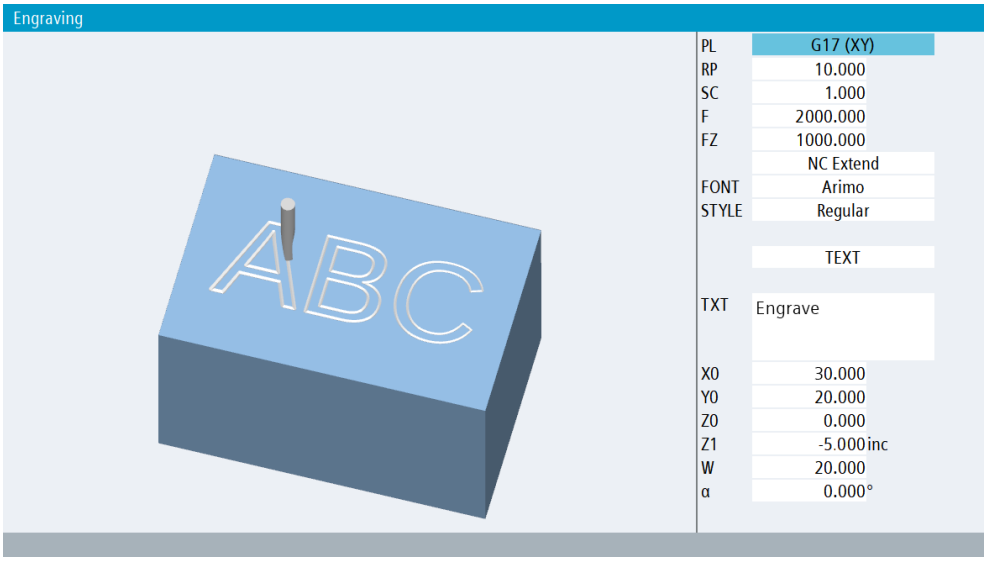
Procedure

1. Call the SMTE application "Engraving".
   → See Chapter "Calling the SMTE application "Engraving" (Page 42)".
2. Enter the following parameter values in the "Engraving" input window to engrave the first line:



3. Applying the settings.
   The program line with the cycle to engrave the first line is generated in the part program.
4. Call the SMTE application "Engraving" again to enter the parameters for the second line.

5. Enter the following parameter values in the "Engraving" input window to engrave the second line:



6. Applying the settings.
   The program line with the cycle to engrave the second line is generated in the part program.

Part program

Program code

```
T="BALLNOSE_D4"
M6
G54 F2000
WORKPIECE(, "C", , "BOX", 0, 0, -10, -80, -10, -10, 200, 150)
G0 Z100
G0 X10 Y80

CYCLE_ENGRAVE("\\SYS_DRIVE:\", "engrave", "SINUMERIK", "Arimo-Regular.ttf", 10, 0,
1, -5, 10, 80, 0, 0, 0, 20, 0, 1000, 2000, 0, 0, 0, 0, 1, 1, 1, 1, 1, 2, )

CYCLE_ENGRAVE("\\SYS_DRIVE:\", "engrave", "Engrave", "Arimo-Regular.ttf", 10, 0, 1,
-5, 30, 20, 0, 0, 0, 20, 0, 1000, 2000, 0, 0, 0, 0, 1, 1, 1, 1, 1, 2, )

M30
```

QR code

6

6.1 Requirements

The following preconditions apply when using the SMTE "QR code" application:

Licensing

The "SMTE QR code" option that requires a license (article number: 6FC5800-0BR53-0Yx0) must be set.

Note

If the license is only activated after the SMTE application has been installed, a restart of the system is required for the license verification.

Memory usage

→ See Chapter "General information, preconditions and settings (Page 13)".

Setting up a drive

→ See Chapter "General information, preconditions and settings (Page 13)".

Machine kinematics

The machine tool must have the following kinematics:

1. At least three linear axes
2. One spindle

6.2 Function

The SMTE application "QR code" is used to create position patterns in the form of data codes (QR codes or data matrix codes). The individual "data points" in the position pattern are surface structures, such as e.g. holes or rectangular pockets.

A function-specific input screen on the user interface supports the user when entering all the required parameters.

Based on these parameters, the cycle for creating the data code position pattern is created automatically.

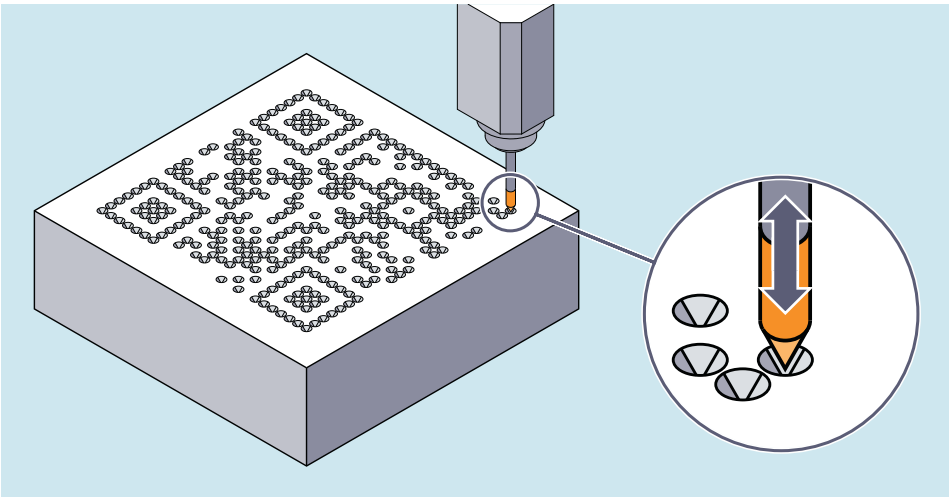


Figure 6-1 Creating a QR code position pattern

Application examples

For example, the following applications are typical:

- Products with a QR code that contain the internet address of the company as information.
- Mark a workpiece with a data matrix code that contains the part number as information so that it can be automatically identified in the subsequent production process.

6.3 Commissioning

6.3.1 Importing the archive data

Requirement

To install the SMTE application "QR code" it is necessary to log on as manufacturer.

Installation file

The data package provided by Siemens to install the SMTE application "QR code" is the archive file "smte_qrgen.arc".

Installation

You start the installation by importing the archive file "smte_qrgen.arc". The components contained in the archive file then integrate themselves independently into your system.

Procedure

1. Copy the "smte_qrgen.arc" file to an external storage medium to transfer the file to the SINUMERIK control system via the USB interface.
   - OR -
   Connect to the SINUMERIK control system to access the NC memory.
2. Copy the "smte_qrgen.arc" file to your control system.
3. Select file "smte_qrgen.arc" in the program manager and then press the "Read in" softkey.
4. To complete installation, restart the SINUMERIK control system.

After the installation

After successful installation, all components required for the application to work are present on your system.

Storage location: .../oem/sinumerik/hmi/smte_qrgen

SMTE application "QR code" has now been commissioned.

Note

Uninstallation

If necessary, the SMTE application "QR code " can be easily uninstalled again. You only have to delete the directory "smte_qrgen" completely.

6.4 Operation and programming

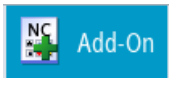
6.4.1 Calling the SMTE "QR code" application

The part program to be edited has been created and you are in the editor.

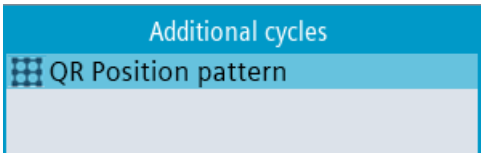
Now call the SMTE application "QR code".

Procedure

1. Press the menu forward key > and then the "Addition" softkey:

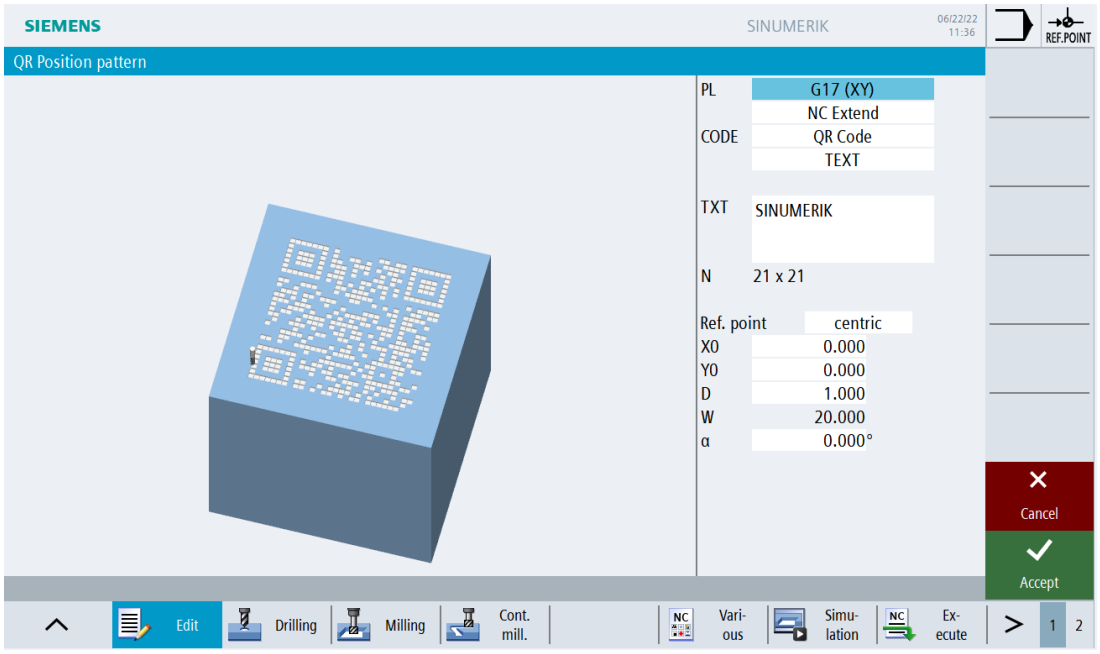
   

   A drop-down list with all SMTE applications installed on your system opens:

2. Select the "QR position pattern" entry and click "OK" to confirm.

The "QR position pattern" input window opens:



6.4.2 Setting parameters

Information about the parameters from input window "QR position pattern" is provided in the following table:

Parameters	Meaning		Unit [1)]
PL	Machining plane		
Drives	Drive selection list Drive on which the program to be generated will be saved.		
CODE	Data code to be generated		
	QR code	The input text is converted into a QR code.	
	Data matrix code	The input text is converted into a data matrix code.	
Text/variable	Method of transferring the input text		
	TEXT	Transfer from the text box	
	VARIABLE	Transfer from a variable	

Parameters	Meaning	Unit [1]
TXT	Input text Text that should be converted into data code. **Note:** To exclude errors in the "reverse translation" of the text to be converted, the following characters should not be included: • Comma • Inverted comma • Spaces • Parentheses • Semicolon Should the text to be converted nevertheless require one or more of these characters, a variable defined in the execution program must be used instead of the "TXT" parameter for input.	
Variable	Variable defined in the execution program that contains the text to be converted	
N	Calculated data code size (read only)	Pixels
Reference point	Data code reference point The following settings are possible: • Top left • Top right • Bottom left • Bottom right • Centered	
X0	Reference point for the 1st axis in the machining plane	mm; inch
Y0	Reference point for the 2nd axis in the machining plane	mm; inch
D	Distance between the data points	mm; inch
W	Position pattern size (read only)	mm; inch
Alpha	Angle between the 1st geometry axis and the position pattern to be created	Degrees
[1] The dimensions are interpreted in mm or inches depending on the selected base system.		

6.4.3 Permissible tool types

The SMTE "QR code" application allows the use of the following tool types:

- Milling cutter (type 100 - 131)
- Drill (type 200 - 210)
- Centering tool (type 220)
- Reamer (type 230 -231)

6.5 External programming

6.5.1 CYCLE_QRGEN - external programming

Note

Creating the data code position pattern using CYCLE_QRGEN is an option that requires a license!

Syntax

```
CYCLE_QRGEN(<_DRIVENAME>, <_PRGNAME>, <S_MODE>, <_TEXT>, <_X0>,
<_Y0>, <_DIST>, <_ANGLE>, <_HIGHT>, <_DMODEZ>, <_DMODEE>, <_DRVLST>,
<_REFPOINT>, <_VARIABLE>)
```

Parameters

No.	Parameter Mask	Parameter Inside	Data type	Meaning	
1		<_DRIVENAME>	STRING[100]	Drive on which the program to be generated will be saved	
2	PRG	<_PRGNAME>	STRING[100]	Name of the program to be generated	
3		<S_MODE>	INT	Code type	
				1	QR code
				2	Data matrix code (ECC200)
4	TXT	<_TEXT>	STRING[200]	Input text	
5	X0	<_X0>	REAL	Reference point 1st axis of the plane (absolute)	
6	Y0	<_Y0>	REAL	Reference point 2nd axis of the plane (absolute)	
7	W	<_DIST>	REAL	Distance between the data points	
8	ALPHA	<_ANGLE>	REAL	Angle between the 1st geometry axis and the position pattern to be created	
9		<_HIGHT>	INT	Reserved	
10		<_DMODEZ>	INT	Method of transferring the input text	
				1	Text from parameter <_TEXT>
				2	Text from parameter <_VARIABLE>
11	PL	<_DMODEE>	INT	Machining speed rpm	
12		<_DRVLST>	INT	Reserved	
13		<_REFPOINT>	INT	Data code reference point	
				1	centered
				2	bottom left
				3	bottom right
				4	top left
				5	top right
14	Variable	<_VARIABLE>	STRING[200]	Variable for input text	

6.6 Example

In this example, you create a QR code that contains the webpage www.siemens.com The data points comprise centerings.

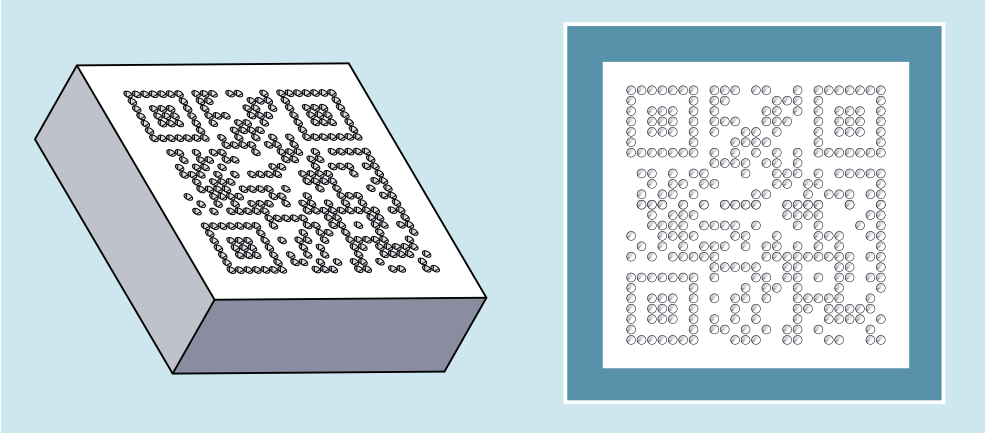


Figure 6-2 Preview

Tool

A centering drill should be used for machining.

Creating a tool

1. Create the following tool in the tool management:

Type	Designation	Name	Cutting edge position
220	Centering drill	CENTERDRILL_D3	

2. Enter the values for the following parameters in the tool list:
   - Lengths
   - Radius
   - Acute angle
3. Adapt the cutting data to the tools used and the specific rated conditions in the NC program.

Blank

The blank is a cuboid with the following dimensions:

Length	200 mm
Width	200 mm
Height	10 mm

Programming a workpiece

To program the workpiece, carry out the following steps:

1. Create the program.
2. Specify the work offset.
3. Blank input for visualization.
4. If necessary, add additional parameters.

Calling a tool

You are in the part program. Call the centering tool before calling the cycle.

Procedure

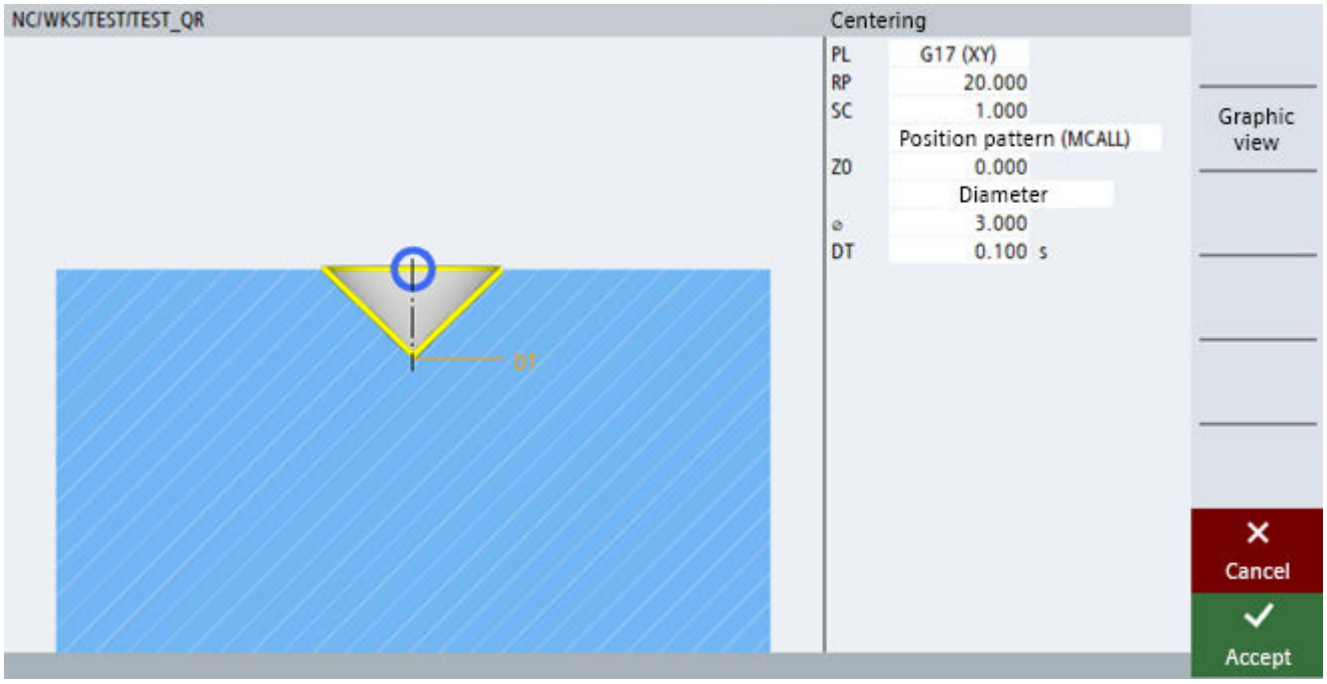
1. Press the "Select tool" softkey.
   The "Tool selection" window is opened.
2. Position the cursor on the required tool.

3. Press the "Accept" softkey.
   The selected tool is loaded into the G code editor. The corresponding text, e.g. T="CENTERDRILL_D2.5", is displayed at the current cursor position in the G code editor.
4. Program the tool change (M6).
5. Define the following parameters:
   - Spindle speed (S...)
   - Direction of spindle rotation (M3)
   - Cooling (M8), if applicable

Programming the machining cycle for data points

Procedure

1. Call standard cycle "Centering".
2. Enter the following parameter values in the "Centering" input window:

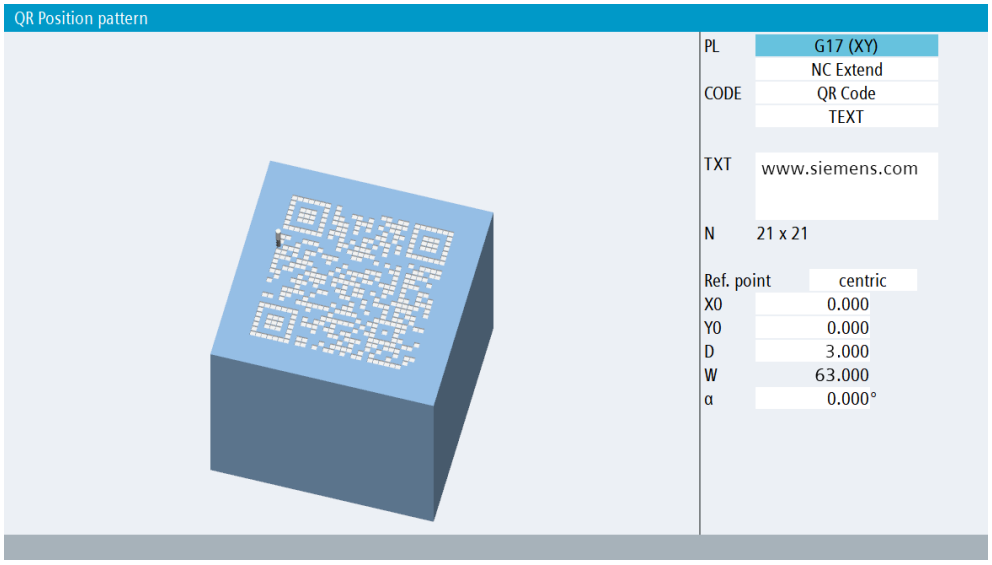


3. Applying the settings.
   The program line with the centering cycle is generated in the part program.

Programming the cycle to create the QR position pattern

Procedure

1. Call the SMTE application "QR code".
   → See Chapter "Calling the SMTE "QR code" application (Page 53)".
2. Enter the following parameter values in the "QR position pattern" input window:



3. Applying the settings.
   The program line with the cycle to create the QR position pattern is generated in the part program.

Part program

Program code

```
T="CENTERDRILL_D3"
M6
G54 F2000

S2000 M3
G0 Z100
G0 X0 Y0

MCALL CYCLE81(20, 0, 1, 3, , 0.1, 10, 1, 11)
CYCLE_QRGEN("\\SYS_DRIVE:\", "qrfile", 1, "www.siemens.com", 0, 0, 3, 0, , 1, 1, 2,
1, )

M30
```

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