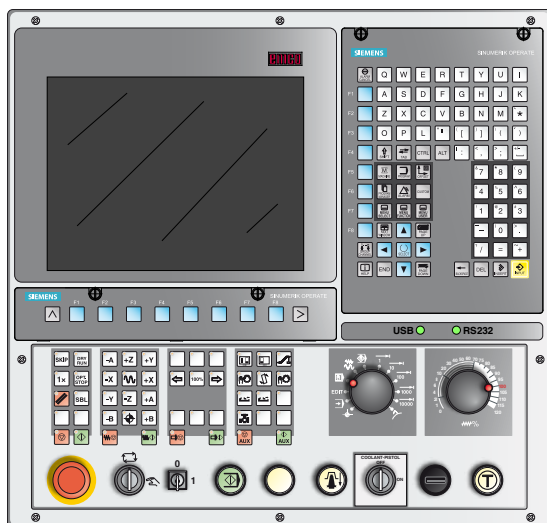


# EMCO WinNC for Sinumerik Operate Mill

## Software description software version from 01.04



### Software description

### WinNC for Sinumerik Operate Mill

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Edition C 2013-12

This instruction manual is also available on the  
EMCO homepage in electronic form (.pdf).

**Original instruction manual**

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**Instructions:**

Some of the functionality of the EMCO WinNC for Sinumerik Operate control software is beyond the scope of these instructions. Emphasis is placed instead on representing the most important functions simply and clearly, in order to achieve the greatest possible learning success. Depending on the machine you are operating with EMCO WinNC for Sinumerik Operate, not all functions may be available.

# Preface

The software EMCO WinNC for Sinumerik Operate is part of the EMCO training concept. With the EMCO WinNC for Sinumerik Operate, CNC turning and milling machines are easy to operate. Background knowledge of ISO programming is not necessary.

An interactive contour programming serves to define workpiece contours with linear and circular contour elements.

The programming of a cycle is interactive and with graphic support. The programming of a cycle is interactive and with graphic support. A large number of machining cycles that can be combined to a program, are available for the customer. Single cycles or the created cycle programs can be graphically simulated on the screen.

This instruction manual does not include the whole functionality of the control software EMCO WinNC for Sinumerik Operate. However, emphasis was put on the simple and clear illustration of the important functions, so as to achieve a most comprehensive learning success.

If you have any further queries or suggestions for improvement regarding this instruction manual, please do not hesitate to contact us.

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Designed for your profit

EC conformity



The CE mark certifies, together with the EC declaration of conformity, that the machine and the guidelines are in conformity with the regulations of the directives applicable to the products.

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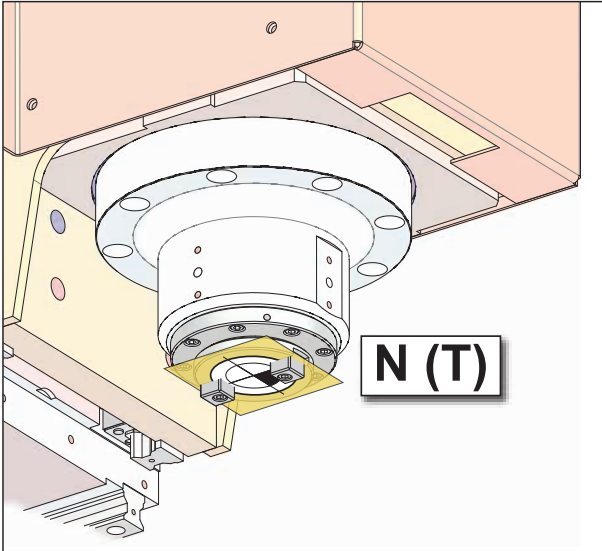
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# A: Fundamentals



Points on the machine

## EMCO milling machine reference points

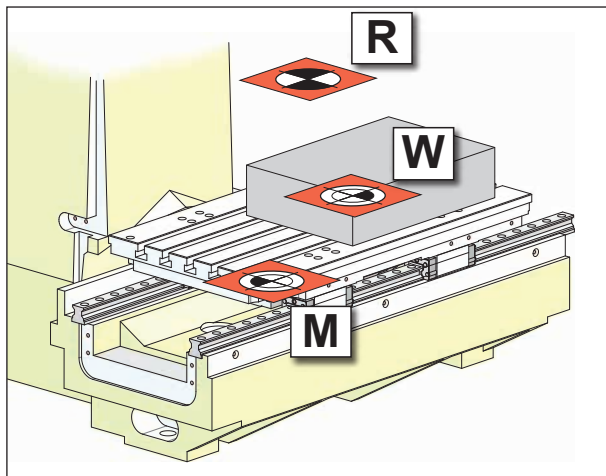
### ⊕ N (T) = Workpiece zero point

The workpiece zero point N (T) lies exactly at the cutting point of the spindle axis with the front part of the milling spindle.

The workpiece zero point is the start point for measuring the tools.

#### Instructions:

The actual reference points may have been defined at other positions depending on the machine type. In any case, the information in operation manual of the respective machine applies!



Machine reference point

### ⊕ M = Machine zero point

The machine zero point M is an unchangeable reference point defined by the manufacturer.

The entire machine is measured from this point. The machine zero point M is the origin of the coordinate system.

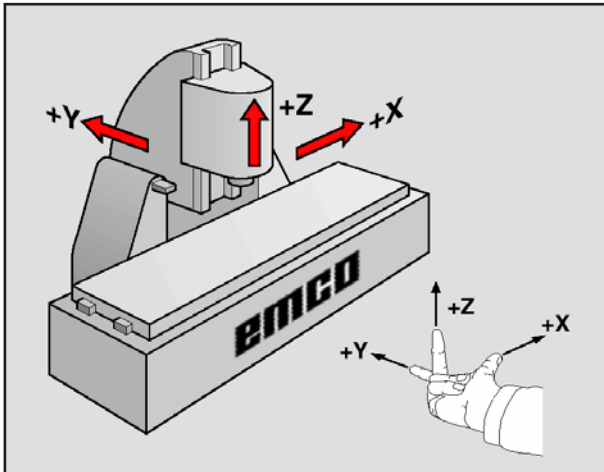
### ⊕ W = Workpiece zero point

The workpiece zero point W can be freely programmed by the user. By programming a workpiece zero point, the origin of the coordinate system will be shifted from the machine zero point M to the workpiece zero point W.

The workpiece change point W is the start point for the measurements in the parts program.

### ⊕ R = Reference point

The reference point R is a firmly defined point on the machine which is used to calibrate the measurement system. The reference point must be approached each time after the machine is switched on, in order to make the exact distance between the points M and N (T) known to the control system.



coordinate system

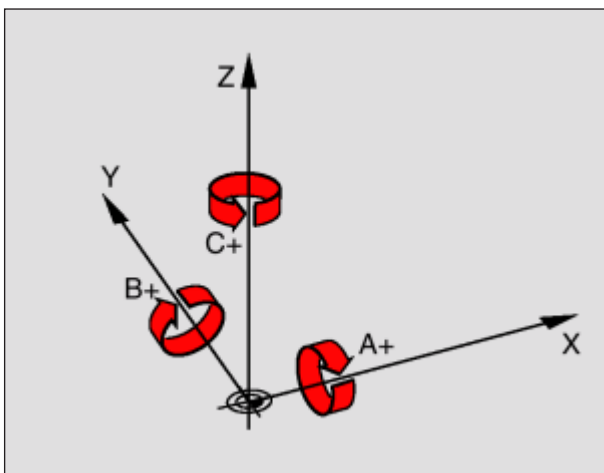
## Reference system for milling machines

A reference system is required to define positions in a plane or in space. The position data are always referenced to a predetermined point and are described through coordinates.

The Cartesian coordinate system (a rectangular coordinate system) is based on three coordinate axes X, Y and Z. The axes are mutually perpendicular and intersect at one point called the datum. a coordinate

indicates the distance from the datum in one of these directions. a position in a plane is thus described through two coordinates, and a position in space through three coordinates.

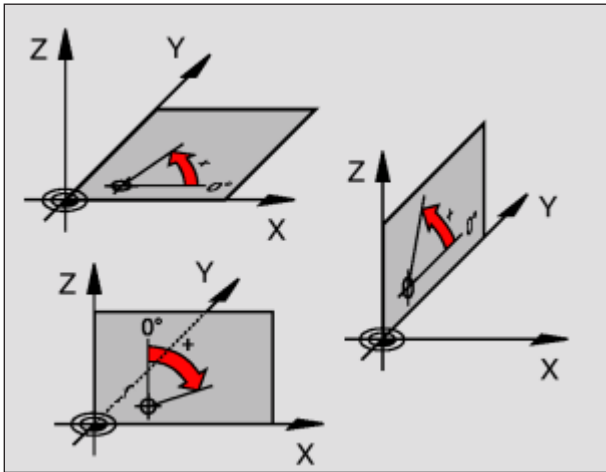
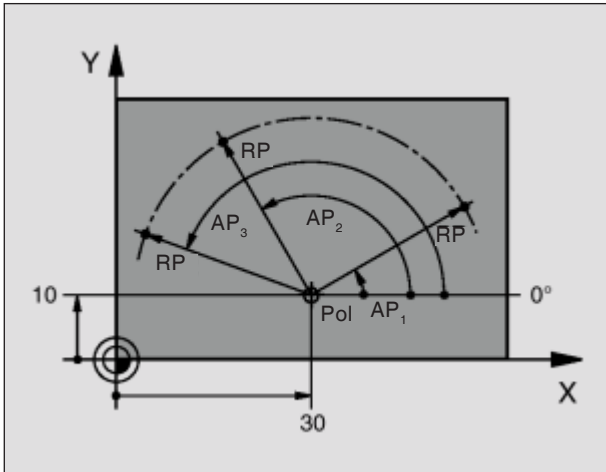
Coordinates that are referenced to the datum are called **absolute coordinates**. Relative coordinates are referenced to any other known position (reference point) within the coordinate system. Relative coordinate values are also referred to as **incremental coordinate** values.



Allocation of turning axes to main axes.

When working a workpiece on a milling machine you generally orient tool movement to the Cartesian coordinate system. The illustration on the left shows how the Cartesian coordinate system describes the machine axes. The "right-hand-rule" helps to remember the three axes directions: the middle finger is pointing in the positive direction of the tool axis from the workpiece towards the tool (the Z axis), the thumb is pointing in the positive X direction, and the index finger in the positive Y direction.





## Polar coordinates

If the production drawing is dimensioned in Cartesian coordinates, you also write the part program using rectangular coordinates. For parts with circular arcs or angles it is often simpler to fix the positions in polar coordinates.

In contrast to the Cartesian coordinates X, Y and Z, which are three-dimensional and can describe points in space, polar coordinates are two-dimensional and describe points in a plane. Polar coordinates have their datum in the circle center (CC) or pole.

Therefore, a position in a plane is clearly defined by:

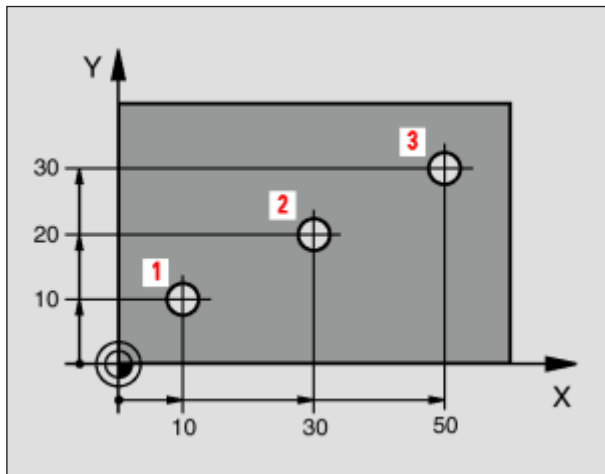
- Polar radius (RP): the distance from the circle center CC to the position
- Polar angle (AP): the size of the angle between the reference axis and the line that connects the circle center CC with the position (see figure on upper left).

### Definition of pole and angle reference axis

The pole is set by entering two Cartesian coordinates in one of the three planes. These coordinates also set the angle reference axis for the polar angle (AP).

Coordinates of the pole (plane)	Reference axis of the angle
X/Y (G17)	+X
Y/Z (G19)	+Y
Z/X (G18)	+Z

## Absolute and incremental workpiece positions



### Absolute workpiece positions

Absolute coordinates are position coordinates that are referenced to the datum of the coordinate system (origin). Each position on the workpiece is clearly defined by its absolute coordinates.

Example 1: Holes dimensioned in absolute coordinates

Hole 1	Hole 2	Hole 3
X = 10 mm	X = 30 mm	X = 50 mm
Y = 10 mm	Y = 20 mm	Y = 30 mm

### Incremental workpiece positions

Incremental coordinates are referenced to the last programmed nominal position of the tool, which serves as the relative (imaginary) datum. When a part program is written in incremental coordinates, the tool is programmed to move by the distance between the previous and the subsequent nominal positions. That is why incremental coordinates are also referred to as chain dimensions.

To program a position in incremental coordinates, enter the prefix "I" before the axis.

Example 2: Holes dimensioned in incremental coordinates

Absolute coordinates of hole 4

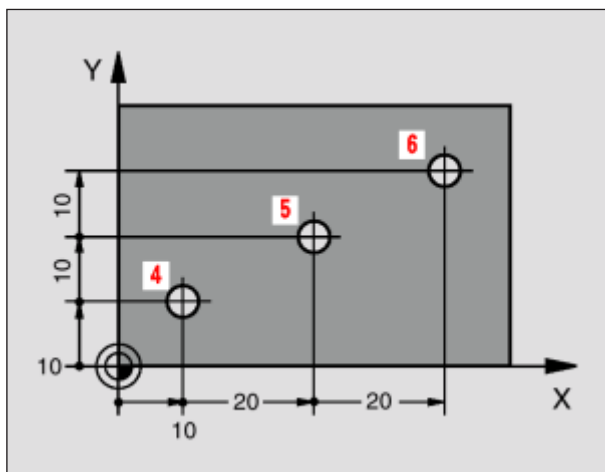
IX = 10 mm  
IY = 10 mm

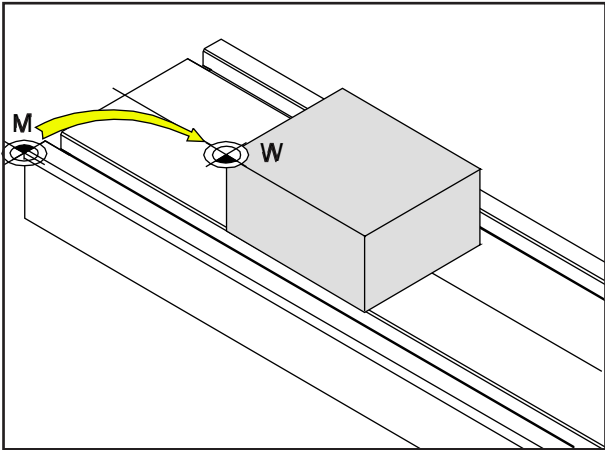
Hole 5, referenced to 4

IX = 20 mm  
IY = 10 mm

Hole 6, referenced to 5

IX = 20 mm  
IY = 10 mm





Zero offset from machine zero point M to workpiece zero point W

## Zero point offset

On EMCO milling machines, the machine zero point "M" is on the left front edge of the machine table. This position is unsuitable as a start point for programming. Using the so-called zero point offset, the coordinate system can be shifted to a suitable point in the machine working area.

A distinction is made between the following zero point offsets:

- Machine coordinate systems (MCS) with the machine zero point M
- Base Zero Point System (BZS)
- Configurable Zero Point System (CZS)
- Workpiece coordinate system (WCS) with workpiece zero point W.

### Machine coordinate system (MCS)

After approaching the reference point the NC position displays of the axis coordinates are relative to the machine zero point (M) of the machine coordinate system (MCS).

Workpiece change points are defined in the machine coordinate system.

### Base zero point (BZS).

If a base shift is performed in the machine coordinates system (MCS), a base zero point offset is the result (BZS). With this, for example, a palette zero point can be defined.

### Configurable zero point system (CZS)

#### Configurable zero point offset

If a configurable zero point system (G54-G599) is performed from the base zero point system (BZS), a configurable zero point system (CZS) is the result.

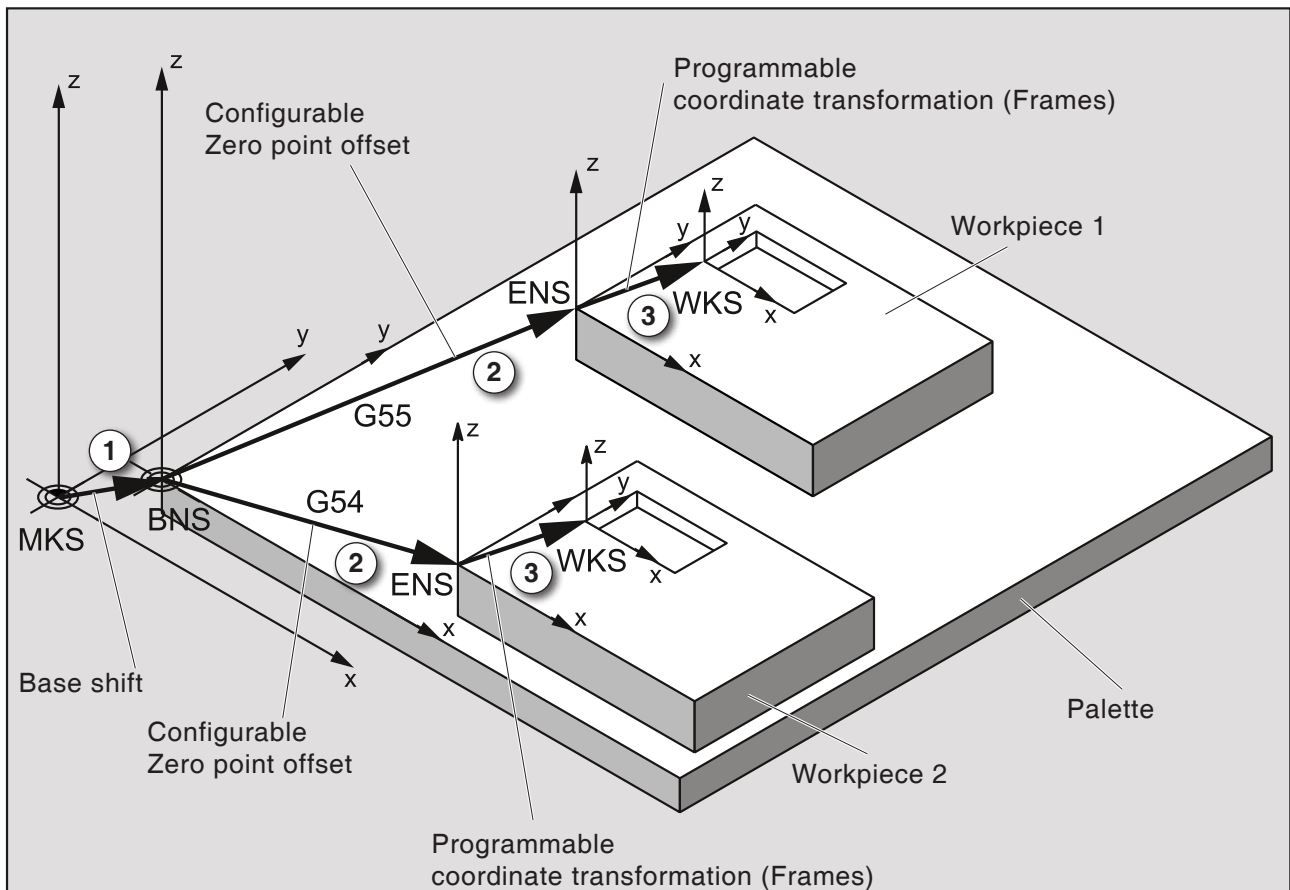
### Programmable coordinate transformation (Frames)

Programmable coordinate transformations (Frames) make it possible to shift the originally selected workpiece coordinate system to another position, to rotate it, to scale it or to mirror it.

### Workpiece coordinate system (WCS)

The program for executing the workpiece is relative to the workpiece zero point (W) of the workpiece coordinate system (WCS).

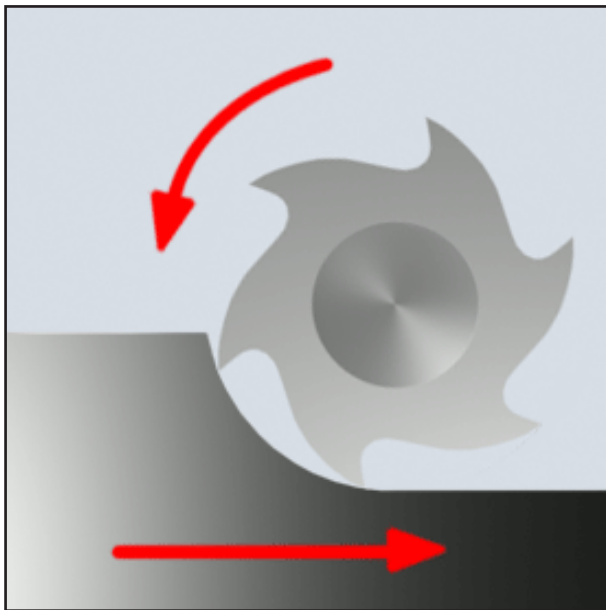
Machine zero point and workpiece zero point are usually not identical. The distance between the points is the entire zero point offset and is made up of various shifts:



- ① With the base shift the result is the base zero point offset (BNS) with the palette zero point.
- ② With the configurable zero point offset (G54-G599) and with Frames zero point systems are defined for workpiece 1 or workpiece 2.
- ③ With the programmable coordinate transformation (Frames) the workpiece coordinate systems (WKS) for workpiece 1 or workpiece 2 are defined.

## Milling operations

### Down-cut Milling



*Down-cut Milling*

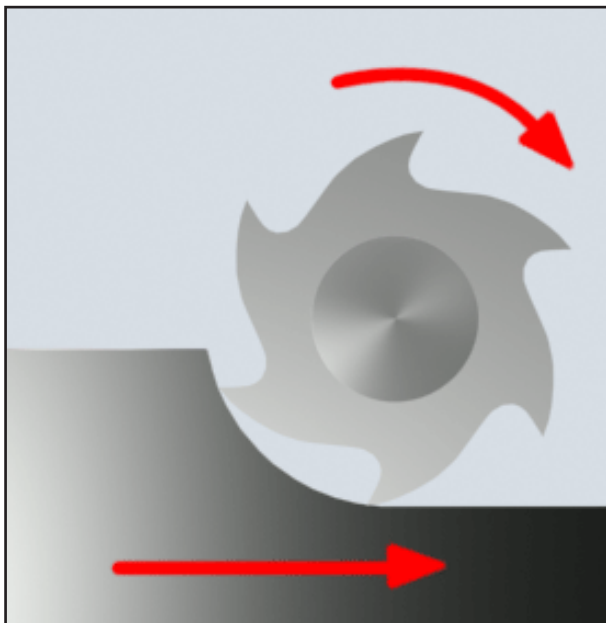
In down-cut milling, the feed direction and the cutting direction of the milling tool are the same. The blade now first penetrates the material at the surface of the raw part.

It is advantageous that a larger chamfer angle enables the immediate penetration of the blade into the material. It is not as with up-cut milling, in which a specific sliding cutting path is left behind under pressure and friction.

In down-cut milling, the feed force supports the feed drive in the same direction of rotation. In machines with backlash in the feed drive, retrograde movements occur which lead to the destruction of the blades.

Down-cut milling is generally to be preferred if the machine permits it (backlash-free table drive in EMCO CNC machines).

### Up-cut Milling



*Up-cut Milling*

In up-cut milling, the feed direction and the cutting direction of the milling tool are opposed to one another.

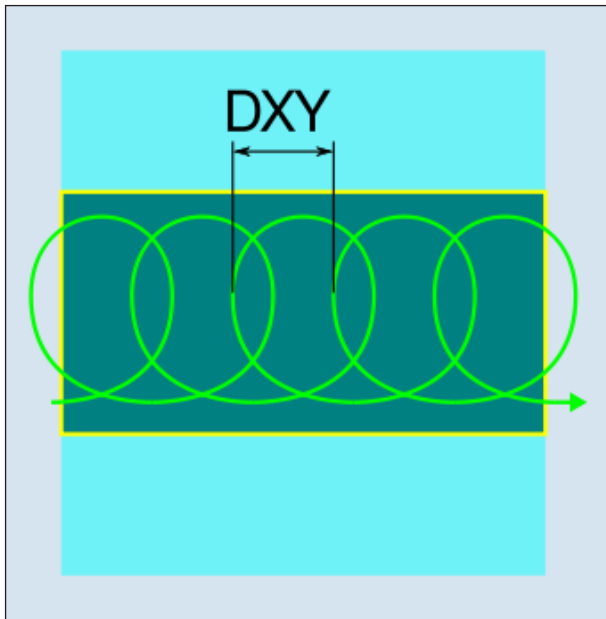
The blades of the tool strike at a very sharp angle ( $j = 0$ ) on the material.

Before the blades penetrate into the material, they slide with increasing contact force a little piece on the surface. After penetration, the chip cross-section slowly increases and then falls away quickly.

Up-cut milling is to be preferred in unstable machine conditions (conventionally constructed machines) and more resistant materials.

### Down-cut/up-cut milling

Down-cut/up-cut milling is a combination of down-cut and up-cut milling.

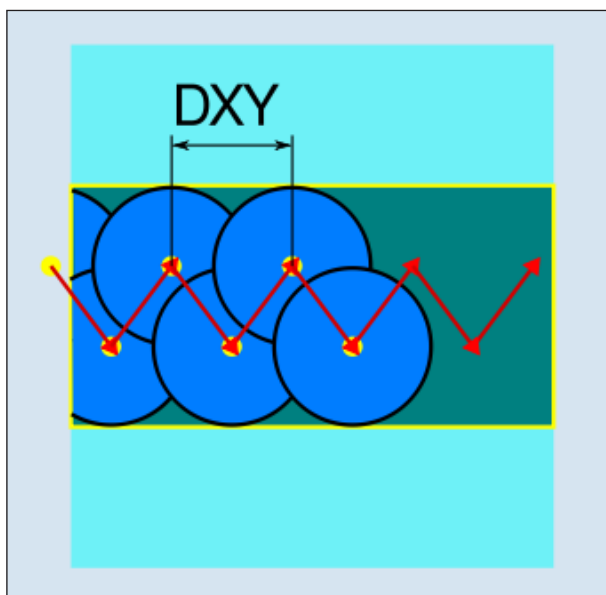


Trochoidal milling

## Trochoidal milling

In trochoidal milling the roughing process takes place with circular movements, which are overlain additionally with a linear forwards movement. It is used especially during roughing and with the contour processing of high-strength or hardened materials, where normally because of high tool and machine loads only small infeed depths are possible.

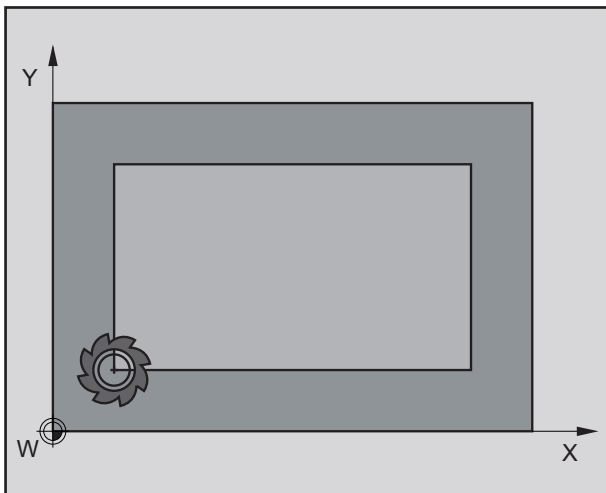
During trochoidal milling it is possible to process with greater cutting depth and higher cutting speed, as thanks to the special cutting conditions no wear-increasing influences are exercised on the tool. By contrast, during the use of cutting plates the complete cutting length can be used. This achieves a higher chip volume per tooth. Thanks to the circular plunging into the material small radial forces affect the tool. This is gentler on the machine's mechanical system and prevents vibrations, thus bringing about an enormous time saving.



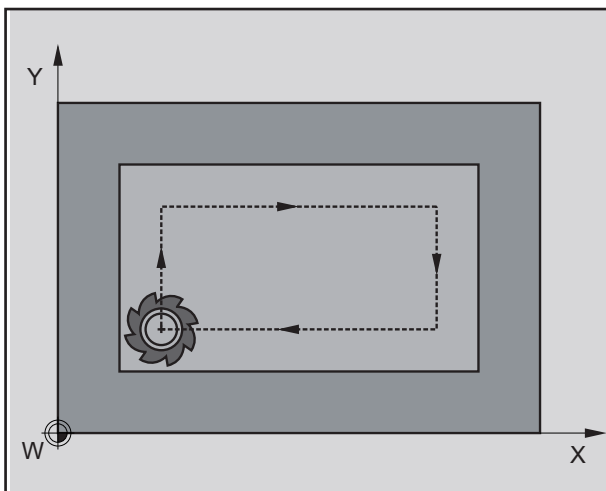
Plunge milling

## Plunge milling

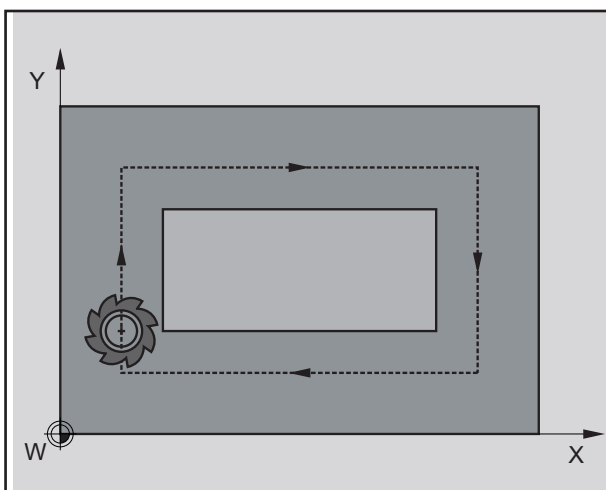
Plunge milling is considered the preferred strategy when clearing slots for "unstable" machines and workpiece geometries. With this strategy forces primarily apply only longitudinally on the tool axis, i.e. vertically on the surface of the pocket/slot to be cleared (with XY plane in Z-direction). The tool is therefore subject to almost no bending. Thanks to the axial load of the tool, even with unstable workpieces there is scarcely any danger that vibrations will occur. The cutting depth can be significantly increased. Thanks to the so-called plunge miller you achieve a greater service life because there is less vibration with large unsupported lengths.



Without tool radius compensation



Right-hand tool radius compensation



Left-hand tool radius compensation

## Tool radius compensation

### Without tool radius compensation

If tool radius compensation is switched off, the tool traces the contour's central track.

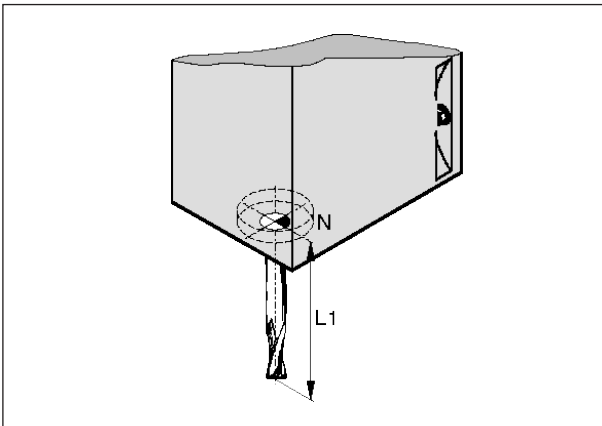
### Right-hand tool radius compensation

With right-hand tool radius compensation, the control system automatically calculates the equidistant tool distance right of the contour in each case for the various tools.

### Left-hand tool radius compensation

With left-hand tool radius compensation, the control system automatically calculates the equidistant tool distance left of the contour in each case for the various tools.

## Tool Data



*Length correction*

Aim of the tool data calculation: The control should use the tool tip or the tool centre point for positioning, not the tool mount reference point.

Every tool used for machining must be measured. Important is to measure the distance from the tool tip to the tool mount reference point "N".

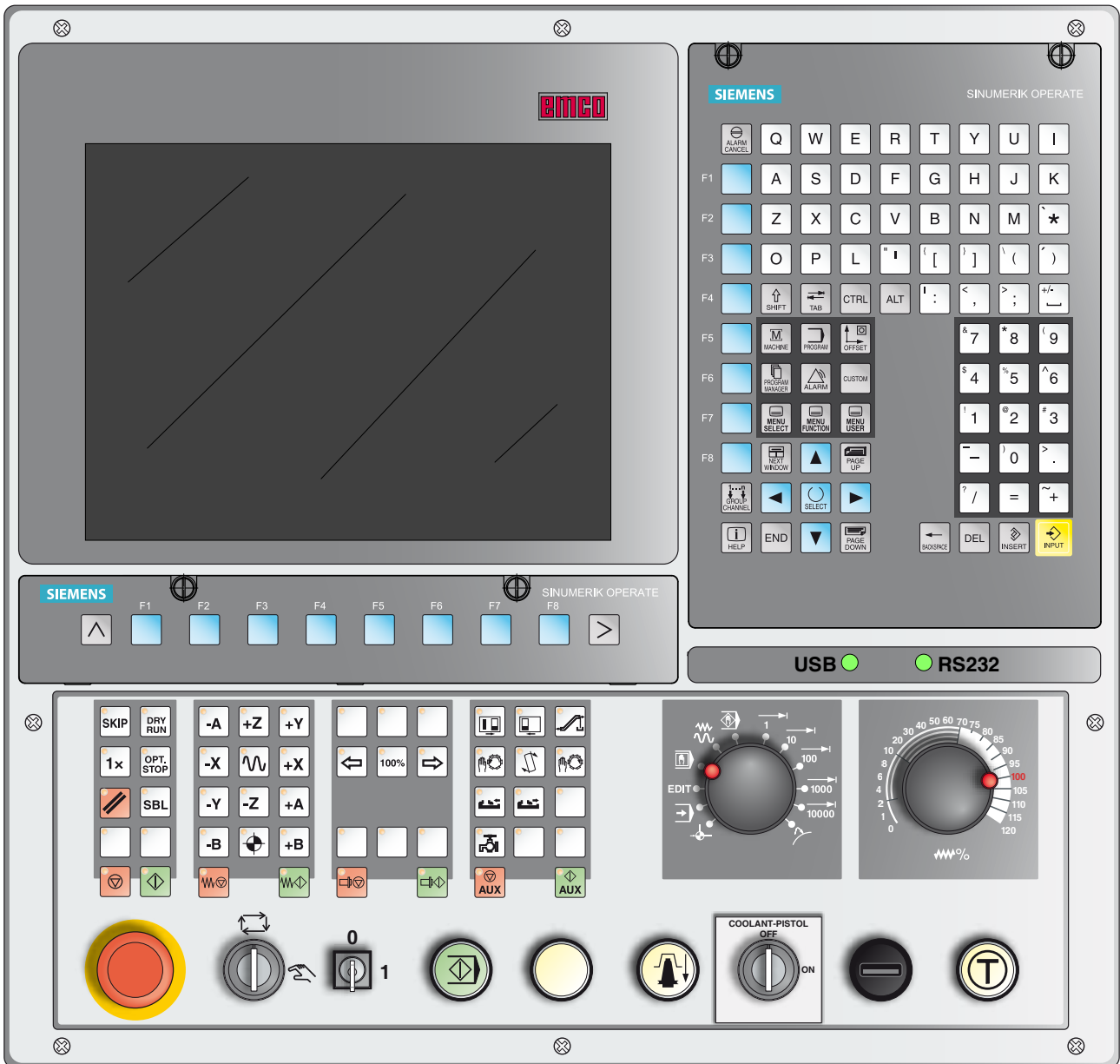
In the so-called tool data register the measured tool length data and tool radii can be stored.

Indicating the cutter radius is necessary **only** when a **cutter radius compensation** is used for this tool, or when a milling cycle is used! (see chapter F Tool programming)



# B: Key Description

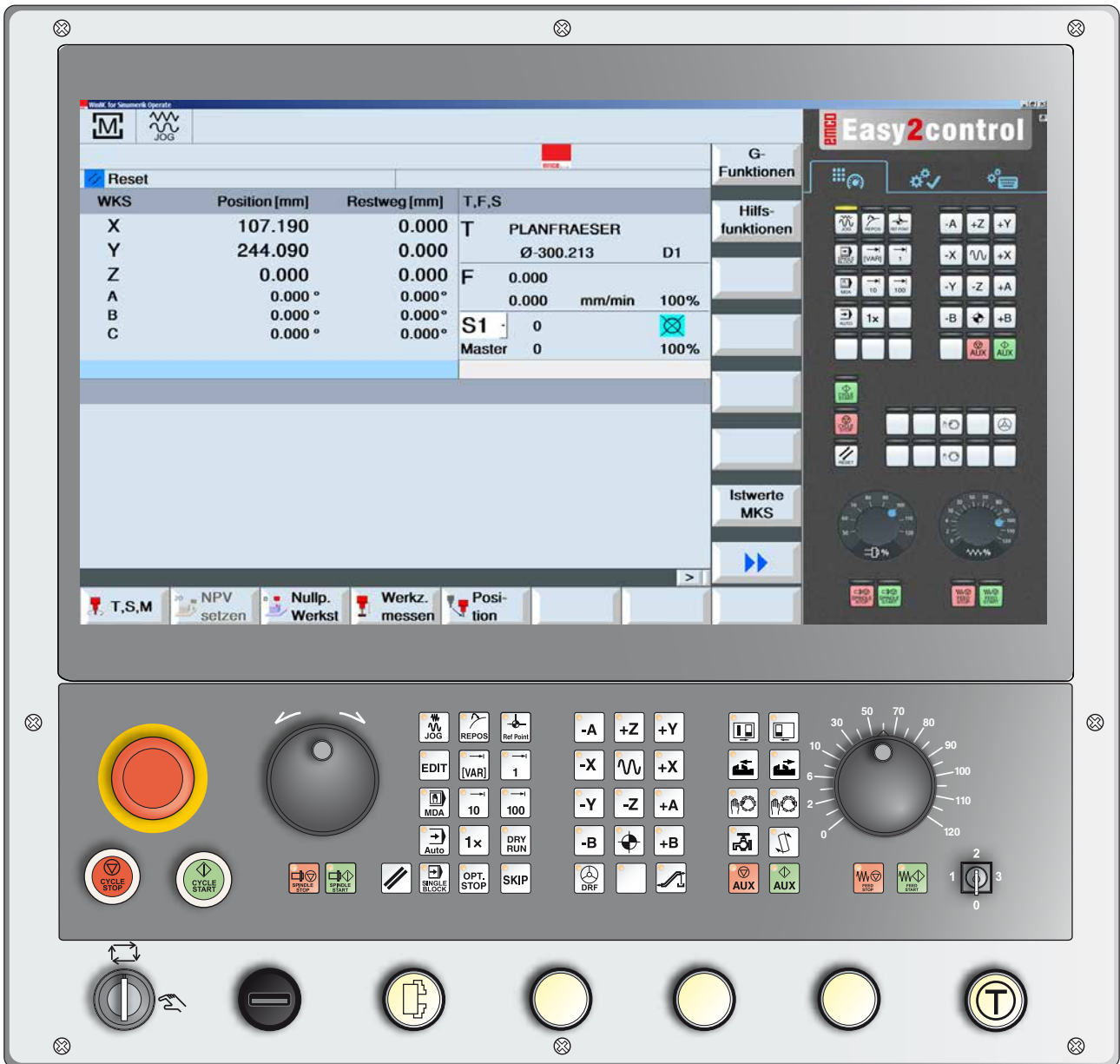
## WinNC for Sinumerik Operate Control Keyboard



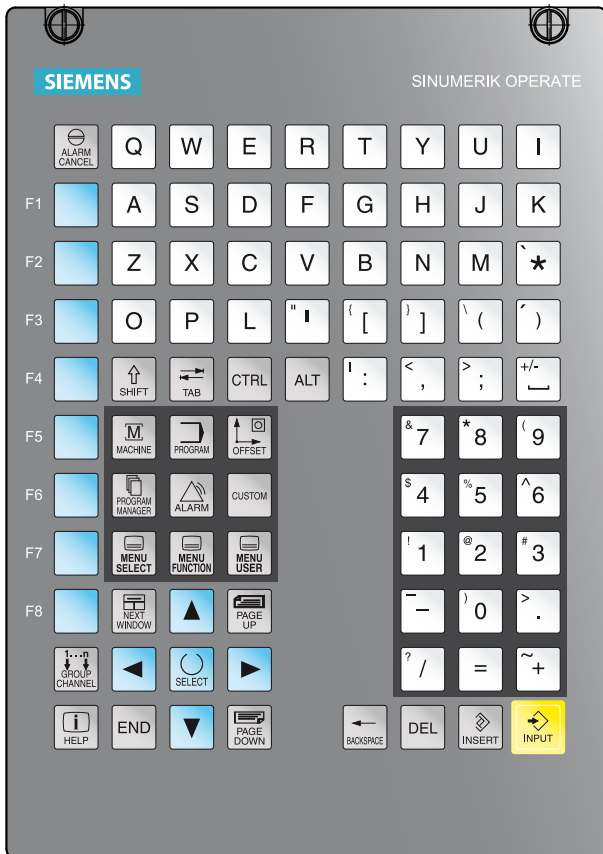
**Note:**  
Depending on the machine you are operating with Sinumerik Operate, not all functions and machine buttons may be available.



# WinNC for Sinumerik Operate control keyboard Variant with Easy2control and MOC-Touch



**Note:**  
Depending on the machine you are operating with Sinumerik Operate, not all functions and machine buttons may be available.

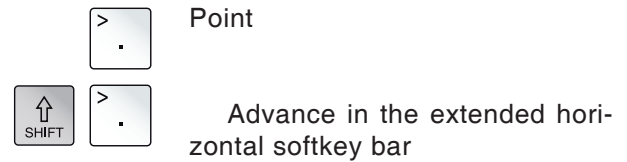


Address and numeric keyboard

## Address and Numeric Keyboard

The shift key bottom left shifts to the second key function (indicated in the left top edge of the keys).

Example:



## Button functions



Direct jump to the machine operating area.



Direct jump to the parameter operating area.



Direct jump to the program operating area.



Direct jump to the program manager operating area.



Direct jump to the diagnosis operating area.



Back to the higher-level menu.



Extension of the horizontal softkey bar in the same menu.



Show basic menu (operating area selection).  
Jump to the previous operating area when pressed again.



no function



no function



Acknowledge alarm  
Pressing this button deletes alarms and reports that are marked with this symbol.



Call context-sensitive help



Advance screen to next window.  
Button input only works on the selected window.



Channel  
Select or advance control channel (no function)



Cursor right  
Navigates the cursor one symbol to the right.  
Edit operational mode:  
Open directory or program (e.g. cycle).



Cursor left

Navigates the cursor one symbol to the left.  
 Edit operational mode:  
 Close directory or program.



Cursor down/up



Browse backwards/forwards



Space



Backspace

- Editing field: Delete a marked character to the left of a cursor.
- Navigation: Delete all marked characters to the left of a cursor.



DEL

- Editing field: Deletes the first character to the right of the cursor.
- Navigation: Deletes all characters.



Selection button / Toggle button

- Select button for specified values in input fields and selection lists that are identified by this symbol
- Activating / Deactivating a selection field
- Selects a program block or a program in the program editor and in the program manager.



Edit button / Undo

- Jump to edit mode from the input fields. Pressing the button again will leave the input field unchanged.
- Opens a selection field and shows the options.
- Undo function, as long as the data in the fields has not been applied or the enter button was not pressed.



Calculation function in the input fields



Jump to line end (list end)




























Enter button

- Apply an edited value
- Open / close directory
- Open file



Shift button

## Shortcuts

		Copy	
		Cut	
		Paste	
		Repeat input	
		Undo	
		Select all	
		Go to program start	
		Go to program end	
		Mark to end of block	
		Mark to start of line	
		Jump to start of line	
			Close WinNC for Sinumerik Operate.

## Screen layout

The screenshot displays the EMCO Sinumerik Operate Mill control interface. At the top, a status bar shows the active operating area (M) and mode (AUTO), along with an alarm (106) and a notification (Z- Software limit overtravel). Below this, the program name (PRG/MPF.DIR/test11.MPF) and a Reset button are visible. The main display area is divided into several sections: a table for axis positions (Mach, Position [mm], Dist-to-go [mm]), a table for tool and feed parameters (T, F, S), and a G-functions list. A work window (8) is used for program display. The bottom of the screen features a row of softkey bars (11) for Prog. cntrl., Block search, and Prog. corr., along with a dialog line (10) for additional user instructions.

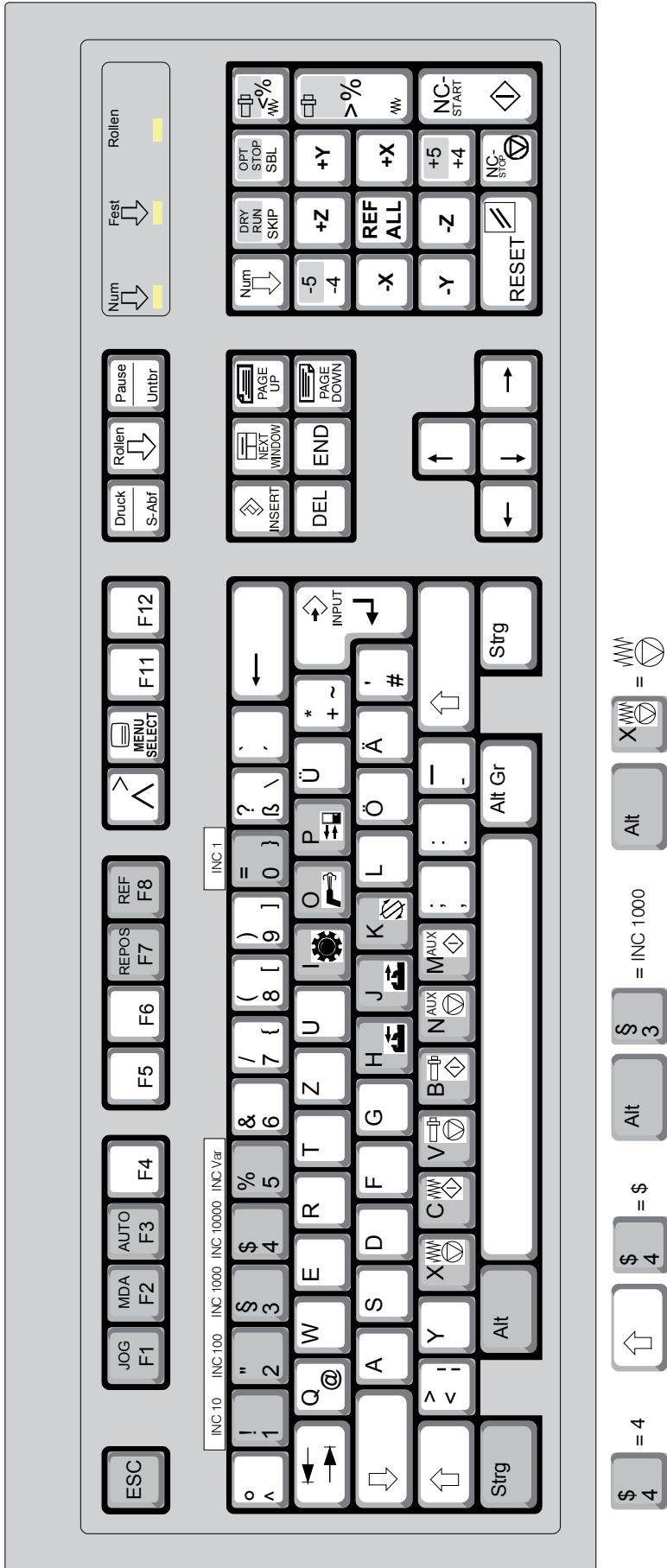
Mach	Position [mm]	Dist-to-go [mm]	T, F, S
MX	84.900	0.000	T ZENTRIERER
MY	24.900	0.000	R5.000 D1
MZ	69.900	0.000	F 0.000
MA	0.000 °	0.000	0.000 mm/min 100%
MB	0.000 °	0.000	S1 0
MC	0.000 °	0.000	Master 0 100%

G functions	
1: G0	13: G71
2:	14: G90
3:	15: G94
6: G17	16: CFTCP
7: G40	21: BRISK
8: G54	22: CUT2D
9:	29: DIAMOF
10: G60	30: COMPOF

- |   |   |
|---|---|
| 1 Active operating area and operating mode                  | 7 Display for <ul style="list-style-type: none"> <li>• active tool T</li> <li>• current feed F</li> <li>• active spindle with current condition (S)</li> <li>• Spindle utilization in per cent</li> </ul> |
| 2 Alarm and notification lines                              |   |
| 3 Program name  |   |
| 4 Channel state and program influence                       | 8 Work window with program display  |
| 5 Channel operation message                                 | 9 Display of active G-functions, all G-functions, help functions as well as input window for various functions (e.g.: Skip blocks, program influence).  |
| 6 Position display of the axes in the current values window |   |
|   | 10 Dialog lines for additional user instructions  |
|   | 11 Horizontal and vertical softkey bars   |





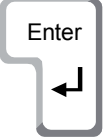

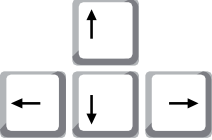
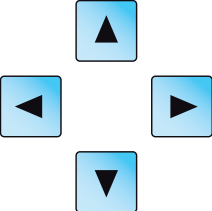
















# PC keyboard


















To activate patterned key functions, the CTRL or ALT keys must be pressed at the same time.

**Note:**  
The machine functions in the numerical keypad are only active if NUM Lock is not active.

## Overview button assignment control keyboard

PC button	Control system button	Function
		Delete input
		Conclude input and continue dialog.
		Move mark
		Upper/lower case
		Selection button / Toggle button
		Single block (SBL)
		Reset key (Reset)
		Dryrun (test-run feed)
		Optional stop
		Skip (block mask)
		Call context-sensitive help

## Overview Button Assignment Machine Operating Elements







PC button	Control elements	Function
Alt I		Swivel divider
Alt O		Coolant / Purge on / off
Alt P		Door open / closed
Alt H		Clamp device closed
Alt J		Clamp device open
Alt K		Swivel tool holder
Alt X		Feed Stop
Alt C		Feed Start
Alt V		Spindle Stop
Alt B		Spindle Start
Alt N		Switch auxiliary drives on AUX ON
Alt M		Switch auxiliary drive off AUX OFF
Enter		NC Start
,		NC Stop
5		Approach reference point

### Instructions:

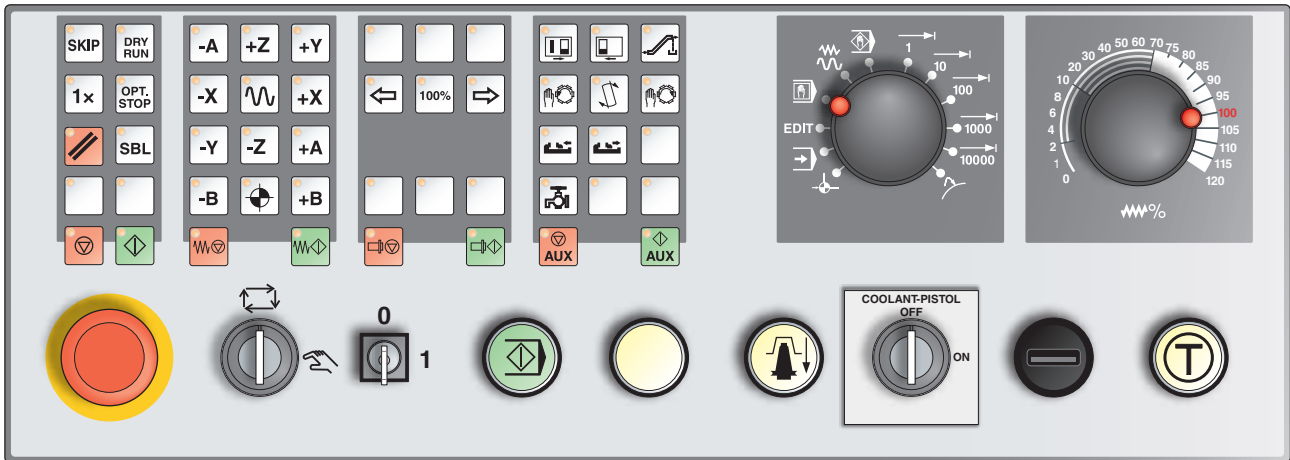
Selecting the machine buttons via the PC keyboard:

- 1.) Hold "Alt" button down.
- 2.) Press and then release machine button.
- 3.) Release "Alt" button.

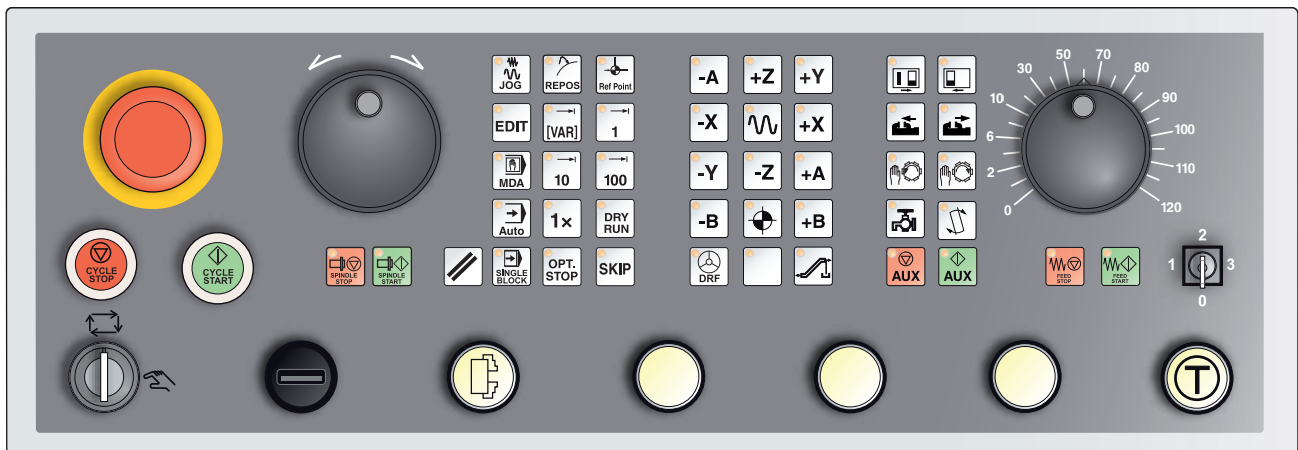


PC button	Control elements	Function
   		Spindle speed correction
 		Override (feed rate override)

## Machine control panel



Depending on machine configuration, the control panel can differ slightly from what is shown here.



Machine control panel variant with Easy2Control and MOC-Touch

## Key Description

### Instructions:

The buttons for the Concept Mill 250 machine are explained below. For other machines always take note of Chapter D EMCO-specific Programming and Operation in the operating manual.

**SKIP**

### Skip (block mask)

In Skip mode, program blocks will be jumped over when the program is running.

**DRY RUN**

### Dryrun (test-run feed)

In Dry-run mode, positioning movements will be carried out with the dry-run feed.

The dry-run feed works instead of the programmed movement commands.

On starting the NC program, the main spindle will not be activated and the slides will move with dry-run feed speed.

Only perform the test run without a workpiece to avoid the danger of collisions.

If the test run is engaged, the test "DRY" appears in the simulation window.

## Individual piece mode



This button makes individual piece mode or constant operation in conjunction with automatic loading equipment available for selection. Individual state is the default state when switched on.

## Optional stop



When this function is active, program processing will always stop at blocks in which the M01 special function has been programmed. You start processing again with the NC Start button. If the function is not active, the M01 special function will be ignored.

## Reset key (Reset)



- A running program or a movement will be broken off.
- Alarm notifications will be cleared.
- The control system is in the starting position and ready for a new program sequence.

## Single block



This function allows you to execute a program block by block. The Single Block function can be activated in the automatic mode (a program will be executed automatically) operation type.

### When single block processing is active:

- "SBL" (=SingleBlock) is shown on the screen.
  - the current block of the part program is only processed when you press the NC Start button.
  - processing stops after a block is executed.
  - the following block is executed by pressing the NC Start key again.
- The function can be deselected by pressing the Single Block key again.

## NC Stop

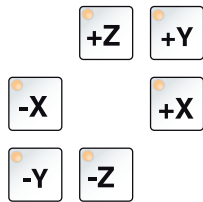


After pressing the NC Stop button the execution of the running program will be broken off. Processing can then be continued by pressing the NC Start button.

## NC Start



After pressing the NC Start button the selected program will be started with the current block.



### Arrow keys

With these buttons, the NC axes can be moved in JOG operation mode.



### Reference point

Pressing this button causes the reference points to be approached in all axes.



### Rapid Traverse

If this function is pressed in addition to the direction buttons, the axes concerned move in rapid traverse.



### Feed Stop

In "AUTOMATIC" operation mode, this function cancels a slide movement.



### Feed Start

This function resumes a programmed slide movement which has been interrupted.  
If the main spindle motion was also broken off, it must be switched on first.



### Spindle speed correction

The set spindle speed value S will be shown on the screen as an absolute value and as a percentage.  
Effective for the milling spindle.

Adjustment range: 50 - 120% of the programmed spindle speed  
Increment: 5% per button press  
100% spindle speed: 100% button



### Spindle Stop

This button interrupts the motion of the milling spindle. If it happens during a feed movement, that has to be stopped first.



### Spindle Start

This function resumes the programmed spindle motion.

## Automatic machine doors



To open and close the machine doors.

## Chip conveyor (Option)



Switch on chip conveyor:

Forwards: Press button for less than 1 second.

Backwards: Press button for longer than 1 second.

The chip conveyor will be switched off after a defined time (approx. 35 seconds).

This value is set in the factory.

## Swing tool drum

Pressing this button causes the tool drum to swivel by one position:



Cycle in the clockwise direction (one position further)



Cycle in the counter-clockwise direction (one position back)

### Preconditions:

- Machine doors closed
- "JOG" operating mode
- Key switch in "Hand" position

## Manual tool change



Pressing this button starts a manual tool change.

The tool clamped in the milling spindle will be removed and replaced with the tool from the currently swivelled-in tool drum.

### Preconditions:

- Machine doors closed
- "JOG" operating mode
- Key switch in "Hand" position

### Note:

- Interrupt the change process by moving the override switch below 4%.
- Cancellation of the change procedure by pressing the reset button.



## Clamping device



These functions activate the clamping device.





## Coolant

This function switches the coolant equipment on or off.



## Auxiliary OFF

This function switches off the machine's auxiliary unit. Only effective if spindle and program are off.

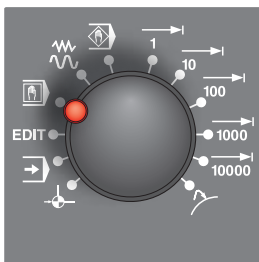


## Auxiliary ON

This function makes the machine's auxiliary unit ready for operation (e.g.: hydraulics, feed drives, spindle drives, lubrication, chip conveyors, coolant).

The button must be pressed for around 1 second.

Briefly pressing the AUX ON button is a quit function and causes the central lubrication system to perform a lubrication impulse.



### REF - Reference mode

Approaching the reference point (Ref) in the JOG operating mode.



### AUTO - Automatic mode

Control the machine by automatically executing programs.

Here part programs are selected, started, adjusted, deliberately influenced (e.g. individual block) and executed.



### EDIT

no function



### MDA - Semi-automatic mode

Control the machine by executing a set or a sequence of sets. Block input is performed via the operating panel.



### JOG - Jogging

Standard movement of the machine by continuous movement of the axes via the directional buttons or by incremental movement of the axes via the directional buttons or the handwheel.

JOG is used in manual mode as well as for set-up of the machine.



### TEACH IN

no function

**Inc 1** - Incremental Feed

Move step by step a predefined distance of 1 increment.  
 Metrical measurement system: Inc 1 corresponds to 1 $\mu$ m  
 Imperial (inch-based) measurement system: Inc 1 corresponds to 0,1  $\mu$ inch

**Inc 10** - Incremental Feed

Move step by step a predefined distance of 10 increments.  
 Metrical measurement system: Inc 10 corresponds to 10 $\mu$ m  
 Imperial (inch-based) measurement system: Inc 10 corresponds to 1  $\mu$ inch

**Inc 100** - Incremental Feed

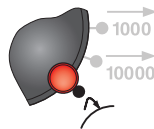
Move step by step a predefined distance of 100 increments.  
 Metrical measurement system: Inc 100 corresponds to 100 $\mu$ m  
 Imperial (inch-based) measurement system: Inc 100 corresponds to 10  $\mu$ inch

**Inc 1000** - Incremental Feed

Move step by step a predefined distance of 1000 increments.  
 Metrical measurement system: Inc 1000 corresponds to 1000 $\mu$ m  
 Imperial (inch-based) measurement system: Inc 1000 corresponds to 100  $\mu$ inch

**Inc 10000** - Incremental Feed

Move step by step a predefined distance of 10000 increments.  
 Metrical measurement system: Inc 10000 corresponds to 10000 $\mu$ m  
 Imperial (inch-based) measurement system: Inc 10000 corresponds to 1000  $\mu$ inch

**REPOS** - Repositioning

Back-positioning, approach contour again in the JOG operating mode

**Instructions:**

- The operating modes can be selected via softkeys (PC keyboard) or with the operating mode selector switch.
- Switching between the metrical measurement system and the imperial (inch-based) measurement system is carried out with the EmConfig utility software (see Chapter X EmConfig).

**Note:**

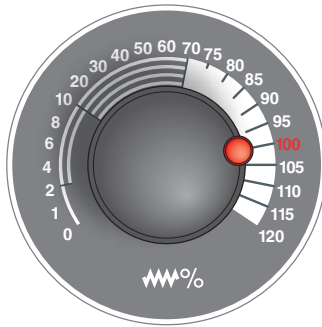
The allocation from metric to the imperial system is as follows:

**feed:**

millimeter to inch:  
 mm/min => inch/min  
 mm/U => inch/U

**constant cutting speed:**

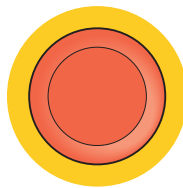
meter to feet:  
 m/min => feet/min



### Override switch (feed rate override)

The rotary switch with notch positions enables you to change the programmed feed value F (corresponds to 100%). The set feed value F in % will be shown on the screen.

Adjustment range:  
 0% to 120% of the programmed feed.  
 In rapid traverse 100% will not be exceeded.  
 No effect with thread commands G33, G63



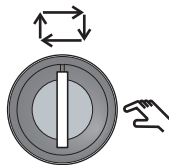
### EMERGENCY STOP

Press the red button in emergency situations only.

Effects:  
 As a rule, the EMERGENCY STOP button will lead to all drives being stopped with the greatest possible braking torque.

Unlock: Twist button

To continue working, press the following buttons:  
 RESET, AUX ON, doors OPEN and CLOSED.



### Key Switch Special Operations Mode

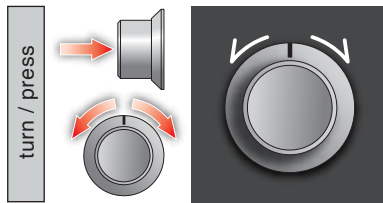
The key switch can be set to "AUTOMATIC" or "READY" (hand) mode.  
 With this key switch it is possible to perform movements in Jog Mode when the sliding door is open.



**Danger:**

When Special Operations mode is active, the danger of accidents is increased.  
 The key for this switch should only be held by persons who have the required knowledge about the dangers and exercise appropriate care.  
 Keep the chip guard door closed even in Set-up mode.  
 Keys should only be used by authorised persons.  
 After work is carried out in Special Operations mode, always withdraw key (accident danger).  
 Observe country-specific safety instructions (e.g.: SUVA, BG, UVV ...).

## Multifunction switch for operating modes

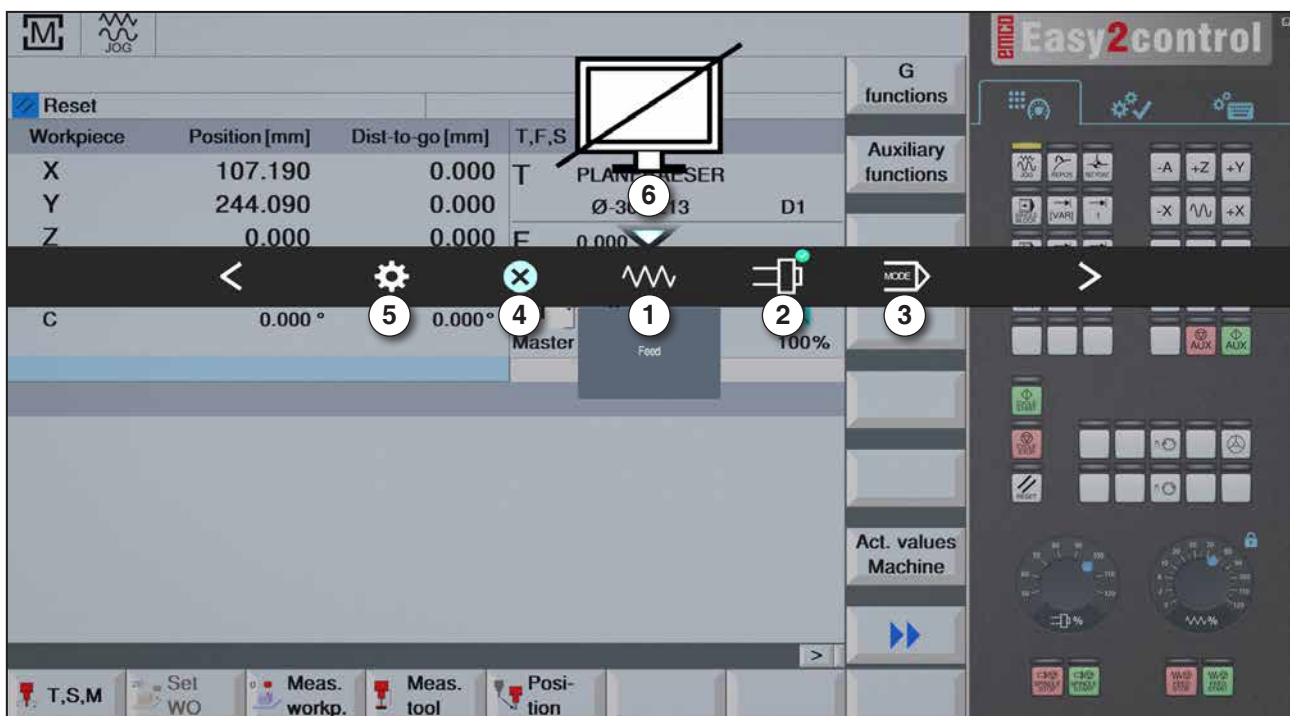


The multi-function switch is designed as a rotary switch with a press feature.

### Populated function

- The user interface is opened by pressing the multifunction operation. The active function is indicated by a green check-box.
- Turning the switch allows you to switch between the functions. The black bar with the symbols moves to the left or to the right.
- Activating a function or a change to a sub-menu is executed by pressing the button.

The interface offers the following functions:



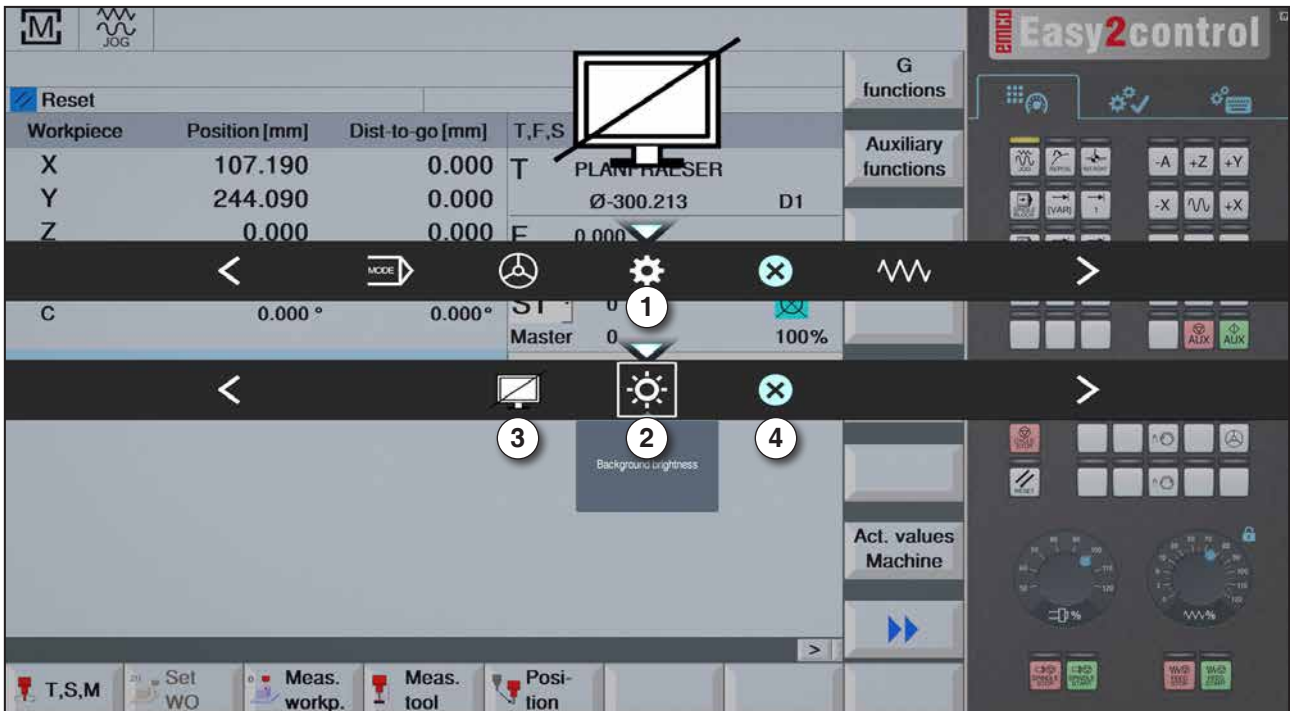
### Overview

- |  |   |
|--|---|
| 1 Feed override: controls the feed rate equivalent to conventional feed override           | 4 Close: The user interface is closed. The menu disappears, return to the control surface |
| 2 Spindle override: controls the spindle speed equivalent to conventional spindle override | 5 Settings: opens another level with settings   |
| 3 Modes: allows you to select the operating mode using the multifunction operation         | 6 Cursor: shows the actual position in the menu   |

### Note:

The functionality of the multifunction operation is depending on the installed software version.





Settings the background brightness

1 Settings

2 Background brightness: adjusts the transparency of the background

3 Lock screen: pressing again unlocks the screen.

4 Close: closes the submenu and returns to a higher-level menu.

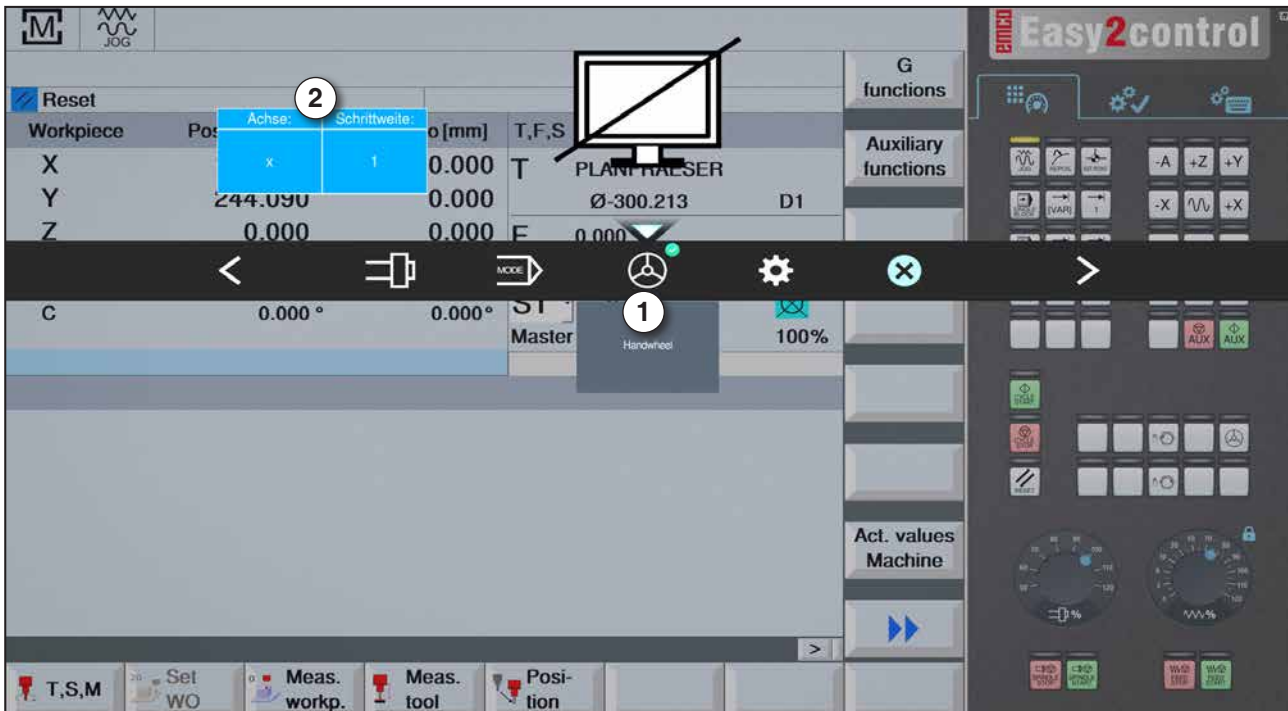
### Setting the background transparency



- By pressing once, a white border around the icon appears. The menu item is activated.



- Now, the transparency of the background can be changed by turning the rotary switch:  
Turn to the left: brighter  
Turn to the right: darker
- Pressing again closes the menu and the white border disappears.



Handwheel function

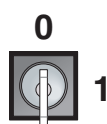
The handwheel (1) activates the handwheel mode. The parameters for axis and step width (2) are set with the axis- and operating -mode buttons on the machine keyboard.

### Operation

- The electronic handwheel is used to traverse the slides at a defined step width.
- The step width depends on the selected Inc mode: Inc 1, Inc 10, Inc 100.
- There must be one pre-selected Inc mode and an axis defined by a direction key.
- Also refer to "types of operation" und "arrow keys" in chapter B.

### Note:

In the mode "Inc 1000" the slides cannot be moved with the handwheel. "Inc 1000" operates with "Inc 100".



### Key switch

The function of the key switch is machinespecific



### Additional NC start button

The additional button has the same function as on the machine control panel.  
(Double movement because of better operation).



### USB connection (USB 2.0)

Data is exchanged with the machine (data copying, software installation) via this USB connection.



### Enable button

When the door is open, axis movements via direction buttons and tool changer movements are authorized by pressing the enable button (precondition: key switch in SET-UP position).  
In machines with automated doors (option) pressing the enable switch opens the machine doors.

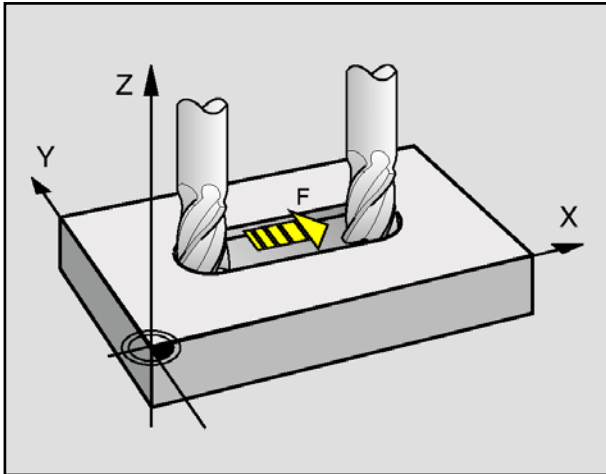




# C: Operation

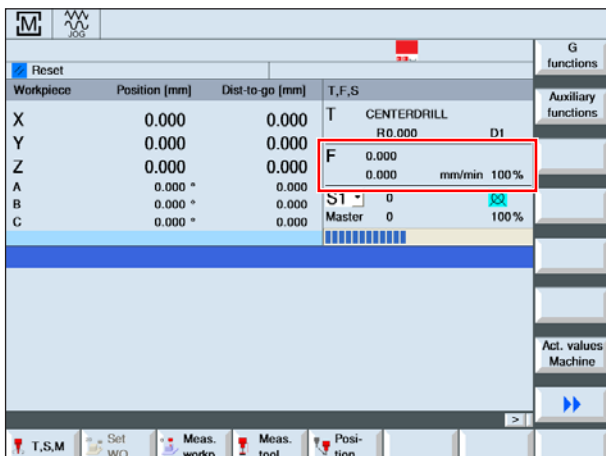
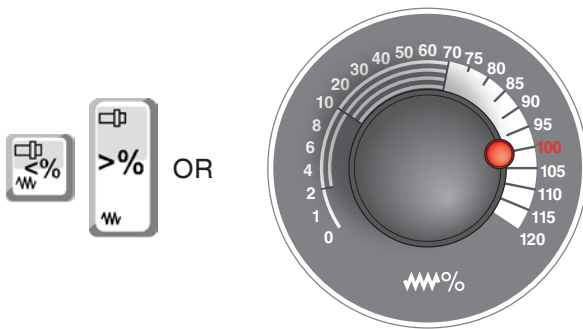
## Feed F [mm/min]

The feed F is the speed in mm/min (inch/min) with which the tool center point moves on its path. The maximum feed can be different for each machine axis and is defined by machine parameters.

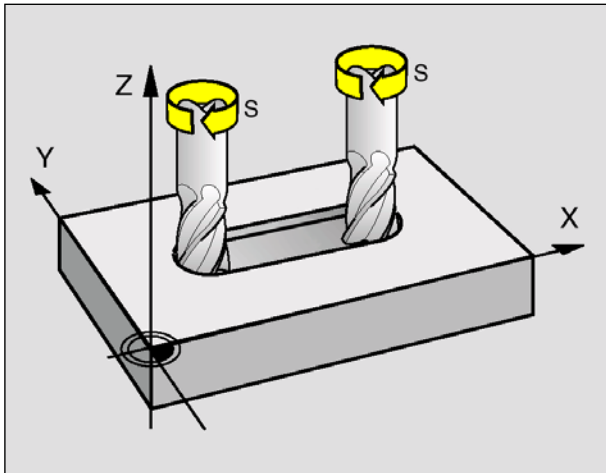


### Feed influence

The feed value F programmed by you corresponds to 100%. With this button or with the feed override the set feed value F can be changed in %.

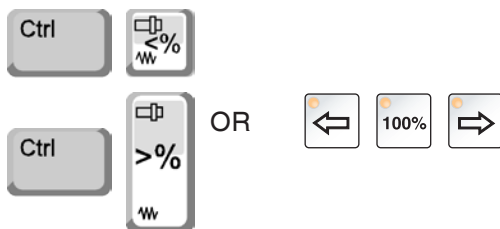


Adjustment range:  
0% to 120% of the programmed feed.  
Only the changed percentage and not the resulting effective value will be shown.  
In rapid traverse 100% of the maximum rapid traverse feed will not be exceeded.



## Spindle speed S [rev/min]

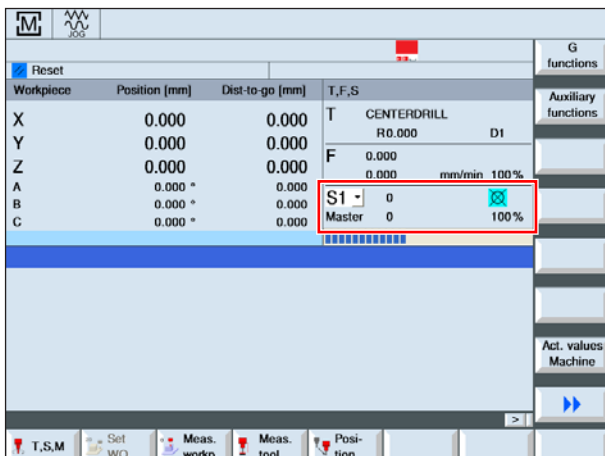
Indicate the spindle speed S in revolutions per minute (rpm).



### Spindle speed correction

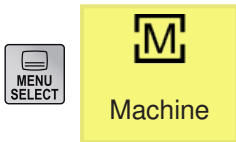
The spindle speed S programmed by you corresponds to 100%.

With these button combinations or with the spindle speed override the set spindle speed value S can be changed in %.



Adjustment range:

0% to 120% of the programmed spindle speed.  
Only the changed percentage and not the resulting effective value will be shown.



## Machine operating area

The machine operating area includes all functions and influence variables that lead to actions on the tool machine or its state.

The following operating modes are distinguished:



OR



### Types of operation

#### JOG - Jogging

Standard movement of the machine by continuous movement of the axes via the directional buttons or by incremental movement of the axes via the directional buttons or the handwheel.

JOG is used in manual mode as well as for set-up of the machine.



OR



#### MDA - Semi-automatic mode

Control the machine by executing a set or a sequence of sets. Block input is performed via the operating panel or the PC keyboard.



OR



#### AUTO - Automatic mode

Control the machine by automatically executing programs.

Here part programs are selected, started, adjusted, deliberately influenced (e.g. individual set) and executed.

#### Instructions:

The operating modes can be selected via softkeys (PC keyboard) or with the operating mode selector switch.





OR



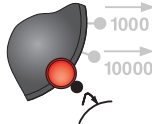
The following options exist for JOG mode set-up.

**REF** - Reference mode

Approaching the reference point (Ref) in the JOG operating mode.



OR



**REPOS** - Repositioning, approach contour again in the JOG operating mode



**Inc 1** - Incremental Feed

Move step by step a predefined distance of 1 increment.

Metrical measurement system: Inc 1 corresponds to 1 $\mu$ m

Imperial (inch-based) measurement system: Inc 1 corresponds to 0,1  $\mu$ inch



**Inc 10** - Incremental Feed

Move step by step a predefined distance of 10 increments.

Metrical measurement system: Inc 10 corresponds to 10 $\mu$ m

Imperial (inch-based) measurement system: Inc 10 corresponds to 1  $\mu$ inch



**Inc 100** - Incremental Feed

Move step by step a predefined distance of 100 increments.

Metrical measurement system: Inc 100 corresponds to 100 $\mu$ m

Imperial (inch-based) measurement system: Inc 100 corresponds to 10  $\mu$ inch



**Inc 1000** - Incremental Feed

Move step by step a predefined distance of 1000 increments.

Metrical measurement system: Inc 1000 corresponds to 1000 $\mu$ m

Imperial (inch-based) measurement system: Inc 1000 corresponds to 100  $\mu$ inch



**Inc 10000** - Incremental Feed

Move step by step a predefined distance of 10000 increments.

Metrical measurement system: Inc 10000 corresponds to 10000 $\mu$ m

Imperial (inch-based) measurement system: Inc 10000 corresponds to 1000  $\mu$ inch

**Note:**

The allocation from metric to the imperial system is as follows:

**feed:**

millimeter to inch:

mm/min => inch/min

mm/U => inch/U

**constant cutting speed:**

meter to feet:

m/min => feet/min

**Instructions:**

Switching between the metrical measurement system and the imperial (inch-based) measurement system is carried out with the EmConfig utility software (see Chapter X EmConfig).

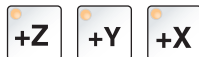
## Approach reference point

The reference point R is a specified fixed point on the machine. It is used to calibrate the measurement system.

The reference point must be approached each time after the machine is switched on or the EMERGENCY STOP button is unlocked, in order to make the exact distance between the machine zero point M and the tool fixture reference point N or T known to the control system.



- Switch to the reference mode REF.



### Option A:

#### Reference the axes individually

Press the buttons +Z, +Y, and +X, or +A and +B.

The slides move one another to their reference points, after each has reached the collision-free area.

(Button "+A" and "+B" only with activated accessory).

#### Instructions:

- After reaching the reference points the software limit switches are active. The reference point position will be shown as the current position on the screen.
- The tailstock (if available) must be at the right end of the bed when referencing the axes, so that the Z-slides do not collide with the tailstock.



### Option B:

#### Reference automatically

Pressing the button "Reference point" causes the axes to approach their reference points automatically one after another. First the axes then the tool changer will be referenced.

## Move slides manually



The machine axes are moved manually using the direction buttons.

- Switch to JOG mode.



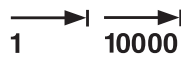
- The direction buttons move the axes in the corresponding direction as long as the button is pressed.

- The feed speed is set with the override switch.



- If the button is pressed simultaneously, the slides move in rapid traverse.

## Move slides in step-movement

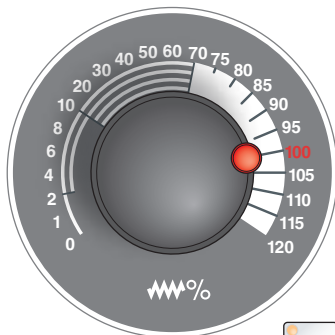


The machine axes can be moved in steps using the direction buttons.

- Switch to INC mode.



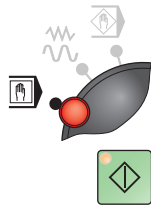
- The direction buttons move the axes in the corresponding direction by the set step distance each time the button is pressed.



- The feed speed is set with the override switch.



- If the button is pressed simultaneously, the slides move in rapid traverse.



**MDA mode** - Semi-automatic mode

Control the machine by executing a set or a sequence of sets. For this the desired movements can be entered via the control keyboard in the form of part program sets.

The control system executes the sets entered after the control button is pressed.

For running an MDA program, the same preconditions are necessary as for fully automatic mode.



**AUTO mode** - Automatic mode

Control the machine by automatically executing programs. Here part programs are selected, started, adjusted, deliberately influenced (e.g. individual set) and executed.

Preconditions for executing part programs:

- The reference point was approached
- The part program is loaded into the control system.
- The correction values required were checked or entered (e.g. zero point offsets, tool corrections)
- The safety locks are activated (e.g. chip-guard doors closed).

Options in Automatic mode:

- Program correction
- Block search run
- Overstore
- Program influence

(see Section G program sequence)

**Screen division T, S, M**

Workpiece	Position [mm]	Dist-to-go [mm]	T,F,S
X	0.000	0.000	T CENTERDRI
Y	0.000	0.000	R0.000 D1
Z	0.000	0.000	F 0.000
A	0.000 °	0.000	0.000 mm/min 100%
B	0.000 °	0.000	S1 0
C	0.000 °	0.000	Master 0 100%

**T,S,M**

T  D 1

Spindle S1

Spindle M function

Other M function

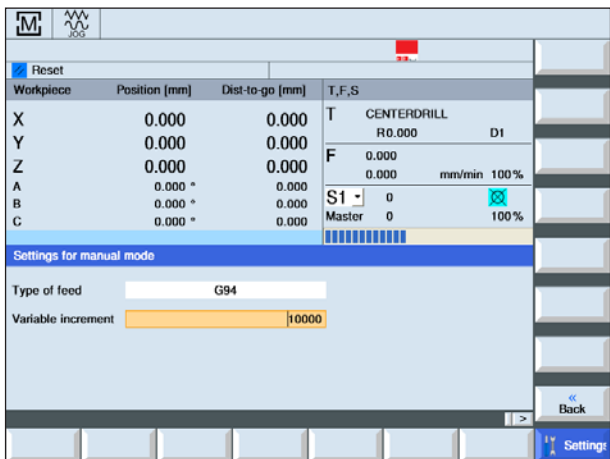
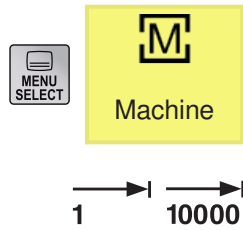
Work offset

Softkeys: Select tool (8), Select work offs. (9), Back

Bottom buttons: T,S,M, Set WO, Meas. workp., Meas. tool, Position

- 1 Tool name
- 2 Place number of current tool
- 3 Blade number of current tool
- 4 Spindle speed
- 5 Spindle direction of rotation (M3, M4, M5, SPOS)
- 6 Input option for additional M-functions
- 7 Selection of zero point offset
- 8 Softkey to switch to the tool list
- 9 softkey to switch to the table for zero point offsets





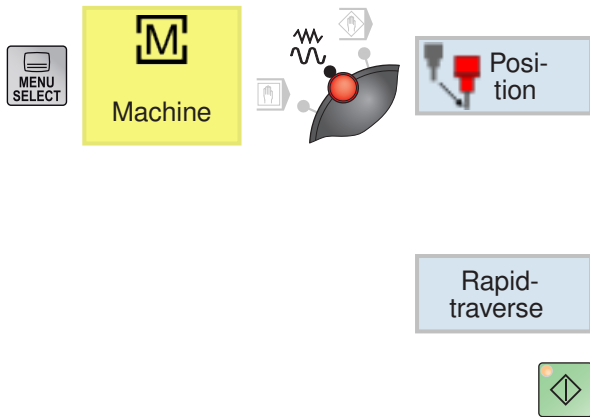
## Move Axes

### Move axes by fixed increments

- 1 Switch to the machine operating area.
- 2 Select INC setting on mode rotary switch to set the increment. 1, 10, ..., 10000.  
The numbers indicate the movement distance in micrometres or micro-inches. Example: For a desired increment of 100 µm (= 0.1 mm) press the button "100".
- 3 Select axes to be moved.  
With each press the desired axis will be moved by the fixed increment.

### Move axes by fixed increments

- 1 Switch to the machine operating area.
- 2 Press softkey. Enter desired value for the variable step distance.  
With each press the desired axis will be moved by the fixed increment.  
Example: For a desired increment of 500 µm (0.5 mm) enter 500.
- 3 Set operating mode INC-Var via PC keyboard.
- 4 Select axes to be moved.  
With each press the desired axis will be moved by the fixed increment.



### Approach target position

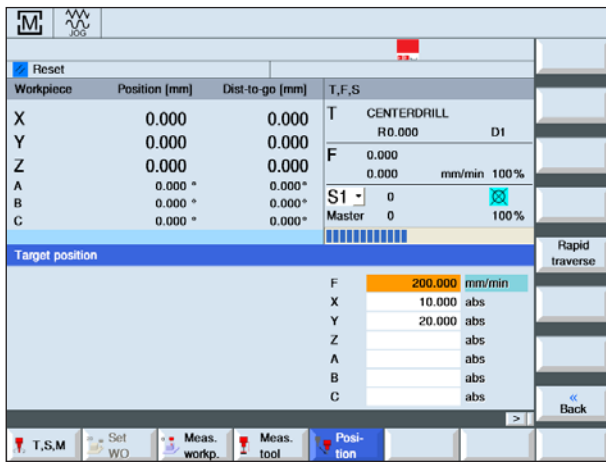
1 Enter the desired coordinate value.

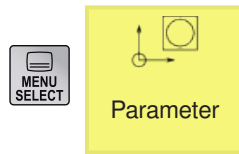
2a Enter the desired feed.

OR

2b Select rapid traverse.

3 With the NC-Start button move the axes with the set speed to the target position.





## Parameters operating area

In the Parameters operating area you can enter and edit the data for programs and tool management.

### Tool data

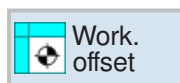
(see Chapter F Tool Programming)

### Zero point offset

- Press softkey.
- (See Chapter a Zero point offset Fundamentals)

### Display and process zero point offset

- 1 Press softkey. The associated window will be opened.

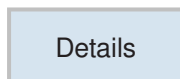


Work offset - Overview [mm]						
	X	Y	Z	A	B	
Basic reference	10.000	10.000	20.000	0.000	0.000	
Total basic WO	10.000	10.000	20.000	0.000	0.000	Active
G500	0.000	0.000	0.000	0.000	0.000	
Total WO	10.000	10.000	20.000	0.000	0.000	

- 1 Press softkey. The associated window will be opened.



- 2 To learn more about the shift move the cursor to the desired shift.



- 3 Press softkey. All configurable shifts will be shown, divided into crude and fine shift, and rotation, scaling and mirroring. Fields with a bright background can be edited.



- 4 Press softkey to select the next or the previous shift.



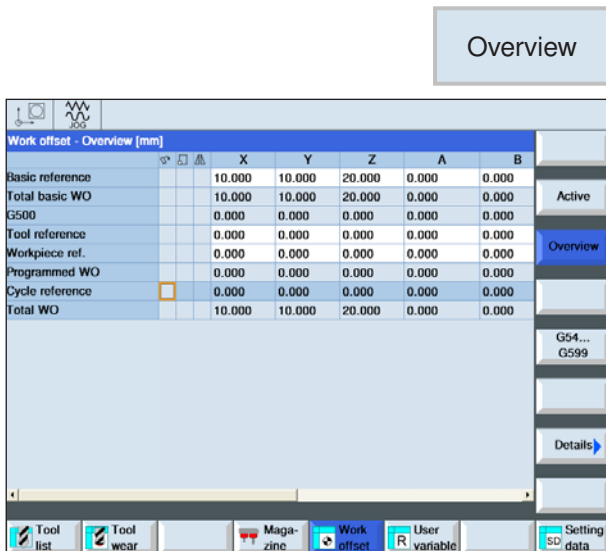
- 5 Press softkey to delete values.



- 6 Confirm or cancel delete with softkey.

## Show overview of zero point offsets

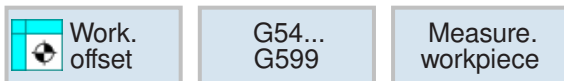
- Press softkey. All zero point offsets will be shown.



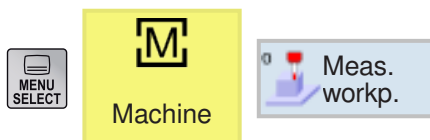
Overview

## Measure workpiece zero point

- Set operating mode selection switch to JOG mode.



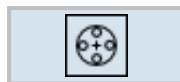
OR

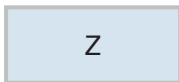
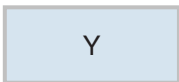
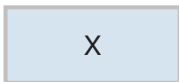
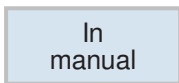
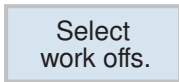
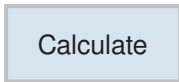
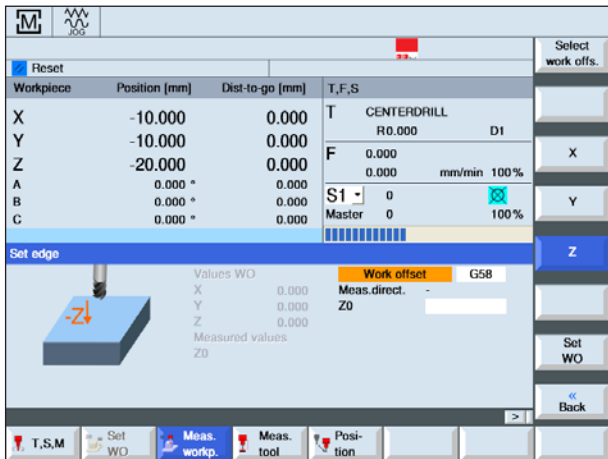
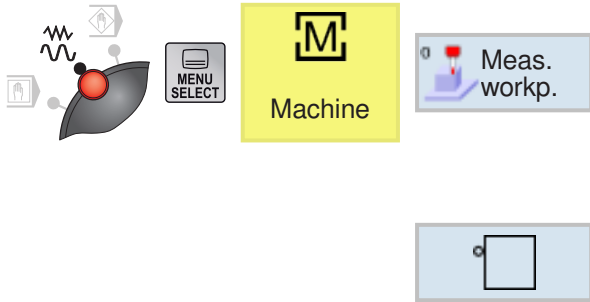


- Press softkey. The associated window will be opened.

The following manual measurement variants are available for selection:

- Set edge
- Align edge
- Rectangular corner
- 1 Hole
- 1 circular spigot





## Set edge

The workpiece is on the clamping table, parallel to the coordinate system. a reference point will be measured in one of the axes (X, Y, Z). Manual measurement is carried out by scratching a tool on the workpiece.

1 Press softkey.

2 Different measurement options to be selected:

- Select Measure only if measured values should only be shown,

OR

- Select zero point offset if the adjustable zero point offset should be saved,

OR

- Select point of reference.

3 Select positive or negative measurement direction.

4 In the input field X0, Y0 and Z0 enter the reference position of the workpiece edge. Take the reference position from the measurement details of the workpiece drawing.

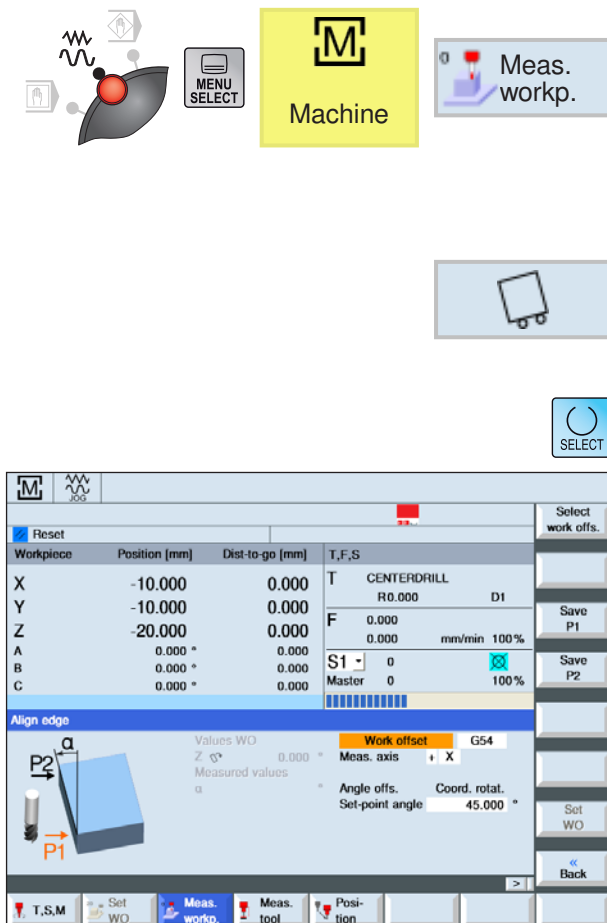
5 If the pure measurement option was selected, the values will be calculated by pressing the softkey and shown on the screen.

6 For all other options (zero point offset or point of reference):  
Press softkey and select G-command under which the measurement values should be saved.

7 Apply selection with softkey. The selected G-command will be shown.

8 Select axes one after another. With the tool in the selected axis alignment carefully bring the tool to and scratch the workpiece.

9 Apply the measurement values with the softkey. This will enter the measured values in the previously selected G-command.



Calculate

Select work offs.

In manual

## Align edge

The workpiece is on the clamping table, not parallel to the coordinate system. Two points will be measured on the workpiece reference edge. This determines the angle to the coordinate system. Manual measurement is carried out by scratching a tool on the workpiece.

1 Press softkey.

2 Different measurement options to be selected:

- Select Measure only if measured values should only be shown,

OR

- Select zero point offset if the adjustable zero point offset should be saved,

OR

- Select point of reference.

3 Select positive or negative measurement direction and measurement axis (X, Y, Z).

4 If the pure measurement option was selected, the values will be calculated by pressing the softkey and shown on the screen.

5 For all other options (zero point offset or point of reference):  
Press softkey and select G-command under which the measurement values should be saved.

6 Apply selection with softkey. The selected G-command will be shown.

7 Indicate reference angle between workpiece edge and reference axis.

Save  
P1

**8** With the tool in the selected axis alignment carefully bring the tool to and scratch the first measurement point P1.

**9** Press softkey.

Save  
P2

**10** With the tool in the selected axis alignment carefully bring the tool to and scratch the second measurement point P2.

**11** Press softkey.

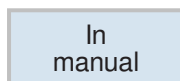
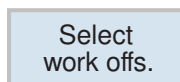
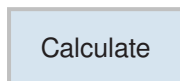
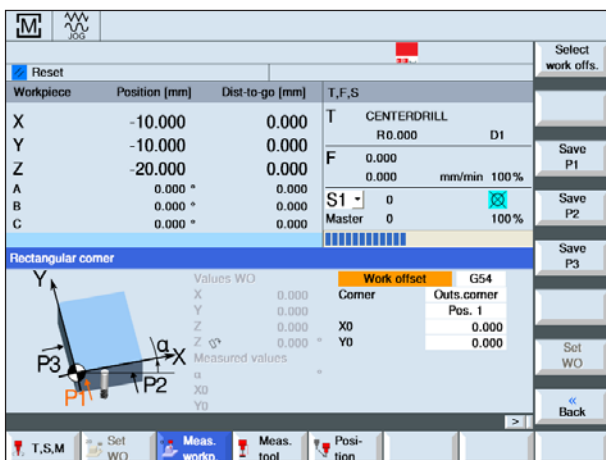
**Instructions:**

The positions of the measurement points must be different from one another. Otherwise an error message appears.



Set  
WO

**12** Apply the measurement values with the softkey. This will enter the measured values in the previously selected zero point offset.



## Rectangular corner

The workpiece with right-angled corner is on the clamping table, not parallel to the coordinate system. Three points will be measured. From this the right-angled corner point and the angle to the coordinate system will be determined. Manual measurement is carried out by scratching a tool on the workpiece.

1 Press softkey.

2 Different measurement options to be selected:

- Select Measure only if measured values should only be shown,

OR

- Select zero point offset if the adjustable zero point offset should be saved,

OR

- Select point of reference.

3 Select whether external or internal corner will be measured.

4 Select position of the corner point (position 1... position 4).

5 If the pure measurement option was selected, the values will be calculated by pressing the softkey and shown on the screen.

6 For all other options (zero point offset or point of reference):  
Press softkey and select G-command under which the measurement values should be saved.

7 Apply selection with softkey. The selected G-command will be shown.

8 In the input field X0, Y0 and Z0 enter the reference position of the workpiece edge. Take the reference position from the measurement details of the workpiece drawing.



Save  
P1

9 With the tool in the selected axis alignment carefully bring the tool to and scratch the first measurement point P1.

10 Press softkey.

Save  
P2

11 With the tool in the selected axis alignment carefully bring the tool to and scratch the second measurement point P2.

12 Press softkey.

Save  
P3

13 With the tool in the selected axis alignment carefully bring the tool to and scratch the second measurement point P3.

14 Press softkey.

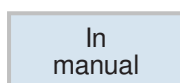
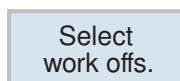
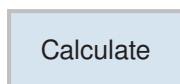
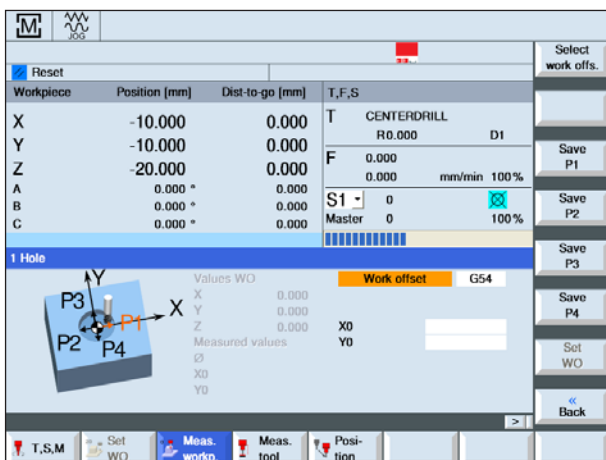
**Instructions:**

The positions of the measurement points must be different from one another. Otherwise an error message appears.



Set  
WO

15 Apply the measurement values with the softkey. This will enter the measured values in the previously selected zero point offset.



## 1 Hole

The workpiece with circular pocket is on the clamping table. Four points will be measured. From this the circle diameter and the circle center point are determined.

Manual measurement is carried out by scratching a tool on the workpiece.

1 Press softkey.

2 Different measurement options to be selected:

- Select Measure only if measured values should only be shown,

OR

- Select zero point offset if the adjustable zero point offset should be saved,

OR

- Select point of reference.

3 If the pure measurement option was selected, the values will be calculated by pressing the softkey and shown on the screen.

4 For all other options (zero point offset or point of reference):  
Press softkey and select G-command under which the measurement values should be saved.

5 Apply selection with softkey. The selected G-command will be shown.

6 In the input field X0, Y0 and Z0 enter the reference position of the workpiece edge. Take the reference position from the measurement details of the workpiece drawing.

Save  
P1

**7** With the tool in the selected axis alignment carefully bring the tool to and scratch the first measurement point P1.

**8** Press softkey.

Save  
P2

**9** With the tool in the selected axis alignment carefully bring the tool to and scratch the second measurement point P2.

**10** Press softkey.

Save  
P3

**11** With the tool in the selected axis alignment carefully bring the tool to and scratch the second measurement point P3.

**12** Press softkey.

Save  
P4

**13** Move the tool clear and again in the selected axis alignment carefully bring the tool to and scratch the second measurement point P4.

**14** Press softkey.

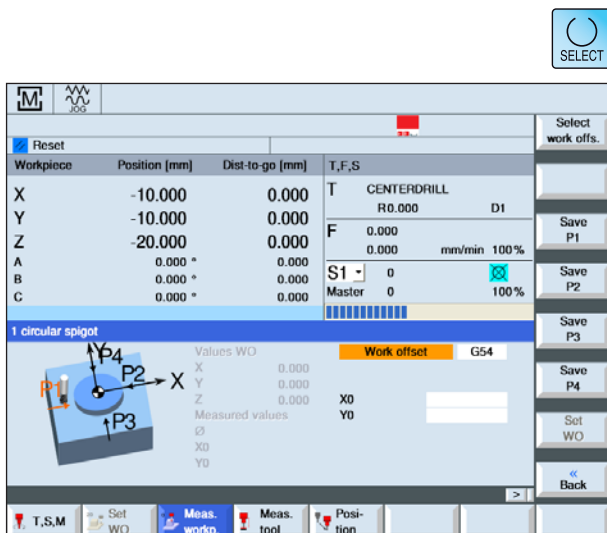
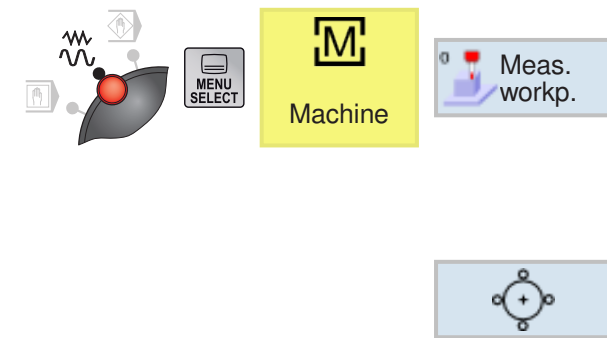
**Instructions:**

The positions of the measurement points must be different from one another. Otherwise an error message appears.



Set  
WO

**15** Apply the measurement values with the softkey. This will enter the measured values in the previously selected zero point offset.



Calculate

Select work offs.

In manual

## 1 circular spigot

The workpiece with circular spigot is on the clamping table. Four points will be measured. From this the spigot diameter and the spigot center point are determined.

Manual measurement is carried out by scratching a tool on the workpiece.

1 Press softkey.

2 Different measurement options to be selected:

- Select Measure only if measured values should only be shown,

OR

- Select zero point offset if the adjustable zero point offset should be saved,

OR

- Select point of reference.

3 If the pure measurement option was selected, the values will be calculated by pressing the softkey and shown on the screen.

4 For all other options (zero point offset or point of reference):  
Press softkey and select G-command under which the measurement values should be saved.

5 Apply selection with softkey. The selected G-command will be shown.

6 In the input field X0, Y0 and Z0 enter the reference position of the workpiece edge. Take the reference position from the measurement details of the workpiece drawing.

Save  
P1

**7** With the tool in the selected axis alignment carefully bring the tool to and scratch the first measurement point P1.

**8** Press softkey.

Save  
P2

**9** With the tool in the selected axis alignment carefully bring the tool to and scratch the second measurement point P2.

**10** Press softkey.

Save  
P3

**11** With the tool in the selected axis alignment carefully bring the tool to and scratch the second measurement point P3.

**12** Press softkey.

Save  
P4

**13** Move the tool clear and again in the selected axis alignment carefully bring the tool to and scratch the second measurement point P4.

**14** Press softkey.

**Instructions:**

The positions of the measurement points must be different from one another. Otherwise an error message appears.



Set  
WO

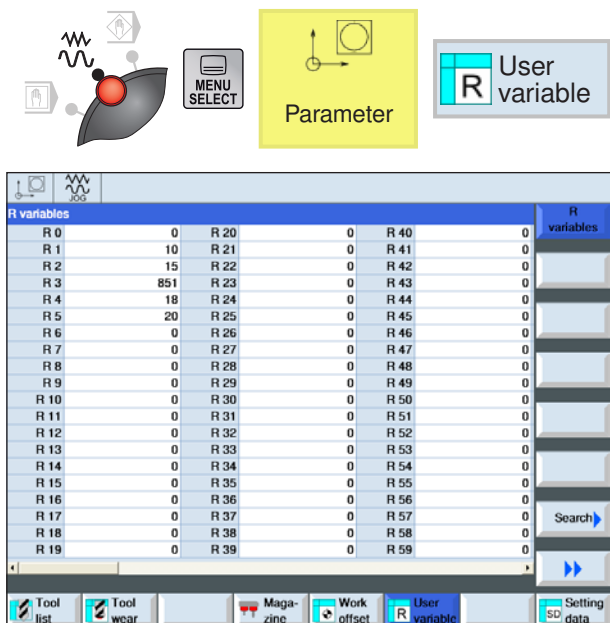
**15** Apply the measurement values with the softkey. This will enter the measured values in the previously selected zero point offset.

## R-parameters (calculation parameters)

Under the address R in the Sinumerik Operate control system there are 300 calculation variables (= R-parameters) of type REAL available by default.

Press softkey to go to program management.

It is possible to browse through the parameter list with the cursor buttons.



### Search R-parameters

To search press the softkey and enter the desired parameter address.

Confirm search with softkey.

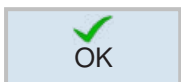
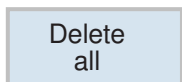
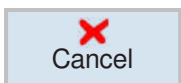
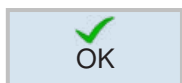
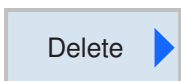
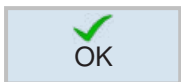
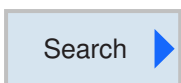
### Delete R-parameters

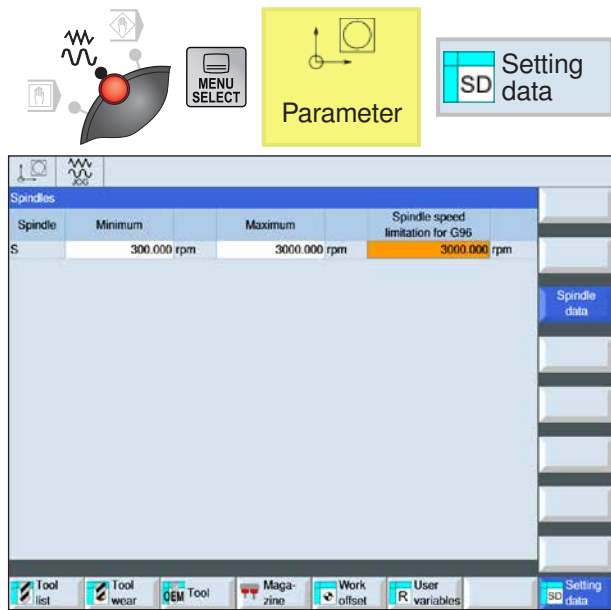
Press softkey to delete and enter parameter addresses to be deleted from R... to R....

Confirm or cancel delete with softkey.

### Delete all R-parameters

The softkey deletes all values.





## Setting data

Press the softkey to open the window for the setting data.

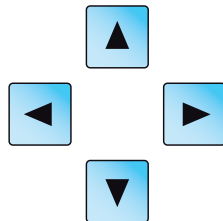
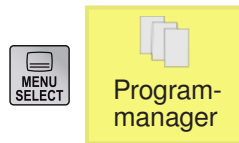
The following spindle data can be entered:

- Minimum
- Maximum
- Spindle speed limitation for G96

## Program management

A program consists of the succession of cycles, commands and/or sub-programs.

Press the softkey to go to program management.



You can navigate between the directories and programs using the mouse or cursor keys. A selected and thus active program is represented with a green symbol.

The following options are available from the program management screen:

- Create program
- Delete program
- Copy program
- Change program
- Select/deselect program on the machine

### Note:

There is no limitation for the length of filenames (no limit in the number of characters). The number of characters is depending on the operating system and the file system that is used.

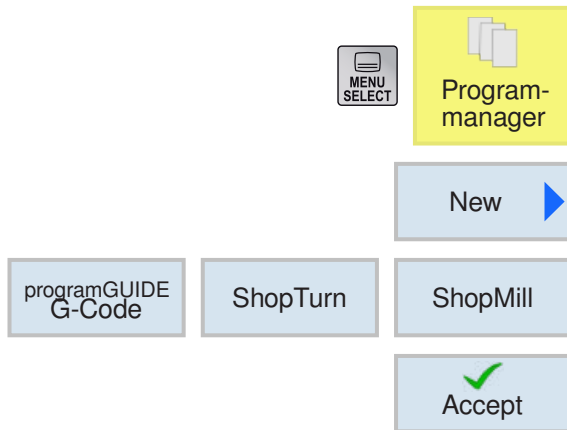
Type	Name
DIR	Directory for parts or sub-programs or workpieces. Other directories can be created.
WPD	Tool directory. No additional directories can be created.
MPF	Program
SPF	sub-program



### Where programs are saved

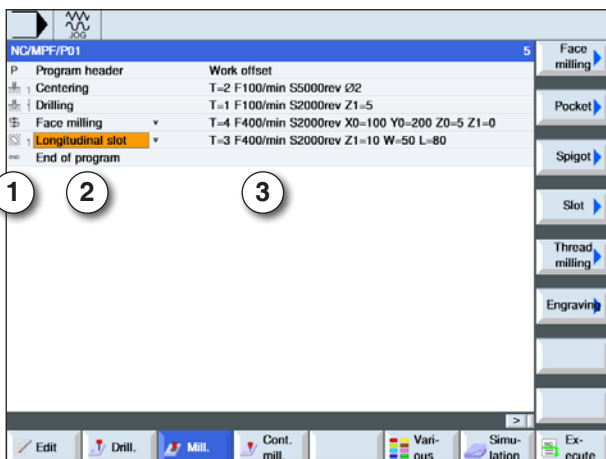
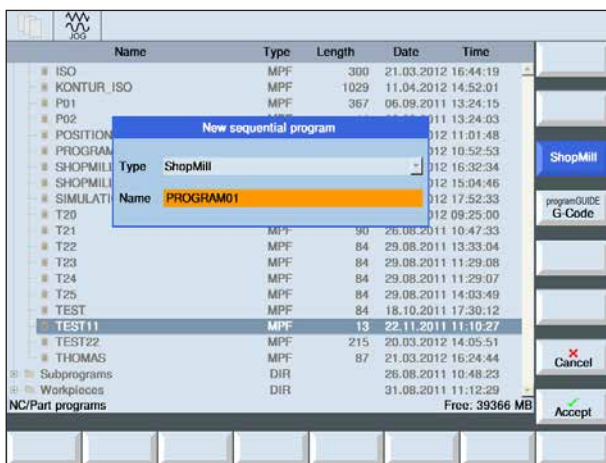
Programs can be saved in and invoked from the control system's program directory, a local drive or a USB data storage device.



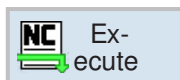
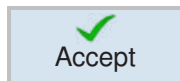


## Create program

- 1 Select "Program manager".
- 2 Press softkey.
- 3 Choose whether a ShopTurn/ShopMill or a G-Code program should be created.
- 4 Enter program name and confirm with softkey. If the program name already exists the softkey remains deactivated.



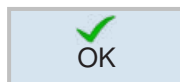
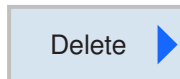
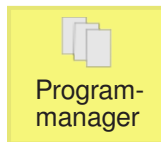
- 1 Cycle symbols
- 2 Program header
- 3 Technology values



### Instructions:

The individual cycles of a program will be shown symbolically in the indicated sequence (1) on the left next to the program header.

- 5 Then cycles or program lines can be entered (see Chapter D Programming ShopMill or Chapter E Programming G-Code).
- 6 Press softkey to apply the cycle in the workpiece program.
- 7 Enter additional cycles.
- 8 Select or simulate cycles via softkeys.

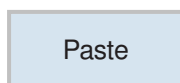
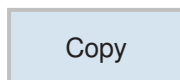
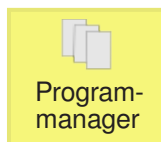


## Delete program

Only deselected programs can be deleted, see also page C-29 select / deselect program  
Therefore to delete an active program another program must initially be selected in order to delete the original.

1 Press softkey to delete.

2 Confirm selection with softkey.

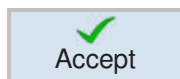
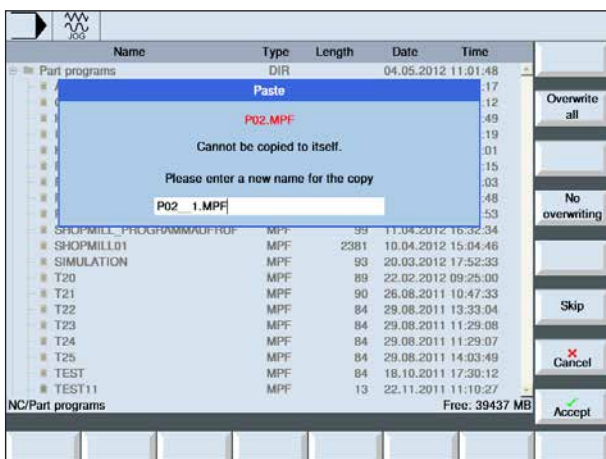


## Copy program

1 Move mark to the desired program.

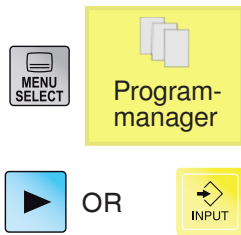
2 Press softkey to copy.

3 Press softkey to paste.



4 Enter a new program name or select a program name suggested by the control system.

5 Press softkey to apply.



### Open / close program

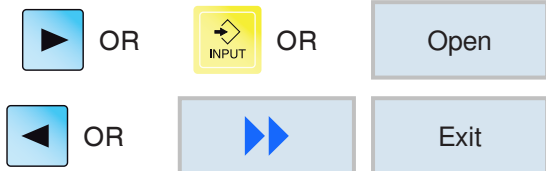
1 Position cursor on directory in which the program should be selected.

2 Press button.

3 Position cursor on the desired program.

4 Press button or softkey.

5 Press button or softkeys to close.



### Selected / deselect program

1 Position cursor on directory in which the program should be selected.

2 Press button.

3 Position cursor on the desired program.

4 Press softkey to select.

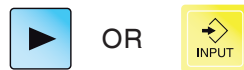


## Print program

1 Position cursor on directory in which the program should be selected.



2 Print with Filemanager:  
press softkey to print the active NC-programm.



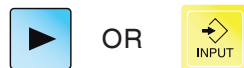
3 Print with ISO-editor:

4 Open an ISO-program.



5 Press softkey to print the opened NC-program.

6 Print with Shop-editor.



7 Open a Shop-program.

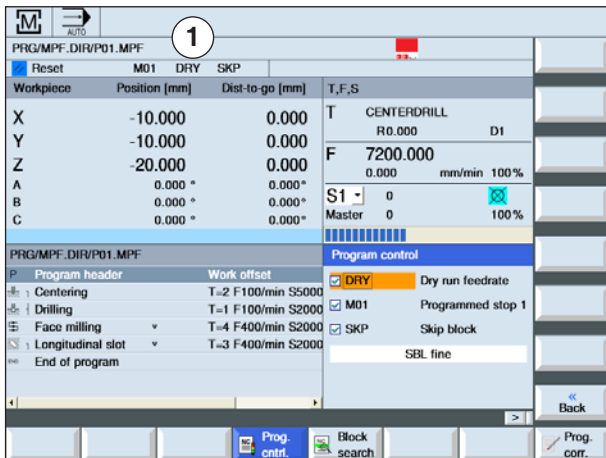


8 Press softkey to print the cyclelist of the opened NC-program.



9 Press softkey to print the opened NC-program.





## Program influence

In the operating modes "AUTO" and "MDA" selected NC programs can be influenced by the following commands:

- DRY feed test run
- M01 Programmed stop 1
- SKP skip blocks
- SB Single block (SingleBlock SBL)

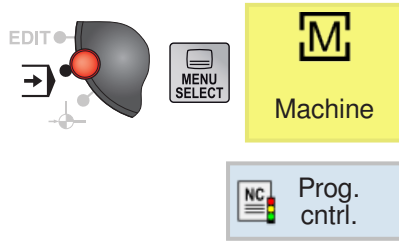
Active program influences will be shown in the status display (1).

The functions DRY, M01, SKP will be activated by selecting the particular control boxes.



The SB function is activated via the SBL button.

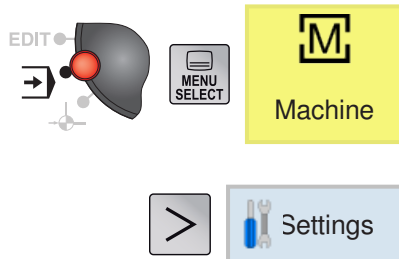
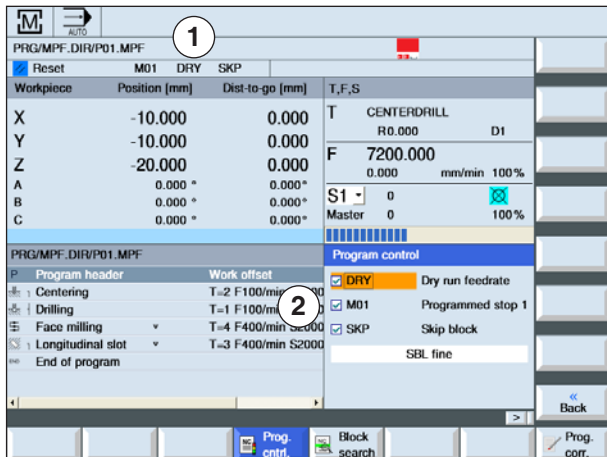
Type of program influence	Description
DRY Feed test run	For test run without workpiece (without chip removal). All blocks for which a feed is programmed (G1, G2, G3, G33, etc.) move with a preset feed test run instead of the programmed feed. The spindle does not run. The test run feed value also applies instead of the programmed feed rotation. Caution: When "Test run feed" is activated, no workpiece programming takes place, as the cutting speeds of the tools may be excessive because of the changed values or the workpiece or the machine may be destroyed.
M01 Programmed stop 1	The program processing will stop at each of the blocks in which the M01 special function has been programmed. This is how you do interim checking of the results already achieved on a workpiece. Continue with button
SKP Skip blocks	Skip blocks will be skipped during processing.
SBL Single block	Single block mode with stop after machine function blocks. The program sequence will stop after each movement. Continue with button



### Activate / deactivate program influence for DRY, M01, SB

1 Press softkey.

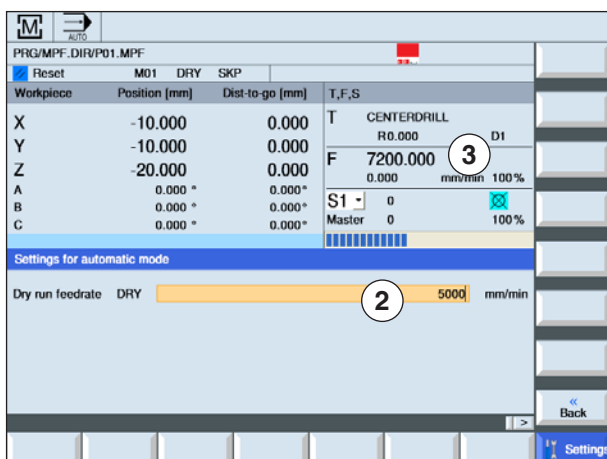
2 Select control boxes (2). On the screen the active program influences will be shown in the status display (1).



### Set feed test run for DRY.

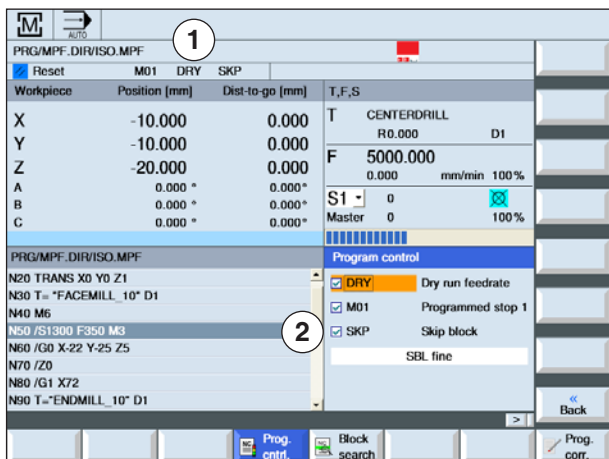
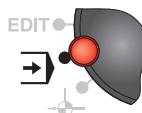
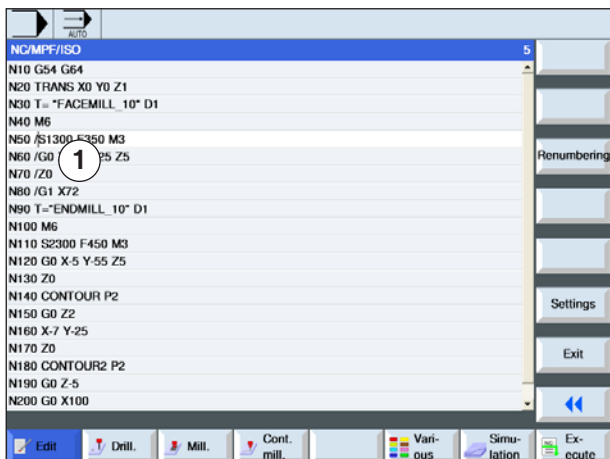
1 Press extension button or softkey.

2 Enter the desired feed test run in the input field (2) and confirm with "Enter". The test run feed will be applied in the T, F, S window (3).



**Instructions:**

ShopMill or ShopTurn cycles cannot be skipped.

**Create skip blocks for program**

ISO program blocks that are not executed on every program run can be skipped.

These skip blocks are identified by the symbol "/" (slash) in front of the block number. Several blocks can also be skipped in succession.

The instructions in the skipped blocks will not be executed, i.e. the program will continue in each case with the next unskipped block.

1 Place "/" character before the block number. After SKP is activated, the highlighted block will be skipped.

2 Press softkey.

3 Select control box SKP (3). On the screen the active program influences will be shown in the status display (2).

3 Press button. The control system only executes program blocks that were not marked with the symbol "/".

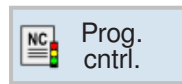
4 If the SKP control box is not selected, the entire program will be executed. The program blocks marked with "/" will also be executed.



## Execute program in Single Block (SBL)

In SBL the control system executes the program block-by-block.

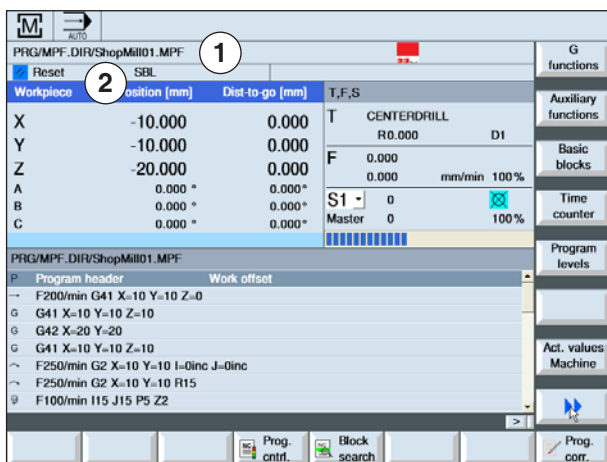
A program must be selected in "AUTO" mode. The name of the selected program will be shown (1).



1 Press softkey.



2 Press button. On the screen active single block mode (SBL) will be shown in the status display (2).



3 Press button. The control system executes the first program block and afterwards stops the processing.



4 Press button again. The control system works on the next program block and afterwards stops the processing.



5 Press button if the processing should no longer take place block-by-block. On the screen the Single Block mode display (2) goes off.

## Block search run

The block search run enables a program pre-run to the desired point in the NC program.

The following search target variants are available:

- Define search target with cursor  
Direct input of the search target by positioning the cursor in the selected program (main program).
- Define search target by text search.

**1** The desired program is selected in "AUTO" mode.

**2** The control system is in the reset state.

**3** Press softkey.

**4a** Position cursor on the target block.

OR

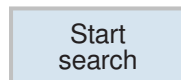
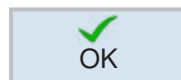
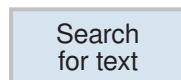
**4b** Press softkey to search for text. For this select search direction and enter the text to be searched for.  
Confirm with softkey.

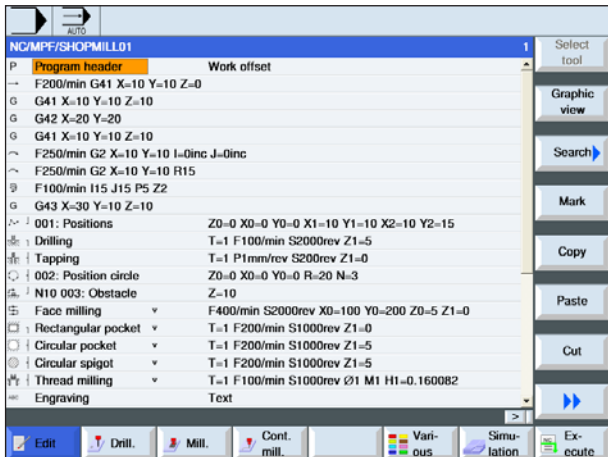
**5** The search run is started with the softkey. The control system counts through all blocks to the search target, but still carries out no movements.

**6** Press NC-Start button.

During the block search run the same calculations will be carried out as in normal program mode (the program will be simulated internally). At the start of the block of the target block the machine state will be established that would also be active in a normal program run.

In the mode "with calculation with approach" the end position of the block before the target block will be approached. The mode is used to be able to approach the contour in arbitrary situations. Afterwards the target block and the following blocks are executed as in a normal program sequence.





## Correct program

A program correction can only take place in reset state. All lines can be edited.

A program must be selected in "AUTO" mode.

- 1 Press softkey.  
The program will be opened in the editor.

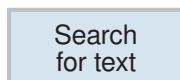
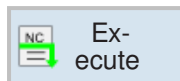
- 2 Perform corrections.

- 3 Press softkey.  
The control system switches back into the "Machine" operating area and selects the "AUTO" operating mode. The control system is now in "Search for text" mode.

- 4a Press button. The control system starts processing the program from the beginning.

OR

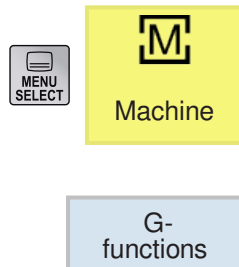
- 4b with search for text the actual line of the program can be started.



## Show G-functions

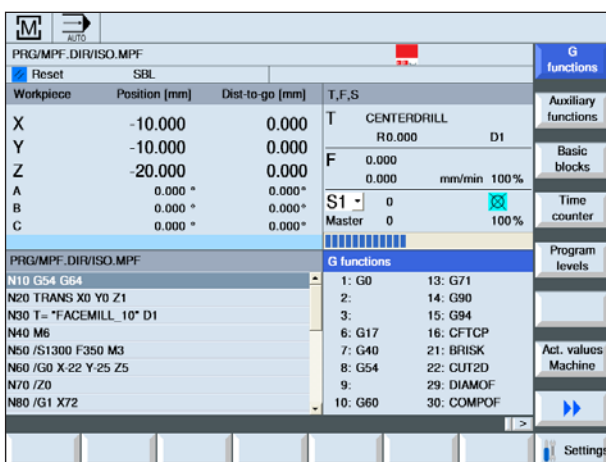
Selected G-groups will be shown in the "G-functions" window.

Inside a G-group the G-function currently active in the control system will always be shown. Some G-codes (e.g. G17, G18, G19) are active immediately after the machine control is switched on.



1 Place "/" character before the block number. After SKP is activated, the highlighted block will be skipped.

2 Press softkey. The G-functions used in the NC program will be shown in groups.



Group	Meaning
G-Group 1	Modally effective movement commands (e.g. G0, G1, G2, G3)
G-Group 2	Block-by-block effective movements, e.g. dwell time (e.g. G4)
G-Group 3	Programmable shifts, work field limitation and pole programming (e.g. TRANS, ROT, G25, G110)
G-Group 6	Plane selection (e.g. G17, G18)
G-Group 7	Tool radius correction (e.g. G40, G42)
G-Group 8	Configurable zero point offset (e.g. G54, G57, G500)
G-Group 9	Suppression of shifts (e.g. SUPA, G53)
G-Group 10	Precision stop - path control mode (e.g. G60, G641)
G-Group 13	Workpiece dimensioning inch/metric (e.g. G70)
G-Group 14	Workpiece dimensioning absolute/incremental (G90)
G-Group 15	Feed type (e.g. G93, G961, G972)
G-Group 16	Feed correction on internal and external curve (e.g. CFC)
G-Group 21	Acceleration profile (e.g. SOFT, DRIVE)
G-Group 22	Tool correction types (e.g. CUT2D, CUT2DF)
G-Group 29	Radius/Diameter programming (e.g. DIAMOF, DIAMCYCOF)

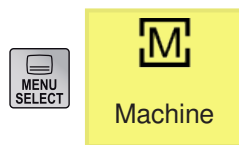
## Show all G-functions

All G-groups with their group numbers will be listed in the "G-functions" window.

Inside a G-group the G-function currently active in the control system will always be shown. The following additional information will be shown at the bottom:

- Spindle speed
- Feed
- Active tool (tool name)
- Current zero point offsets

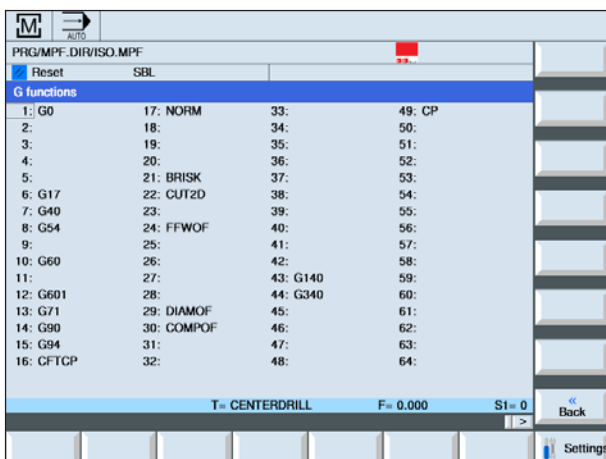
Current zero point offsets	Description
TRANSMIT	Polar-Transformation active
TRACYL	Cylinder jacket transformation active

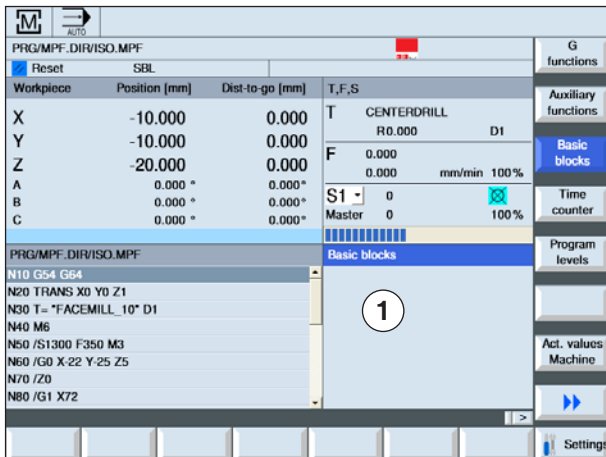


1 Call up "Machine" operating area.



2 Press softkey.





## Show basic blocks

The basic block display gives more precise information during the execution of the program. All axis positions and important G-functions are superimposed. If a cycle is executed there can be a test to see which movements the machine actually carries out.

For the currently active program block all G-code commands that trigger a function on the machine will be shown in the window "Basic blocks".

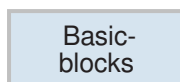
- Absolute axle positions
- G-functions of the first G-group
- Other modal G-functions
- Other programmed addresses
- M-functions

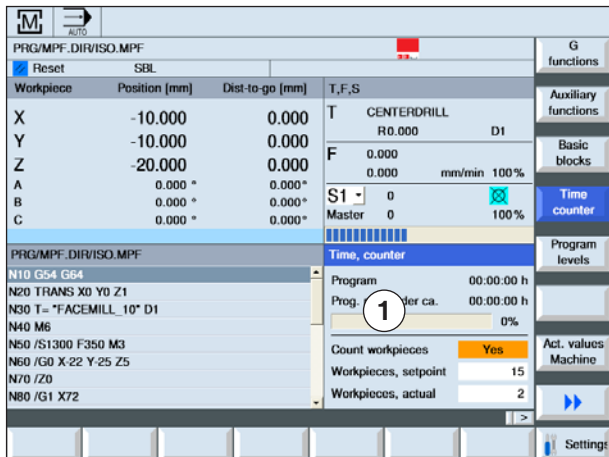
1 A program is opened.

2 Press softkey.

3 Press button for the program to be executed block-by-block.

4 Press button. The control system begins execution of the program.





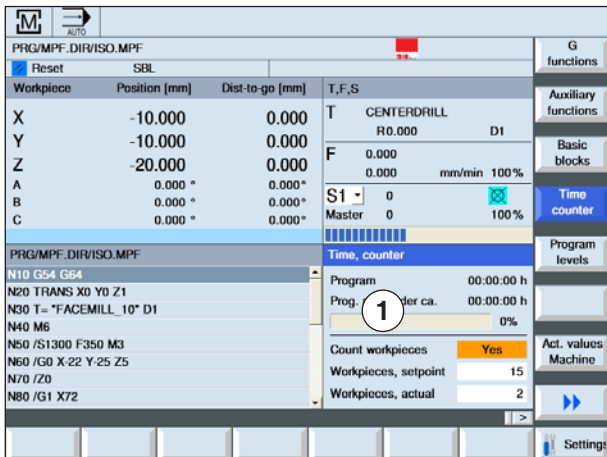
## Show running time and workpieces

The program running time and the number of finished workpieces can be shown (1).

## Show times

- Program**  
 When the softkey is first pressed how long the program has been running will be shown. On each new program start the time required for the entire program run the first time it was run will be shown. If the program or the feed are changed, the new program running time will be corrected after the first run-through.
- Remaining program time**  
 How long the current program still has to run will be shown. In addition the program progress display shows how close the current program run-through is to completion in per cent. The display appears for the first time during the second run-through of a program.
- Time measurement influence**  
 The time measurement begins with the start of the program and ends when the program ends (M30). When the program is running time measurement is interrupted with NC-STOP and continued with NC-START. RESET followed by NC-START starts the time measurement from the beginning. NC-STOP or a Feed-override = 0 stops the time measurement.

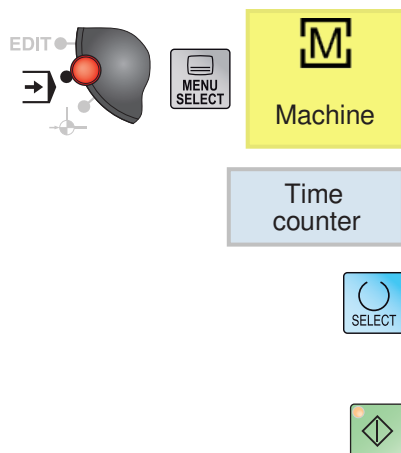




## Count workpieces

Program repetitions or the number of finished workpieces can be shown. For the workpiece counter the actual and target numbers are shown (1).

The counting of finished workpieces can be carried out via the program end (M30) or an M-command.



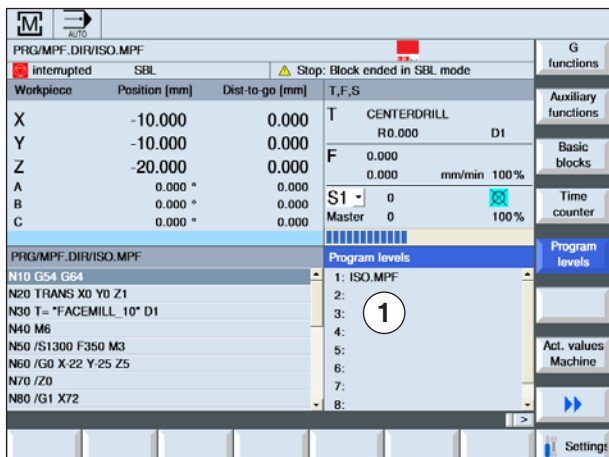
1 A program is selected.

2 Press softkey.

3 Press button to switch workpiece counting on or off.

4 Enter number of workpieces required.  
Enter number of already finished workpieces.  
After the defined number of workpieces is reached, the display of the current workpieces will be automatically set to zero.





## Show program levels

During processing of an extensive program with several sub-program levels, which program level the processing is currently on can be shown (1).

### Several program runs

If several program runs were programmed, i.e. sub-programs are executed several times in succession by input of the additional parameter P, during processing the program runs still to be executed will be shown.

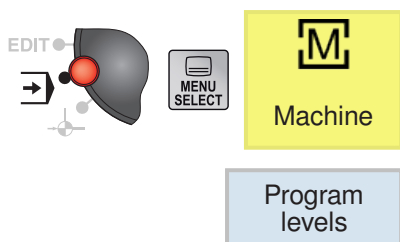
### Program example

N10 sub-program P25

If in a program plane at least one program still has to run through, a horizontal scrollbar appears to make it possible to see the run-counter P in the right part of the window. If there are no multiple runs pending, the scroll bar disappears.

The following information will be shown:

- Level number
- Program name
- Block number or line number
- Remaining program runs (only for multiple program runs)



1 A program is selected.

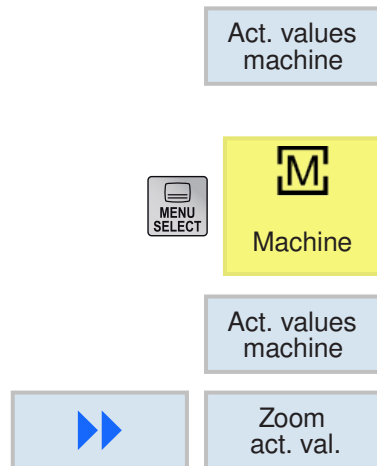
2 Press softkey.

The following information will be shown:

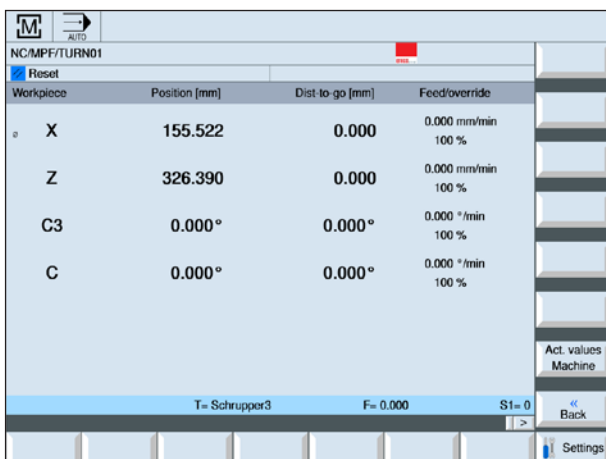
- Level number
- Program name
- Block number or line number
- Remaining program runs (only for multiple program runs)

## MCS / WCS switch

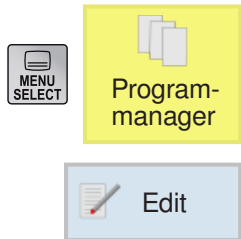
The coordinates shown are relative either to the machine or the workpiece coordinate system. In contrast to the workpiece coordinate system (WCS), the machine coordinate system (MCS) does not take any zero point offsets into account. The softkey switches the display between machine coordinate system (MCS) and workpiece coordinate system (WCS).



- 1 Open "Machine" operating area.
- 2 Use softkey to switch between MCS and WCS.
- 3 Press softkey. The screen window shows detailed displays:



Display	Meaning
WCS / MCS	Display of the axes in the selected coordinate system.
Get	Position of the axes displayed.
Distance-to-go display	While the program is running the distance-to-go for the current NC block will be shown.
Feed/Override	In the full-screen version the effective feed on the axes as well as the Override will be shown.
Repos shift	The travel difference between the axes that has been brought about in manual mode is shown. This information will only be shown when you are in the sub-mode "Repos".
Footer	Display of the active zero point offsets and transformations. In the full-screen version, the T, F, S values will also be shown.



## Editing program blocks

An NC program consists of several program blocks.

Program blocks can be edited as follows:

- Mark
- Copy
- Paste
- Cut
- Renumber
- Change cycles



## Quit editing

1 Press softkey. The control system again shows the program management screen.

## Search program block

1 A program is selected.

2 Press softkey.

2 Press softkey.

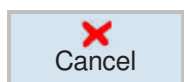
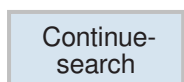
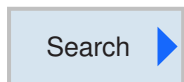
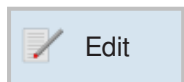
3 Enter search term. Active control box when the search should be based on full-words.

4 Select search direction with button.

5 Press softkey to start search. If the text being searched for is found, the corresponding lines will be highlighted.

6a Using the softkey continue the search until the desired text is found at the desired location.

OR  
6b Cancel search with softkey.

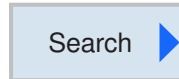


## Search and replace program text

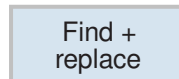
1 A program is selected.



2 Press softkey.



2 Press softkey.



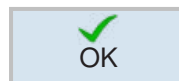
3 Press softkey.

4 Enter search term. Active control box when the search should be based on full-words.



5 Select search direction with button.

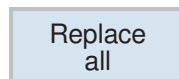
6 Enter replacement text. The search text will be replaced by the replacement text.



7 Press softkey to start search. If the text being searched for is found, the corresponding lines will be highlighted.

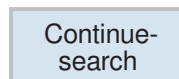


6 Press softkey to paste.



OR

8b Press softkey if all text in the files that corresponds to the search term should be replaced.



OR

8c Using the softkey continue the search until the desired text is found at the desired location.



OR

8d Cancel search with softkey.

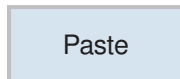
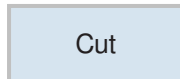
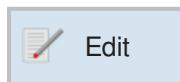
### Instructions:

Within ShopTurn/ShopMill cycles it's not possible to search for text. It's also not possible to replace text.



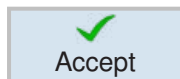
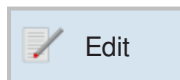


OR



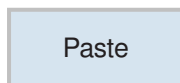
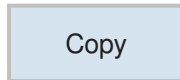
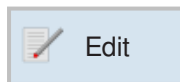
## Move program block

- 1 Press softkey.
- 2 Position cursor on the cycle to be moved.
- 3 Press softkey. Cursor movement can be used to highlight several program lines at the same time.
- 4 Press softkey to cut.
- 5 Position cursor on the program block after which the cut program block should be pasted.
- 6 Press softkey to paste.



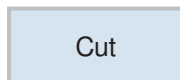
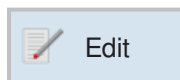
## Change cycle

- 1 Press softkey.
- 2 Position cursor on the cycle to be changed.
- 3 Press button to open the cycle. Carry out changes.
- 4 Terminate change with softkey.



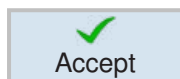
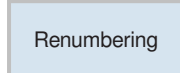
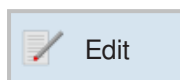
## Copy program block

- 1 Press softkey.
- 2 Position cursor on the program block to be copied.
- 3 Press softkey to copy.
- 4 Position cursor on the program block after which the copied program block should be pasted.
- 5 Press softkey to paste.



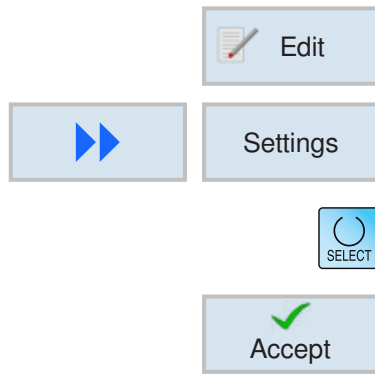
## Delete program block

- 1 Press softkey.
- 2 Position cursor on the program block to be deleted.
- 3 Press softkey to cut. The program block will be deleted.



## Renumber program block

- 1 Press softkey.
- 2 Press softkey. Enter first block number and the increment.
- 3 Terminate change with softkey.



## Define settings for program blocks

1 Press softkey.

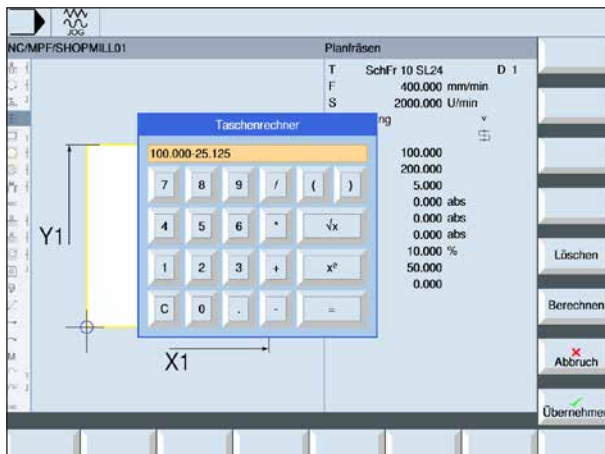
2 Press softkey.

3 Select settings with button.

4 Terminate change with softkey.

## Calculation operations in input fields

Using the calculator it's possible to run calculations directly in the input field.



calling up the pocket calculator:  
Hit the "=" button in the input field

Data can be input by using the keyboard or using the softkeys from the calculator.

Besides the functions from the calculator the following softkeys are available:

Delete

delete input

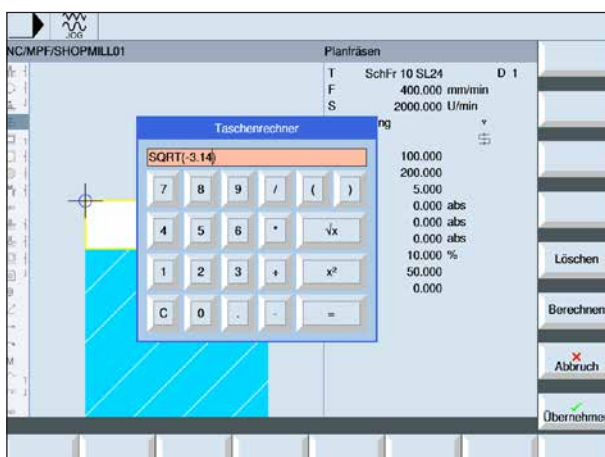
Calculate

process the calculation

Accept

Cancel

Accept the calculation or cancel the process



Incorrect calculations are displayed in red will therefore not be executed.

Will the softkey accept be pressed anyway, the last valid calculation is displayed in the input field.



### Calculation operators in input fields

Using the calculation operators, mathematical expressions can be evaluated directly in an input field.

Any number of bracket levels can be used in the expressions.

Press "Enter" or leave the input field to calculate the expressions.

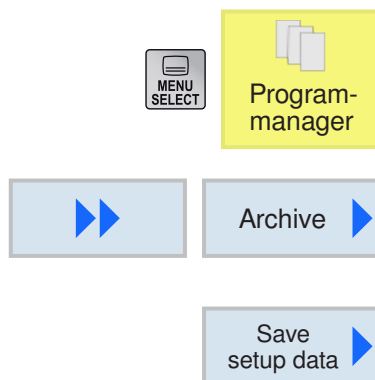
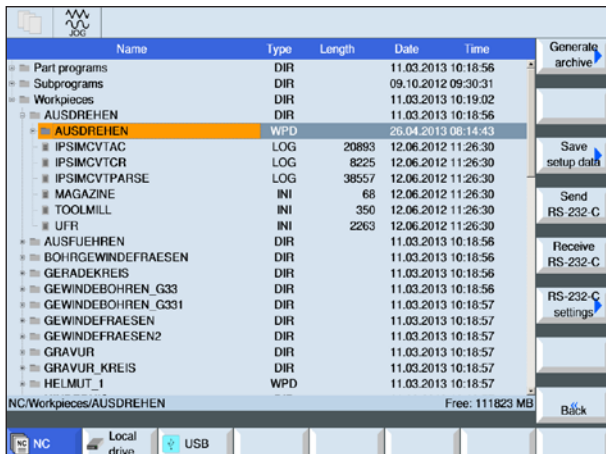
If errors occur when the formula is being evaluated, the last expression entered will be shown and the control system displays an error message.

COMMAND	MEANING
+, -, *, /, %, ^	Calculation functions
SIN()	Sine function
COS()	Cosine function
TAN()	Tangent function
ASIN()	Arc sine function
ACOS()	Arc cosine function
ATAN()	Arc tangent function (value)
ATAN2(,)	Inverse tangent function (X-section, Y-section)
SQRT()	Square root function
POT()	Power function
SQR()	2 power function
EXP()	Exponential function (base e)
LOG()	Logarithm function (base e)
LN()	Natural logarithmic function
PI	Circle division number (3.141592...)
TRUE	logically true (1)
FALSE	logically false (0)
ABS()	Absolute function
TRUNC()	Integer part function
ROUND()	Rounding function
MOD()	Modulo function

## Backup fitting data

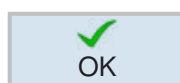
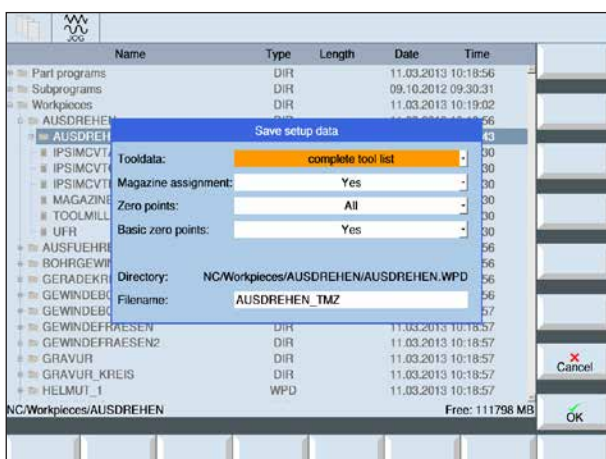
Tool data and zero point settings can be stored, as well as programs.

This option is useful for saving the required tools and zero point data for a particular work step program. If this program is processed again at a later date, then these settings can be retrieved quickly. Also, tool data that was computed using an external tool default setting device can be recorded in the tool management with ease.



### Backup fitting data

- 1 Select "Workpiece overview" in Program Manager
- 2 Position cursor on the workpiece for machining.
- 3 Press the Continue and Archive softkey.
- 4 Press Save fitting data softkey to open the Save fitting data window.



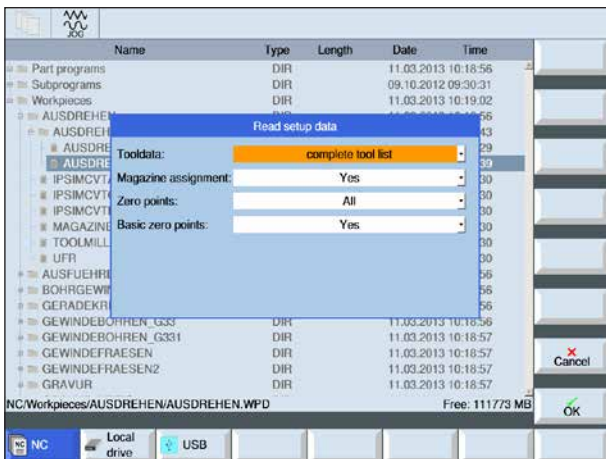
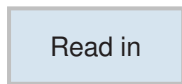
- 5 Confirm entry of the fitting data for saving with OK

Anzeige	Einstellungsmöglichkeiten
Tool data	<ul style="list-style-type: none"> <li>• complete tool list</li> <li>• no</li> </ul>
Magazine assignment	<ul style="list-style-type: none"> <li>• yes</li> <li>• no</li> </ul>
Zero points	<ul style="list-style-type: none"> <li>• all</li> <li>• no</li> </ul>
Basic zero points	<ul style="list-style-type: none"> <li>• yes</li> <li>• no</li> </ul>
Directory	The directory in which the selected program is located is shown.
File name	You can change the proposed filenames.

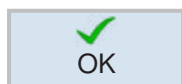


**Read in fitting data**

- 1 Select "Workpiece overview" in Program Manager
- 2 Position cursor on the .ini file for opening.
- 3 Press Read softkey.



**Note:**  
Depending on the choice of tool data and zero points when saving, this selected data is available again when reading in the fitting data.



- 4 Confirm the fitting data that should be read in with OK

**Instructions for the system of measurement:**  
When read in the backup fitting data please note that the control must be set to the system of measurement that was used when the data was saved. eg: the backup fitting data will only be read in and displayed in metric units when the controller was set to metric when saving.

## Graphical simulation

Using the graphical simulation the current program is fully calculated and the result graphically displayed. This monitors the result of the programming without moving the machine axes. Wrongly programmed processing steps are recognized in a timely fashion, preventing the workpiece being mis-processed.

### Raw part definition

The raw part dimensions enter in the program editor are used for the workpiece.

The raw part will be clamped relative to the coordinate system valid at the time of the raw part definition. Prior to the raw part definition in the G-code program the desired start conditions must be established, e.g. by selecting a suitable zero point offset.

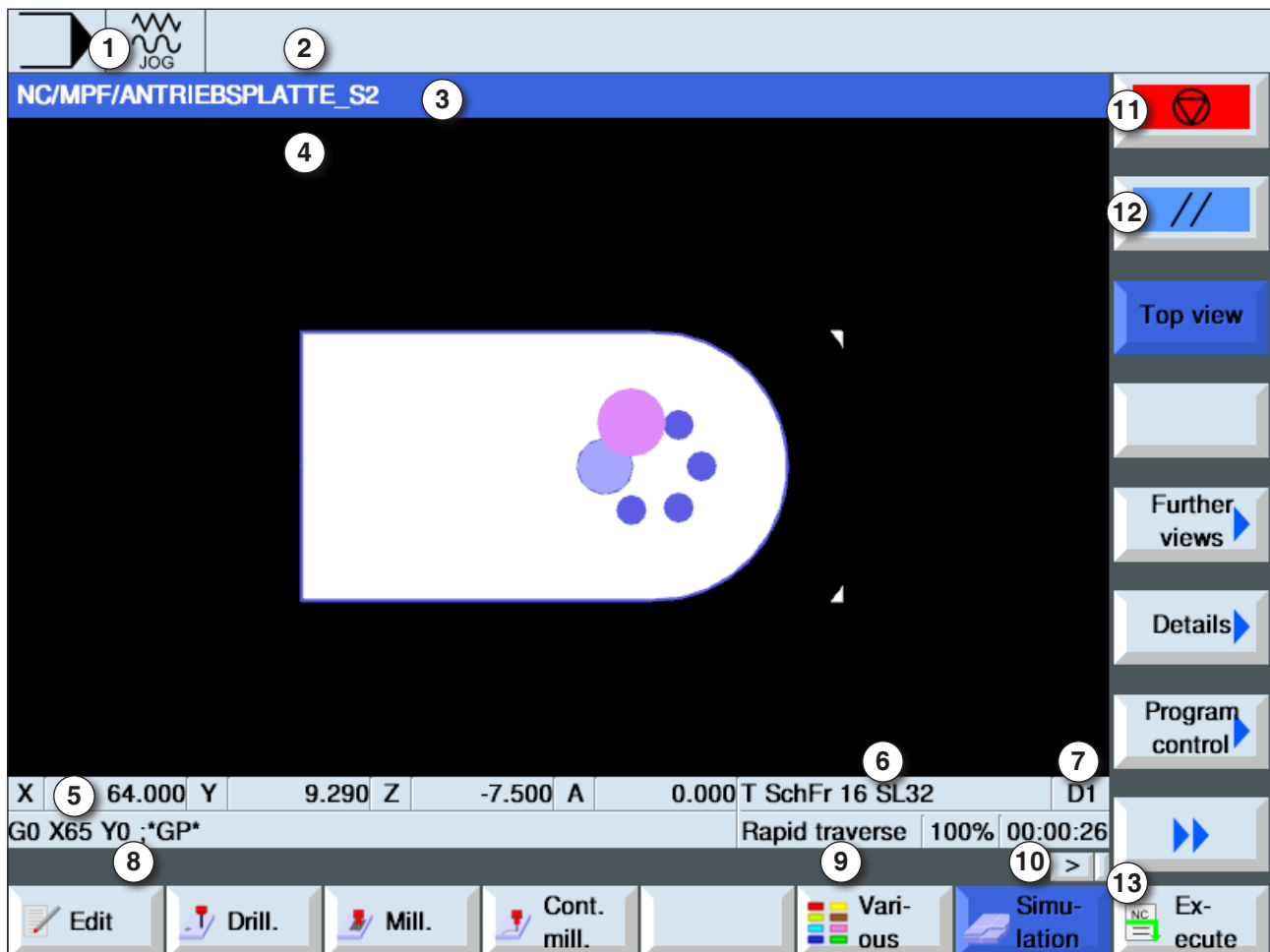
### Processing time

The The processing time is the approximate time the control system calculates for the duration of the tool movements executed with feed.

The processing time will be shown in the form (hh:mm:ss).

The time calculated by the control system lends itself only to a limited extent to the calculation of the production time, as the control system does not take account of machine-dependent times (e.g. for tool change).

## Screen layout graphical simulation



- |   |   |
|---|---|
| 1 Active operating area and operating mode    | 8 Current NC program block                                    |
| 2 Control system alarm and notification lines | 9 Display for rapid traverse or feed                          |
| 3 Program name                                | 10 Processing time  |
| 4 Simulation alarm and notification lines     | 11 softkey "Start" to start or "Stop" to stop the simulation. |
| 5 Position display of the axes                | 12 softkey "Reset" to reset the simulation.                   |
| 6 Tool name                                   | 13 Horizontal and vertical softkey bars                       |
| 7 Blade number                                |   |

## softkey functions



### Start simulation

This softkey starts the simulation. For the simulation to be started, an NC program must be selected. The program name of the currently selected NC program will be shown in the top left in the simulation window.



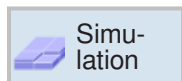
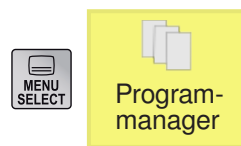
### Stop simulation

This softkey stops the simulation and the NC program. The simulation can be continued with "Start".



### Cancel simulation

This softkey cancels the simulation and the NC program. The simulation can be started again with "Start".



## Simulating workpiece processing

1 Position cursor on directory in which the program should be selected.

2 Press button.

3 Press softkey to simulate.

4 Press softkey to start simulation. The program processing will be shown graphically on the screen. In the process, the machine axes do not move.

5a Press softkey to stop simulation.

OR

5a Press softkey to cancel simulation.

6 Press softkey to continue simulation or to start again after cancelling.

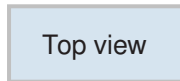
## Select workpiece views

The following views are available:

- Top view
- Side views

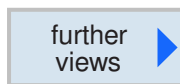
### Top view

1 Press softkey to show the workpiece from above in the top view.



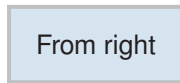
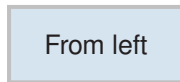
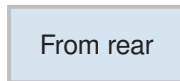
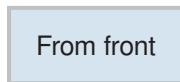
### Side views

1 Press softkey to open the selection for side views.



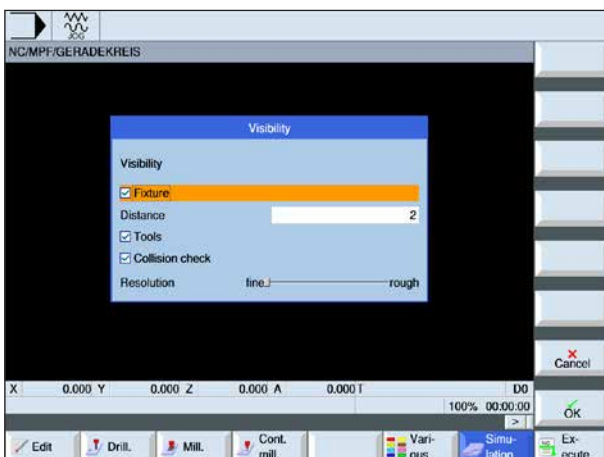
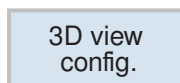
The following additional views are available for selection:

- View workpiece from front
- View workpiece from behind
- View workpiece from left
- View workpiece from right



## 3D view configuration


Press softkeys to start 3D view configuration



**Note:**

The choice of setting options available depends on whether a 3D view license is present or not.



Details 

## Zoom graphics

The zoom commands enable the simulation image to be made larger or smaller. It can be moved with the cursor keys.

Zoom +

### Larger

After pressing the softkey the view will be increased by one level in size.

Zoom -

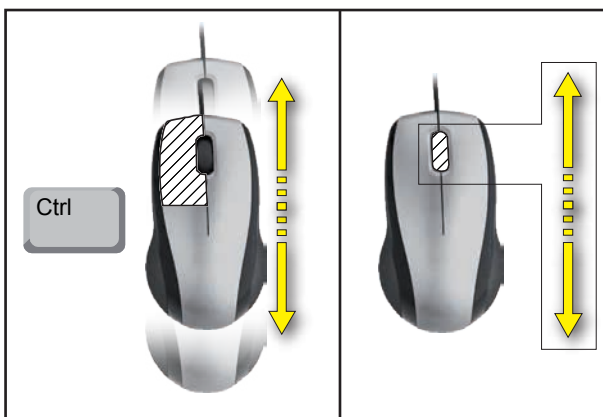
### Smaller

After pressing the softkey the view will be reduced by one level in size.

Autozoom

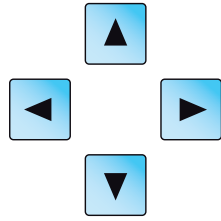
### Automatic

Increases or reduces the display area to the window size.



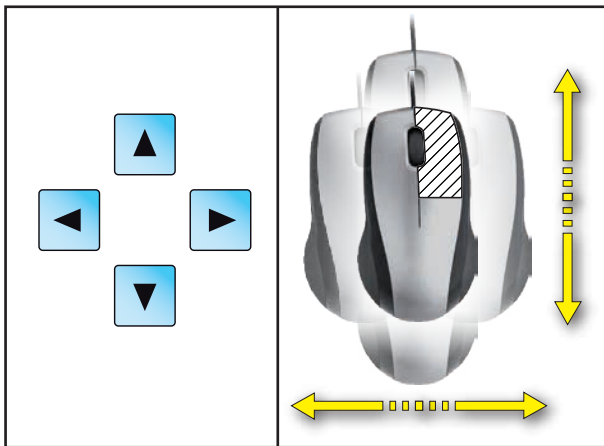
### Zoom with the mouse





## Shift graphics

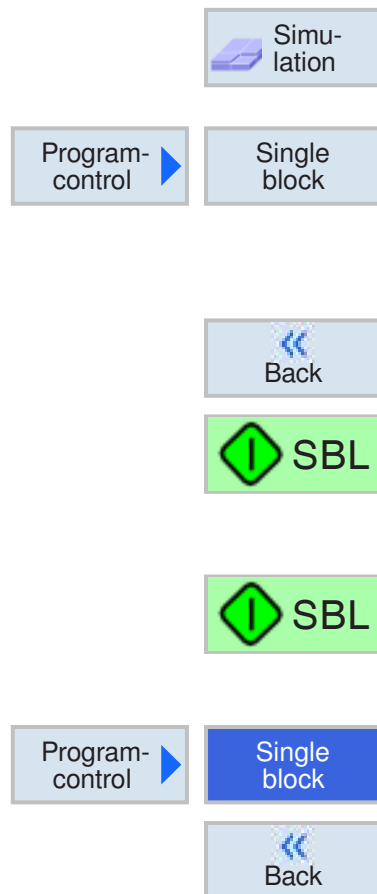
Press cursor button to shift the graphics.



Shift



With the graphics the representation area can be adapted quickly again to the window size.



## Block-by-block simulation

Analogously to the program execution in single block mode (SBL) the simulation can also be simulated block for block.

1 The NC program is selected in simulation mode.

### Activate block-by-block simulation

2 Press softkey to start simulation. The program processing will be shown graphically on the screen. In the process, the machine axes do not move.

3 Press softkey.

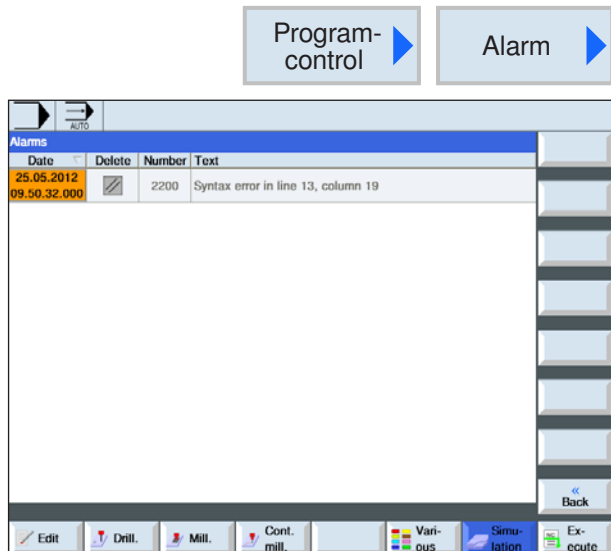
4 Press softkey to start simulation in single block mode (SBL). The next program block will be simulated. Afterwards the simulation will stop.

5 Press softkey again to simulate the next program block.

### Deactivate block-by-block simulation

6 Press softkey to deactivate single block mode.

7 Press softkey.



## Simulation alarm

If alarms or messages occur during the simulation, they will be shown in the alarm and message lines in the simulation window.

- 1 Press softkey to open alarm overview.  
The alarm overview contains the following information:
  - Date and time
  - Deletion criteria indicate the softkey the alarm can be acknowledged with
  - Alarm number
  - Alarm text

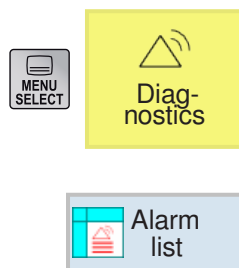
## Quit graphical simulation

- 1 Press softkey. The control system switches to the program view of the NC program previously selected for the simulation.



- 2 Press button to go to program management.





## Diagnosics operating area






In the diagnostics operating area alarms, messages and version data can be shown.

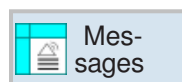
### Show alarm list

This softkey shows the alarm list.

All pending alarms can be shown and acknowledged. The alarm overview contains the following information:

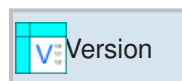
- Date and time
- Deletion criteria indicate the button or softkey the alarm can be acknowledged with
- Alarm number
- Alarm text

Symbol	Meaning
	Switch machine off at the main switch and then on again.
	Press reset button. 
	Press the button to acknowledge alarms. 
PLC	Press reset button and, if applicable, also remove the machine's error condition.



### Show messages

This softkey shows the messages. Messages do not interrupt the processing. Messages give information about the specific behaviour of the cycles and on the processing progress.



### Version data

This softkey shows the version numbers of the installed software products.



## Commissioning operating area

In the commissioning operating area the licence data for EMCO software products can be shown.



## Close Sinumerik Operate

1 Switch off auxiliary drives with AUX OFF.

2 By simultaneously pressing these buttons WinNC for Sinumerik Operate will be deliberately closed.

This corresponds to Alt+F4 on the PC keyboard.



## Restart Sinumerik Operate

This softkey deliberately restarts WinNC for Sinumerik Operate.



# D: ShopMill Programming

**Instructions:**

This programming manual describes all functions that can be executed with WinNC. Depending on the machine you are operating with WinNC, not all functions may be available.

**Example:**

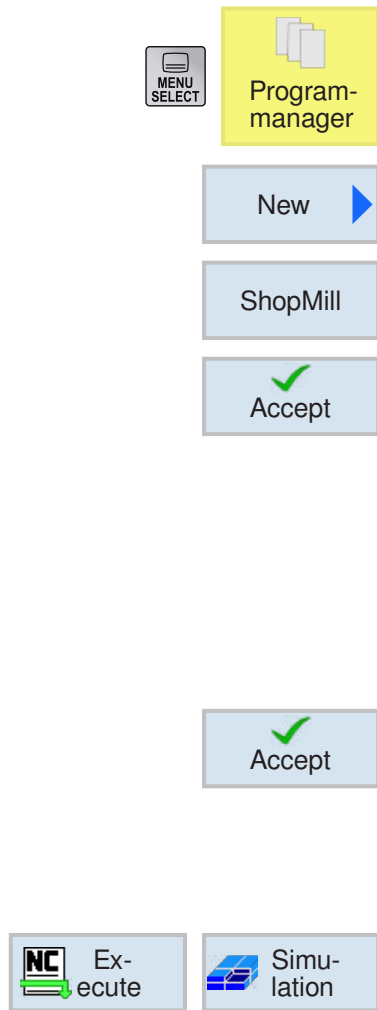
The Concept MILL 55 milling machine has no position-controlled main spindle. Therefore no spindle positions can be programmed for it either.



## Overviews

### M-Commands

M 00	Programmed stop
M 01	Optional stop
M 02	Program end
M 03	Milling cutter on in clockwise direction
M 04	Milling cutter on in counter-clockwise direction
M 05	Milling cutter stop
M 06	Perform tool change
M 07	Minimal lubrication on
M 08	Coolant on
M 09	Coolant off / Minimal lubricant off
M 10	Dividing attachment clamp on
M 11	Dividing attachment clamp loose
M 17	End sub-program
M 25	Open clamping device
M 26	Close clamping device
M 27	Swivel dividing attachment
M30	Main program end
M71	Fan on
M72	Fan off

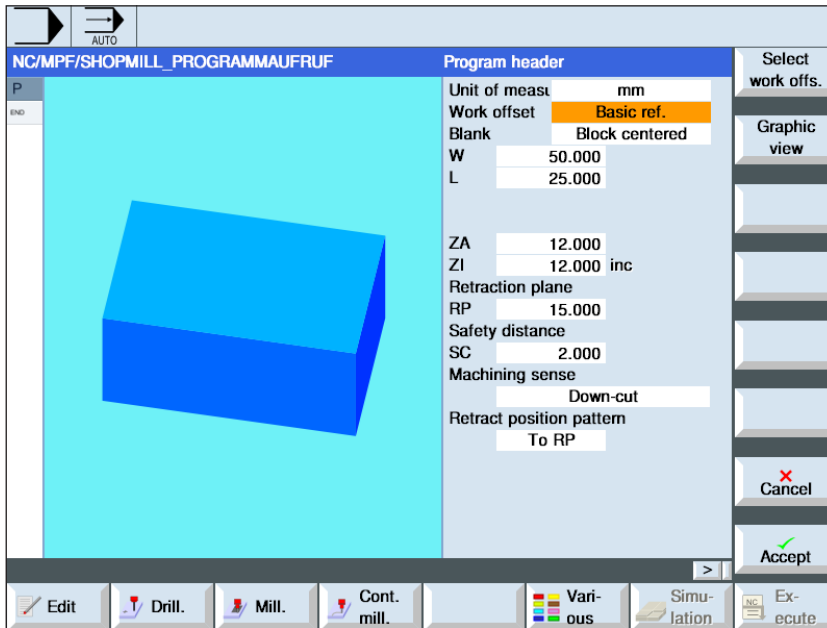


## Create ShopMill program

- 1 Select "Program manager".
- 2 Press softkey.
- 3 Option to create a ShopMill program.
- 4 Enter program name and confirm with softkey. If the program name already exists the softkey remains deactivated.
- 5 Then fill out program header. Select zero point offsets, enter raw part measurements and parameters. These inputs (e.g.: measurement unit mm or inch, retraction plane, safety distance and processing direction of rotation) apply across the entire program.
- 6 Press softkey to apply the program header in the workpiece program. Program header and program end will be created in the block list. The program end is defined automatically.
- 7 Enter additional cycles.
- 8 Select or simulate cycles via softkeys.
- 9 Finally define the program end. The program end signals to the machine that the processing of the workpiece is finished.



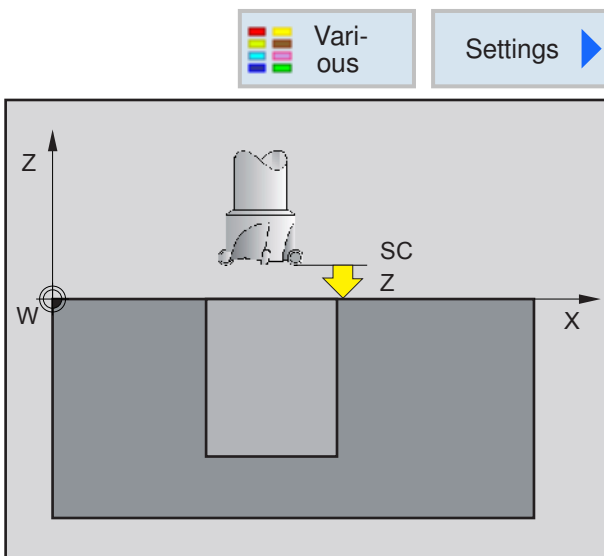
## Program header



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Measurement unit	Setting the measurement unit (mm or inch) in the program header relates only to the position details in the current program.	mm inch
Zero point shift	Zero point offset in which the zero point of the workpiece is saved.	
Raw part	<ul style="list-style-type: none"> <li>• Cuboid center</li> <li>• Cuboid</li> <li>• Tube</li> <li>• Cylinder</li> <li>• Polygon</li> </ul>	
X0 Y0	1. Corner point in X, Y	mm
X1 Y1	2. Corner point in X,Y (absolute), or relative to X0, Y0 (incremental)	mm
ZA	Start measurement	mm
ZI	End measurement	mm
XA	External diameter (only for tube or cylinder)	
XI	Internal diameter (only for tube or cylinder)	
N	Number of edges (only with polygon)	
L	Edge length (only with polygon)	
W	Width of the raw part (only with cuboid center)	
L	Length of the raw part (only with cuboid center)	

Parameters	Description	Unit
Retraction plane RP Safety distance SC	Planes over the workpiece. During processing the tool moves in rapid traverse from the tool change point to the retraction plane (RP) and then to the safety distance (SC). There will be a switch to the processing feed at this height. Once the processing is finished, the tool moves in the processing feed out of the workpiece to the safety distance height. The movement from the safety distance to the retraction plane and then to the tool change point will be in rapid traverse. The retraction plane will be indicated absolutely. The safety distance will be indicated incrementally (without sign).	
Processing direction of rotation	<ul style="list-style-type: none"> <li>• Down-cut milling</li> <li>• Up-cut</li> </ul> When processing a pocket, a longitudinal slot or a spigot, the processing direction of rotation (down-cut milling or up-cut milling) and the spindle's direction of rotation in the tool list will be heeded. The pocket will then be processed in the clockwise direction or in the counter-clockwise direction.  During path milling the programmed direction of the contour defines the processing direction.	
Retraction position template	<ul style="list-style-type: none"> <li>• optimized</li> </ul> During processing with optimized retraction the tool moves in a contour-dependent way with processing feed in the safety distance (SC) via the workpiece.  <ul style="list-style-type: none"> <li>• on RP</li> </ul> In retraction to RP after processing the tool moves back to the retraction plane and feeds in to the new position. This prevents a collision with workpiece obstacles when pulling out and in-feeding of the tool, e.g. when completing drill holes in pockets or slots on different planes and at different positions.	

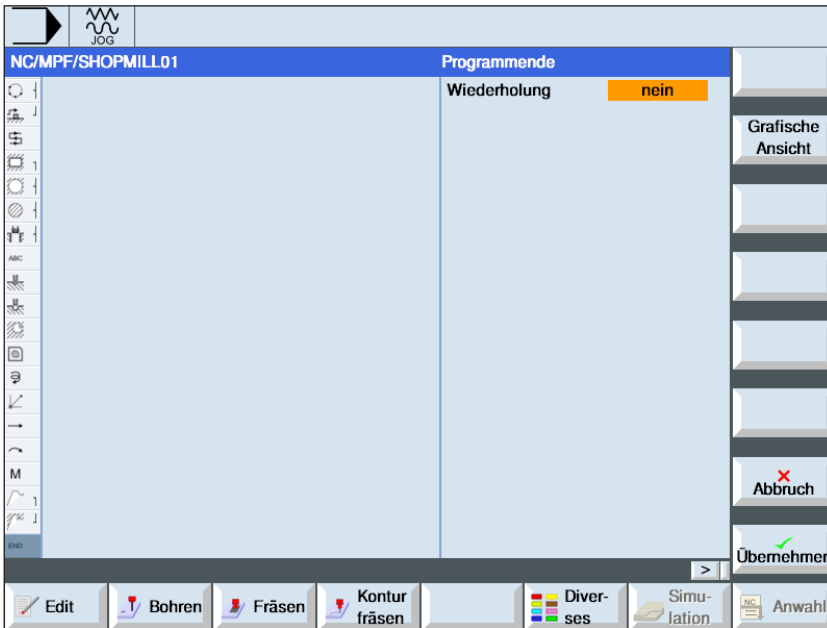


**Safety distance**

To avoid collisions with the workpiece, an approach height ("Safety distance SC") can be defined that is approached prior to the cycle start point.

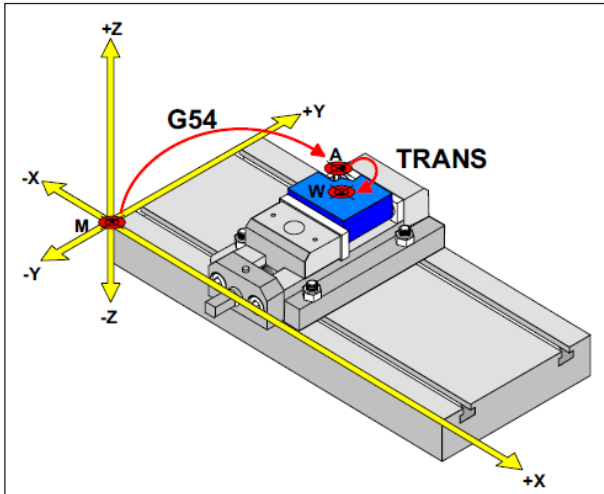
The safety plane SC is entered incrementally. The measurement details are relative to the current cycle reference plane. (see cycle "settings").

## End of program



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Repetition	<ul style="list-style-type: none"> <li>• yes The program execution will be repeated.</li> <li>• no The program execution will not be repeated.</li> </ul>	



In the following situation the raw part must be described from the stop point A

## Raw part definition

When a program with a stop point (e.g. G54) and a transformation (TRANS / ATRANS ) is used to machine to the actual workpiece zero point, the raw part definition must be described from the stop point.

M= Machine zero point

A= Stop point

W= Workpiece zero point

## Cycle overview

The cycle groups with the Sinumerik Operate cycles defined within them are listed here.



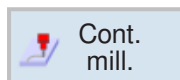
### Drilling

- Centering
- Drilling
- Reaming
- Long-hole drilling
- Boring
- Thread
- Positions



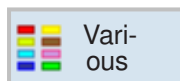
### Milling

- Face milling
- Pocket
- Spigot
- Slot
- Thread milling
- Engraving



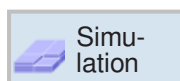
### Contour milling

- New contour
- Path milling
- Pre-drilling
- Pocket
- Spigot



### Various

- Settings
- Transformations
- Sub-routine
- Repeat program



### Simulation



### Straight line or circular processing

- Tool
- Straight line
- Circle center point
- Circle radius
- Helix
- Polar
- Machine functions

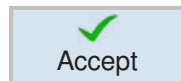
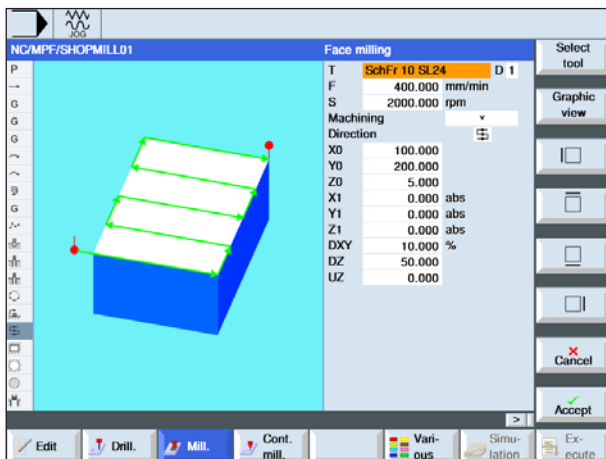
## Working with cycles

Processes that repeat often, and which include several processing steps, are saved in the control system as cycles. Some special functions are also available as cycles.

### Define cycle

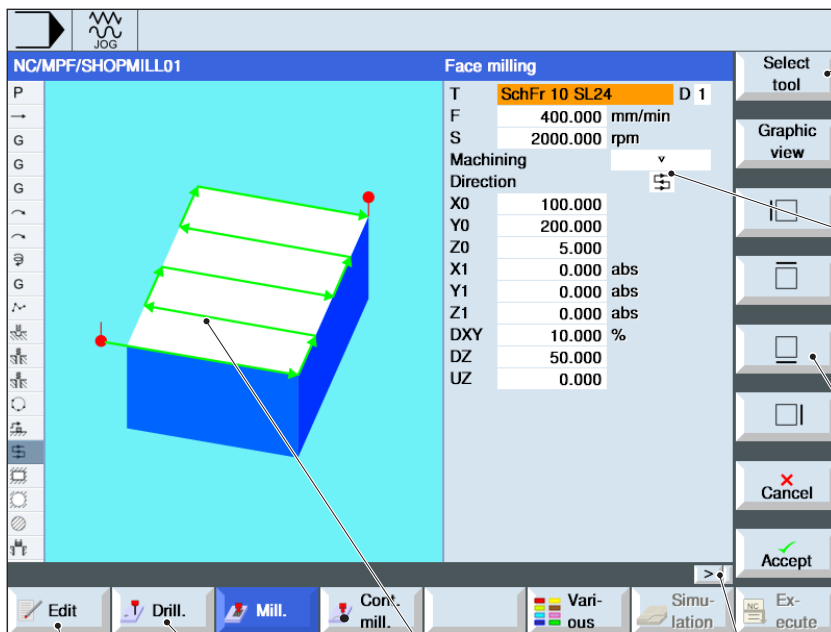
The softkey bar shows the different cycle groups.

- Select cycle group
- Select cycle
- Enter all required parameters



- Terminate input with this softkey.

### Geometry and technology data input



softkey for tool programming

Selection fields: Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

softkeys for additional functions



The horizontal softkey bar is extended with this button.

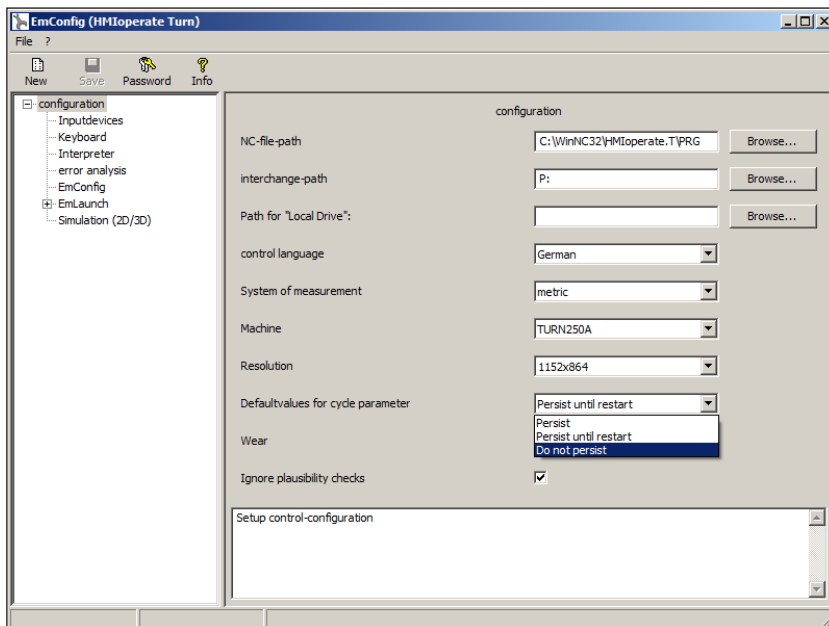
Coloured positioning movements:

- Red positioning movement = tool moves in rapid traverse.
- Green positioning movement = tool moves in processing infeed.

This softkey is used, for example to "Copy", "Paste" and "Delete" cycles.

These softkeys show the cycle groups that are additionally available.

## Default values for cycle parameters



EMConfig is an auxiliary software to WinNC. WinNC settings can be changed with EMConfig.

Open EMConfig and select the configuration point:

*Default values for cycle parameters*

### Instructions:

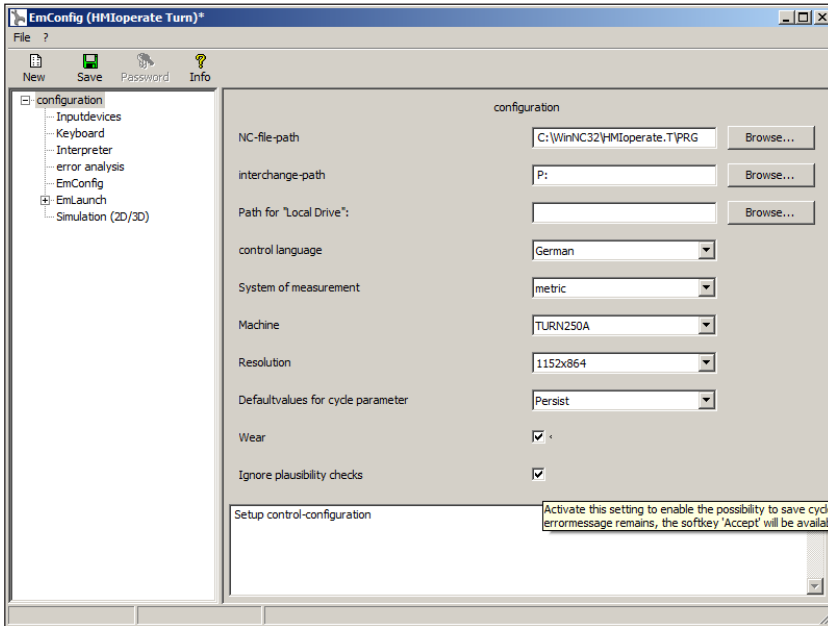
If cycles have already been programmed once, then these input values are saved and next time are proposed as default values. This can be unfavourable in training and can therefore be configured via EMConfig.

The following settings can be reached under the default values heading:

- **always maintained**  
last entered cycle data remains even after receiving a control system restart
- **replace for restart**  
last entered cycle data remains received while the control system is still running
- **never maintained**  
Cycle data is reset to the default values immediately after quitting the cycle



## Ignore plausibility check for saving

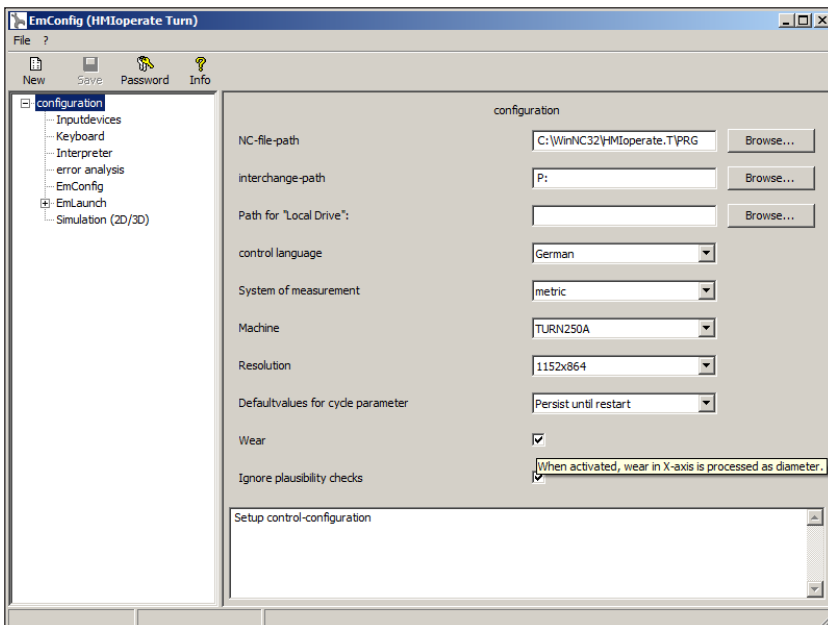


Use this checkbox to activate or deactivate the plausibility check for saving.

Activate this setting to be able to save cycles, despite an error message being present. The corresponding error messages certainly remain in existence, but the "Accept" softkey is available.

Set plausibility check for saving

## Set length tool wear



Use this checkbox to state tool wear length for rotating tools as diameter or as length.

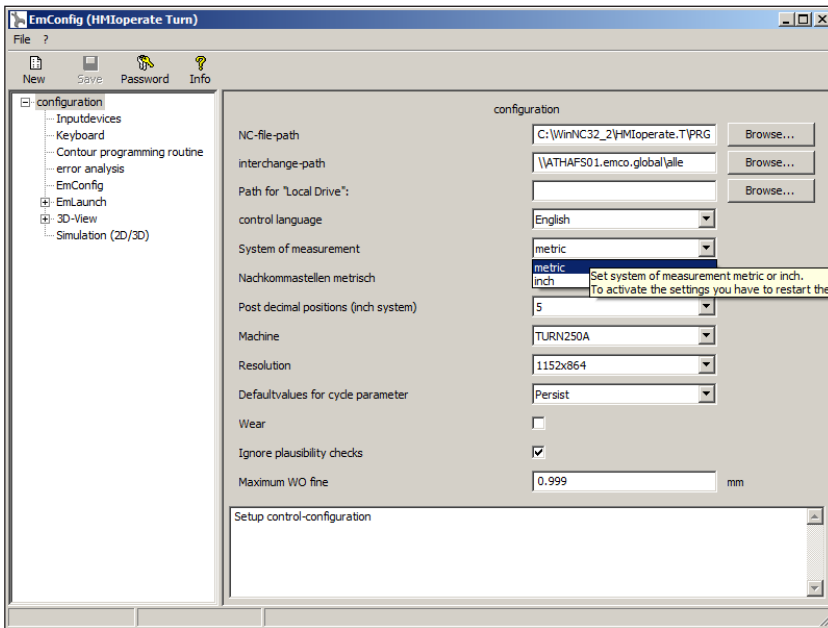
Set wear as diameter or length

**Instructions:**

This setting is only valid for turning tools.



## Set system of measurement



With this checkbox the system of measurement for the control software can be set to metric or inch.

Set the system of measurement to metric or inch

**Note:**

Inch programs can not be used with metric control (and vice versa).

### Table of units

inch			
feet <sup>*)</sup>	inch	mm	m
1	12	304,5	0,304
inch <sup>°)</sup>	feet	mm	m
1	0,83	25,4	0,0254

metric			
m	mm	inch	feet
1	1000	39,37008	3,28084
mm	m	inch	feet
1	0,001	0,0393701	0,0032808

\*) **feet:** only for constant cutting speed

°) **inch:** standard input

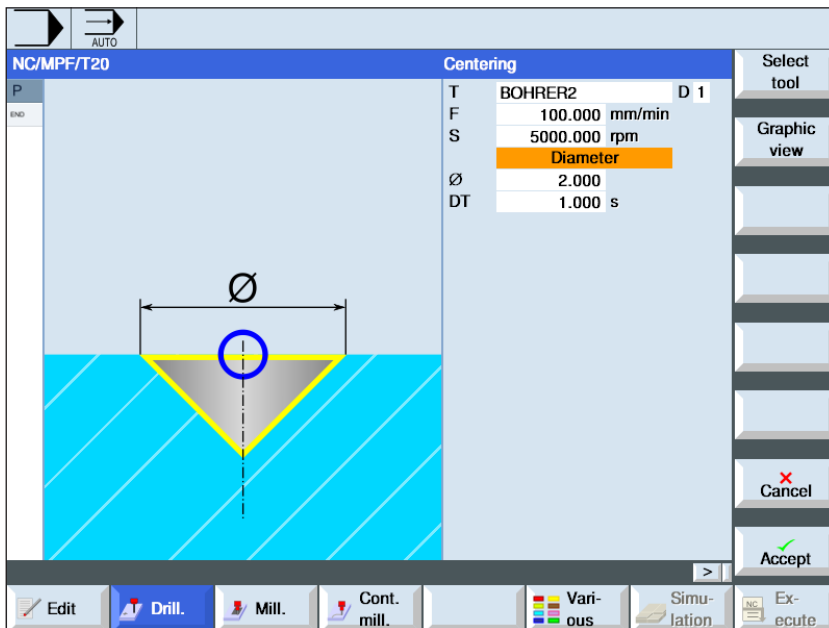


## Drilling

- Centering
- Drilling
- Reaming
- Deep hole drilling
- Boring
- Thread
- Positions



## Centering

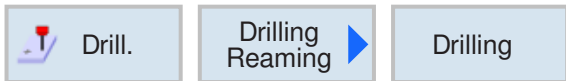


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

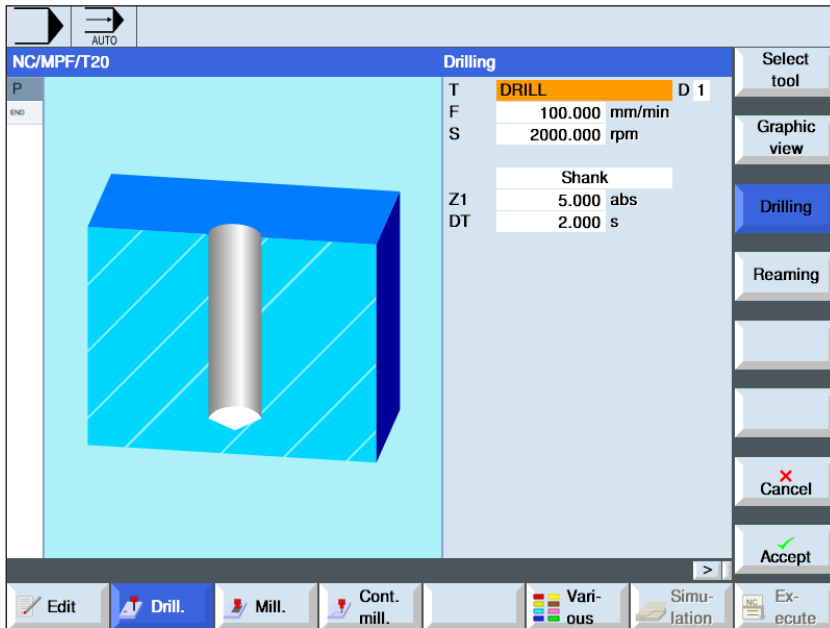
Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/rev
S / V	Spindle speed or constant cutting speed	R/min m/min
Centering	<ul style="list-style-type: none"> <li>Diameter (centering relative to the diameter). The center drill angle indicated in the tool list will be taken into account.</li> <li>Tips (centering relative to the depth) The tool plunges to the programmed plunge depth.</li> </ul>	
Ø	The tool plunges until the diameter is reached.	mm
Z1	Drill depth (absolute) or depth related to Z0 (incremental). The tool plunges until Z1 is reached.	mm
DT	<ul style="list-style-type: none"> <li>Dwell time on the ground in seconds</li> <li>Dwell time on the ground in revolutions</li> </ul>	s R

### **Cycle Description**

- 1** The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2** The tool centers with the programmed feed (F) till the depth (Z1) or the centering diameter ( $\emptyset$ ) is reached and lingers there (DT) - if indicated.
- 3** From the centering bottom the tool moves back to the retraction plane in rapid traverse after expiry of the dwell time (DT).



## Drilling



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

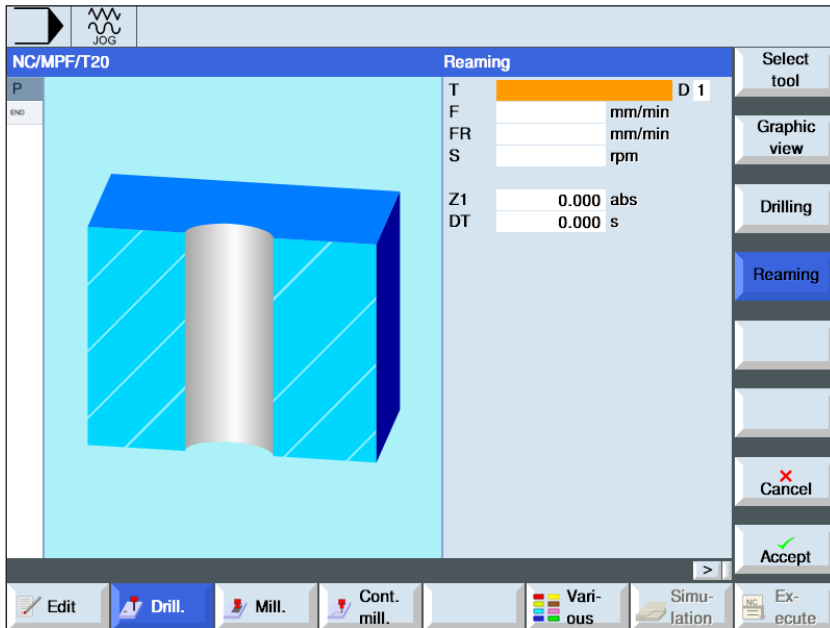
Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/rev
S / V	Spindle speed or constant cutting speed	R/min m/min
Drill depth	<ul style="list-style-type: none"> <li>• Shaft (drill depth relative to the shaft). The drill plunges until the drill shaft reaches the programmed value Z1.</li> <li>• Tip (drill depth relative to the tip) The drill plunges until the drill tip reaches the programmed value Z1.</li> </ul>	mm
Z1	Drill depth (absolute) or depth related to Z0 (incremental). The tool plunges until Z1 is reached.	mm
DT	<ul style="list-style-type: none"> <li>• Dwell time on the ground in seconds</li> <li>• Dwell time on the ground in revolutions</li> </ul>	s R

**Cycle Description**

- 1** The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2** The tool centers with the programmed feed (F) till the depth (Z1) is reached and dwells there (DT) - if indicated.
- 3** From the drill bottom the tool moves back to the retraction plane in rapid traverse after expiry of the dwell time (DT).



## Reaming



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/rev
FR	Feed during retraction	mm/min mm/rev
S / V	Spindle speed or constant cutting speed	R/min m/min
Z1	Drill depth (absolute) or depth relative to Z0 (incremental). The tool plunges until Z1 is reached.	mm
DT	<ul style="list-style-type: none"> <li>Dwell time on the ground in seconds</li> <li>Dwell time on the ground in revolutions</li> </ul>	s R

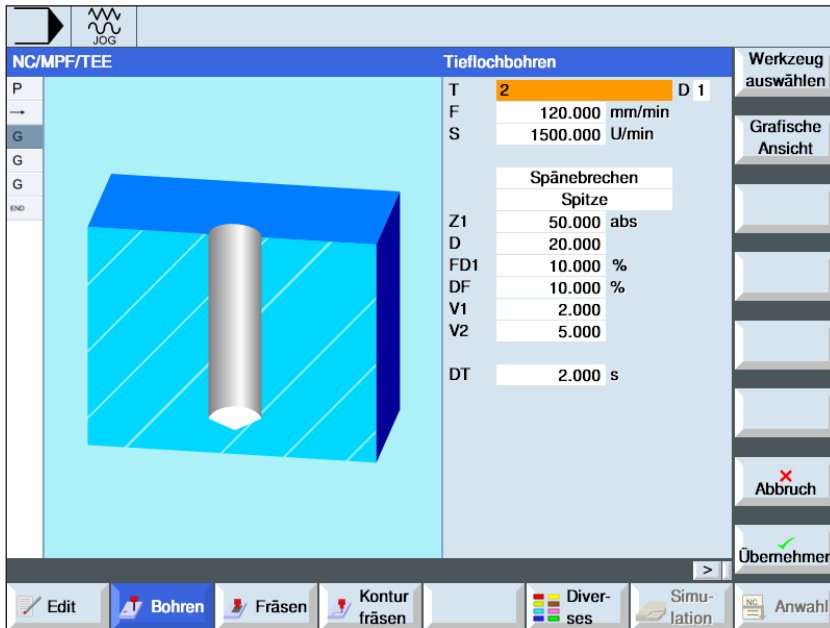


**Cycle Description**

- 1** The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2** The tool reams with the programmed feed (F) till the depth (Z1) is reached and dwells there (DT) - if indicated.
- 3** From the drill bottom the tool moves back to the retraction plane with retraction feed after expiry of the dwell time (DT).



## Deep hole drilling



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/rev
S / V	Spindle speed or constant cutting speed	R/min m/min
Processing	<ul style="list-style-type: none"> <li>Chip clearing The drill moves completely out of the workpiece for chip clearing.</li> <li>Chip crushing The drill plunges until the drill tip reaches the programmed value Z1.</li> </ul>	mm
Z1	Drill depth (absolute) or drill depth (incremental) relative to Z0. The tool plunges until Z1 is reached.	mm
D	maximum depth infeed	mm
FD1	Percentage rate for the feed during the first infeed	%
DF	Percentage rate for each additional infeed	mm %
V1	minimum depth infeed (only when DF indicated in %)	mm
V2	Retract amount after each processing (only when chip crushing selected)	mm
V3	Advanced stop distance (only when chip clearing and advanced stop distance manually selected)	mm
DT	<ul style="list-style-type: none"> <li>Dwell time on the ground in seconds</li> <li>Dwell time on the ground in revolutions</li> </ul>	s R

### **Cycle Description**

#### **Chip crushing**

- 1** The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2** The tool drills with the programmed spindle speed and the feed speed  $F = F * FD1[\%]$  up to 1. Infeed depth.
- 3** The tool moves back by the retraction amount (V2) for chip crushing. Then the tool drills with the programmed feed (F) to the next infeed depth. This will be repeated until the end drilling depth (Z1) is reached.
- 4** From the drill bottom the tool moves back to the retraction plane in rapid traverse (G0) after expiry of the dwell time (DT).

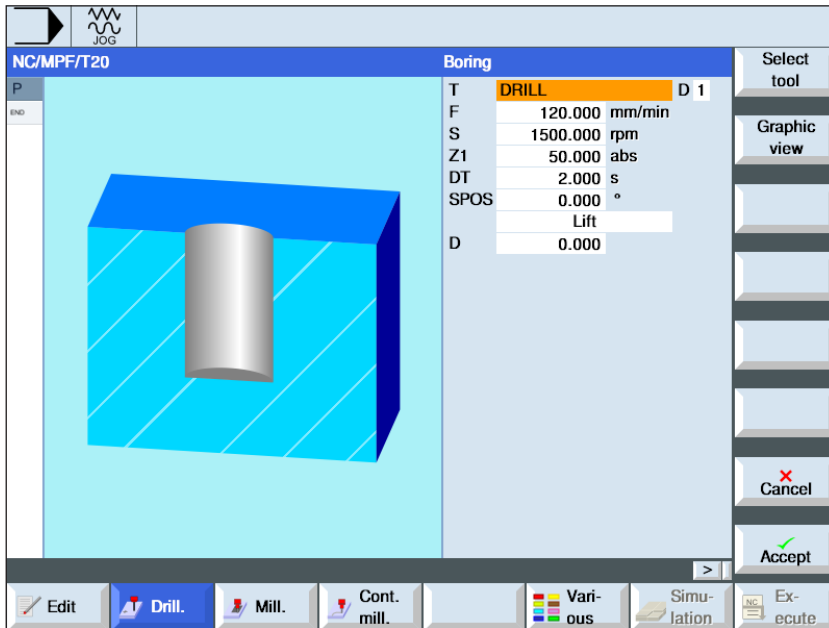
### **Cycle Description**

#### **Chip clearing**

- 1** The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2** The tool drills with the programmed spindle speed and the feed speed  $F = F * FD1[\%]$  up to 1. Infeed depth.
- 3** The tool moves out of the workpiece to the safety distance in rapid traverse for chip clearing.
- 4** The tool moves in rapid traverse (G0) to the last drilling depth, reduced by the advanced stop distance (V3).
- 5** Then there will be drilling to the next infeed depth.
- 6** Steps 3 to 5 will be repeated until the programmed end drilling depth (Z1) is reached.
- 4** From the drill bottom the tool moves back to the retraction plane in rapid traverse (G0) after expiry of the dwell time (DT).



## Boring



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/rev
S / V	Spindle speed or constant cutting speed	R/min m/min
Z1	Drill depth (absolute) or depth related to Z0 (incremental). The tool plunges until Z1 is reached.	mm
DT	<ul style="list-style-type: none"> <li>Dwell time on the ground in seconds</li> <li>Dwell time on the ground in revolutions</li> </ul>	s R
SPOS	Measure spindle stop position manually in degrees and enter.	Degrees
Lift mode	<ul style="list-style-type: none"> <li>lift (only for machine with C-axis) The blade moves clear of the drill hole edge and then pulls back to the safety distance from the reference point and then positions on the retraction plane and drill hole center point.</li> <li>do not lift The blade does not move clear, but moves back to the retraction plane in rapid traverse.</li> </ul>	
D	Lift amount (incremental, only with lift mode "lift")	mm

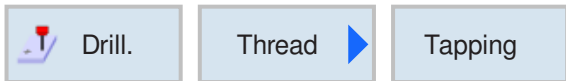
**Instructions:**

Clamp the tool in such a way that at the indicated angle SPOS the tool blade is clamped in the +X direction.

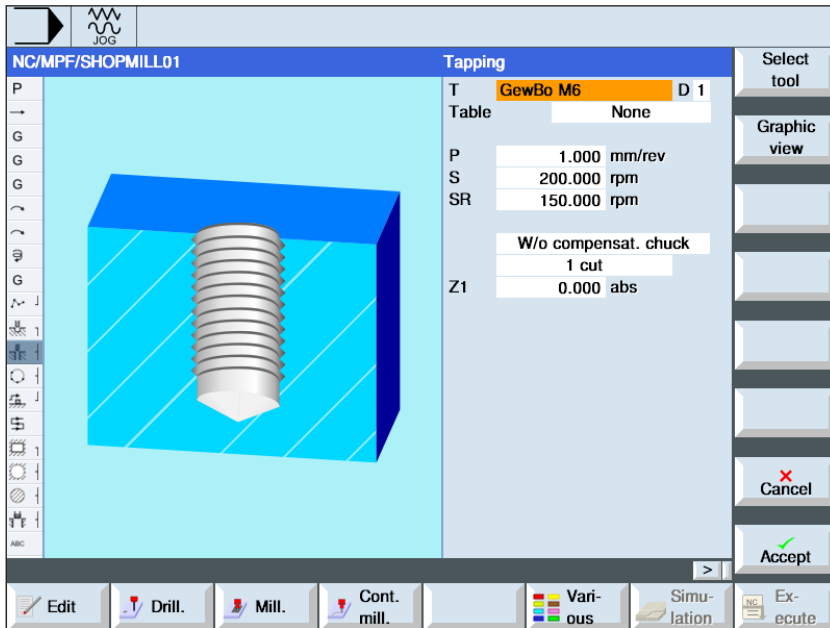


**Cycle Description**

- 1 The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2 The tool moves with the programmed feed (F) to the drill depth (Z1).
- 3 The tool dwells there (DT) - if indicated.
- 4 Oriented spindle stop at the spindle position programmed under SPOS. To program SPOS the spindle position must be measured manually.
- 5 In lift mode "lift" the tool moves clear of the edge of the drill hole by the lift amount (D) in direction -X/ +Z.
- 6 The tool moves back to the safety distance in rapid traverse (G0).
- 7 The tool moves back in rapid traverse (G0) on the coordinates of the drill hole center point on the retract level.



## Tapping



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
Table	Thread selection table: <ul style="list-style-type: none"> <li>• None</li> <li>• ISO metric</li> <li>• Whitworth BSW</li> <li>• Whitworth BSP</li> <li>• UNC</li> </ul>	
Selection	Selection of the table value e.g.: <ul style="list-style-type: none"> <li>• M1; M5; etc. (ISO metric)</li> <li>• W1/8"; etc. (Whitworth BSW)</li> <li>• G 1 3/4"; etc. (Whitworth BSP)</li> <li>• N8 - 32 UNC; etc. (UNC)</li> </ul> (also see thread table with the respective pitches)	
P	Display of the thread pitch (only with table selection "none") <ul style="list-style-type: none"> <li>• in MODULE: <math>MODULE = pitch/\pi</math></li> <li>• in threads per inch: typical for tube threads.</li> </ul> With the per inch input, in the first parameter field the whole number before the decimal point is entered and in the second and third field the number after the decimal point is entered as a fraction. <ul style="list-style-type: none"> <li>• in mm/rev</li> <li>• in inch/rev</li> </ul> The thread pitch is dependent on the tool used.	MODULE Threads/" mm/rev inch/rev
S / V	Spindle speed or constant cutting speed	Rev/min m/min
SR	Spindle speed for retraction	R/min
VR	constant cutting speed for retraction	m/min

Parameters	Description	Unit
Compensating chuck mode	<ul style="list-style-type: none"> <li>• without compensating chuck</li> <li>• with compensating chuck:</li> </ul>	
Processing (without compensating chuck)	<ul style="list-style-type: none"> <li>• 1 cut The thread will be drilled in one cut, without interruption.</li> <li>• Chip crushing The drill pulls back by the retract amount (V2) for chip crushing.</li> <li>• Chip clearing The drill moves completely out of the workpiece.</li> </ul>	
Z1	Thread length (incremental) or end point of the thread (absolute). The tool plunges until Z1 is reached.	mm
D	maximum depth infeed	mm
Retract	Retract amount (only when "without compensation chuck" and "chip crushing" selected) <ul style="list-style-type: none"> <li>• manual With retract amount (V2) after each processing.</li> <li>• automatic Without retract amount (V2) after each processing. The tool will be pulled back by one revolution after each processing.</li> </ul>	
V2	Retract amount after each processing Amount by which the tool will be pulled back during chip crushing	mm

## Thread table

ISO_METRIC		WHITWORTH_BSW		WHITWORTH_BSP		UNC	
M 1	0.250	W 1/16"	60.000	G 1/16"	28.000	N 1 - 64 UNC	64.000
M 1.2	0.250	W 3/32"	48.000	G 1/8"	28.000	N 2 - 56 UNC	56.000
M 1.6	0.350	W 1/8"	40.000	G 1/4"	19.000	N 3 - 48 UNC	48.000
M 2	0.400	W 5/32"	32.000	G 3/8"	19.000	N 4 - 40 UNC	40.000
M 2.5	0.450	W 3/16"	24.000	G 1/2"	14.000	N 5 - 40 UNC	40.000
M 3	0.500	W 7/32"	24.000	G 5/8"	14.000	N 6 - 32 UNC	32.000
M 3.5	0.600	W 1/4"	20.000	G 3/4"	14.000	N 8 - 32 UNC	32.000
M 4	0.700	W 5/16"	18.000	G 7/8"	14.000	N 10 - 24 UNC	24.000
M 4.5	0.750	W 3/8"	16.000	G 1"	11.000	N 12 - 24 UNC	24.000
M 5	0.800	W 7/16"	14.000	G 1 1/8"	11.000	1/4" - 20 UNC	20.000
M 6	1.000	W 1/2"	12.000	G 1 1/4"	11.000	5/16" - 18 UNC	18.000
M 8	1.250	W 9/16"	12.000	G 1 3/8"	11.000	3/8" - 16 UNC	16.000
M 10	1.500	W 5/8"	11.000	G 1 1/2"	11.000	7/16" - 14 UNC	14.000
M 12	1.750	W 3/4"	10.000	G 1 3/4"	11.000	1/2" - 13 UNC	13.000
M 14	2.000	W 7/8"	9.000	G 2"	11.000	9/16" - 12 UNC	12.000
M 16	2.000	W 1"	8.000	G 2 1/4"	11.000	5/8" - 11 UNC	11.000
M 18	2.500	W 1 1/8"	7.000	G 2 1/2"	11.000	3/4" - 10 UNC	10.000
M 20	2.500	W 1 1/4"	7.000	G 2 3/4"	11.000	7/8" - 9 UNC	9.000
M 22	2.500	W 1 3/8"	6.000	G 3"	11.000	1" - 8 UNC	8.000
M 24	3.000	W 1 1/2"	6.000	G 3 1/4"	11.000	1 1/8" - 7 UNC	7.000
M 27	3.000	W 1 5/8"	5.000	G 3 1/2"	11.000	1 1/4" - 7 UNC	7.000
M 30	3.500	W 1 3/4"	5.000	G 3 3/4"	11.000	1 3/8" - 6 UNC	6.000
M 33	3.500	W 1 7/8"	4.500	G 4"	11.000	1 1/2" - 6 UNC	6.000
M 36	4.000	W 2"	4.500	G 5"	11.000	1 3/4" - 5 UNC	5.000
M 39	4.000	W 2 1/4"	4.000	G 6"	11.000	2" - 4 1/2 UNC	4.500
M 42	4.500	W 2 1/2"	4.000			2 1/4" - 4 1/2 UNC	4.500
M 45	4.500	W 2 3/4"	3.500			2 1/2" - 4 UNC	4.000
M 48	5.000	W 3"	3.500			2 3/4" - 4 UNC	4.000
M 52	5.000	W 3 1/4"	3.250			3" - 4 UNC	4.000
M 56	5.500	W 3 1/2"	3.250			3 1/4" - 4 UNC	4.000
M 60	5.500	W 3 3/4"	3.000			3 1/2" - 4 UNC	4.000
M 64	6.000	W 4"	3.000			3 3/4" - 4 UNC	4.000
M 68	6.000					4" - 4 UNC	4.000

Thread table with pitches



**Cycle Description**

**Thread tapping with compensating chuck**

- 1 The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2 The tool moves with the programmed speed (S) to the thread depth (Z1). The feed will be calculated inside the cycle from speed (S) and thread pitch (P).
- 3 After reaching the thread depth (Z1) the spindle stops and reverses direction.
- 4 The tool moves back to the safety distance in rapid traverse with G1.
- 5 The tool moves back in rapid traverse (G0) to the coordinates of the drill hole center on the retraction plane.

**Instructions:**  
 When single block processing (SBL) is active, the thread tapping will be carried out without block interruption.



**Cycle Description**

**Chip clearing**

- 1 The tool drills with the programmed speed (S) (dependent on %S) to the 1st infeed depth (maximum depth infeed D).
- 2 Spindle stop.
- 3 The tool moves out of the workpiece for chip clearing with spindle speed for the return (SR) (dependent on %S).
- 4 Spindle stop.
- 5 The tool drills with spindle depth (S) to the next infeed depth.
- 6 Repeat steps 2 to 5 until the programmed end drilling depth (Z1) is reached.
- 7 The tool moves out of the workpiece with spindle speed for the return (SR) (dependent on %S). The spindle stops and the tool moves back in rapid traverse (G0) to the coordinates of the drill hole center on the retraction plane.

**Cycle Description**

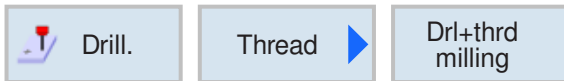
**Thread tapping without compensation chuck 1 cut**

- 1 The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2 The spindle will be synchronised and activated with the programmed speed (S) (dependent on %S).
- 3 With spindle-feed-synchronisation, the tool drills to depth (Z1).
- 4 After reaching the thread depth (Z1) the spindle stops and reverses direction.
- 5 The tool moves back to the safety distance with spindle speed for the return (SR) (dependent on %S).
- 6 Spindle stop.
- 7 The tool moves back in rapid traverse (G0) to the coordinates of the drill hole center on the retraction plane.

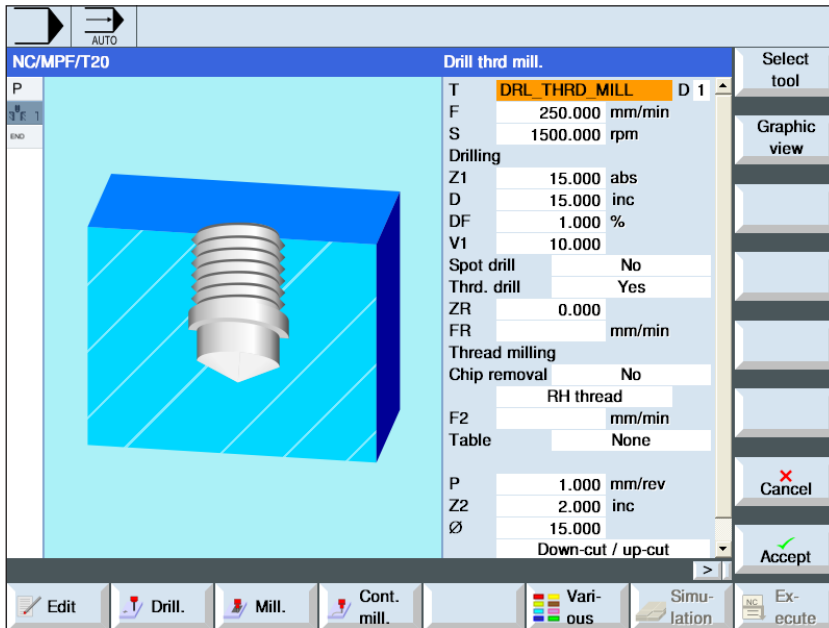
**Cycle Description**

**Chip crushing**

- 1 The tool drills with the programmed speed (S) (dependent on %S) to the 1st infeed depth (maximum depth infeed D).
- 2 Spindle stop.
- 3 The tool moves back by the return amount (V2) for chip crushing.
- 4 The tool drills with spindle depth (S) to the next infeed depth.
- 5 Repeat steps 2 to 4 until the programmed end drilling depth (Z1) is reached.
- 7 The tool moves out of the workpiece with spindle speed for the return (SR) (dependent on %S). The spindle stops and the tool moves back in rapid traverse (G0) to the coordinates of the drill hole center on the retraction plane.



### Mill drill thread



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/rev
S / V	Spindle speed or constant cutting speed	Rev/min m/min
Z1	Thread length (incremental) or end point of the thread (absolute).	mm
DF	<ul style="list-style-type: none"> <li>Percentage rate for each additional infeed DF=100: Infeed amount remains the same DF&lt;100: Infeed amount will be reduced in the direction final drilling depth Z1. Example: last infeed 5 mm; DF 80% next infeed = 5 x 80% = 4.0 mm next but one infeed = 4.0 x 80% = 3.2 mm etc.</li> <li>Amount for each additional infeed</li> </ul>	% mm
V1	minimum infeed (only with DF "Percentage for each additional infeed"). If the infeed amount is very small, a minimum depth infeed (V1) can be programmed. <ul style="list-style-type: none"> <li>V1 &lt; Infeed amount (DF): It will be infed by the infeed amount.</li> <li>V1 &gt; Infeed amount (DF): It will be fed in with the value programmed under V1.</li> </ul>	mm

Parameters	Description	Unit
Boring	Boring with reduced feed <ul style="list-style-type: none"> <li>• yes</li> <li>• no</li> </ul> The reduced drill feed results from: Drill feed $F1 < 0.15$ mm/rev: Bore feed = 30% of F1 Drill feed $F1 > 0.15$ mm/rev: Bore feed = 30% of F1	
Through-drilling	Remaining drill depth with drill feed <ul style="list-style-type: none"> <li>• yes</li> <li>• no</li> </ul>	
ZR	Remaining drill depth with through-drilling (only when through-drilling "yes")	mm
FR	Drill feed for remaining drill depth (only when through-drilling "yes")	mm/mm mm/rev
Chip clearing	Chip clearing before thread milling <ul style="list-style-type: none"> <li>• yes</li> <li>• no</li> </ul> Move back to the tool surface for chip clearing before thread milling.	
Thread's direction of rotation	<ul style="list-style-type: none"> <li>• Right-hand thread</li> <li>• Left-hand thread</li> </ul>	
F2	Infeed depth thread milling	mm/min mm/tooth
Table	Thread selection table: <ul style="list-style-type: none"> <li>• None</li> <li>• ISO metric</li> <li>• Whitworth BSW</li> <li>• Whitworth BSP</li> <li>• UNC</li> </ul>	
Selection	Selection of the table value e.g.: <ul style="list-style-type: none"> <li>• M1; M5; etc. (ISO metric)</li> <li>• W1/8"; etc. (Whitworth BSW)</li> <li>• G 1 3/4"; etc. (Whitworth BSP)</li> <li>• N8 - 32 UNC; etc. (UNC)</li> </ul> (also see thread table with the respective pitches)	
P	Display of the thread pitch (only with table selection "none") <ul style="list-style-type: none"> <li>• in MODULE: <math>MODULE = pitch/\pi</math></li> <li>• in threads per inch: As is typical for example with pipe threads. With the per inch input, in the first parameter field the whole number before the decimal point is entered and in the second and third field the number after the decimal point is entered as a fraction.</li> <li>• in mm/rev</li> <li>• in inch/rev</li> </ul> The thread pitch is dependent on the tool used.	MODULE Threads/" mm/rev in/rev
Z2	Return amount before thread milling (incremental) With Z2 the thread depth is defined in the direction of the tool axis. In this, Z2 is relative to the tool tip.	
∅	Nominal diameter	

Parameters	Description	Unit
Milling direction	<ul style="list-style-type: none"><li>• Down-cut: Mill thread in one revolution.</li><li>• Up-cut: Mill thread in one revolution.</li><li>• Down-cut - up-cut: Mill thread in 2 revolutions, in which an up-cut rough-milling with a defined extent is carried out followed by a finish-milling with mill feed FS in the down-cut.</li></ul>	
FS	Finishing feed rate (only when "Up-cut - Down-cut selected")	mm/min mm/tooth

### Cycle Description

- 1 The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance.
- 2 The tool drills with drill feed (F1) to the first drilling depth (maximum infeed depth D). If the final drilling depth (Z1) has still not been reached, the tool moves in rapid traverse (G0) for chip clearing back to the workpiece surface. Then positions the tool with rapid traverse (G0) to 1 mm above the previously reached drilling depth, in order to drill further with the next infeed with drill feed (F1). From the 2nd infeed the parameter (percentage rate or amount for each additional infeed DF) will be taken into account.
- 3 When through-drilling if another feed is desired during retraction (FR), the remaining drill depth (ZR) is drilled with this feed.
- 4 The tool moves to the start position for the thread milling.
- 5 The thread milling (up-cut, down-cut or down-cut + up-cut) will be carried out with infeed depth (F2). The inward and outward movement of the milling cutter takes place in a semi-circle with simultaneous infeed in the tool axis.



## Position and position template

When programming processing cycles there is an option to enter positions or position templates.

A position or position template will only be created after the processing cycle.

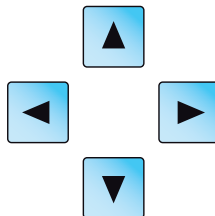
Positions or position templates allow several drill or threading operations of the same diameter to be executed together in a cycle. The defined position or a position template will be saved in the cycle list. Various templates are available for this purpose:

- Arbitrary positions
- Positioning on a line, a grid or a frame
- Positioning on full or partial circle

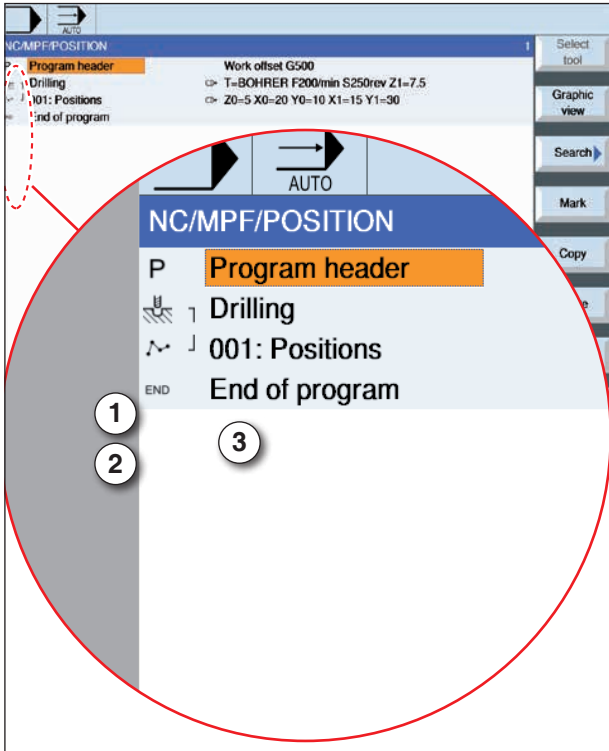


Several position templates can be programmed successively. They will be covered in the programmed sequence.

The previously programmed technologies and the subsequently programmed positions will be automatically chained.



If there are more cycles than are shown in the window, use the cursor keys to move through the list.



**Link representation of position templates with cycles:**

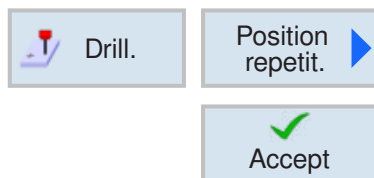
A complete processing cycle consists of the processing cycle (1) and the associated position template (2).

The programming sequence must be observed: First the processing cycle (e.g. drilling) is created and then the position template.

The control system links both program parts with a symbolic bracket (3) in the cycle list.

**Cycle Description**

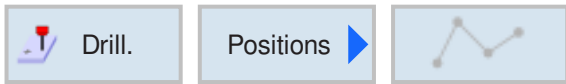
- 1 The control system positions the programmed tool in the preceding cycle. Processing always begins at the reference point.
- 2 Within a position template and when approaching the next position template there will be a movement back to the retraction plane and then the new position or the new position template will be approached in rapid traverse (G0).
- 3 With technological follow-up operations (e.g. Centering - Drilling - Thread tapping), after calling up the next tool (e.g. drill), the particular drilling cycle is to be programmed and immediately afterwards the calling up of the position template to be executed.



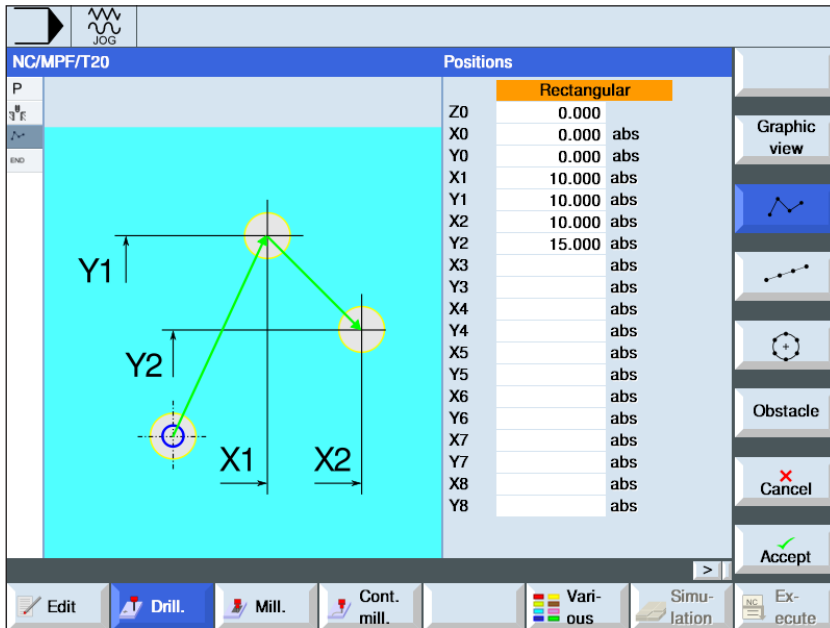
**Repeat positions**

Press softkey for repeated approach of already programmed positions.

- Indicate and confirm the number of the position template.  
The position number will be assigned automatically when a position is created in the cycle list. In the cycle list, the position number appears to the left of the position name.



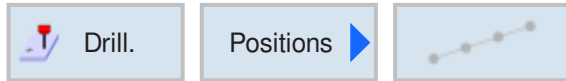
### Arbitrary positions



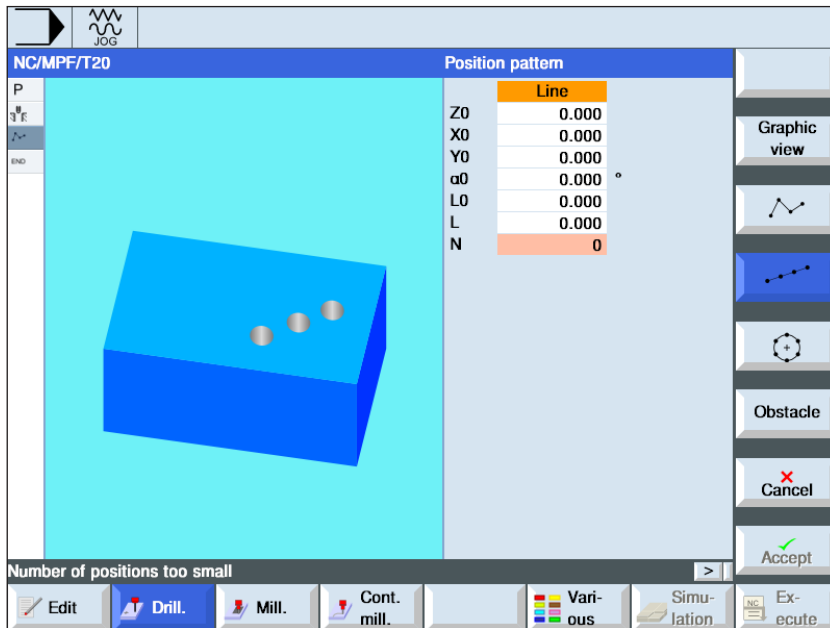
Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Selection	Coordinate system • orthogonal • polar	
Z0	Reference point Z	mm
X0, Y0	X and Y-coordinates of the first position (absolute)	mm
L0, C0	Polar coordinates of the first position, only when "polar" selected Length (absolute), angle (absolute)	mm Grad
L1...L7 C1...C7	Polar coordinates of the respective positions, (only when "polar" selected) Length (absolute), angle (absolute)	mm degrees
X1...X8 Y1...Y8	X-coordinates of the respective position (absolute) Y-coordinates of the respective position (absolute)	mm





**Position template line, grid or frame**



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Position template	<ul style="list-style-type: none"> <li>• Line</li> <li>• Grid</li> <li>• Frame</li> </ul>	
Z0	Reference point Z	mm
X0 Y0	Coordinate of the reference point (absolute).	mm
α0	Angle of the line, relative to the X-axis Positive angle: Line will be rotated counter-clockwise. Negative angle: Line will be rotated clockwise.	degrees
L0	Distance of 1st position to reference point (only when "Position template line" selected)	mm
L	Distance between the positions - (only when "Position template line" selected)	mm
N	Number of positions - (only when "Position template line" selected)	
L1 L2	Spacing of lines and columns - (only when "Position template grid or frame" selected)	mm
N1 N2	Number of lines and columns - (only when "Position template grid or frame" selected)	

**Cycle Description**

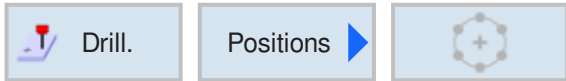
**Grid**

1 For grid the processing will first be in the direction of the 1st axis and then loop-shaped afterwards.

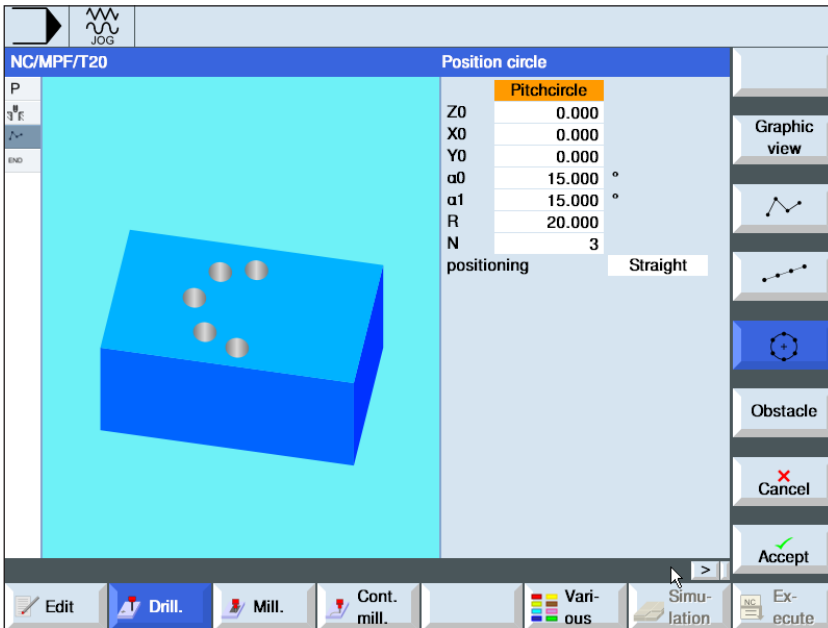
**Cycle Description**

**Frame**

1 With frame additional processing will be in the counter-clockwise direction.



**Position template circle**

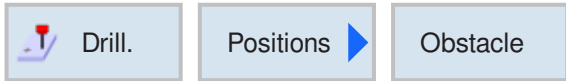


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

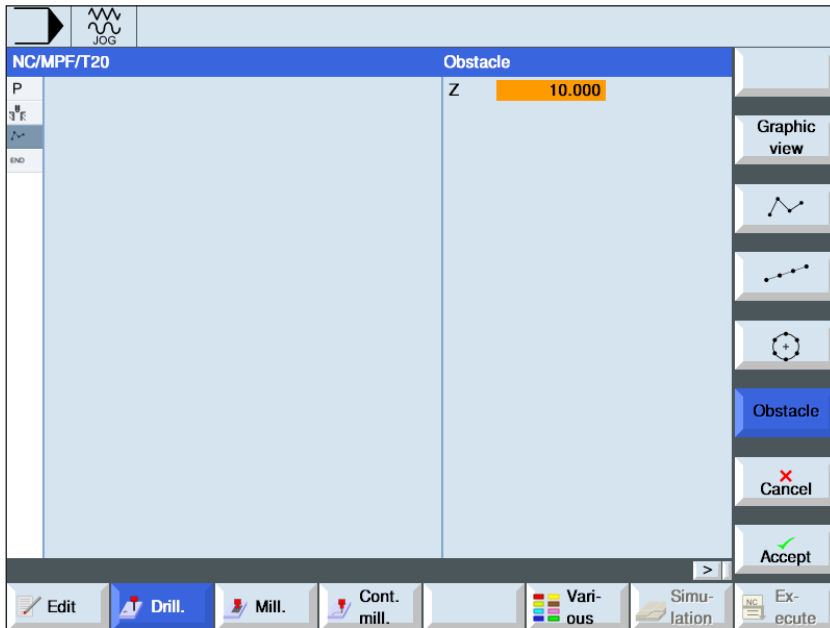
Parameters	Description	Unit
Circle template	<ul style="list-style-type: none"> <li>• Full circle</li> <li>• Partial circle</li> </ul>	
Z0	Reference point Z	mm
X0 Y0	Coordinate of the reference point (absolute).	mm
α0	Start angle for first position Positive angle: Full circle will be rotated counter-clockwise. Negative angle: Full circle will be rotated clockwise.	degrees
α1	Angle of advance (only when "Circle template partial circle" selected) After the first drill hole is finished, all further positions will be positioned onward by this angle. Positive angle, further positions will be rotated in the counter-clockwise direction. Negative angle: further positions will be rotated in the counter-clockwise direction.	Degrees
R	Radius	mm
N	Number of positions	
Positioning	Positioning movement between the positions <ul style="list-style-type: none"> <li>• Straight Next position will be approached in rapid traverse (G0) in a straight line.</li> <li>• Circle Next position will be approached on a circular path with the programmed feed (FP).</li> </ul>	

**Cycle Description**

- 1 The circle template will be processed further in the counter-clockwise direction.



**Position template obstacle**



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Z	Obstacle height (absolute or incremental)	mm

**Information:**

The obstacle will only be heeded in between 2 position templates. If the workpiece change point and the programmed retraction plane are below the obstacle, the tool moves to the height of the retraction plane and to the new position without taking the obstacle into account. The obstacle may not be higher than the retraction plane.



**Cycle Description**

- 1 Once the processing of the 1st position template is complete the tool axis moves in rapid traverse (G0) to the programmed obstacle height (Z) + safety distance (SC).
- 2 At this height the new position is approached in rapid traverse (G0).
- 3 Then the tool axis moves in rapid traverse to Z0 of the position template + safety distance (SC).



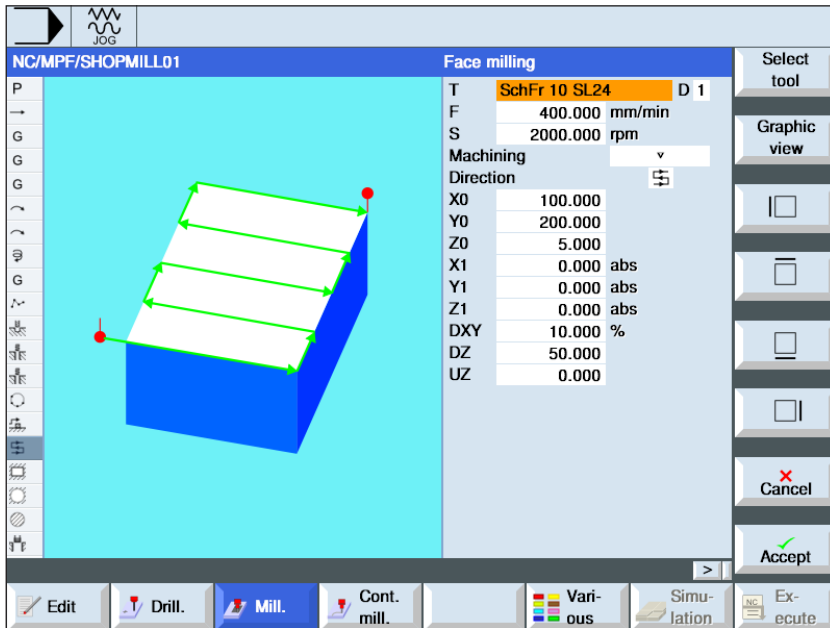


## Milling





- Face milling
- Pocket
- Spigot
- Slot
- Thread milling
- Engraving



## Face milling



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/tooth
S / V	Spindle speed or constant cutting speed	Rev/min m/min
Processing	<ul style="list-style-type: none"> <li>• ▾ Roughing</li> <li>• ▾ ▾ ▾ Finishing</li> </ul>	
Direction	alternating processing direction •  •  same processing direction •  • 	
X0 Y0 Z0	The positions are relative to the reference point: 1 Corner point in X and Y Height of the raw part	mm mm
X1 Y1 Z1	2 Corner point in X and Y (absolute) or 2 Corner point in X and Y relative to X0 and Y0 (incremental) Height of the finished part (absolute) or height of the finished part relative to Z0 (incremental)	

Parameters	Description	Unit
DXY	<ul style="list-style-type: none"> <li>• maximum level infeed</li> <li>• Maximum plane infeed in %, as a proportion of the plane infeed (mm) to the flute end-mill (mm)</li> </ul>	mm %
DZ	Maximum depth infeed (only for roughing)	mm
UZ	Finishing pass depth	mm

**Cycle Description**

- 1 With vertical processing the start point is always above or below.  
The control system shows the start and end point.
- 2 The processing takes place from the outside.

**Roughing:**

The surface will be milled.  
The tool moves over the workpiece edge.

**Finishing:**

The surface will only be milled once.  
The tool moves to the X/Y plane for safety distance. Then the milling cutter moves freely.  
For finishing the same finishing pass as for roughing must be registered. The finishing pass will be used when positioning the tool for free movement.

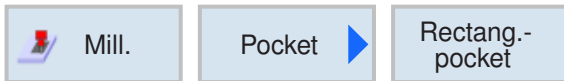
The depth infeed will always be carried out outside of the workpiece.  
During surface milling the effect milling cutter diameter for a milling cutter tool is stored in the tool table.

**Select boundaries**

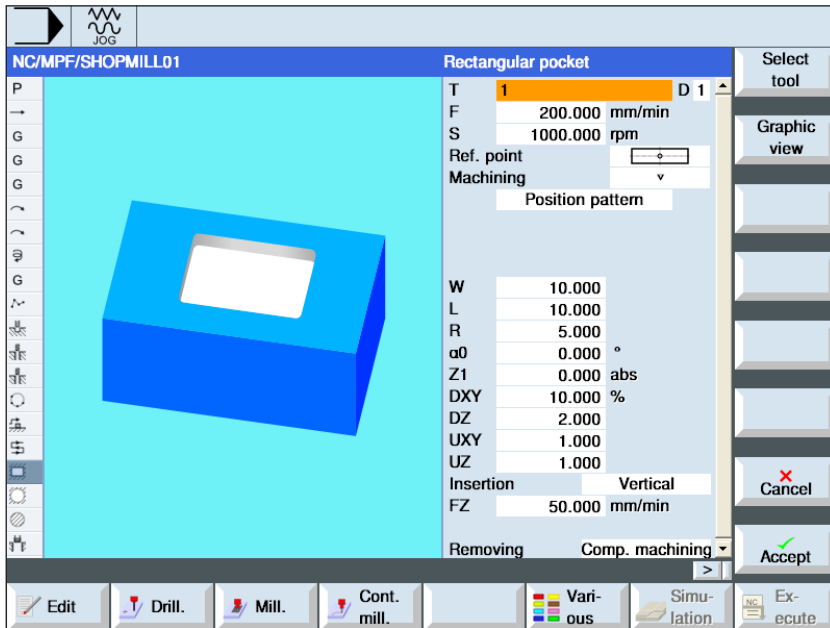
For each desired movement press the corresponding softkey. The limits are shown by the control system.



- left
- top
- bottom
- right



## Rectangular pocket



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/tooth
S / V	Spindle speed or constant cutting speed	Rev/min m/min
Reference point	<ul style="list-style-type: none"> <li> (centre)</li> <li> (bottom left)</li> <li> (bottom right)</li> <li> (top left)</li> <li> (top right)</li> </ul>	
Processing	<ul style="list-style-type: none"> <li>▽ Roughing</li> <li>▽▽ Finishing</li> <li>▽▽▽ Edge finishing</li> <li>Chamfer</li> </ul>	
Processing position	<ul style="list-style-type: none"> <li>Individual position Mill rectangular pocket at the programmed position (X0, Y0, Z0).</li> <li>Position template Position with MCALL</li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point: (only for "single position") Reference point in X, Y and Z	mm
W	Width of the pocket	mm
L	Length of the pocket	mm

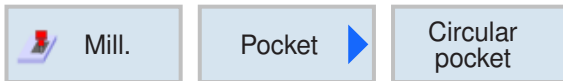


Parameters	Description	Unit
R	Corner radius	mm
$\alpha_0$	Angle	Degrees
Z1	Depth relative to Z0 (incremental) or pocket depth (absolute) (only if ▽, ▽▽▽ or ▽▽▽ Edge)	mm
DXY	<ul style="list-style-type: none"> <li>• maximum level infeed</li> <li>• Plane infeed %, as a proportion of the plane infeed (mm) to the flute end mill (mm); (only if ▽, ▽▽▽ or ▽▽▽ edge)</li> </ul>	mm %
DZ	maximum depth infeed (only if ▽, ▽▽▽ or ▽▽▽ Edge)	mm
UXY	Finishing pass plane (only if ▽, ▽▽▽ or ▽▽▽ edge)	mm
UZ	Finishing pass depth; (only if ▽, ▽▽▽ or ▽▽▽ edge)	mm
Plunge mode	<p>(only if ▽, ▽▽▽ or ▽▽▽ edge)</p> <ul style="list-style-type: none"> <li>• vertical: Plunge vertically on pocket center The calculated current infeed depth will be executed in the pocket center in one block. The milling cutting tool must cut via the center or it must be pre-drilled.</li> <li>• helical: Plunging on spiral path The center of the milling cutter moves on the spiral path defined by the radius and the depth per revolution (helical path). Once the depth for the infeed has been reached, another full circle will be executed, in order to overcome the angular path of the plunge.</li> <li>• swinging: Plunge swinging on center axis of the rectangular pocket axis The center of the milling cutter swings on a straight line back and forth till the depth infeed is reached. Once the depth has been reached, the path will be executed again without the infeed, in order to overcome the angular path of the plunge.</li> </ul>	
FZ	Infeed depth (only when vertical)	mm/min mm/tooth
EP	Maximum pitch of the helix (only with helical plunging)	mm/rev
ER	Radius of the helix (only with helical plunging) The radius may not be larger than the milling cutting tool radius, as otherwise material remains.	mm
EW	Maximum plunge angle (only with swinging plunging)	Degrees
Clearing	<p>(only for roughing)</p> <ul style="list-style-type: none"> <li>• Complete processing The right corner pocket will be milled from the complete material.</li> <li>• Re-working A smaller right corner pocket or a drill hole is already available. This can be enlarged in one or more axes. Then the parameters AZ, W1 and L1 must be programmed.</li> </ul>	
AZ	Depth of the pre-processing (only when re-working)	mm
W1	Width of the pre-processing (only when re-working)	mm
L1	Length of the pre-processing (only when re-working)	mm

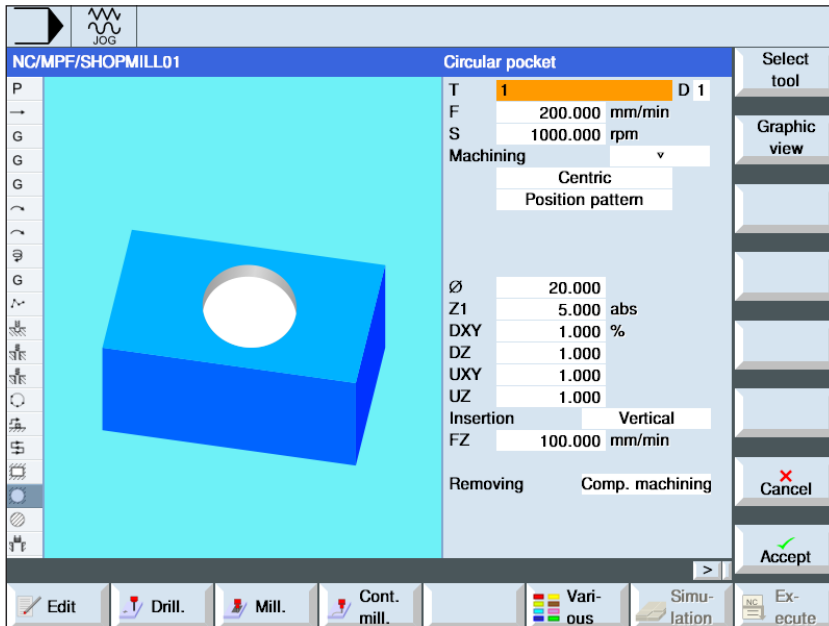
Parameters	Description	Unit
FS	Bevel width for chamfering - (only for chamfering)	mm
ZFS	Tool tip plunge depth (absolute or incremental) (only for chamfering)	mm

### Cycle Description

- 1** The control system positions the tool in rapid traverse (G0) at the retraction plane height on the rectangular pocket center point and at the safety distance.
- 2** The tool mills into the material according to the selected strategy.
- 3a** Processing ▽ Roughing  
During roughing the processing will be from the centre out of the individual levels of the rectangular pocket until the depth Z1 is reached.
- 3b** Processing ▽ ▽ Finishing  
During finishing the edge will always be processed first. In the process the rectangular pocket edge will be approached in the quarter circle in which it joins the corner radius. In the last infeed the bottom will be finished from the center.
- 3c** Processing ▽ ▽ ▽ Edge finishing  
Edge finishing takes place as with finishing. Only the last infeed (bottom finishing) is absent.
- 3d** Processing Chamfering  
During chamfering the edge on the top of the rectangular pocket will be breached.
- 4** The processing of the right corner pocket always takes place from inwards to outwards with the selected processing type.
- 5** The tool moves back to the safety distance in rapid traverse (G0).



## Circular pocket



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/tooth
S / V	Spindle speed or constant cutting speed	R/min m/min
Processing	<ul style="list-style-type: none"> <li>▾ Roughing</li> <li>▾ ▾ ▾ Finishing</li> <li>▾ ▾ ▾ Edge finishing</li> <li>Chamfering</li> </ul>	
Processing type	<ul style="list-style-type: none"> <li>planar Planar processing of circular pocket</li> <li>helical Helical processing of circular pocket</li> </ul>	
Processing position	<ul style="list-style-type: none"> <li>Individual position A circular pocket will be milled at the programmed position (X0, Y0, Z0).</li> <li>Position template Several circular pockets will be milled on a position template (e.g. full circle, partial circle, grid, etc.).</li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point = center point of the circular pocket: (only for "single position") Reference point in X, Y and Z	mm
Ø	Diameter of the pocket	mm
Z1	Pocket depth (absolute) or depth related to Z0 (incremental) (only if ▾, ▾ ▾ ▾ or ▾ ▾ ▾ edge)	mm

Parameters	Description	Unit
DXY	<ul style="list-style-type: none"> <li>• maximum level infeed</li> <li>• maximum plane infeed as a percentage rate of the milling cutter diameter (only when ▽, ▽▽▽ or ▽▽▽ edge)</li> </ul>	mm %
DZ	Maximum depth infeed (only if ▽, ▽▽▽ or ▽▽▽ edge)	mm
UXY	Finishing pass plane (only if ▽, ▽▽▽ or ▽▽▽ edge)	mm
UZ	Finishing pass depth (only if ▽, ▽▽▽ or ▽▽▽ edge)	mm
Plunging	<p>(only if "planar", ▽, ▽▽▽ or ▽▽▽ edge)</p> <ul style="list-style-type: none"> <li>• vertical: Plunge vertically on pocket center The calculated infeed depth will be executed vertically in the pocket center. Feed: Infeed as programmed under FZ. When plunging vertically on the pocket center the milling cutting tool must cut via the center or it must be pre-drilled.</li> <li>• helical: Plunging on spiral path The center of the milling cutter moves with the processing feed on the spiral path defined by the radius and the depth per revolution (helical path). Once the depth for the infeed has been reached, another full circle will be executed, in order to overcome the angular path of the plunge.</li> </ul>	
FZ	Infeed depth	mm/min mm/tooth
EP	Maximum pitch of the helix (only with helical plunging)	mm/rev
ER	Radius of the helix (only with helical plunging) The radius may not be larger than the milling cutting tool radius, as otherwise material remains.	mm
Clearing	<ul style="list-style-type: none"> <li>• Complete processing The circular pocket should be milled from the whole material (e.g. cast part).</li> <li>• Re-working If a circular pocket or a drill hole already exists, it will be enlarged. The parameters AZ, and Ø1 must be programmed.</li> </ul>	
FS	Bevel width for chamfering (only for chamfering)	mm
AZ	Depth of the pre-processing (only when re-working)	mm
Ø1	Diameter of the pre-processing (only when re-working)	mm

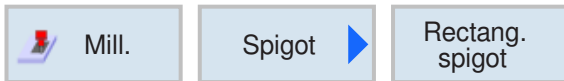
**Cycle Description****Planar plunge mode**

- 1 The control system positions the tool in rapid traverse (G0) at the retract plane height on the rectangular pocket center point and at the safety distance.
- 2 The tool mills into the material according to the selected strategy.
- 3a Processing ▾ Roughing  
During roughing the processing will be from the centre out of the individual planes of the circular pocket until the depth Z1 is reached.
- 3b Processing ▾ ▾ Finishing  
During finishing the edge will always be processed first. In the process the pocket edge will be approached in the quarter circle in which it joins the corner radius. In the last infeed the bottom will be finished from the center.
- 3c Processing ▾ ▾ Edge finishing  
Edge finishing is performed like the finishing. The last infeed (bottom finishing) is not applicable.
- 4 The processing of the circular pocket always takes place from inwards to outwards with the selected processing type. The material will be cleared away ("by plane").
- 5 The tool moves back to the safety distance in rapid traverse (G0).

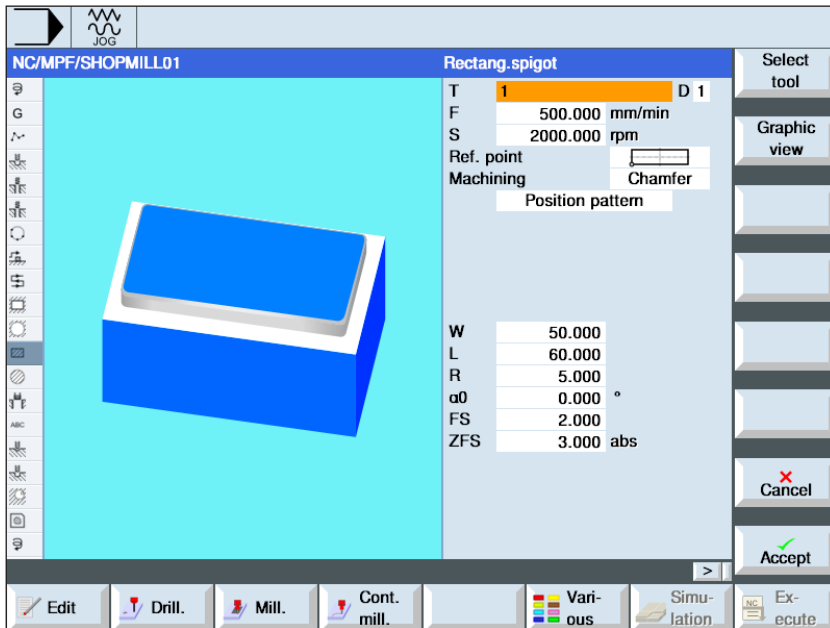
**Cycle Description****Helical plunge mode**

- 1 The control system positions the tool in rapid traverse (G0) at the retract plane height on the rectangular pocket center point and at the safety distance.
- 2 The tool feeds in to the first processing diameter and mills into the material according to the selected strategy.
- 3a Processing ▾ Roughing  
During roughing the circular pocket will be processed with top-down helical movements. a full circle will be performed at the pocket depth to remove the remaining material. The tool will be moved freely from the pocket edge and bottom in the quadrant and pulled back to the safety distance in rapid traverse. This sequence repeats in a shell-like way from inside to outside, until the circular pocket is fully processed.
- 3b Processing ▾ ▾ Finishing  
When finishing the edge will be processed first with a helical movement to the bottom. a full circle will be performed at the pocket depth to remove the remaining material. The bottom will be milled out in a spiral shape from outside to inside. From the pocket centre there will be a pull-back in rapid traverse to the safety distance.
- 3c Processing ▾ ▾ Edge finishing  
When finishing the edge will be processed first with a helical movement to the bottom. a full circle will be executed at the pocket depth to remove the remaining material. The tool will be moved freely from the pocket edge and bottom in the quadrant and pulled back to the safety distance in rapid traverse.
- 4 The processing of the circular pocket takes place with the selected processing type to the pocket depth or to the pocket depth with finishing pass.
- 5 The tool moves back to the safety distance in rapid traverse (G0).





## Rectangular spigot



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

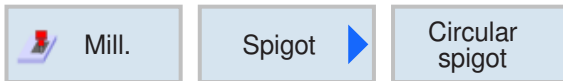
Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/tooth
S / V	Spindle speed or constant cutting speed	R/min m/min
Reference point	<ul style="list-style-type: none"> <li> (center)</li> <li> (bottom left)</li> <li> (bottom right)</li> <li> (top left)</li> <li> (top right)</li> </ul>	
Processing	<ul style="list-style-type: none"> <li>▽ Roughing</li> <li>▽▽ Finishing</li> <li>Chamfering</li> </ul>	
Processing position	<ul style="list-style-type: none"> <li>Individual position Mill rectangular pocket at the programmed position (X0, Y0, Z0).</li> <li>Position template Mill rectangular spigot on a position template.</li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point: (only for "single position") Reference point in X, Y and Z	mm
W	Spigot width	mm
L	Spigot length	mm



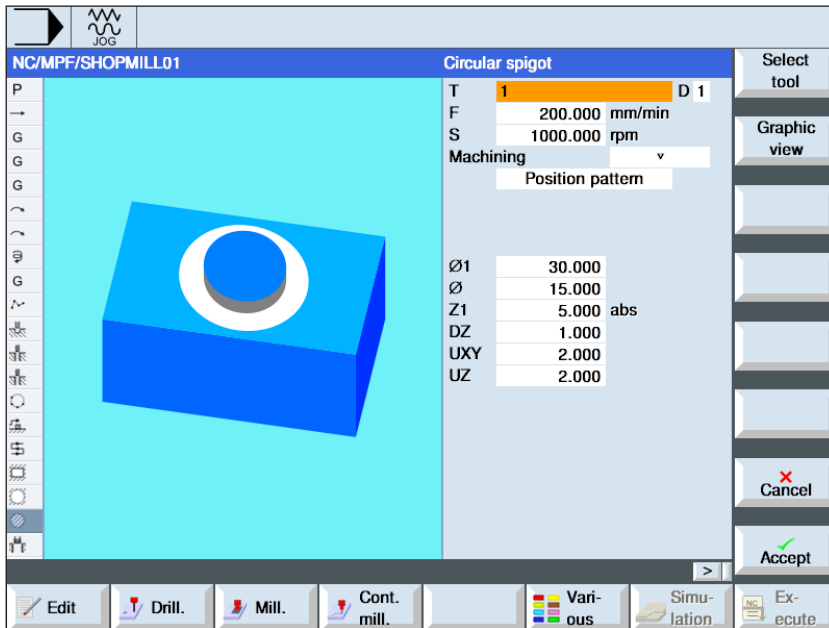
Parameters	Description	Unit
R	Corner radius	mm
$\alpha 0$	Angle	Degrees
Z1	Slot depth (absolute) or depth relative to Z0 (incremental) (only if ▽, ▽ ▽ ▽, or ▽ ▽ ▽)	mm
DZ	maximum depth infeed (only if ▽ or ▽ ▽ ▽)	mm
UXY	Finishing pass plane at the length (L) of the circular spigot and the width (W) of the circular spigot. Smaller circular spigot dimensions will be achieved by calling the cycle again and programming it with reduced finishing pass. (only if ▽ or ▽ ▽ ▽)	mm
UZ	Finishing pass depth (only if ▽ or ▽ ▽ ▽)	mm
W1	Width of the raw part spigot (only when ▽ or ▽ ▽ ▽)	mm
L1	Length of the raw part spigot (only when ▽ or ▽ ▽ ▽)	mm
FS	Bevel width for chamfering (only for chamfering)	mm
ZFS	Tool tip plunge depth (only when chamfering)	mm

**Cycle Description**

- 1 The control system positions the tool in rapid traverse (G0) at the retract plane height and at the safety distance. The start point lies on the positive X-axis rotated by  $\alpha 0$ .
- 2 The tool approaches the spigot contour in the semi-circle with processing feed. First the infeed to the processing depth takes place, then the movement in the plane. The rectangular spigot will be processed in the clockwise or counter-clockwise direction according to the programmed direction of rotation for processing (up-cut milling/down-cut milling).
- 3a Processing ▽ Roughing  
When roughing the rectangular spigot will be bypassed, until the programmed finishing pass is reached.
- 3b Processing ▽ ▽ ▽ Finishing  
During finishing the rectangular spigot will be bypassed, until depth Z1 is reached.
- 3c Processing Chamfering  
During chamfering the edge on the top of the rectangular spigot will be breached.
- 4 Once the rectangular spigot has been bypassed once, the tool leaves the contour in the semi-circle and the infeed to the next processing plane takes place.
- 5 The rectangular spigot will again be approached in the semi-circle and bypassed once. This will be repeated until the programmed spigot depth is reached.
- 6 The tool moves back to the safety distance in rapid traverse (G0).



## Circular spigot



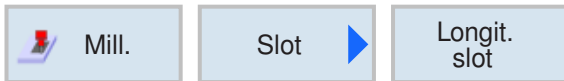
Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/tooth
S / V	Spindle speed or constant cutting speed	R/min m/min
Processing	<ul style="list-style-type: none"> <li>▾ Roughing</li> <li>▾ ▾ ▾ Finishing</li> <li>• Chamfering</li> </ul>	
Processing position	<ul style="list-style-type: none"> <li>• Individual position Mill circular spigot at the programmed position (X0, Y0, Z0).</li> <li>• Position template Mill circular spigot on a position template.</li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point: (only for "single position") Reference point in X, Y and Z	mm
Ø	Spigot diameter	mm
R	Corner radius	mm
α0	Angle	Degrees
Z1	Slot depth (absolute) or depth relative to Z0 (incremental) (only if ▾, ▾ ▾ ▾, or ▾ ▾ ▾)	mm

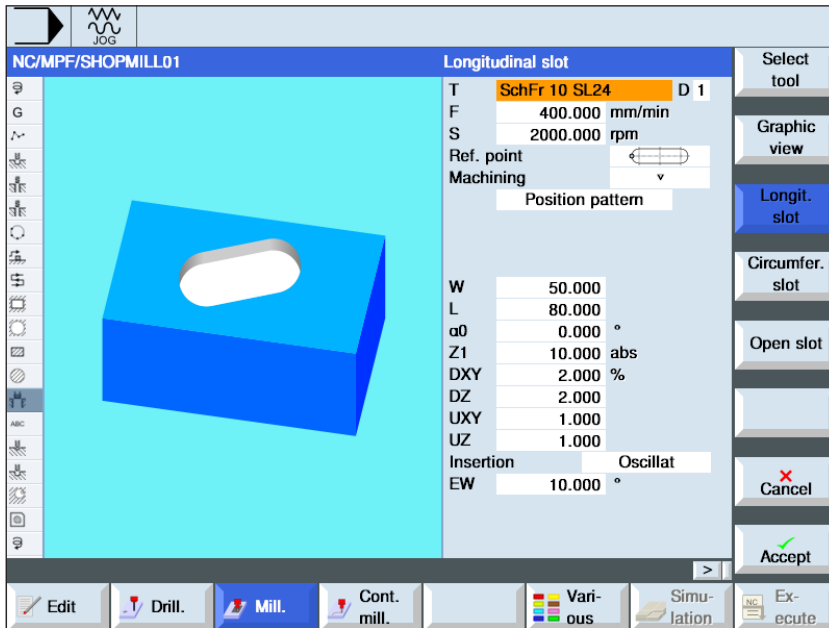
Parameters	Description	Unit
DZ	maximum depth infeed (only if ▽ or ▽ ▽ ▽)	mm
UXY	Finishing pass plane at the length (L) of the circular spigot and the width (W) of the circular spigot. Smaller circular spigot dimensions will be achieved by calling the cycle again and programming it with reduced finishing pass. (only if ▽ or ▽ ▽ ▽)	mm
UZ	Finishing pass depth (only if ▽ or ▽ ▽ ▽)	mm
Ø1	Diameter of the raw part spigot (only when ▽ or ▽ ▽ ▽)	mm
FS	Bevel width for chamfering (only for chamfering)	mm
ZFS	Tool tip plunge depth (only when chamfering)	mm

**Cycle Description**

- 1 The control system positions the tool in rapid traverse (G0) at the retract plane height and at the safety distance. The start point is always on the positive X-axis.
- 2 The tool approaches the spigot contour in the semi-circle with processing feed. First the infeed to the processing depth takes place, then the movement in the plane. The circular spigot will be processed in the clockwise or counter-clockwise direction according to the programmed direction of rotation for processing (up-cut milling/down-cut milling).
- 3a Processing ▽ Roughing  
When roughing the rectangular spigot will be bypassed, until the programmed finishing pass is reached.
- 3b Processing ▽ ▽ ▽ Finishing  
During finishing the rectangular spigot will be bypassed, until depth Z1 is reached.
- 3c Processing Chamfering  
During chamfering the edge on the top of the rectangular spigot will be breached.
- 4 Once the rectangular spigot has been bypassed once, the tool leaves the contour in the semi-circle and the infeed to the next processing depth takes place.
- 5 The circular spigot will again be approached in the semi-circle and bypassed once. This will be repeated until the programmed spigot depth is reached.
- 6 The tool moves back to the safety distance in rapid traverse (G0).



## Longitudinal Slot



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/tooth
S / V	Spindle speed or constant cutting speed	R/min m/min
Reference point	<ul style="list-style-type: none"> <li> (left edge)</li> <li> (inside left)</li> <li> (centre)</li> <li> (inside right)</li> <li> (right edge)</li> </ul>	
Processing	<ul style="list-style-type: none"> <li>▽ Roughing</li> <li>▽▽ Finishing</li> <li>▽▽▽ Edge finishing</li> <li>Chamfering</li> </ul>	
Processing position	<ul style="list-style-type: none"> <li>Individual position Mill groove at the programmed position (X0, Y0, Z0).</li> <li>Position template Mill several grooves at the programmed position template (e.g. partial circle, grid, line).</li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point: (only for "single position") Reference point in X, Y and Z	mm
W	Width of the groove	mm
L	Length of the groove	mm

Parameters	Description	Unit
$\alpha 0$	Angle	Degrees
Z1	Groove depth (absolute) or depth relative to Z0 (incremental) (only if ▽, ▽▽▽, or ▽▽▽edge)	mm
DXY	<ul style="list-style-type: none"> <li>• maximum level infeed</li> <li>• maximum level infeed as a percentage of the milling cutter diameter (only when ▽, ▽▽▽, or ▽▽▽Edge)</li> </ul>	mm %
DZ	maximum depth infeed (only when ▽, ▽▽▽, or ▽▽▽Edge)	mm
UXY	Finishing pass plane (only when ▽, ▽▽▽, or ▽▽▽edge)	mm
UZ	Finishing pass depth (only when ▽, ▽▽▽, or ▽▽▽edge)	mm
Plunging	(only if ▽, ▽▽▽ or ▽▽▽ edge) <ul style="list-style-type: none"> <li>• vertical: Plunge vertically on longitudinal slot center: It will be moved to the center of the pocket at the infeed depth. With this setting the milling cutting tool must cut via the center.</li> <li>• swinging: Plunge swinging on the center axis of the longitudinal groove: The center of the milling cutter swings on a straight line back and forth till it reaches the depth infeed. Once the depth has been reached, the path will be executed again without the depth infeed, in order to overcome the angular path of the plunge.</li> </ul>	
FZ	Infeed depth (only with vertical plunging)	mm/min mm/tooth
EW	Maximum plunge angle (only with swinging plunging)	Degrees
FS	Bevel width for chamfering (only for chamfering)	mm
ZFS	Tool tip plunge depth (only when chamfering)	mm

**Cycle Description**

- 1 The control system positions the tool in rapid traverse (G0) at the retract plane height and at the safety distance. The start point lies on the positive X-axis rotated by  $\alpha 0$ .
- 2 The tool mills into the material according to the selected strategy.
- 3 The processing of the longitudinal groove always takes place with the selected processing type from inside to outside.

**3a Processing ▽ Roughing**

During roughing the processing will be from the centre out of the individual planes of the groove until the depth Z1 is reached.

**3b Processing ▽▽▽ Finishing**

During finishing the edge will always be processed first. In the process the slot edge will be approached in the quarter circle in which it joins the corner radius. In the last infeed the bottom will be finished from the center.

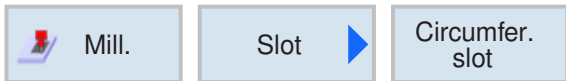
**3c Processing ▽▽▽ Edge finishing**

Edge finishing takes place as with finishing. Only the last infeed (bottom finishing) is absent.

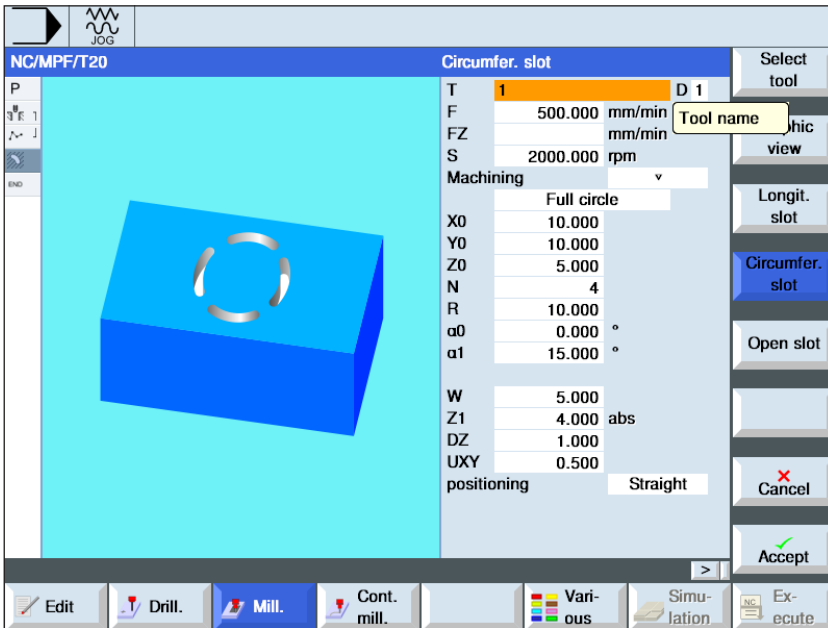
**3d Processing Chamfering**

During chamfering the edge on the top of the longitudinal slot will be breached.

- 4 The tool moves back to the safety distance in rapid traverse (G0).



### Circumferential slot



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/tooth
S / V	Spindle speed or constant cutting speed	R/min m/min
Processing	<ul style="list-style-type: none"> <li>▾ Roughing</li> <li>▾▾▾ Finishing</li> <li>▾▾▾ Edge finishing</li> <li>• Chamfering</li> </ul>	
FZ	Infeed depth	mm/min
Circle template	<ul style="list-style-type: none"> <li>• Full circle The circumferential slots will be positioned on a full circle. The distance from one circumferential slot to the next circumferential slot is always the same and will be calculated by the control system.</li> <li>• Partial circle The circumferential slots will be positioned on a partial circle. The distance from one circumferential slot to the next circumferential slot can be defined by the angle <math>\alpha_2</math>.</li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point: Reference point in X, Y and Z	mm
N	Number of slots	mm
R	Radius of the circumferential slot	mm

Parameters	Description	Unit
$\alpha 0$	Start angle	Degrees
$\alpha 1$	Opening angle of the groove	Degrees
$\alpha 2$	Angle of advance (only with partial circle)	Degrees
W	Width of the groove	mm
Z1	Groove depth (absolute) or depth relative to Z0 (incremental) (only if ▽, ▽▽▽, or ▽▽▽edge)	mm
DZ	maximum depth infeed (only when ▽, ▽▽▽, or ▽▽▽Edge)	mm
FS	Bevel width for chamfering (only for chamfering)	mm
ZFS	Tool tip plunge depth (only when chamfering)	mm
UXY	Finishing pass plane (only when ▽, ▽▽▽, or ▽▽▽edge)	mm
Positioning	Positioning movement between the slots: <ul style="list-style-type: none"> <li>• Straight line: Next position will be approached in rapid traverse in a straight line.</li> <li>• Circle: Next position will be approached on a circular path with the programmed feed FP.</li> </ul>	

**Information:**

Enter to create a circumferential slot for number (N)=1 and opening angle ( $\alpha 1$ ) = 360°.

**Cycle Description**

**1** The control system positions the tool in rapid traverse (G0) at the retract plane height on the center point of the half circle at the slot end and at the safety distance. The start point lies on the positive X-axis rotated by  $\alpha 0$ .

With the last feed there will be finished from the center point of the semi-circle at the slot end from the center.

Minimum diameter of the milling tool: 1/2 Slot width  $W \leq$  milling cutter tool

**2** The tool mills into the material with the processing feed according to the selected strategy. The max. infeed in the Z-direction as well as the finishing pass will be taken into account.

**3c** Processing ▽▽▽ Edge finishing

Edge finishing takes place as with finishing. Only the last infeed (bottom finishing) is absent.

Minimum diameter of the milling tool: Finishing pass  $UXY \leq$  milling cutter tool diameter

**3a** Processing ▽ Roughing

During roughing the individual planes of the slot will be processed from the centre point of the half circle at the slot end until the depth Z1 is reached.

Minimum diameter of the milling tool: 1/2 Slot width  $W -$  Finishing pass  $UXY \leq$  Milling cutting tool diameter

**3d** Processing Chamfering

During chamfering the edge on the top of the circular slot will be breached.

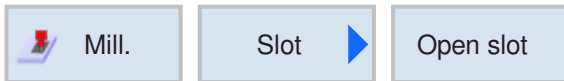
**4** Once the first circumferential slot is finished, the tool moves to the retract level in rapid traverse.

**3b** Processing ▽▽▽ Finishing

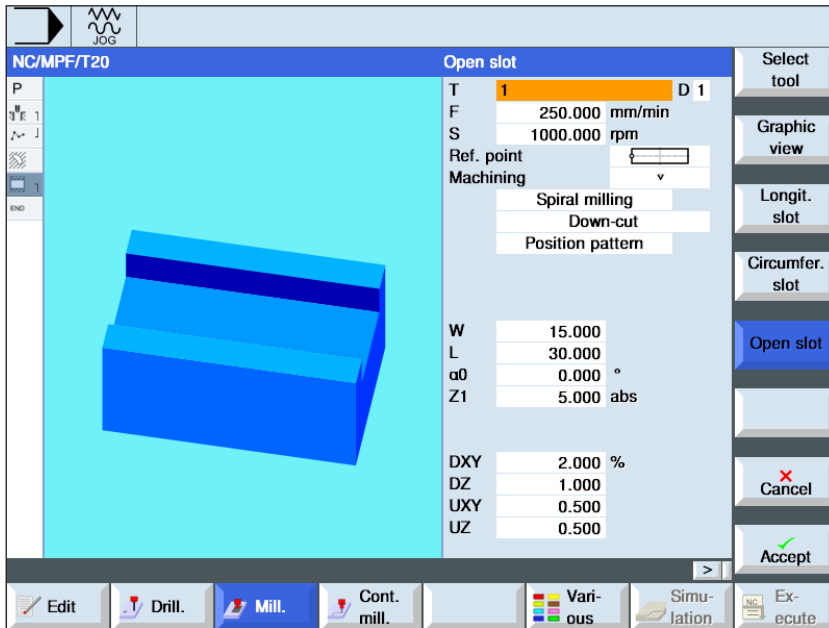
During finishing the edge will always be processed first, until depth Z1 is reached. In the process the slot edge will be approached in the quarter circle in which it joins the radius.

**5** The following circumferential slot will be approached on a straight line or circular path and then milled.

**6** The tool moves back to the safety distance in rapid traverse (G0).



## Open slot



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/tooth
S / V	Spindle speed or constant cutting speed	R/min m/min
Reference point	<ul style="list-style-type: none"> <li> (left edge)</li> <li> (centre)</li> <li> (right edge)</li> </ul>	
Processing	<ul style="list-style-type: none"> <li>▽ Roughing</li> <li>▽▽ Pre-finishing</li> <li>▽▽▽ Finishing</li> <li>▽▽▽ Bottom finishing</li> <li>▽▽▽ Edge finishing</li> <li>• Chamfering</li> </ul>	
Technology	<ul style="list-style-type: none"> <li>• Trochoidal milling Circular movement of the milling cutter tool through the slot and back again.</li> <li>• Plunge milling Sequential drilling movements along the tool axis.</li> </ul>	
Milling direction	<ul style="list-style-type: none"> <li>• Down-cut milling</li> <li>• Up-cut</li> </ul>	



Parameters	Description	Unit
Processing position	<ul style="list-style-type: none"> <li>Individual position Mill slot at the programmed position (X0, Y0, Z0).</li> <li>Position template Mill several slots on a programmed position template (e.g.: full circle or grid).</li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point: Reference point in X, Y and Z	mm
W	Width of the groove	mm
L	Length of the groove	mm
$\alpha_0$	Width of the groove	Degrees
Z1	Slot depth (absolute) or depth relative to Z0 (incremental) (only if $\nabla$ , $\nabla\nabla\nabla$ , or $\nabla\nabla\nabla\nabla$ )	mm
DXY	<ul style="list-style-type: none"> <li>maximum level infeed</li> <li>Position template maximum level infeed as a percentage of the milling cutter diameter (only when <math>\nabla</math>)</li> </ul>	mm
DZ	maximum depth infeed	mm
UXY	Finishing pass plane (slot edge)	mm
UZ	Finishing pass depth (slot bottom)	mm
FS	Bevel width for chamfering (only for chamfering)	mm
ZFS	Tool tip plunge depth (only when chamfering)	mm

**General limit conditions:**

- $1/2$  Slot width  $W \leq$  milling cutter tool
- Finishing edge finishing pass  $UXY \leq$  milling cutting tool diameter
- Chamfer tip angle must be registered in tool table.

**Limit conditions for trochoidal milling:**

- Roughing:  $1/2$  Slot width  $W -$  Finishing pass  $UXY \leq$  Milling cutting tool diameter
- Slot width: at least  $1.15 \times$  milling cutting tool diameter + finishing pass at most  $2 \times$  milling cutting tool diameter +  $2 \times$  finishing pass
- Radial infeed: at least  $0.02 \times$  milling cutting tool diameter at most  $0.25 \times$  milling cutting tool diameter
- Maximum infeed depth  $\leq$  Cutting height of the milling cutting tool

**Limit conditions for plunge milling:**

- Roughing:  $1/2$  Slot width  $W -$  Finishing pass  $UXY \leq$  Milling cutting tool diameter
- Maximum radial infeed: The maximum infeed is dependent on the cutting width of the milling cutter tool.
- Increment: The sideways increment results from the desired slot width, the milling cutting tool diameter and the finishing pass.
- Retraction: The retraction takes place with withdrawal at an angle of  $45^\circ$ , if the wrap angle is less than  $180^\circ$ . Otherwise a vertical retraction takes place as with drilling.
- Withdrawal: The tracing takes place vertically on the wrapped surface.
- Safety distance: Move the safety distance beyond the end of the workpiece to avoid rounding of the slot walls at the ends.

The cutting width of the milling cutter tool for the maximum radial infeed cannot be tested.

**Cycle Description****Trochoidal milling**

- 1 The control system positions the tool in rapid traverse (G0) at the start point in front of the groove and at the safety distance. The start point lies on the positive X-axis rotated by  $\alpha 0$ .
- 2 The tool feeds in to the cut depth.
- 3 The processing of the open slot always takes place with the selected processing type over the complete slot length.

**3a Processing ▽ Roughing**

The roughing is carried out with a circular movement of the mill cutting tool. During these movements the milling cutter tool will be continually fed further into the plane. If the milling cutter tool has traced the entire slot, the milling cutter tool also moves back in a circular movement and in this way drops to the next level (infeed depth) in the Z-direction. This procedure repeats until the preset slot depth plus finishing pass is reached.

**3b Processing ▽ ▽ Finishing**

If there is too much residual material on the slot walls, superfluous corners will be cleared away to the finishing pass.

**3c Processing ▽ ▽ ▽ Finishing**

When finishing the walls the milling cutter tool moves along the slot walls, in which, as with roughing in the Z-direction, also against is feed in step by step. In this the milling cutter tool moves over the slot start and slot end by the safety distance, in order to guarantee that the slot wall has an even surface over the entire length of the slot.

**3d Processing ▽ ▽ ▽ Bottom finishing**

In bottom finishing the milling cutter tool moves into the finished slot once and once back.

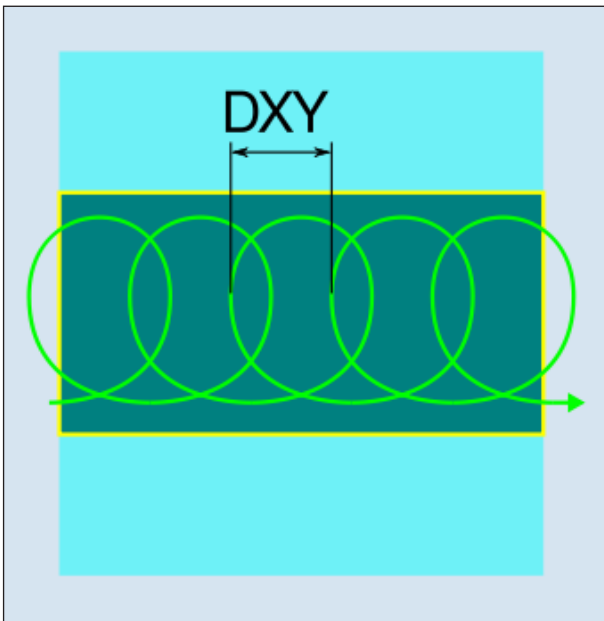
**3e Processing ▽ ▽ ▽ Edge finishing**

Edge finishing takes place as with finishing. Only the last infeed (bottom finishing) is absent.

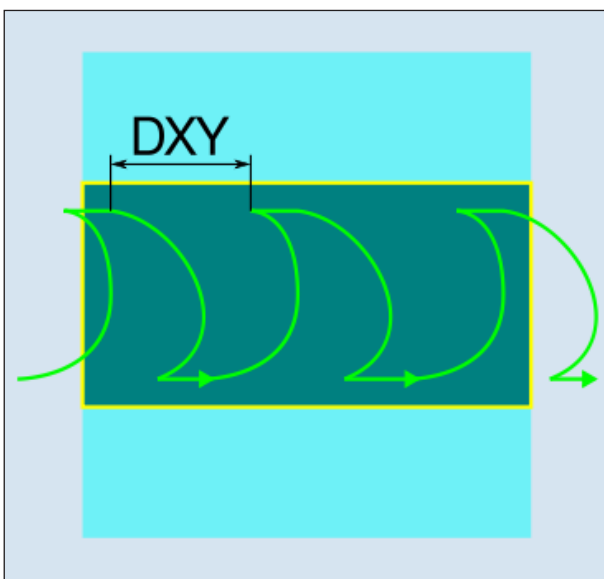
**3f Processing Chamfering**

During chamfering the edge on the top of the slot will be breached.

- 4 The tool moves back to the safety distance in rapid traverse (G0).



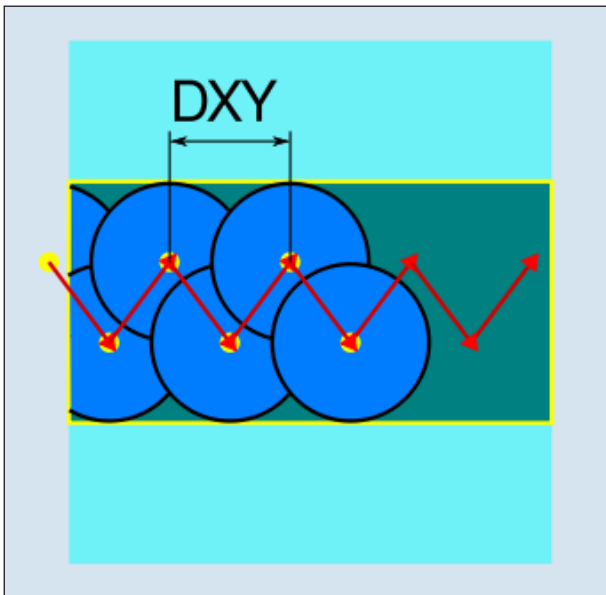
*Down-cut or up-cut milling - plunge milling*



*Down-cut milling/Up-cut milling - trochoidal milling*

**Cycle Description****Plunge milling**

- 1 The control system positions the tool in rapid traverse (G0) at the start point in front of the groove and at the safety distance. The start point lies on the positive X-axis rotated by  $\alpha 0$ .
- 2 The processing of the open slot always takes place with the selected processing type over the complete slot length.

**3a Processing ▾ Roughing***Down-cut or up-cut plunge milling*

The roughing of the slot takes place sequentially along the slot through vertical plunge movements of the milling cutter tool with work feed. Afterwards there is a withdrawal and a position movement to the next plunge point. There will be alternate plunging on the left and right wall, along the slot, displaced by the infeed amount in each case. The first plunge movement takes place at the edge of the slot with a milling cutter operation of a half infeed minus the safety distance. (Thus in the open air if the safety distance is larger than the infeed.) For this cycle the maximum width of the slot must be smaller than the double width of the milling cutter + finishing pass. After each plunging movement the milling cutter also lifts up by the safety distance at working feed. This happens according to possibility in the so-called retract procedure, i.e. when the milling cutter tool has an angle of contact of less than  $180^\circ$  it lifts  $45^\circ$ . Then the milling cutter moves over the material in rapid traverse.

**3b Processing ▾ ▾ Pre-finishing**

If there is too much residual material on the slot walls, superfluous corners will be cleared away to the finishing pass.

**3c Processing ▾ ▾ ▾ Finishing**

When finishing the walls the milling cutter tool moves along the slot walls, in which, as with roughing in the Z-direction, also against is feed in step by step. In this the milling cutter tool moves over the slot start and slot end by the safety distance, in order to guarantee that the slot wall has an even surface over the entire length of the slot.

**3c Processing ▾ ▾ ▾ Bottom finishing**

In bottom finishing the milling cutter tool moves into the finished slot once and once back.

**3e Processing ▾ ▾ ▾ Edge finishing**

Edge finishing takes place as with finishing. Only the last infeed (bottom finishing) is absent.

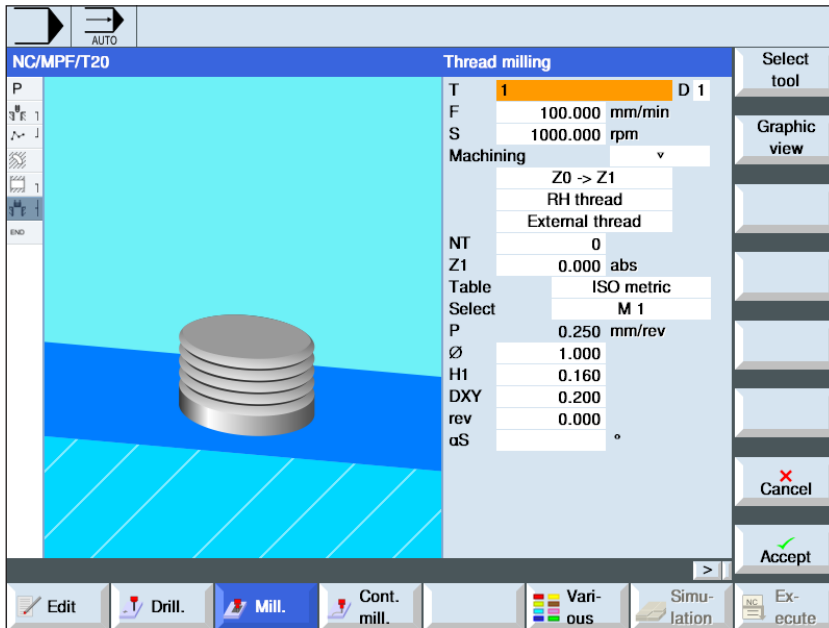
**3f Processing Chamfering**

During chamfering the edge on the top of the slot will be breached.

- 4 The tool moves back to the safety distance in rapid traverse (G0).



## Thread milling



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/tooth
S / V	Spindle speed or constant cutting speed	Rev/min m/min
Processing	<ul style="list-style-type: none"> <li>▾ Roughing</li> <li>▾ ▾ ▾ Finishing</li> </ul>	
Processing direction	<ul style="list-style-type: none"> <li>• Z0 → Z1 Top-down processing</li> <li>• Z1 → Z0 Bottom-up processing</li> </ul>	
Thread's direction of rotation	<ul style="list-style-type: none"> <li>• Right-hand thread A right-hand thread will be milled.</li> <li>• Left-hand thread A left-hand thread will be milled.</li> </ul>	
Position of the thread	<ul style="list-style-type: none"> <li>• Internal thread An internal thread will be milled.</li> <li>• External thread An external thread will be milled.</li> </ul>	
NT	Number of teeth per blade Single or multi-tooth milling inserts can be used. The required movements will be executed by the cycle internally in such a way that upon reaching the thread end position the tip of the lower tooth of a milling insert matches the programmed end position. Depending on the blade geometry a clearance path at the bottom of the workpiece has to be taken into account.	

Parameters	Description	Unit
Z1	End point of the thread (absolute) or thread length (incremental)	mm
Table	Thread selection table: <ul style="list-style-type: none"> <li>• None</li> <li>• ISO metric</li> <li>• Whitworth BSW</li> <li>• Whitworth BSP</li> <li>• UNC</li> </ul>	
Selection	Selection of the table value e.g.: <ul style="list-style-type: none"> <li>• M1; M5; etc. (ISO metric)</li> <li>• W1/8"; etc. (Whitworth BSW)</li> <li>• G 1 3/4"; etc. (Whitworth BSP)</li> <li>• N8 - 32 UNC; etc. (UNC)</li> </ul> (also see thread table with the respective pitches)	
P	Display of the thread pitch (only with table selection "none") <ul style="list-style-type: none"> <li>• in MODULE: <math>MODULE = \text{pitch}/\pi</math></li> <li>• in threads per inch: typical for tube threads.</li> </ul> With the per inch input, in the first parameter field the whole number before the decimal point is entered and in the second and third field the number after the decimal point is entered as a fraction. <ul style="list-style-type: none"> <li>• in mm/rev</li> <li>• in inch/rev</li> </ul> The thread pitch is dependent on the tool used.	MODULE Threads/" mm/rev in/rev
∅	Nominal diameter, Example: Nominal diameter of M12 = 12 mm	mm
H1	Thread depth	mm
αS	Start angle	Degrees
R	Finishing pass in X and Y	mm

## Thread table

ISO_METRIC		WHITWORTH_BSW		WHITWORTH_BSP		UNC	
M 1	0.250	W 1/16"	60.000	G 1/16"	28.000	N 1 - 64 UNC	64.000
M 1.2	0.250	W 3/32"	48.000	G 1/8"	28.000	N 2 - 56 UNC	56.000
M 1.6	0.350	W 1/8"	40.000	G 1/4"	19.000	N 3 - 48 UNC	48.000
M 2	0.400	W 5/32"	32.000	G 3/8"	19.000	N 4 - 40 UNC	40.000
M 2.5	0.450	W 3/16"	24.000	G 1/2"	14.000	N 5 - 40 UNC	40.000
M 3	0.500	W 7/32"	24.000	G 5/8"	14.000	N 6 - 32 UNC	32.000
M 3.5	0.600	W 1/4"	20.000	G 3/4"	14.000	N 8 - 32 UNC	32.000
M 4	0.700	W 5/16"	18.000	G 7/8"	14.000	N 10 - 24 UNC	24.000
M 4.5	0.750	W 3/8"	16.000	G 1"	11.000	N 12 - 24 UNC	24.000
M 5	0.800	W 7/16"	14.000	G 1 1/8"	11.000	1/4" - 20 UNC	20.000
M 6	1.000	W 1/2"	12.000	G 1 1/4"	11.000	5/16" - 18 UNC	18.000
M 8	1.250	W 9/16"	12.000	G 1 3/8"	11.000	3/8" - 16 UNC	16.000
M 10	1.500	W 5/8"	11.000	G 1 1/2"	11.000	7/16" - 14 UNC	14.000
M 12	1.750	W 3/4"	10.000	G 1 3/4"	11.000	1/2" - 13 UNC	13.000
M 14	2.000	W 7/8"	9.000	G 2"	11.000	9/16" - 12 UNC	12.000
M 16	2.000	W 1"	8.000	G 2 1/4"	11.000	5/8" - 11 UNC	11.000
M 18	2.500	W 1 1/8"	7.000	G 2 1/2"	11.000	3/4" - 10 UNC	10.000
M 20	2.500	W 1 1/4"	7.000	G 2 3/4"	11.000	7/8" - 9 UNC	9.000
M 22	2.500	W 1 3/8"	6.000	G 3"	11.000	1" - 8 UNC	8.000
M 24	3.000	W 1 1/2"	6.000	G 3 1/4"	11.000	1 1/8" - 7 UNC	7.000
M 27	3.000	W 1 5/8"	5.000	G 3 1/2"	11.000	1 1/4" - 7 UNC	7.000
M 30	3.500	W 1 3/4"	5.000	G 3 3/4"	11.000	1 3/8" - 6 UNC	6.000
M 33	3.500	W 1 7/8"	4.500	G 4"	11.000	1 1/2" - 6 UNC	6.000
M 36	4.000	W 2"	4.500	G 5"	11.000	1 3/4" - 5 UNC	5.000
M 39	4.000	W 2 1/4"	4.000	G 6"	11.000	2" - 4 1/2 UNC	4.500
M 42	4.500	W 2 1/2"	4.000			2 1/4" - 4 1/2 UNC	4.500
M 45	4.500	W 2 3/4"	3.500			2 1/2" - 4 UNC	4.000
M 48	5.000	W 3"	3.500			2 3/4" - 4 UNC	4.000
M 52	5.000	W 3 1/4"	3.250			3" - 4 UNC	4.000
M 56	5.500	W 3 1/2"	3.250			3 1/4" - 4 UNC	4.000
M 60	5.500	W 3 3/4"	3.000			3 1/2" - 4 UNC	4.000
M 64	6.000	W 4"	3.000			3 3/4" - 4 UNC	4.000
M 68	6.000					4" - 4 UNC	4.000

Thread table with pitches

**Cycle Description****Internal thread**

- 1 The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2 Approach start point of the inward circular arc in the current plane with rapid traverse.
- 3 Infeed with rapid traverse to a start point in the tool axis calculated internally by the control system.
- 4 Inward arc movement at thread diameter at programmed feed to an inward arc calculated internally by the control system, taking into account the finishing pass and maximum infeed depth.
- 5 Thread milling on a spiral path in the clockwise direction or in the counter-clockwise direction (dependent on left-hand/right-hand thread, with number of blade teeth in a milling insert  $(NT) \geq 2$  only 1 revolution, displaced in the Z-direction).
- 6 Outwards movement on a circular path with the same direction of rotation and the programmed feed.
- 7 With a programmed number of thread pitches per blade  $NT > 2$  the tool will be infeed by the number  $NT-1$  in the Z-direction (displaced). Points 4 to 7 are repeated until the programmed thread depth is reached.
- 8 If the plane infeed is smaller than the thread depth, points 3 to 7 will be repeated until the thread depth + programmed extent is reached.
- 9 The tool moves back in rapid traverse (G0) to the coordinates of the thread center on the retraction plane.

**Limit conditions for internal thread milling:**

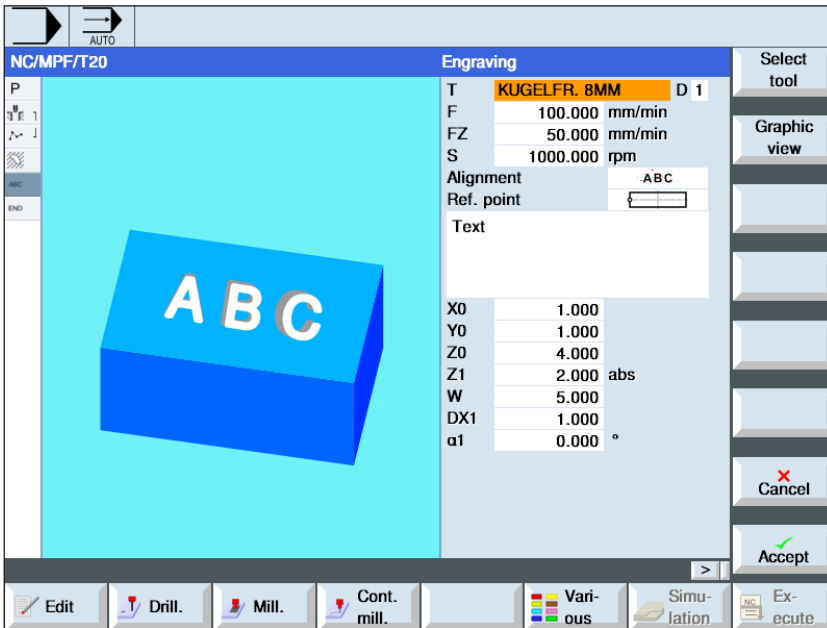
During internal thread milling the milling cutting tool diameter may not exceed the following value:  
Milling cutter diameter < (Nominal diameter - 2x thread depth H1)

**Cycle Description****External thread**

- 1 The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2 Approach start point of the inward circular arc in the current plane with rapid traverse.
- 3 Infeed with rapid traverse to a start point in the tool axis calculated internally by the control system.
- 4 Inward arc movement at thread diameter at programmed feed to an inward arc calculated internally by the control system, taking into account the finishing pass and maximum infeed depth.
- 5 Thread milling on a spiral path in the clockwise direction or in the counter-clockwise direction (dependent on left-hand/right-hand thread, with  $(NT) \geq 2$  only 1 revolution, displaced in the Z-direction).
- 6 Outwards movement on a circular path with the opposite the set direction of rotation and the programmed feed.
- 7 With a programmed number of thread pitches per blade  $NT > 2$  the tool will be infeed by the number  $NT-1$  in the Z-direction (displaced). Points 4 to 7 are repeated until the programmed thread depth is reached.
- 8 If the plane infeed is smaller than the thread depth, points 3 to 7 will be repeated until the thread depth + programmed extent is reached.
- 9 The tool moves back in rapid traverse (G0) to the coordinates of the thread center on the retraction plane.



## Engraving



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/tooth
S / V	Spindle speed or constant cutting speed	Rev/min m/min
FZ	Infeed depth	m/min mm/tooth
Alignment	<ul style="list-style-type: none"> <li>•  (linear alignment)</li> <li>•  (curved alignment)</li> <li>•  (curved alignment)</li> </ul>	
Reference point	<ul style="list-style-type: none"> <li>•  (bottom left)</li> <li>•  (bottom right)</li> <li>•  (top left)</li> <li>•  (top right)</li> <li>•  (left edge)</li> <li>•  (centre)</li> <li>•  (right edge)</li> </ul>	
Engraving text	max. 100 characters	
X0 Y0 Z0	Reference point in X, Y and Z	mm

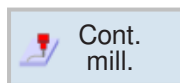


Parameters	Description	Unit
R	Reference polar length (only for curved alignment)	mm
$\alpha 0$	Reference polar angle (only for curved alignment)	Degrees
Z1	Engraving depth (absolute) or depth related to Z0 (incremental)	mm
W	Symbol height	mm
DX1 $\alpha 2$	Character spacing or opening angle (only for curved alignment)	mm Degrees
DX1 DX2	Character spacing or overall width (only for linear alignment)	mm
$\alpha 1$	Text alignment (only for linear alignment)	Degrees

#### Cycle Description

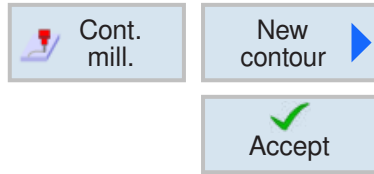
- 1 The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the start point.
- 2 The tool moves with infeed FZ to the processing depth Z1 and mills the symbol.
- 3 The tool pulls back to the safety distance in rapid traverse and moves in a straight line to the next symbol.
- 4 Steps 2 and 3 will be repeated until the whole text has been milled.
- 5 The tool moves back in rapid traverse (G0) to the coordinates of the thread center on the retraction plane.





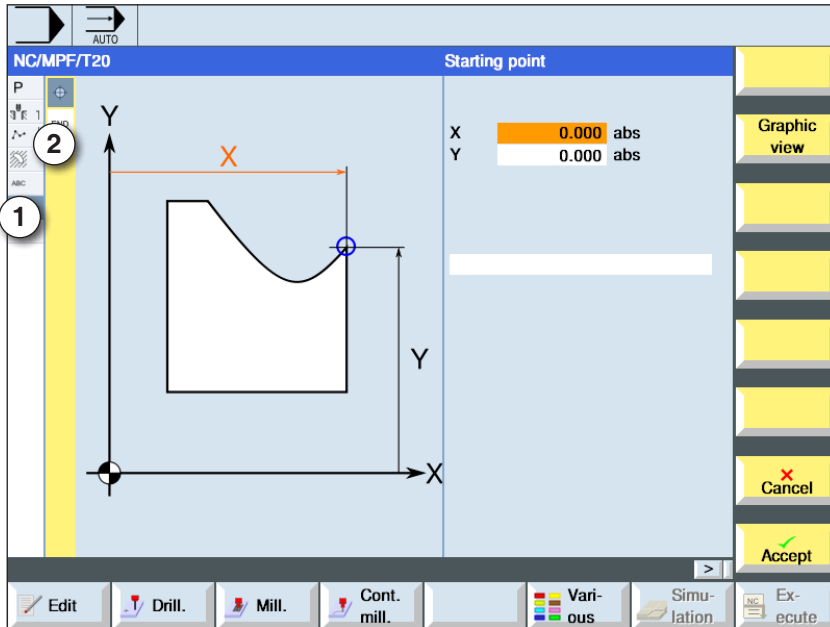
## Contour milling

- New contour
- Path milling
- Rough drilling
- Pocket
- Spigot



## Create new contour

- Enter program name and confirm with softkey. If the program name already exists an error message comes up with the requests to enter a new name.



### Information:

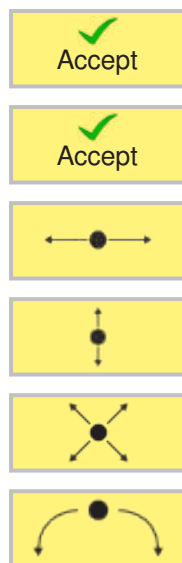
The individual contour elements of a contour will be shown symbolically in the indicated sequence on the left alongside the graphic window.

On the far left the individual cycles of a program are symbolically represented in the indicated sequence (1).

- 1 Cycle symbols
- 2 Contour elements

- Then the start point of the contour will be entered.
- If applicable, enter additional commands in the form of G-Code.
- Press softkey to apply the cycle in the workpiece program.

Enter individual contour elements and apply with softkey:



Straight line element in X

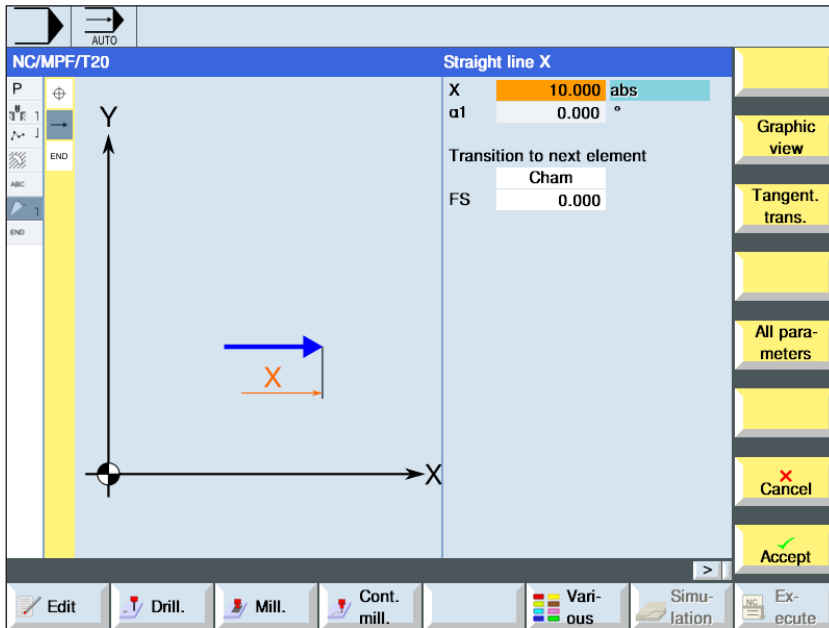
Straight line element in Y

Straight line element in XY

Circular element



### Straight line X

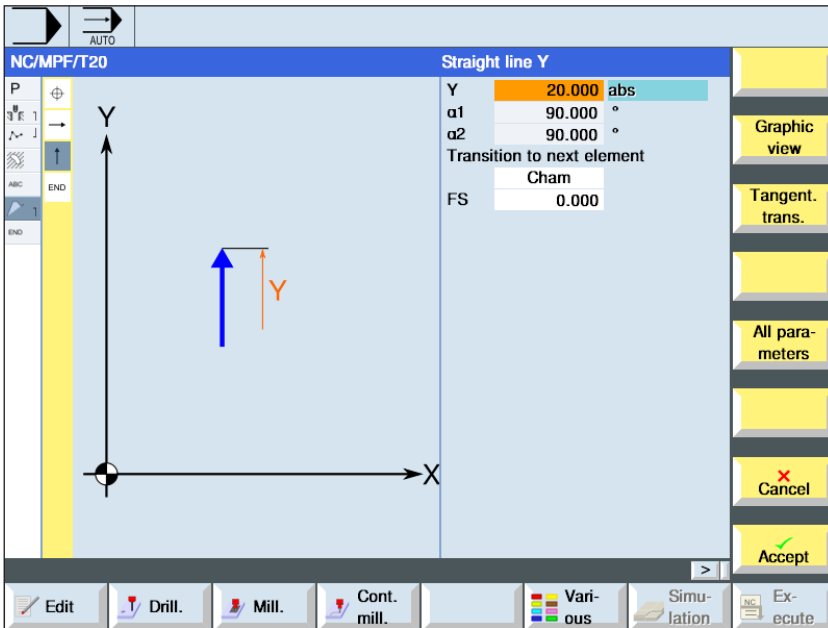


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
X	End point X (absolute or incremental)	mm
$\alpha 1$	Start angle e.g. to X-axis	degrees
$\alpha 2$	Angle to previous element	degrees
Transition to succeeding element	Type of transition <ul style="list-style-type: none"> <li>• Radius</li> <li>• Bevel</li> </ul>	
R	Transition to succeeding element - Radius	mm
F	Transition to succeeding element - Bevel	mm
Additional commands	Additional G-code commands	



### Straight line Y

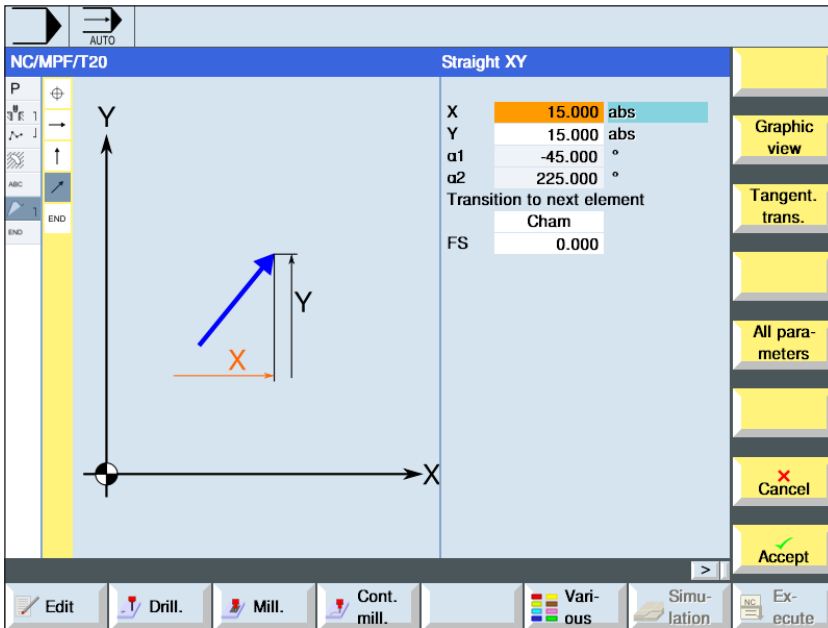


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Y	End point Y (absolute or incremental)	mm
$\alpha 1$	Start angle e.g. to Y-axis	degrees
$\alpha 2$	Angle to previous element	degrees
Transition to succeeding element	Type of transition • Radius • Bevel	
R	Transition to succeeding element - Radius	mm
F	Transition to succeeding element - Bevel	mm
Additional commands	Additional G-code commands	



### Straight XY

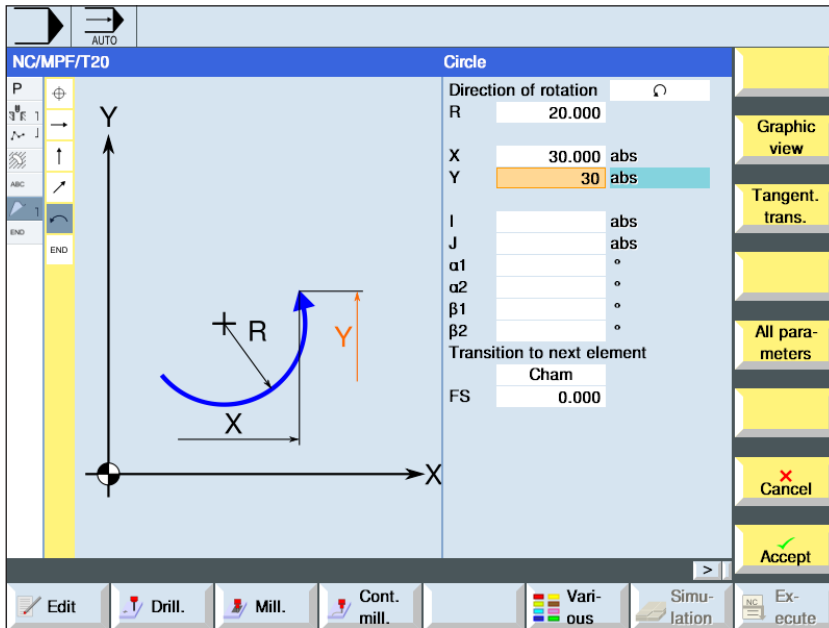


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
X	End point X (absolute or incremental)	mm
Y	End point Y (absolute or incremental)	mm
L	Length	mm
$\alpha 1$	Start angle e.g. to X-axis	degrees
$\alpha 2$	Angle to previous element	degrees
Transition to succeeding element	Type of transition <ul style="list-style-type: none"> <li>• Radius</li> <li>• Bevel</li> </ul>	
R	Transition to succeeding element - Radius	mm
F	Transition to succeeding element - Bevel	mm
Additional commands	Additional G-code commands	



### Contour element circle



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Direction of rotation	<ul style="list-style-type: none"> <li> Direction of rotation right</li> <li> Direction of rotation left</li> </ul>	
R	Radius	mm
X Y	Coordinates of the end points in X and Y (absolute or incremental)	mm
I J	Coordinates of the circle centre in I and J (absolute or incremental)	mm
$\alpha 1$	Start angle to X-axis	degrees
$\alpha 2$	Angle to previous element	degrees
$\beta 1$	End angle to Z-axis	degrees
$\beta 2$	Opening angle	degrees
Transition to succeeding element	Type of transition <ul style="list-style-type: none"> <li>• Radius</li> <li>• Bevel</li> </ul>	
R	Transition to succeeding element - Radius	mm
F	Transition to succeeding element - Bevel	mm
Additional commands	Additional G-code commands	



Graphic view

**Other functions:**

- Change view  
This softkey switches between the graphics window and the input screen.

Tangent to prev.

- Tangent to previous element  
Program the transition to the previous element as a tangent.

Dialog select

- Dialog selection  
If two different contour options result from previously entered parameters, one of them must be selected.

Dialog accept

- Apply the selection contour option with the softkey.

Change selection

- Select dialog concerned  
When a dialogue selection has already been made this softkey changes the selected solution again.

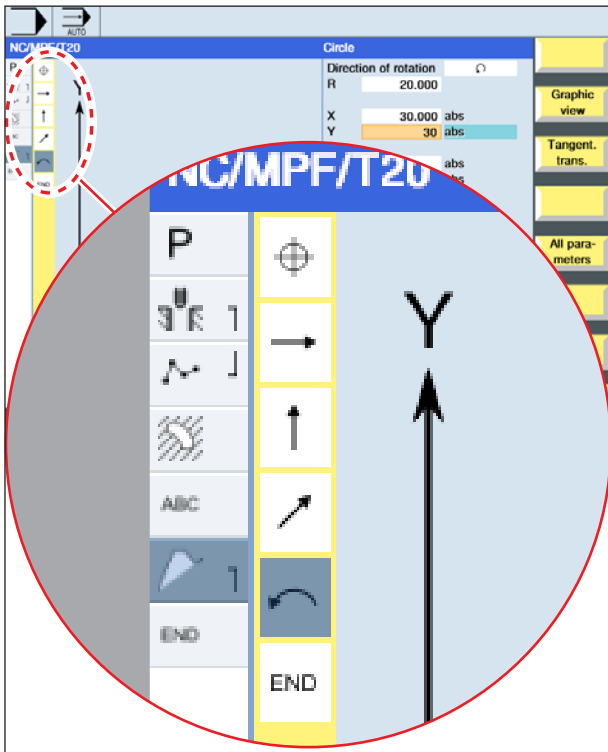
All parameters

- Display additional parameters  
If additional parameters should be shown for individual contour elements, e.g. to enter additional commands.

Close contour

- Close contour  
The contour will be closed from the current position with a straight line to the start point.

**Symbol representation of the contour elements:**

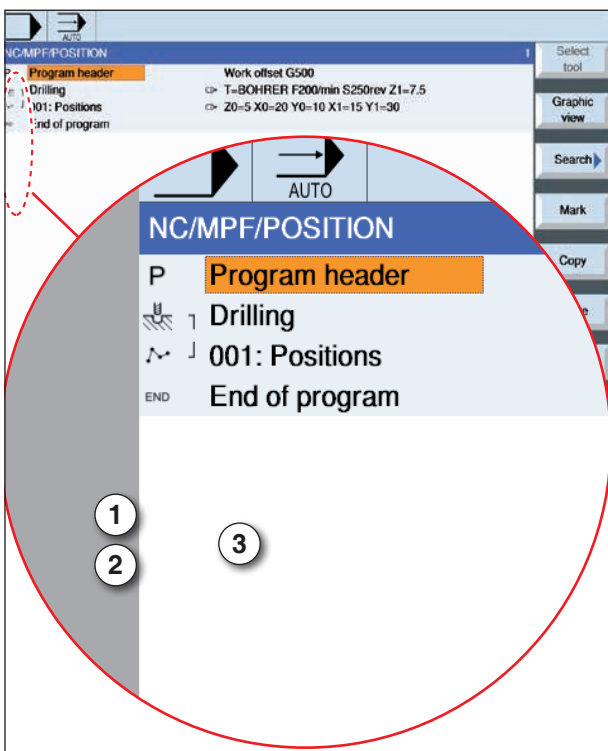


Contour element	Symbol	Meaning
Start point		Start point of the contour
Straight up Straight down		Straight line in 90° grid
Straight left Straight right		Straight line in 90° grid
Straight line anywhere		Straight line with arbitrary pitch
Curve right Curve left		Circle
Contour termination	END	End of the contour description

The contour element can accept different line types and colours:

- Black: Programmed contour
- Orange: Current contour element
- Line-dot-dot: Partially-defined element

The scaling of the coordinate system adapts to the change of the entire contour.

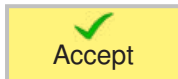
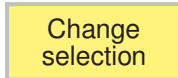


**Link representation of contour elements with contour cycles:**

A complete contour cycle consists of the associated contour (1) and the processing cycle (2). The programming sequence must be observed: The contour will be created first and the processing cycle afterwards (e.g.: path milling). The control system links both program parts with a symbolic bracket (3) in the cycle list.

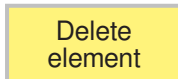
## Change contour

### Change contour element



- Open the program to be processed.
- Use the cursor to select the program block in which the contour should be changed. The individual contour elements will be listed.
- Position cursor at the point to insert or change.
- Select the desired contour element with the softkey.
- Enter parameter in the input screen or delete the element and select a new element.
  - Press softkey. The desired contour element will be inserted or changed on the contour.

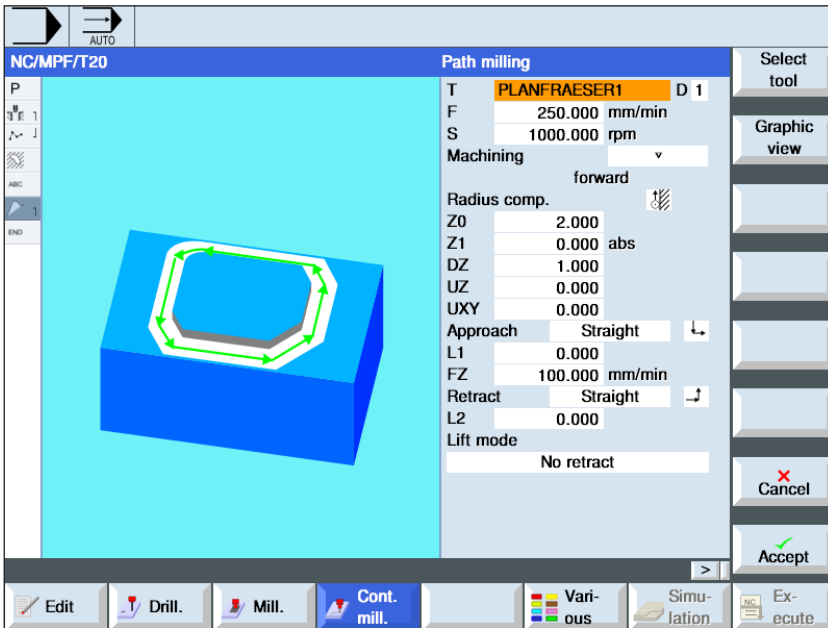
### Delete contour element



- Open the program to be processed.
- Position cursor on the contour element that should be deleted.
- Press softkey.
  - Press softkey.







## Path milling



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/tooth
S / V	Spindle speed or constant cutting speed	Rev/min m/min
Processing	<ul style="list-style-type: none"> <li>• ▾ Roughing</li> <li>• ▾ ▾ Finishing</li> <li>• Chamfer</li> </ul>	
Processing direction	<ul style="list-style-type: none"> <li>• forwards: The processing takes place in the programmed contour direction.</li> </ul>	
Radius correction	<ul style="list-style-type: none"> <li>•  left (processing left from the contour)</li> <li>•  right (processing right from the contour)</li> <li>•  off</li> </ul> <p>A programmed contour can also be programmed on the centre point path. In this, movement in or out is possible in a straight line or vertically. Moving in and out vertically can also, for example, be used with closed contours.</p>	
Z0	Reference point Y (absolute or incremental)	mm
Z1	Final depth (absolute) or final depth relative to Z0 (incremental) (only if ▾, or ▾ ▾ ▾)	mm
DZ	maximum depth infeed (only if ▾, or ▾ ▾ ▾)	mm
UZ	Finishing pass plane (only when ▾)	mm
FS	Bevel width for chamfering (incremental) (only for chamfering)	mm

Parameters	Description	Unit
ZFS	Tool tip plunge depth (absolute or incremental) (only for chamfer)	mm
UXY	Finishing pass plane (only when □)	mm
Approach mode	<p>Approach mode level</p> <ul style="list-style-type: none"> <li>• Straight line: Slope in space</li> <li>• Quarter circle: Part of a spiral (only when path milling left and right of the contour)</li> <li>• Half-circle: Part of a spiral (only when path milling left and right of the contour)</li> <li>• Vertical: Vertical to path (only for path milling on the center point path)</li> </ul>	
Approach strategy	<ul style="list-style-type: none"> <li>•  axially</li> <li>•  three-dimensionally (only when approaching "Quarter circle, semi-circle or straight line")</li> </ul>	
R1	Approach radius	mm
L1	Approach length	mm
Withdraw mode	<p>Withdraw mode plane</p> <ul style="list-style-type: none"> <li>• Straight line:</li> <li>• Quarter circle: Part of a spiral (only when path milling left and right of the contour)</li> <li>• Half-circle: Part of a spiral (only when path milling left and right of the contour)</li> <li>• Vertical: Vertical to path (only for path milling on the center point path)</li> </ul>	
Withdrawal strategy	<ul style="list-style-type: none"> <li>•  axially</li> <li>•  three-dimensionally (only when approaching "Quarter circle, semi-circle or straight line")</li> </ul>	
R2	Withdraw radius	mm
L2	Withdraw length	mm
Lift mode	<p>When several depth infeeds are required, indicate retraction height to which the tool should pull back between the individual infeeds (during transition from end of the contour to the start). Lift mode before renewed infeed</p> <ul style="list-style-type: none"> <li>• Z0 + safety distance</li> <li>• by safety distance</li> <li>• on RP...retraction plane</li> <li>• no retraction</li> </ul>	
FR	Retraction plan for interim positioning - (not during lifting mode "no retraction")	

**Approach and withdrawal mode**

The contour can be approached or withdrawn from in a quarter circle, semi-circle or straight line.

- For the quarter-circle or semi-circle the radius of the milling cutting tool center point must be indicated.
- With straight lines the distance from the external edge of the milling cutter to the contour start point or contour end point must be indicated.

Mixed programming is also possible, e.g. approach in quarter circle.

Withdraw in semi-circle.

**Strategy for approach/withdrawal**

You can selected between planar approach/withdrawal and three-dimensional approach/withdrawal:

- Planar approach:  
first the depth and then the processing plane will be approached.
- Three-dimensional approach:  
the depth and processing plane will be approached simultaneously.
- Withdrawal takes place in the reverse order.

Mixed programming is possible, e.g. approaching in the processing plane, withdrawing three-dimensionally.

**Path milling on the center point path**

A programmed contour can also be processed on the centre point path, if the radius correction was switched off. In this, movement in or out is possible in a straight line or vertically. Vertical approach/withdrawal can be used, for example, with closed contours.

**Cycle Description****1 Path milling (roughing)**

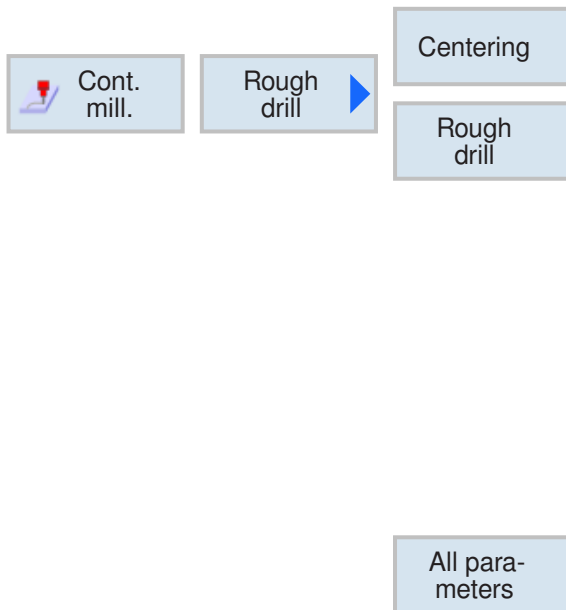
The contour will be processed taking the indicated approach and withdrawal strategies into account.

**2 Path milling (finishing)**

If a finishing pass was programmed during roughing, the contour will be processed again.

**3 Path milling (chamfering)**

If an edge breach is anticipated, the workpiece will be milled with a special tool.



## Pre-drill contour pocket

Alongside pre-drilling the centering option also exists with this cycle. For this centering or pre-drilling programs generated from the cycle are called up.

During clearing of contour pockets, when a milling cutting tool cannot plunge in the center, it is necessary to pre-drill. The number and the positions of the pre-drillings required depends on special circumstances such as e.g. type of contours, tool, plane infeed, finishing pass.

Using this softkey you can enter additional parameters.

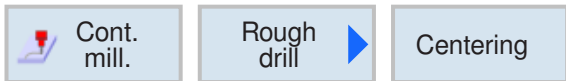
Additional parameters are helpful if several pockets are being drilled and unnecessary tool changes should be avoided. In this way all pockets can initially be pre-drilled and then cleared.

The parameters must correspond to the parameters of the associated clearing step.

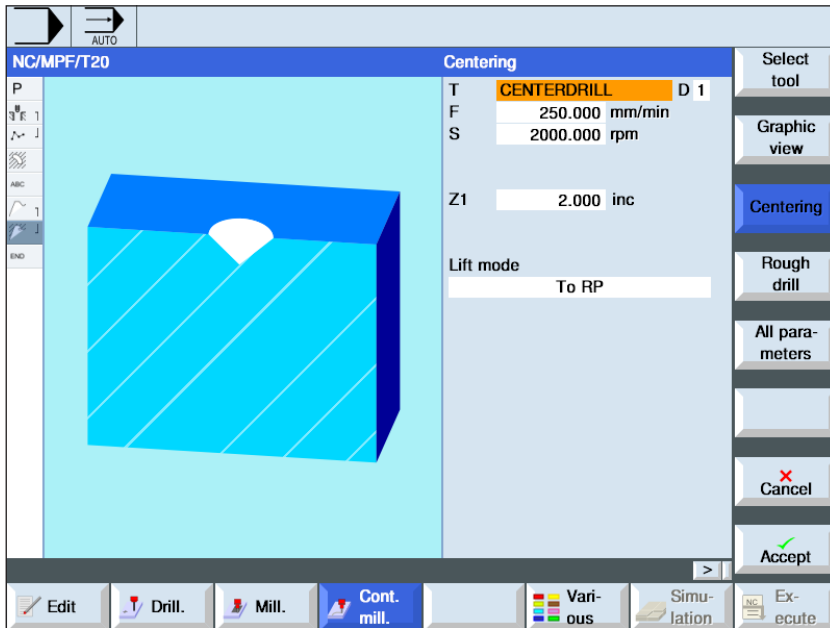
### Programming

- 1 Contour Pocket 1
- 2 Centering
- 3 Contour Pocket 2
- 4 Centering
- 5 Contour Pocket 1
- 6 Rough drill
- 7 Contour Pocket 2
- 8 Rough drill
- 9 Contour Pocket 1
- 10 Clearing
- 11 Contour Pocket 2
- 12 Clearing

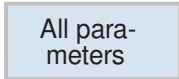
When a pocket is being fully processed (centering, pre-drilling and clearing directly after one another), and the additional parameters for centering/pre-drilling have not been filled out, the cycle applies these parameter values from the Clearing processing step (roughing).



## Centering



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.



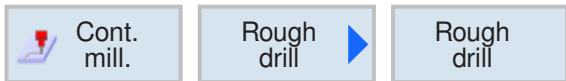
Using this softkey you can enter additional parameters.

Additional parameters are helpful if several pockets are being drilled and unnecessary tool changes should be avoided. In this way all pockets can initially be pre-drilled and then cleared.

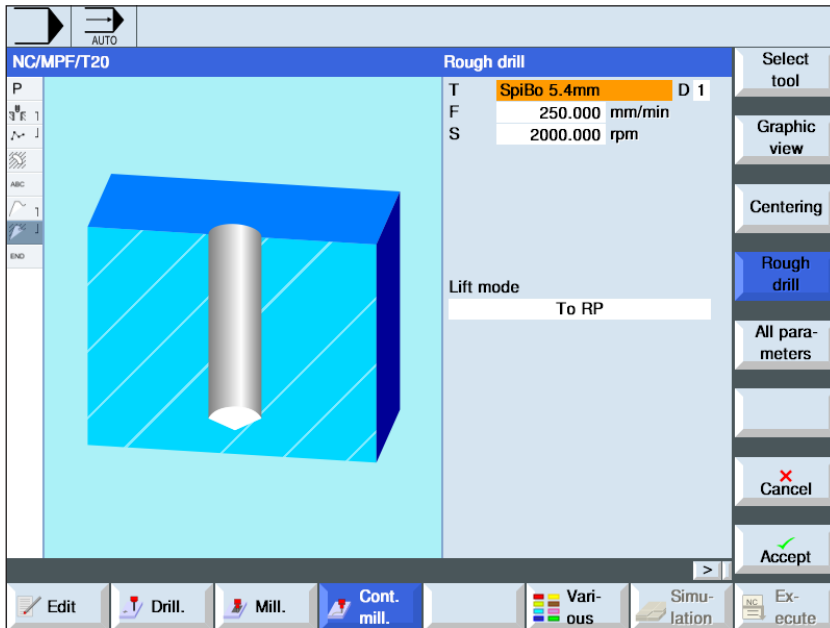
Parameters	Description	Unit
R	Tool name	
D	Cutting number	
F	Feed	mm/min mm/tooth
S / V	Spindle speed or constant cutting speed	Rev/min m/min
TR	Reference tool. Tool used in the "clearing" processing step. Used to determine the plunge position.	
Z0	Reference point	
Z1	Depth relative to Z0 (incremental)	
DXY	<ul style="list-style-type: none"> <li>• maximum plane infeed</li> <li>• maximum plane infeed as a percentage of the milling cutting tool diameter</li> </ul>	mm %
UXY	Finishing pass plane	



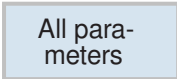
Parameters	Description	Unit
Lift mode	<p>If several plunge points are required during processing, the retraction height can be programmed.</p> <ul style="list-style-type: none"><li>• on the retraction plane</li><li>• Z0 + safety distance</li></ul> <p>During the transition to the next plunge point the tool pulls back to this height. If there are no elements larger than Z0 in the pocket area, Z0 + safety distance can be programmed as lift mode.</p>	mm



## Rough drill



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.



Using this softkey you can enter additional parameters.

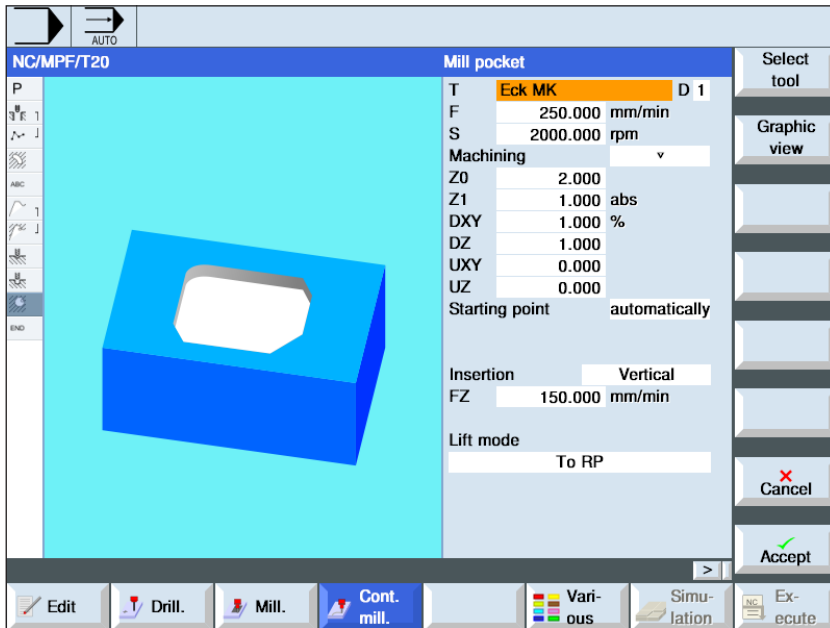
Additional parameters are helpful if several pockets are being drilled and unnecessary tool changes should be avoided. In this way all pockets can initially be pre-drilled and then cleared.

Parameters	Description	Unit
R	Tool name	
D	Cutting number	
F	Feed	mm/min mm/tooth
S / V	Spindle speed or constant cutting speed	Rev/min m/min
TR	Reference tool. Tool used in the "clearing" processing step. Used to determine the plunge position.	
Z0	Reference point	
Z1	Pocket depth (absolute) or depth related to Z0 (incremental)	
DXY	<ul style="list-style-type: none"> <li>• maximum plane infeed</li> <li>• maximum plane infeed as a percentage of the milling cutting tool diameter</li> </ul>	mm %
UXY	Finishing pass plane	
UZ	Finishing pass depth	

Parameters	Description	Unit
Lift mode	<p>If several plunge points are required during processing, the retraction height can be programmed.</p> <ul style="list-style-type: none"><li>• on the retraction plane</li><li>• Z0 + safety distance</li></ul> <p>During the transition to the next plunge point the tool pulls back to this height. If there are no elements larger than Z0 in the pocket area, Z0 + safety distance can be programmed as lift mode.</p>	mm



### Mill pocket



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/tooth
S / V	Spindle speed or constant cutting speed	Rev/min m/min
Processing	<ul style="list-style-type: none"> <li>▾ Roughing</li> <li>▾ ▾ ▾ Bottom finishing</li> <li>▾ ▾ ▾ Edge finishing</li> <li>• Chamfering</li> </ul>	
Z0	Reference point Z	
Z1	Pocket depth (absolute) or depth relative to Z0 (incremental) (only if ▾, ▾ ▾ ▾ bottom, or ▾ ▾ ▾ edge)	mm
DXY	<ul style="list-style-type: none"> <li>• maximum plane infeed</li> <li>• maximum plane infeed as a percentage of the milling cutting tool diameter</li> </ul> (only if ▾, or ▾ ▾ ▾ bottom)	mm %
DZ	maximum depth infeed (only if ▾, or ▾ ▾ ▾ edge)	mm
UXY	Finishing pass plane (only if ▾, ▾ ▾ ▾ bottom, or ▾ ▾ ▾ edge )	mm
UZ	Finishing pass depth (only if ▾, or ▾ ▾ ▾ bottom)	mm
Start point	<ul style="list-style-type: none"> <li>• manual Start point will be specified manually</li> <li>• automatically Start point will be calculated automatically</li> </ul> (only if ▾, or ▾ ▾ ▾ bottom)	

Parameters	Description	Unit
XS YS	Coordinates of the start point in X and Y (only with start point "manual")	
Plunging	(only if ▽, or ▽ ▽ ▽ bottom) <ul style="list-style-type: none"> <li>vertical: Plunge vertically on pocket center: The calculated current infeed depth will be executed in the pocket center in one block. With this setting the milling cutting tool must cut via the center or it must be pre-drilled.</li> <li>helical: Plunging on spiral path: The center of the milling cutter moves on the spiral path defined by the radius and the depth per revolution (helical path). Once the depth for the infeed has been reached, another full circle will be executed, in order to overcome the angular path of the plunge.</li> <li>swinging: Plunge swinging on the center axis of the longitudinal groove: The center of the milling cutter swings on a straight line back and forth till the depth infeed is reached. Once the depth has been reached, the path will be executed again without the depth infeed, in order to overcome the angular path of the plunge.</li> </ul>	
FZ	Infeed depth (only when plunging vertically and ▽)	mm/min mm/tooth
EP	Maximum pitch of the helix - (only with helical plunging)	mm/rev
ER	Radius of the helix (only with helical plunging) The radius may not be larger than the milling cutting tool radius, as otherwise material remains.	mm
EW	Maximum plunge angle (only with swinging plunging)	Degrees
Lift mode before renewed infeed	If several plunge points are required during processing, the retraction height can be programmed. <ul style="list-style-type: none"> <li>on the retraction plane</li> <li>Z0 + safety distance</li> </ul> During the transition to the next plunge point the tool pulls back to this height. If there are no elements larger than Z0 in the pocket area, Z0 + safety distance can be programmed as lift mode. (only if ▽, ▽ ▽ ▽ bottom, or ▽ ▽ ▽ edge)	mm
FS	Bevel width for chamfering (only for chamfering)	mm
ZFS	Tool tip plunge depth (only when chamfering)	mm



**Instructions:**

With manual input the start point can also be outside the pocket. This can, for example, be sensible when clearing a pocket that is open at the side. The processing then begins without plunging with a straight line movement into the open side of the pocket.

**Contours for pockets or islands**

Contours for pockets or islands must be closed, i.e. start and end point of the contour are identical. Pockets can be milled that are contained inside one or more islands. The islands may also be partly outside the pocket or intersect with one another. The first indicated contour will be interpreted as a pocket contour, all the others as islands.

**Calculate start point automatically / enter manually**

The optimal point for plunging can be calculated automatically using "Start point automatic". "Start point manual" defines the plunge point in the parameter screen. If it emerges from the pocket contour, the islands and the milling cutting tool diameter that there must be plunging at various points, the manual input defines only the first plunge point. The others will be calculated automatically.

**Processing**

The processing of contour pockets with islands/raw part contour with spigots will be programmed as follows:

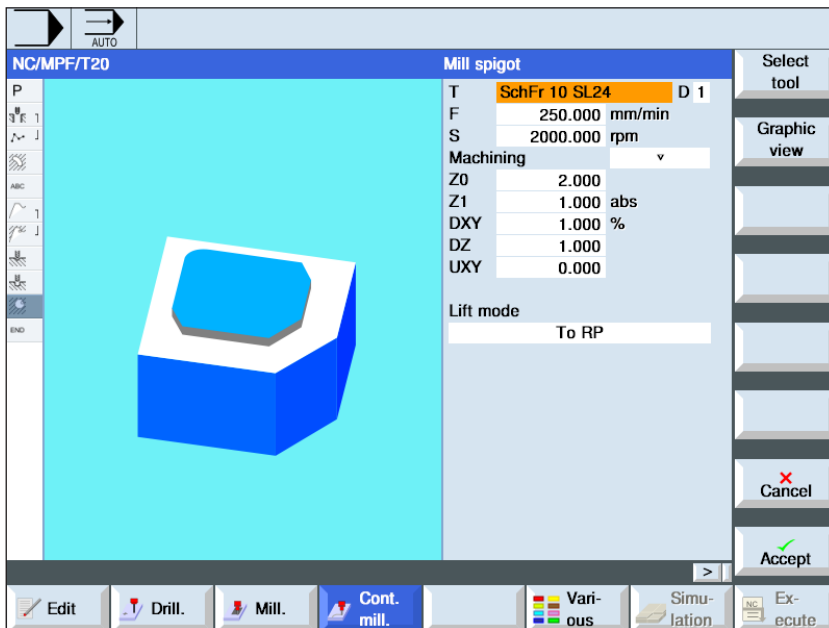
Example:

1. Enter pocket contour/raw part contour
2. Enter island/spigot contour
3. Centering (only possible with pocket contour)
4. Pre-drilling (only possible with pocket contour)
5. Clear/process pocket/spigot - roughing
6. Clear/process remaining material - roughing





## Mill spigot



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
T	Tool name	
D	Cutting number	
F	Feed	mm/min mm/tooth
S / V	Spindle speed or constant cutting speed	R/min m/min
Processing	<ul style="list-style-type: none"> <li>• ▾ Roughing</li> <li>• ▾ ▾ ▾ Bottom finishing</li> <li>• ▾ ▾ ▾ Edge finishing</li> <li>• Chamfering</li> </ul>	
Z0	Reference point Z	
Z1	Spigot depth (absolute) or depth relative to Z0 (incremental) (only if ▾, ▾ ▾ ▾ bottom, or ▾ ▾ ▾ edge)	mm
DXY	<ul style="list-style-type: none"> <li>• maximum level infeed</li> <li>• maximum plane infeed as a percentage of the milling cutting tool diameter</li> </ul> (only if ▾, or ▾ ▾ ▾ bottom)	mm %
DZ	maximum depth infeed (only if ▾, or ▾ ▾ ▾ edge)	mm
UXY	Finishing pass plane (only if ▾, ▾ ▾ ▾ bottom, or ▾ ▾ ▾ edge )	mm
UZ	Finishing pass depth (only if ▾, or ▾ ▾ ▾ bottom)	mm



Parameters	Description	Unit
Lift mode before renewed infeed	<p>If several plunge points are required during processing, the retraction height can be programmed.</p> <ul style="list-style-type: none"> <li>• on the retraction plane</li> <li>• Z0 + safety distance</li> </ul> <p>During the transition to the next plunge point the tool pulls back to this height. If there are no elements larger than Z0 in the pocket area, Z0 + safety distance can be programmed as lift mode. (only if ▽, ▽▽▽ bottom, or ▽▽▽ edge)</p>	mm
FS	Bevel width for chamfering (only for chamfering)	mm
ZFS	Tool tip plunge depth (only when chamfering)	mm

**Contours for pockets or islands**

Contours for pockets or islands must be closed, i.e. start and end point of the contour are identical. Pockets can be milled that are contained inside one or more islands. The islands may also be partly outside the pocket or intersect with one another. The first indicated contour will be interpreted as a pocket contour, all the others as islands.

**Calculate start point automatically / enter manually**

The optimal point for plunging can be calculated automatically using "Start point automatic". "Start point manual" defines the plunge point in the parameter screen. If it emerges from the pocket contour, the islands and the milling cutting tool diameter that there must be plunging at various points, the manual input defines only the first plunge point. The others will be calculated automatically.

**Contours for spigots**

Contours for spigots must be closed. The start and end point of the contour are identical. Several spigots can be defined that can also intersect with one another. The first indicated contour will be interpreted as a raw part contour, all the others as spigots.

**Processing**

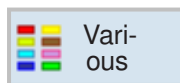
The processing of contour pockets with islands/ raw part contour with spigots will be programmed as follows:

Example:

- 1 Enter pocket contour/raw part contour
- 2 Enter island/spigot contour
- 3 Centering (only possible with pocket contour)
- 4 Pre-drilling (only possible with pocket contour)
- 5 Clear/process pocket/spigot - roughing

**Cycle Description****Chip crushing**

- 1** The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point. The start point will be calculated by the cycle.
- 2** The tool first feeds in to the processing depth and then approaches the spigot contour side-ways in the quarter circle with processing feed.
- 3** The spigot will be cleared in parallel with the contour from outside to in. The direction will be defined by the processing direction of rotation (up-cut milling or down-cut milling).
- 4** Once the spigot in one plane has been cleared, the tool leaves the contour in the quarter-circle and the infeed to the next processing depth takes place.
- 5** The spigot will again be approached in the quarter circle cleared in parallel to the contour from outside to in.
- 6** Steps 4 to 5 will be repeated until the programmed spigot depth is reached.
- 7** The tool moves back to the safety distance in rapid traverse (G0).

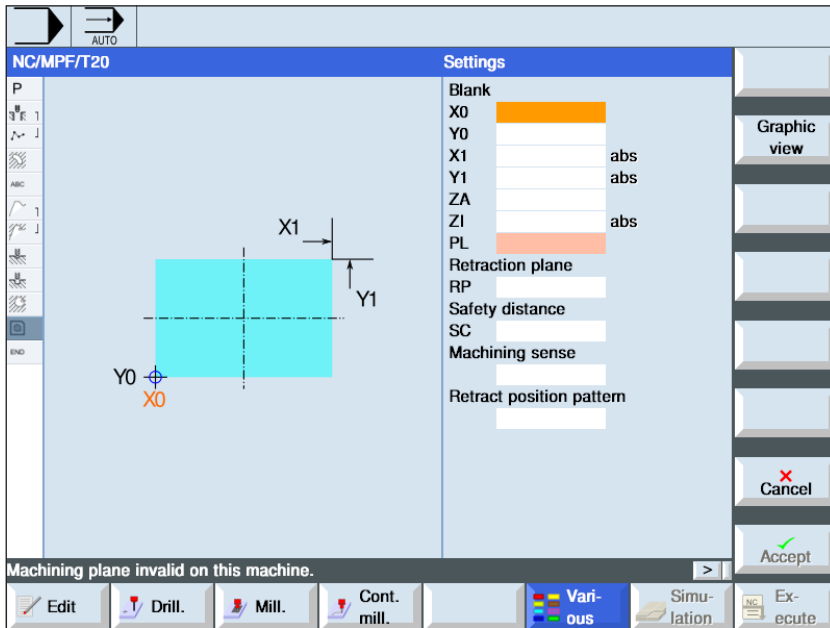


## Various

- Settings
- Transformations
- Subprogram
- Repeat program



## Settings



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

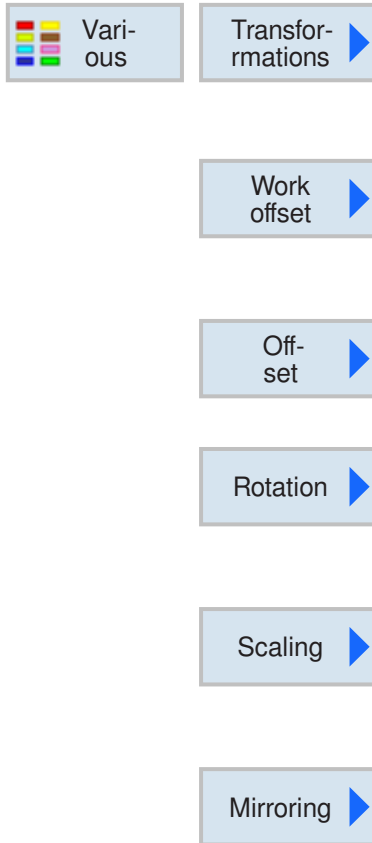
Parameters	Description	Unit
X0 Y0	1. Corner point in X, Y	mm
X1 Y1	2. Corner point in X,Y (absolute), or relative to X0, Y0 (incremental)	mm
ZA	Start measurement	mm
ZI	End measurement	mm
PL	Processing plane G17 (XY) G18 (ZX) G19 (YZ)	
RP SC	Planes over the workpiece: During processing the tool moves in rapid traverse from the tool change point to the retraction plane (RP) and then to the safety distance (SC). There will be a switch to the processing feed at this height. Once the processing is finished, the tool moves in the processing feed out of the workpiece to the safety distance height. The movement from the safety distance to the retraction plane and then to the tool change point will be in rapid traverse. The retraction plane will be indicated absolutely.  The safety distance will be indicated incrementally (without sign).	

Parameters	Description	Unit
Processing direction of rotation	<ul style="list-style-type: none"> <li>• Down-cut milling</li> <li>• Up-cut</li> </ul> <p>When processing a pocket, a longitudinal slot or a spigot, the processing direction of rotation (down-cut milling or up-cut milling) and the spindle's direction of rotation in the tool list will be heeded. The pocket will then be processed in the clockwise direction or in the counter-clockwise direction.</p> <p>During path milling the programmed direction of the contour defines the processing direction.</p>	
Retraction position template	<ul style="list-style-type: none"> <li>• optimized</li> </ul> <p>During processing with optimized retraction the tool moves in a contour-dependent way with processing feed in the safety distance (SC) via the workpiece.</p> <ul style="list-style-type: none"> <li>• on RP</li> </ul> <p>In retraction to RP after processing the tool moves back to the retraction plane and feeds in to the new position. This prevents a collision with workpiece obstacles when pulling out and in-feeding of the tool, e.g. when completing drill holes in pockets or slots on different planes and at different positions.</p>	



**Information:**

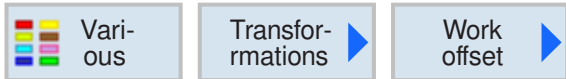
All parameters defined in the program header can be changed at any point in the program. The settings in the program header are effective until they are changed.



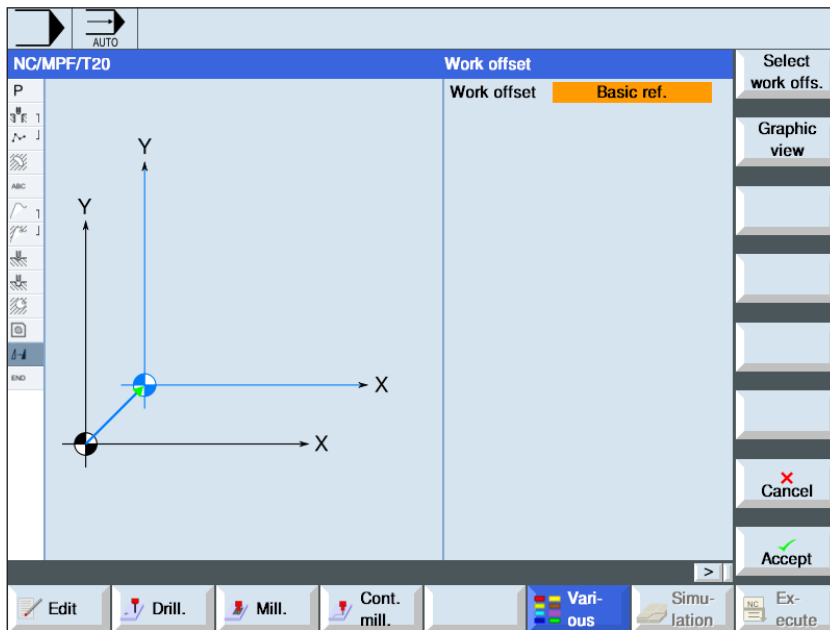
## Transformations

This cycle group is used for zero point offset (NPV), the workpiece zero point (W), mirroring and rotating. The following options exist:

- Zero point offset  
Zero point offsets (G54, ...) can be called from any program (see Chapter a "Zero point offset", as well as Chapter C "Zero point offset").
- Offset  
An offset from the zero point offset can be programmed for every axis.
- Rotation  
Every axis can be rotated by a defined angle. a positive angle corresponds to a rotation in the counter-clockwise direction.
- Scaling  
For scaling in X/Y/Z a scale factor can be entered. The programmed coordinates will then be multiplied with this factor.
- Mirroring  
The axis to be mirrored can be selected.



### Zero point offset



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description
Zero point offset	<ul style="list-style-type: none"> <li>• Base reference</li> <li>• G54</li> <li>• G55</li> <li>• G...</li> </ul>

Select work offs.

#### Select zero point offset

- 1 Switch to the zero point table with the softkey.
- 2 Select zero point offset (see Chapter a "Zero point offset").
- 3 Switch back to the cycle programming with the softkey.

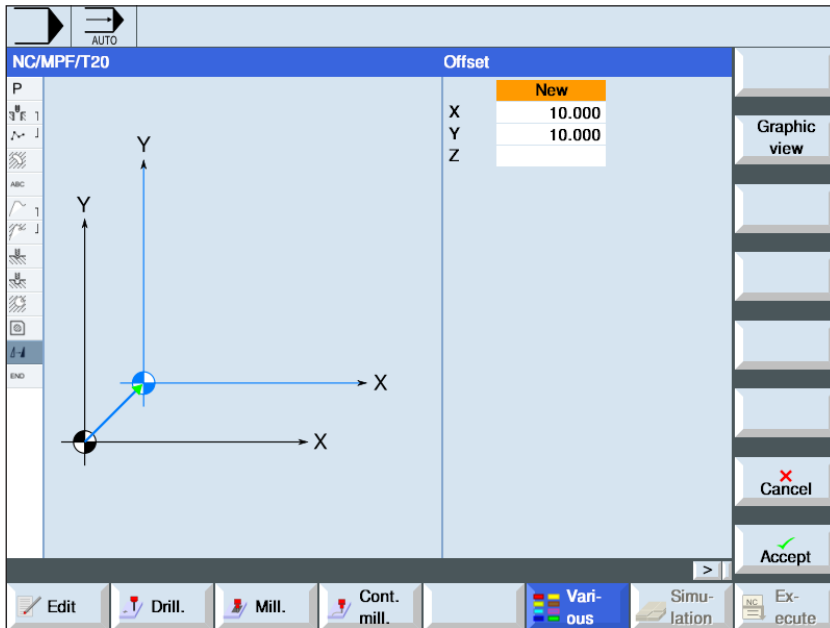
To program

Vari-ous
 

 Transfor-mations 

 Off-set

### Offset



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Offset	<ul style="list-style-type: none"> <li>• new</li> <li>new offset</li> <li>• additive</li> <li>additive offset</li> </ul>	
X Y Z	Reference point in X, Y, Z	mm

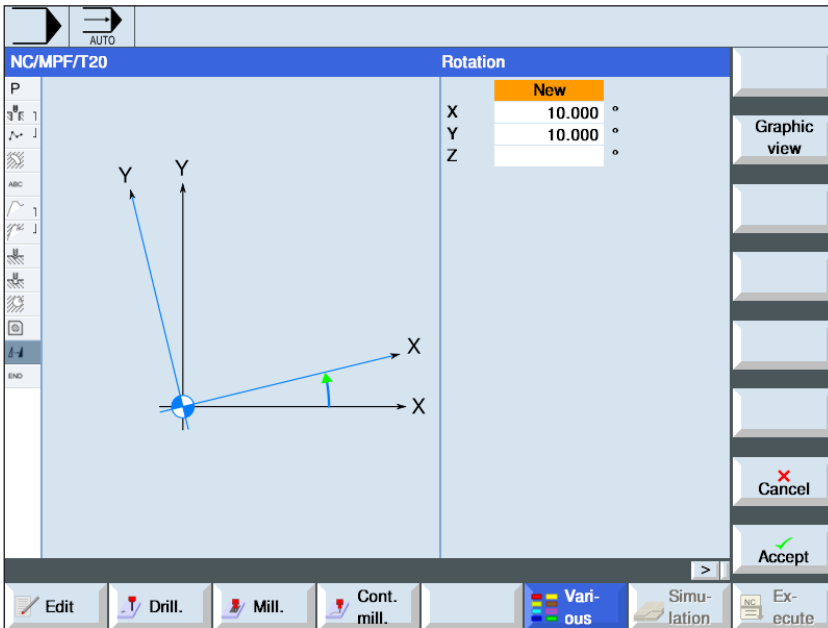


Various
 

 Transformations 

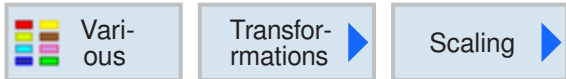
 Rotation

### Rotation

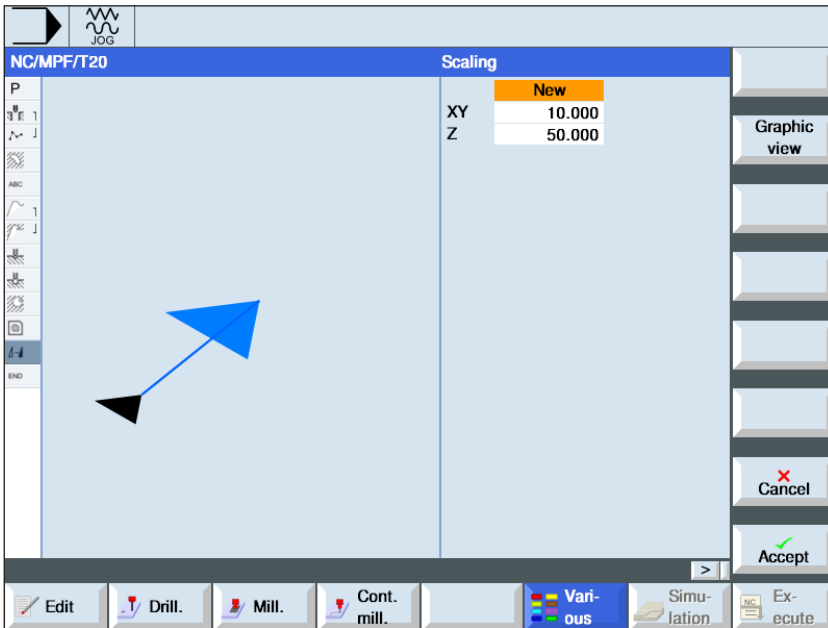


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Rotation	<ul style="list-style-type: none"> <li>• new New rotation</li> <li>• additive additive Rotation</li> </ul>	
X Y Z	Reference point in X, Y, Z	Degrees

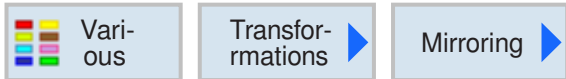


### Scaling

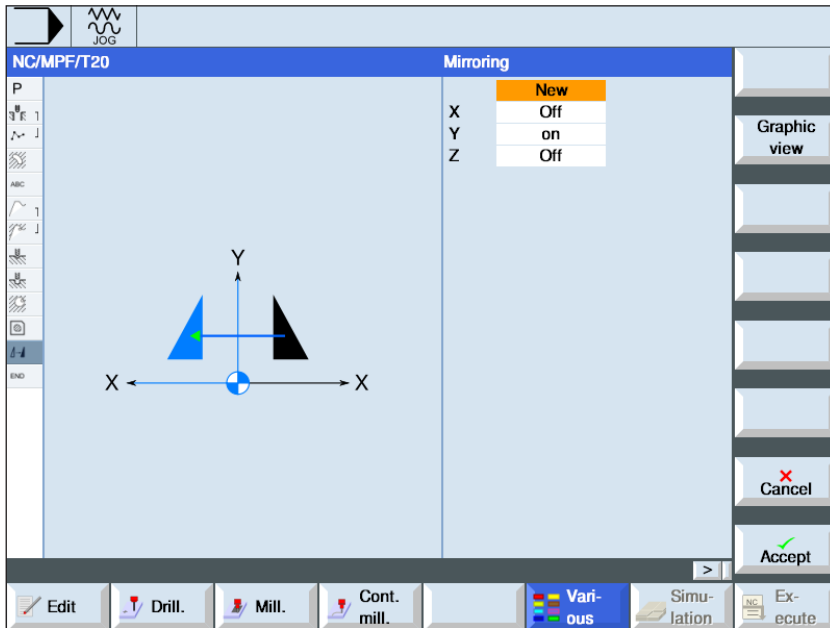


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Scaling	<ul style="list-style-type: none"> <li>• new new scaling</li> <li>• additive additive scaling</li> </ul>	
XY	Scale factor XY	
Z	Scale factor Z	



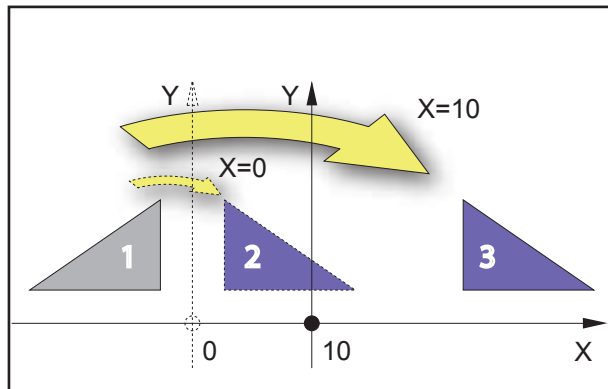
### Mirroring



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Mirroring	<ul style="list-style-type: none"> <li>• new new mirroring</li> <li>• additive additive mirroring</li> </ul>	
X Y Z	Mirroring in X, Y, Z on/off	

**Information:**  
When mirroring around only one axis the tool's direction of machining changes (up-cut milling/down-cut milling).



Mirror around a vertical axis

### Example

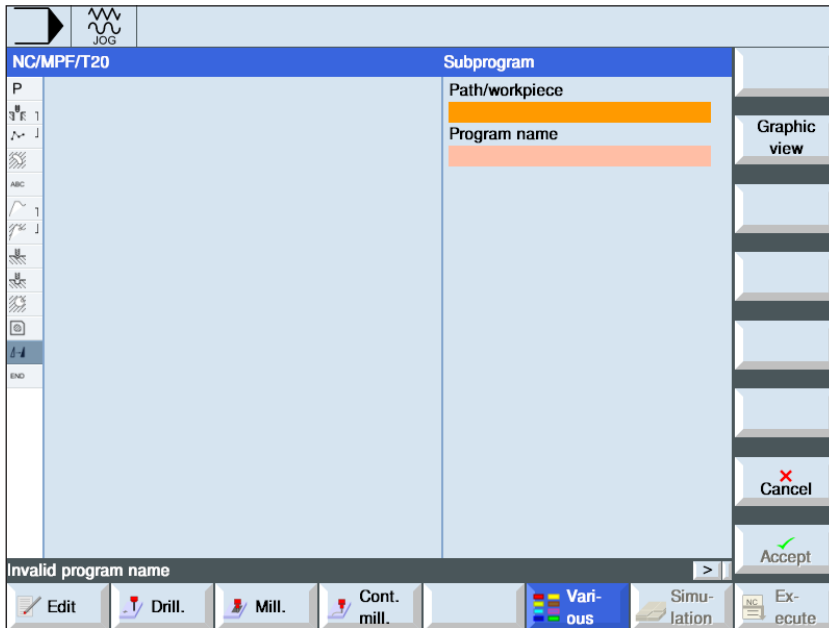
The result of the mirroring is dependent on the situation of the axis:

- Contour 2 is the result of a mirroring of Contour 1 around the vertical axis with the coordinate X=0.
- Contour 3 is the result of a mirroring of Contour 1 around the vertical axis with the coordinate X=10.



## Invoke sub-program

If the desired sub-program is not in the same directory as the main program, the sub-program's path must be indicated.



Parameters	Description
Path/workpiece	Sub-routine's path, if the desired sub-program is not in the same directory as the main program.
Program name	Name of the sub-program that should be inserted.

If the same processing steps are required when programming various workpieces, these processing steps can be defined as a separate sub-program. This sub-program can then be invoked in arbitrary programs. This prevents the need to program the same processing steps multiple times. The control system does not distinguish between main programs and sub-programs. This means that a "normal" work step or G-code program can be called in another work step program as a sub-program. In turn, a sub-program can be called from the sub-program.

The sub-program must be stored in its own directory "XYZ" or in the directories "ShopMill", "Part programs", "Sub-routines".

It should be noted that when calling the sub-program ShopMill evaluates the settings from the program header. These settings also remain effective once the sub-program has finished. If you want to reactivate the settings from the program header of the main program, you can perform the desired settings in the main program after calling the sub-program.



## Repeat program blocks

If specific steps need to be carried out when processing a workpiece, it is sufficient to program these steps only once. Program blocks can be repeated.

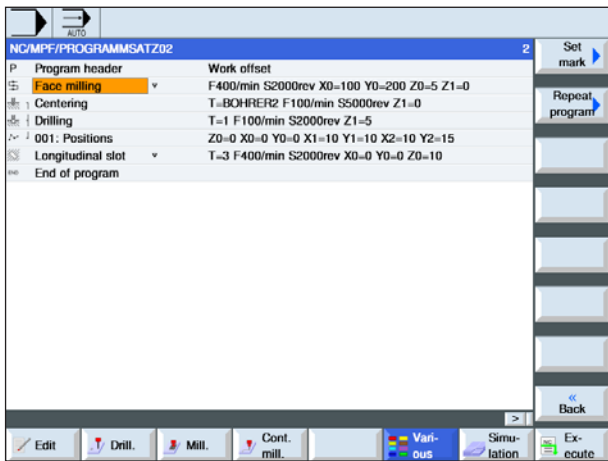
### Start and end marks

The program blocks that need to be repeated must be identified with a start and end mark. These program blocks can be invoked again up to 9999 times inside a program. The marks must have different and unambiguous names. No SIEMENS programming commands must be used as the name of a mark.

Marks and repetitions can also be set later. Setting marks and repetitions is not permitted inside chained program blocks.

### Instructions:

One and the same block can serve both as the end mark of a preceding program block as well as the start mark for the following program blocks.



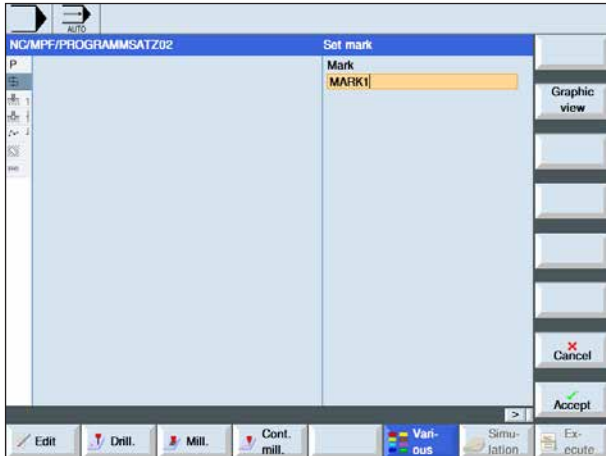
### Programming a program block repetition

1 Position cursor on the program block, behind which a program block should follow that should be repeated.

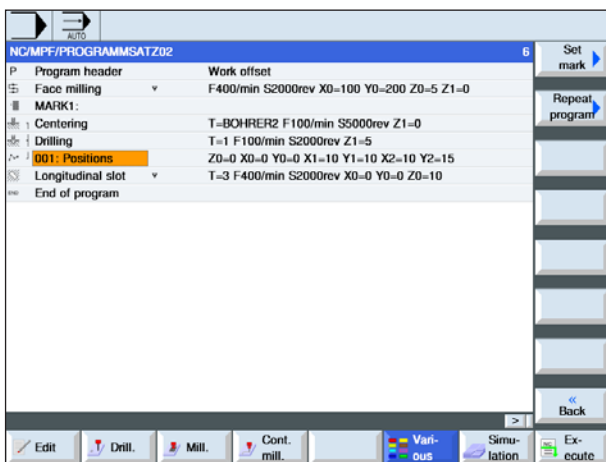


2 Press softkeys.

3 Press softkey to set start mark and confirm.



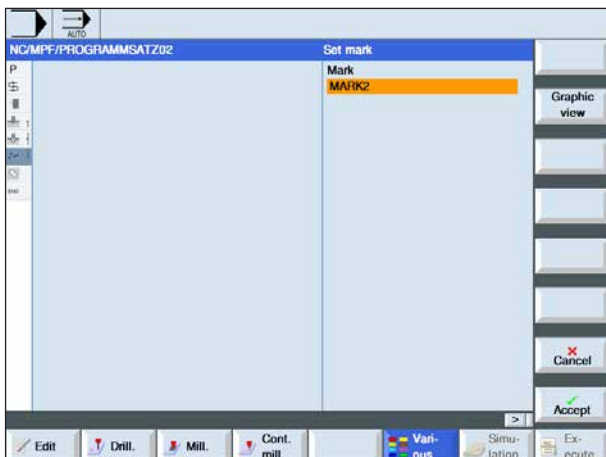
4 Give a name to the start mark (e.g.: "MARK1").



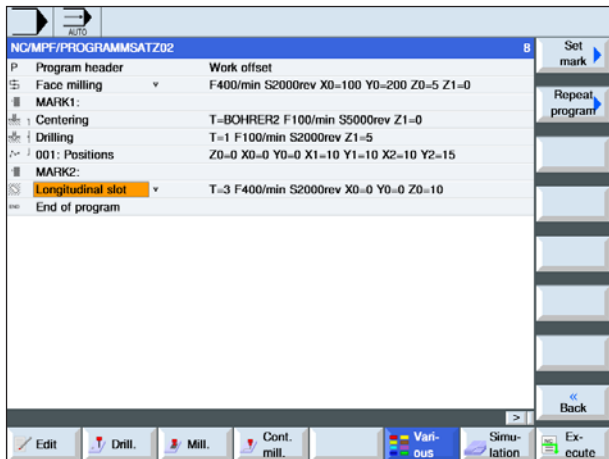
5 Position cursor on the program block behind which the end mark should be set.



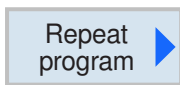
6 Press softkey to set end mark and confirm.



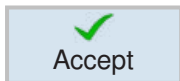
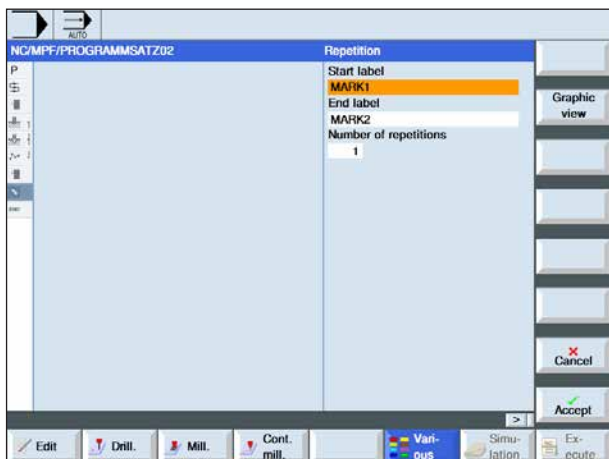
7 Give a name to the end mark (e.g.: "MARK2").



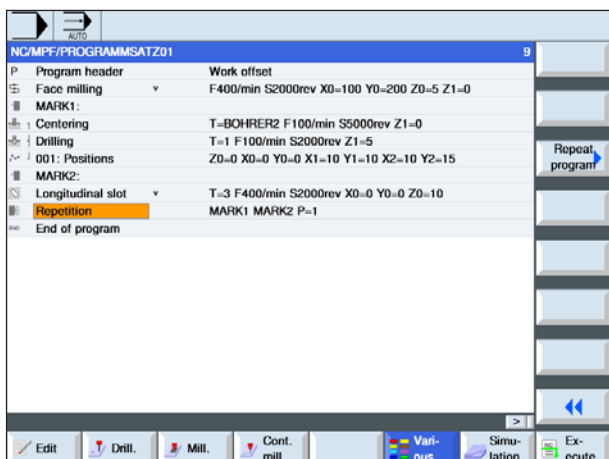
8 Position cursor on the program block behind which the repetitions should be performed.



9 Press softkey to set the repetition mark. Enter the name of the start mark and the name of the end mark (e.g.: MARK1 for the start mark and MARK2 for the end mark). Define number of repetitions (e.g.: 1).



10 Press softkey to confirm.



11 The program blocks between the start and end marks will be performed at the position of the repetition marks with the programmed repetitions.

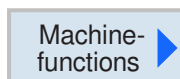
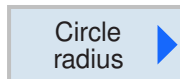
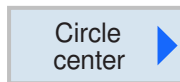
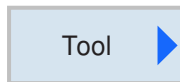






## Straight line or circular processing

- Tool
- Straight line
- Circle center
- Circle center
- Helix
- Polar
- Machine functions

**Caution:**

When the tool is to move with a straight-line or circular path movement into the retraction area defined in the program header, the tool should also be moved out again. Otherwise the movements of a subsequently programmed cycle may result in collisions.

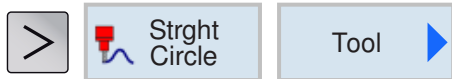
## Straight line or circular processing

This cycle group is used to create straight or circular path movements.

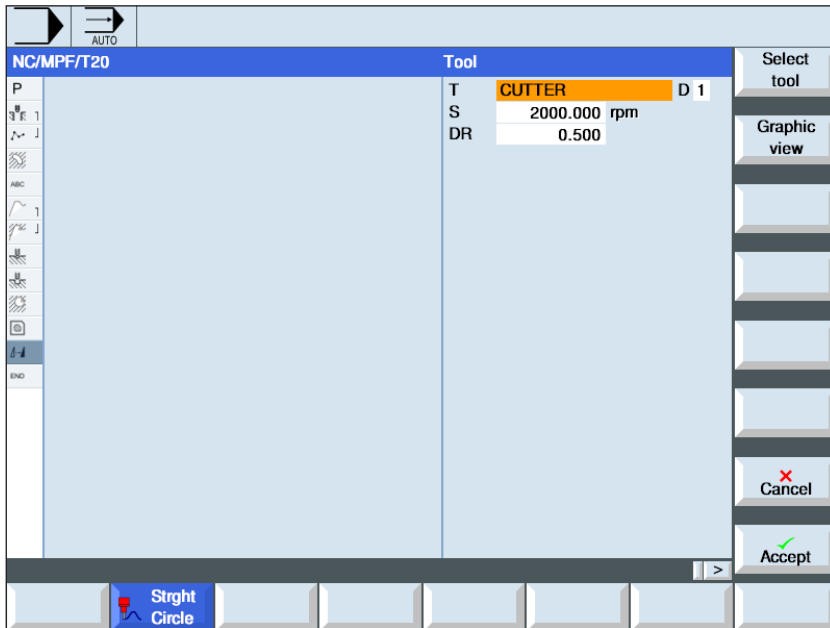
Processings can be carried out without defining a complete contour.

The following options are available for selection:

- Tool  
Before a straight line or a circle is programmed, a tool must be selected and the spindle speed defined.
- Straight line  
The tool moves with the programmed feed or in rapid traverse from the current position to the programmed end position.
- Circular center point  
The tool moves on a circular path from the current position to the programmed circle end point. The position of the circle center point must be known. The radius of the circle/curve will be calculated by entering the interpolation parameters through the control system. It can only be moved in the processing feed. Before the circular movement is made, a tool must be programmed.
- Circle radius  
The tool moves on a circular path with the programmed radius from the current position to the programmed circle end point. The control system calculates the position of the circle center point. Interpolation parameters do not need to be programmed. It can only be moved in the processing feed.
- Helix  
In the helical interpolation a circular movement in the plane will be overlain with a linear movement in the tool axis. This generates a spiral.
- Polar  
If the dimensioning of a workpiece from a central point (pole) has been carried out with radius and angle details, these can be advantageously programmed as polar coordinates. Straight lines and circles can be programmed as polar coordinates.
- Machine functions  
Additional M-functions can be programmed here.

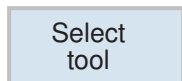


**Tool**



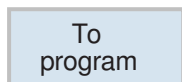
Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

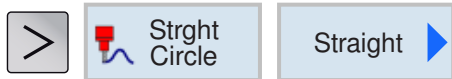
Parameters	Description	Unit
T	Tool name	
D	Cutting number	
S / V	Spindle speed or constant cutting speed	R/min m/min
DR	Tool radius allowance	mm



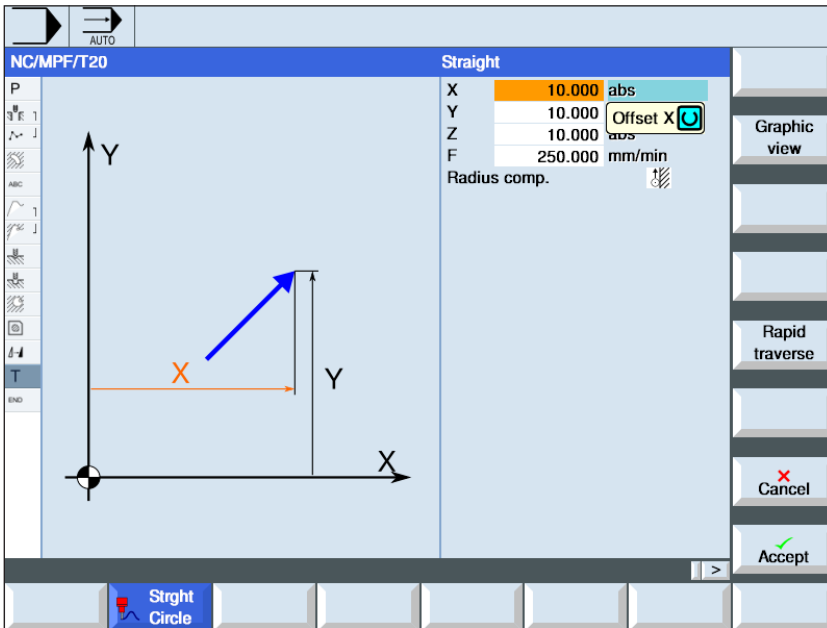
**Select tool**

- 1 Switch to the tool table with the softkey.
- 2 Create a new tool or select an existing tool (see Chapter F "Tool programming"). The tool will be transferred to the parameter field "T".
- 3 Switch back to the cycle programming with the softkey.







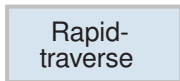


**Program straight line**



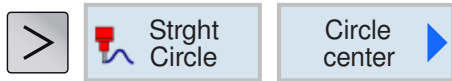
Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
X Y Z	Target position (absolute) or target position relative to the last programmed position	mm
F	Processing feed	mm/min mm/rev mm/tooth
Radius correction	<ul style="list-style-type: none"> <li> left (processing left from the contour)</li> <li> right (processing right from the contour)</li> <li> off</li> <li> no change in the contour</li> </ul>	

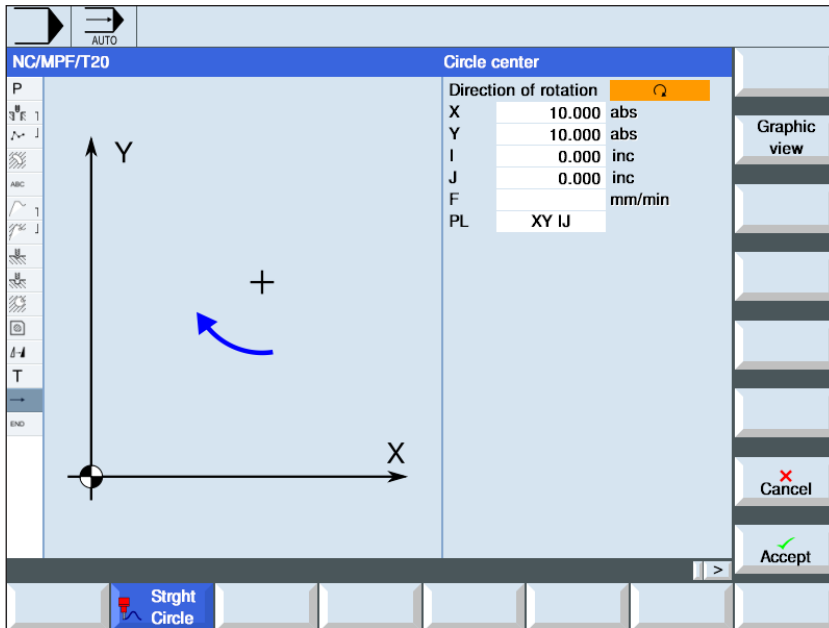


**Programming rapid traverse**

With this softkey the feed will be programmed in rapid traverse.

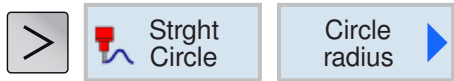


**Program circle with known center point**

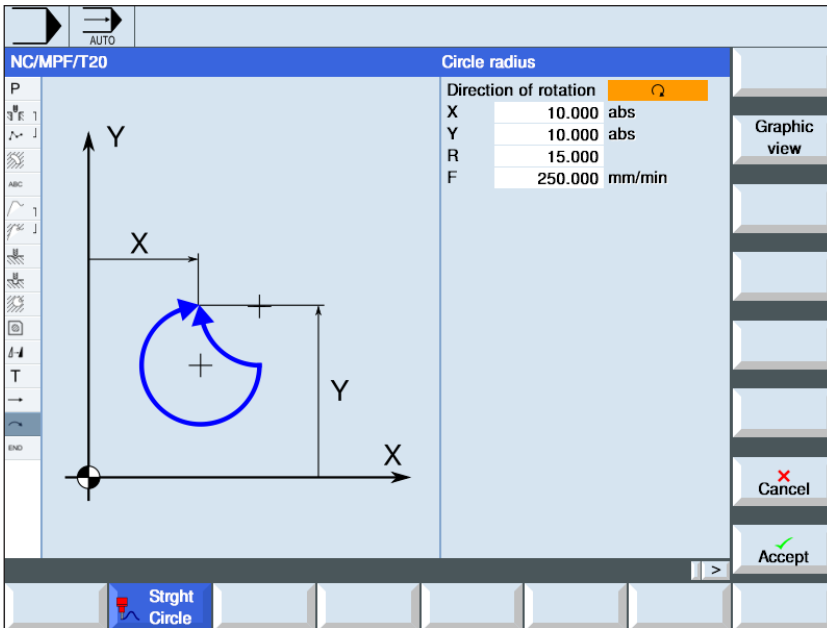


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Direction of rotation	<ul style="list-style-type: none"> <li> Direction of rotation right</li> <li> Direction of rotation left</li> </ul> There will be movement from the circle start point to the circle end point in the programmed direction. This direction can be programmed in the clockwise direction or in the counter-clockwise direction.	
X Y	Target position (absolute) or target position relative to the last programmed position.	mm
I J	Distance circle start point to circle end point (incremental).	mm
F	Processing feed	mm/min mm/rev mm/tooth
PL	Circular plane: There will be a circular movement in the set plane with the associated interpolation parameters: XYIJ: XY plane with the interpolation parameters I and J ZXKI: ZX plane with the interpolation parameters K and I YZJK: YZ plane with the interpolation parameters J and K	mm

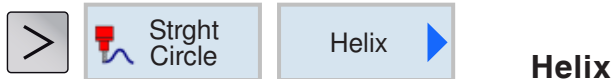


**Program circle with known radius**

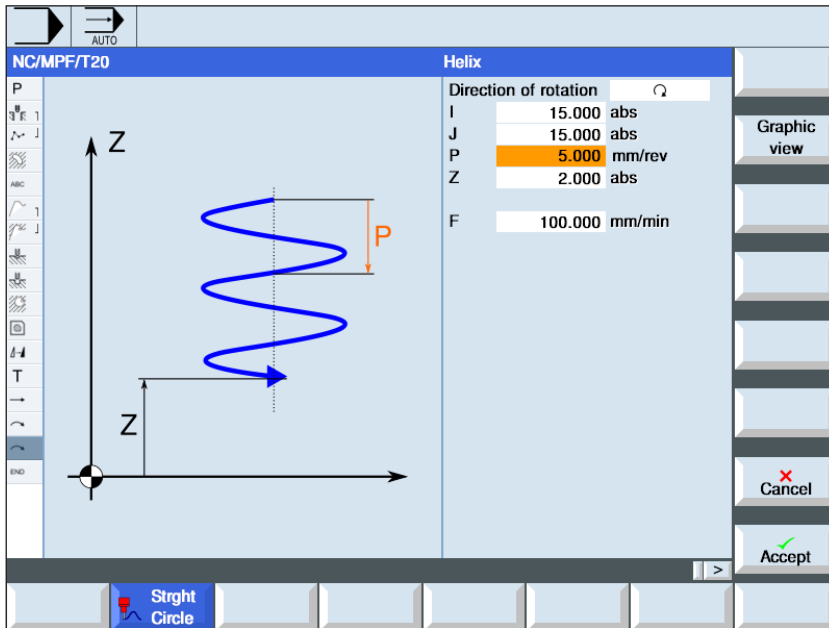


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Direction of rotation	<ul style="list-style-type: none"> <li> Direction of rotation right</li> <li> Direction of rotation left</li> </ul> There will be movement from the circle start point to the circle end point in the programmed direction. This direction can be programmed in the clockwise direction or in the counter-clockwise direction.	
X Y	Target position (absolute) or target position relative to the last programmed position.	mm
R	Radius of the curve. The selection of the desired curve is made through the input of a positive or negative sign.	mm
F	Processing feed	mm/min mm/rev mm/tooth

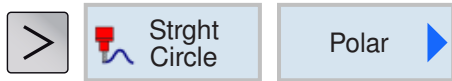


**Helix**



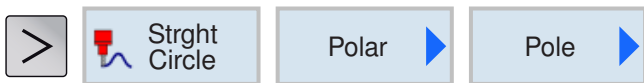
Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Direction of rotation	<ul style="list-style-type: none"> <li> Direction of rotation right</li> <li> Direction of rotation left</li> </ul> <p>There will be movement from the circle start point to the circle end point in the programmed direction. This direction can be programmed in the clockwise direction or in the counter-clockwise direction.</p>	
I J	Center point of the helix in X and Y (absolute or incremental)	mm
P	Helix pitch	mm/rev
Z	Target position of helical end point (absolute or incremental)	mm
F	Processing feed	mm/min mm/rev mm/tooth

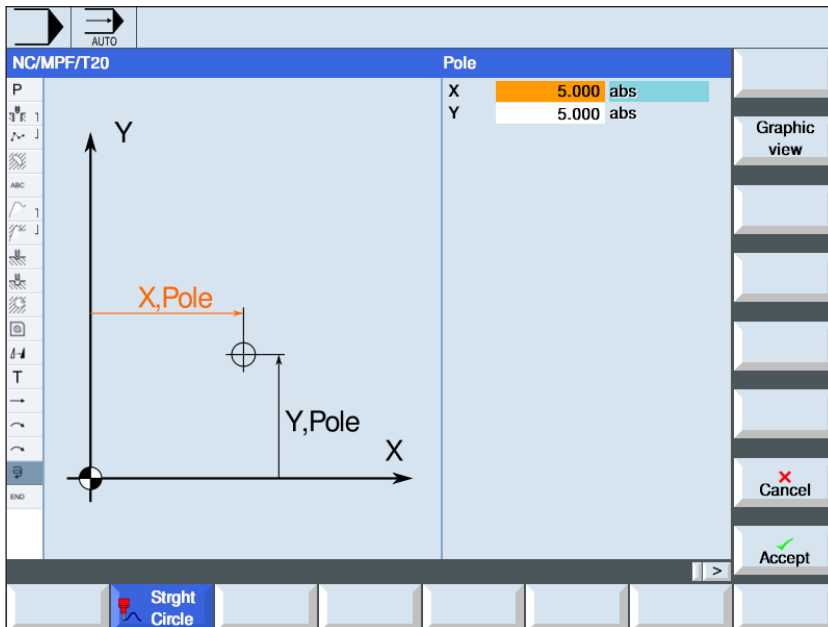


### Polar coordinates

Before programming a straight line or a circle in polar coordinates the pole must be defined. This pole is the reference point of the polar coordinate system. Then the angle for the first straight line or the first circle must be programmed in absolute coordinates. The angle of the other straight lines or curves can optionally be programmed absolutely or incrementally.



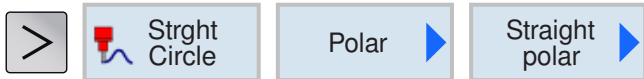
### Pole



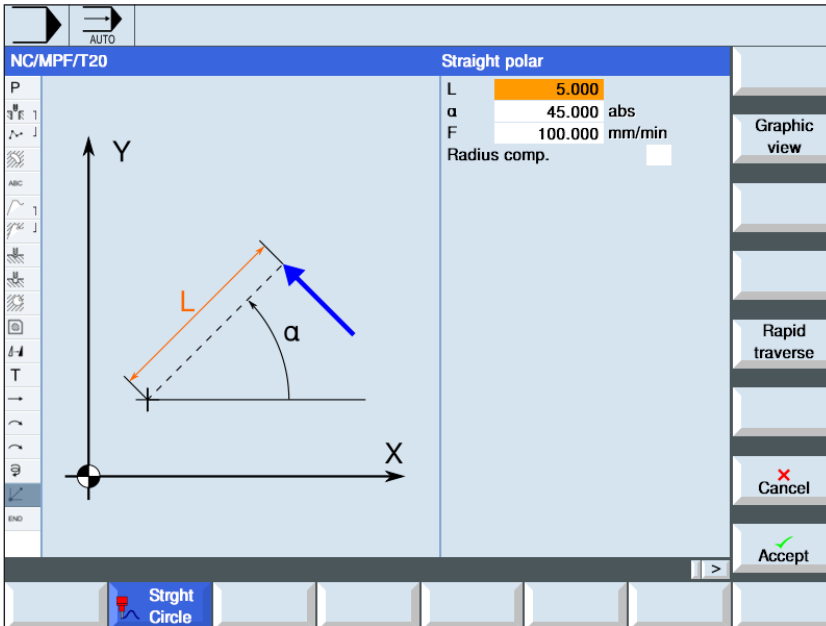
Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
X	Pole X,Y, (absolute) or pole X, Y, relative to the last programmed position (incremental)	mm
Y		






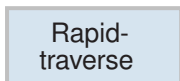


**Straight line polar**



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
L	Distance to pole, end point	mm
$\alpha$	Polar angle to pole, end point (absolute) or polar angle change to pole, end point (incremental)	degrees
F	Processing feed	mm/min mm/rev mm/tooth
Radius correction	<ul style="list-style-type: none"> <li>•  left (processing left from the contour)</li> <li>•  right (processing right from the contour)</li> <li>•  off</li> <li>• <input type="checkbox"/> no change in the contour</li> </ul>	



**Programming rapid traverse**

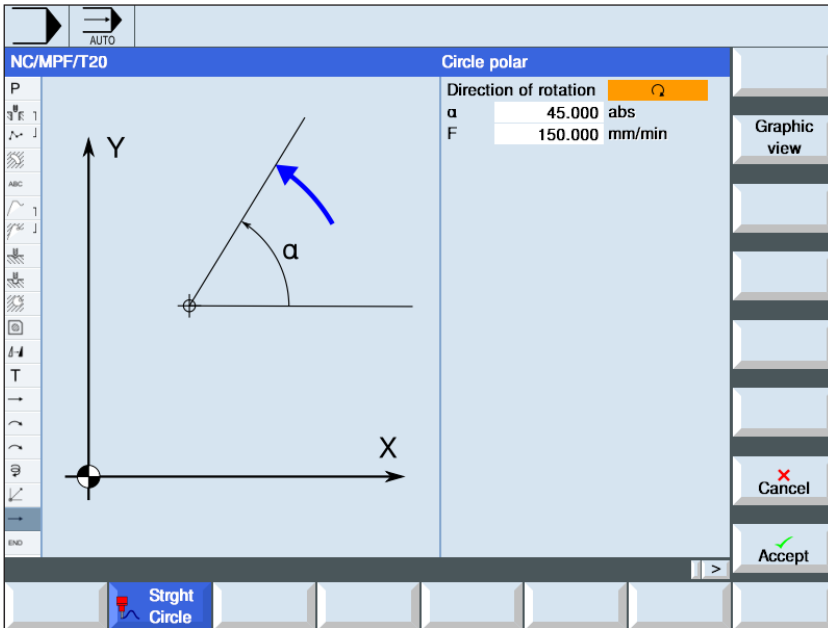
With this softkey the feed will be programmed in rapid traverse.

**Cycle Description**

- 1 The tool moves from the current position on a straight line to the programmed end point in the processing feed or in rapid traverse.
- 2 The 1st straight line in polar coordinates after the pole data must be programmed with an absolute angle.
- 3 All other straight lines or curves can also be programmed incrementally.



**Circle polar**

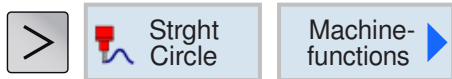


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

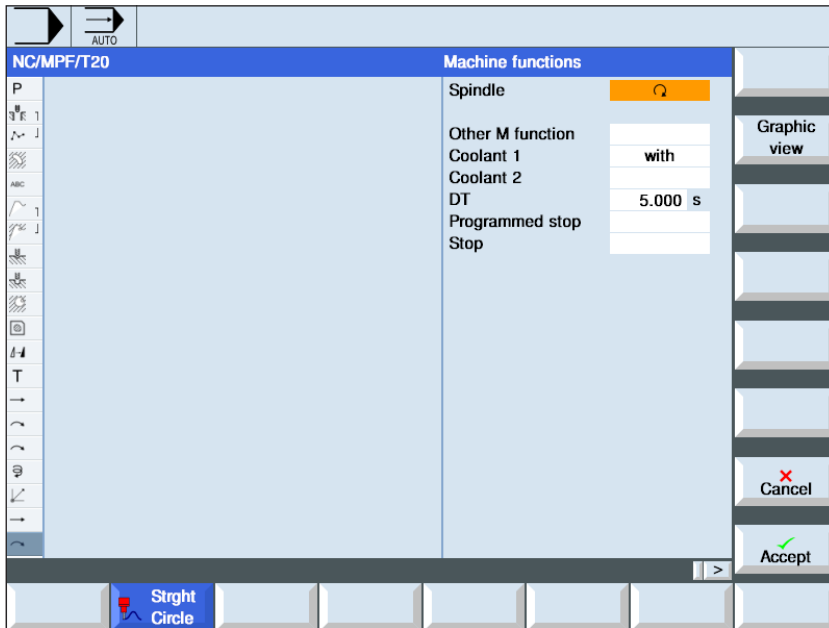
Parameters	Description	Unit
Direction of rotation	<ul style="list-style-type: none"> <li> Direction of rotation right</li> <li> Direction of rotation left</li> </ul> <p>There will be movement from the circle start point to the circle end point in the programmed direction. This direction can be programmed in the clockwise direction or in the counter-clockwise direction.</p>	
$\alpha$	Polar angle to pole, end point (absolute) or polar angle change to pole, end point (incremental)	degrees
F	Processing feed	mm/min mm/rev mm/tooth

**Cycle Description**

- 1 The tool moves from the current position on a circular path to the programmed end point (angle) in the processing feed. The radius emerges from the current position to the defined pole, i.e. circle start position and circle end position have the same distance to the defined pole.
- 2 The 1st Curve in polar coordinates after the pole data must be programmed with an absolute angle. All other straight lines or curves can also be programmed incrementally.



### Machine functions



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Spindle M-function	Definition of the spindle's direction of rotation or the spindle position <ul style="list-style-type: none"> <li><input type="checkbox"/> unchanged</li> <li><input checked="" type="checkbox"/> Spindle rotates right (M3)</li> <li><input checked="" type="checkbox"/> Spindle rotates left (M4)</li> <li><input checked="" type="checkbox"/> Spindle is switched off (M5)</li> <li><input checked="" type="checkbox"/> Spindle positioned (SPOS)</li> </ul>	
Stop position	Spindle stop position (only with spindle M-function SPOS)	Degrees
Other M-function	Machine functions, which are also made available (machine-dependent).	
Coolant 1	Coolant selection on or off <ul style="list-style-type: none"> <li>with</li> <li>without</li> </ul>	
Coolant 2	Coolant selection on or off <ul style="list-style-type: none"> <li>with</li> <li>without</li> </ul>	
DT	Dwell time in seconds Time after which machine processing will be continued.	s
Programmed stop	Programmed stop on (M1) Stops machine processing if the control box "Programmed stop" was activated under Machine in the "Program influence" window.	
Stop	Stop on (M0). Stops machine processing.	



# E: Programming G-code

**Information:**

This programming manual describes all functions that can be executed with WinNC. Depending on the machine you are operating with WinNC, not all functions may be available.

**Example:**

The Concept MILL 55 milling machine has no position-controlled main spindle, so it is also not possible to program spindle positions.



## Overviews

### M-Commands

M 00	Programmed stop
M 01	Optional stop
M 02	Program end
M 03	Milling cutter on in clockwise direction
M 04	Milling cutter on in counter-clockwise direction
M 05	Milling cutter stop
M 06	Perform tool change
M 07	Minimal lubrication on
M 08	Coolant on
M 09	Coolant off / Minimal lubricant off
M 10	Dividing attachment clamp on
M 11	Dividing attachment clamp loose
M 17	End sub-program
M 25	Open clamping device
M 26	Close clamping device
M 27	Swivel dividing attachment
M30	Main program end
M71	Fan on
M72	Fan off

## Overview G-commands

Command	Meaning
G0	Rapid traverse motion
G1	Forward motion
G2	Circular interpolation in clockwise direction
G3	Circular interpolation in counter-clockwise direction
G4	Dwell time
G9	Precision stop effective block-by-block
G17	Interpolation plane XY
G18	Interpolation plane XZ
G19	Interpolation plane YZ
G25	Spindle speed limitation
G26	Spindle speed limitation
G33	Thread with constant lead
G331	Thread tapping
G332	Retraction movement during thread tapping
G40	Tool radius compensation off
G41	Tool radius compensation on left
G42	Tool radius correction on right
G53	Blockwise deselection configurable zero point offset
G54-G57	Configurable zero point offsets
G500	Deselection of the configurable NPV
G505-G599	Configurable zero point offsets
G60	Speed decrease, precision stop
G601	Precision stop fine
G602	Precision stop crude
G63	Thread tapping without synchronisation
G64	Path control operation
G70	Inch dimensions
G71	Metric measurement system
G90	Basic dimensions
G91	Incremental dimensions
G94	Feed mm/min or inch/min
G95	Feed in mm/rev or inches/rev
G96	Constant cutting speed on
G961	const. Cutting speed with minute-based feed
G962	const. Cutting speed and maintenance of the current feed type
G97	Constant cutting speed off
G971	const. Speed with minute-based feed
G972	const. Cutting speed and maintenance of the current feed type
G110	pole details, relative to the last programmed tool position
G111	pole details, relative to the current zero point of the workpiece coordinate system
G112	pole details, relative to the last valid pole
G140	Gentle approach and withdrawal
G141	Approaching from left or withdrawing from left
G142	Approaching from right or withdrawing from right
G143	Approach or withdrawal direction dependent on the relative position of the start or end point to tangent direction
G147	Approach in a straight line
G148	Withdraw in a straight line
G247	Approach in a quarter circle
G248	Withdraw in a quarter circle
G340	Approach and withdraw three-dimensionally (base setting)
G341	Approach and withdraw in the plane
G347	Approach with a semi-circle
G348	Withdraw with a semi-circle

## Command abbreviations overview

### Part 1 valid for turning and milling

Command	Meaning
AC	Absolute position example: X=AC(10)
AMIRROR	Additive mirroring
AND	Logical AND link
ANG	Angle of the straight line
AP	Polar angle of the polar coordinate programming
AR	Opening radius with circular interpolaton
AROT	Additive rotation
ASCALE	Additive scaling
ATRANS	Additive shift
AX	Axis operator
AXIS	Variable type
AXNAME	String operation
B_AND B_NOT B_OR B_XOR	Logical link operators
BOOL	Variable type
CASE	Loop construct
CFC	Constant feed at the contour
CFIN	Constant feed at the tool blade
CFINE	Fine shift
CFTCP	Constant feed at the milling cutting tool center point path
CHAR	Variable type
CHF	Insert bevel
CHR	Bevel over corner length
CMIRROR	Mirroring
CR	Circle via radius data
CROT	Rotation
CRPL	Rotation
CSCALE	Scaling
CTRANS	Crude shift
D	Tool cut number
DC	Absolute dimensions, direct positioning
DEF	Define variable
DEFAULT	Loop construct
DIAMOF	Radius programming
DIAMON	Diameter programming
DISC	Correction at external corners Flexible programming of approach and withdrawal instructions
DISCL	Distance of the end point from the processing plane with WAB
DISPLOF	Display in the program window off
DISPLON	Display in the program window on
DISR	Distance of the milling cutting tool from the start point with WAB
DIV	Integer division

Command	Meaning
ELSE	Loop construct
ENDFOR	Loop construct
ENDIF	Loop construct
ENDLOOP	Loop construct
ENDWHILE	Loop construct
EXECTAB	Trace contour train
EXECUTE	Contour table processing finished
F	Feed
FB	Block-by-block feed
FOR	Loop construct
FRAME	Variable type
FZ	Feed per tooth
GOTOB	Jump in the direction of the start of the program
GOTOF	Jump in the direction of the end of the program
IC	Incremental position example: = IC(10)
IF	Loop construct
INT	Variable type
INTERSEC	Calculate cutting point of contours
ISAXIS	Is a specific axis is available (query via axis number)
KONT	Bypass contour in the start point
LIMS	Speed limitation
LOOP	Loop construct
MCALL	Modal sub-program call
MIRROR	Mirroring on
MSG	Show text on the screen
N	Block number
NORM	Direct approaching of the contour
NOT	Negation
OFFN	Offset contour normal
OR	Logical OR link
P	Number of sub-program runs
PROC	Sub-program procedure definition (transfer parameters)
R	R-parameters R[0]-R[299]
REAL	Variable type
REP	Field initialisation
RET	UP-Jump back
RND	Insertion of roundings
RNDM	Modal insertion of roundings
ROT	Rotation on
RP	Polar angle of the polar coordinate programming
RPL	Defining the rotation plane



Command	Meaning
S	Spindle address
SAVE	Saving register during sub-program call
SBLOF	Single block suppression on
SBLON	Single block suppression off
SCALE	Scale on
SET	Set variables
SETAL	Trigger alarm
SPOS	Position position-controlled spindle
STRING	Variable type
STRLEN	String operation
SUBSTR	Determine part of a string
SVC	Cutting speed
T	Tool address
TRANS	Move on
UNTIL	Loop construct
VAR	Variable definition
WAITS	Wait till the spindle position is reached
WHILE	Loop construct
XOR	Exclusive OR

## Part 2 valid only for milling

Command	Meaning
A	Rotation axis divider left
AFSL	Circular slot, angle for slot length
BRISK	Sharp path acceleration of the axes
CDIR	Cycles, processing direction
CPA	Cycles, center point in X
CPO	Cycles, center point in Y
CRAD	Rectangular pocket cycle, corner radius
DAM	Long-hole drill cycle, degression amount
DBH	Series of holes, distance between holes
DIATH	Thread milling cycle, thread nominal diameter
DP	Cycles, end drilling depth, pocket depth, slot depth, etc.
DPR	Cycles, end drilling depth, pocket depth, slot depth, etc. relative to reference plane
DTP	Cycles, dwell time at drill bottom
DTS	Long-hole drilling cycle, dwell time before infeed
ENC	Cycles, thread tapping with/without transmitter
FAL	Cycles, finishing pass
FDEP	Cycles, first drilling depth absolute
FDIS	Series of holes, distance to first hole
FDPR	Cycles, first drilling depth relative
FFD	Cycles, feed for depth infeed
FFP1	Cycles, feed for surface processing
FFP2	Cycles, feed for surface processing finishing
FFR	Cycles, forwards feed
FL	Feed limit synchronous axis
FRF	Long-hole drilling cycle, feed factor for first drilling depth
H	Help function
I	Circle interpolation, detail of the circle center point
INDA	Cycles, angular increment
J	Circle interpolation, detail of the circle center point
K	Circle interpolation, detail of the circle center point
KDIAM	Thread milling, thread core diameter
L	Sub-routine call
LENG	Cycles, length
MID	Cycles, maximum infeed depth
MIDF	Cycles, maximum infeed depth finishing
MPIT	Thread tapping cycle, thread pitch nominal size
N	Block number
NUM	Cycles, number of elements
PIT	Cycles, thread pitch
POSS	Cycles, spindle position
PRAD	Circular pocket cycle, pocket radius
Q	Rotation axis divider right
RAD	Cycles, radius indication
RFF	Cycles, retraction feed
RFP	Cycles, reference plane
RPA	Cycles, lift movement in X
RPAP	Cycles, lift movement in Z
RTP	Cycles, retraction plane

Command	Meaning
SDAC	Thread tapping cycle, direction of rotation after cycle end
SDIR	Cycles, spindle direction of rotation
SDIS	Cycles, safety distance
SDR	Thread tapping cycle, spindle direction of rotation for retraction
SOFT	Jerk-free path acceleration of the axes
SPCA	Cycles, start point in X
SPCO	Cycles, start point in Y
SSF	Cycles, spindle speed finishing
SST	Thread tapping cycle, spindle speed for thread tapping
SST1	Thread tapping cycle, spindle speed for thread tapping
STA1	Cycles, angle indication
TYPTH	Thread milling, internal/external thread
VARI	Cycles, processing type
WID	Cycles, width
X	Linear axis parallel to table front edge
Y	Linear axis
Z	Linear axis vertical (milling head)
:	Main block number
/	Skip block recognition

## Calculation operators for NC program

Command	Meaning
+, -, *, /, %, ^	Calculation functions
SIN()	Sine function
COS()	Cosine function
TAN()	Tangent function
ASIN()	Arc sine function
ACOS()	Arc cosine function
ATAN()	Arc tangent function (value)
ATAN2(.,.)	Inverse tangent function (X-section, Y-section)
SQRT()	Square root function
POT()	Power function
EXP()	Exponential function (base e)
LN()	Natural logarithmic function
TRUE	logically true (1)
FALSE	logically false (0)
ABS()	Absolute function
TRUNC()	Integer part function
ROUND()	Rounding function
MOD()	Modulo function

## System variables

Command	Meaning
\$A_MYMN	Tool management inactive for all tools
\$A_TOOLMLN	Determine tool magazine place
\$AA_S	Current speed
\$AA_TYP	Axis type
\$AC_MSNUM	Active master spindle
\$AN_NCK_VERSION	NCK version number
\$MA_GEAR_STEP_CHANGE_ENABLE	Configure gear step change
\$MA_NUM_ENCS	Determine axis encoder
\$MA_SPIND_ASSIGN_TO_MACHAX	Axis spindle assignment
\$MC_AXCONF_CHANAX_NAME_TAB	Channel axis name in channel
\$MC_AXCONF_GEOAX_ASSIGN_TAB	Geometry axes (Mill=123, Turn=103)
\$MC_AXCONF_MACHAX_USED	Axis channel assignment
\$MC_CIRCLE_ERROR_CONST	Circle end point monitoring constant
\$MC_DIAMETER_AX_DEF	Geometry axis with plane axis function
\$MC_GCODE_RESET_VALUES	After command for each group after reset
\$MC_MM_SYSTEM_FRAME_MASK	System frames
\$MC_TOOL_CHANGE_MODE	Tool change type: 0=without M6, 1=with M6
\$MC_TOOL_MANAGEMENT_MASK	Activation of the tool management functions
\$MCS_AXIS_USAGE	Meaning of the axis in the channel
\$MCS_AXIS_USAGE_ATTRIB	Attribute of the axes
\$MCS_DISP_COORDINATE_SYSTEM	Geometry axis with plane axis function
\$MCS_ENABLE_QUICK_M_CODES	Enable quick M-codes
\$MCS_FUNCTION_MASK_DRILL	Function mask drill
\$MCS_FUNCTION_MASK_MILL	Function mask mill
\$MCS_FUNCTION_MASK_TECH	Allow block search run in ShopMill/Turn, approach logic via cycle (ShopTurn)
\$MCS_FUNCTION_MASK_TURN	Function mask turn
\$MCS_M_CODE_ALL_COOLANTS_OFF	M-code coolant 1 and 2 off (M9)
\$MCS_M_CODE_COOLANT_1_AND_2_ON	M-code coolant 1 and 2 on
\$MCS_M_CODE_COOLANT_1_ON	M-code coolant 1 (M8)
\$MCS_M_CODE_COOLANT_2_ON	M-code coolant 2 on
\$MCS_TOOL_MCODE_FUNC_OFF	M-code for tool-specific function OFF
\$MCS_TOOL_MCODE_FUNC_ON	M-code for tool-specific function ON
\$MN_ENABLE_CHAN_AX_GAP	Channel axis gaps will be permitted in AXCONF_MACHAX_USED
\$MN_INT_INCR_PER_DEG	Calculating precision for angle positions
\$MN_INT_INCR_PER_MM	Calculating precision for linear positions
\$MN_MM_FRAME_FINE_TRANS	Fine shift with FRAME active
\$MN_MM_NUM_R_PARAM	Number of R-parameters (300)
\$MN_SCALING_SYSTEM_IS_METRIC	Metric measurement system is active
\$MN_SCALING_VALUE_INCH	Scaling factor inch/mm
\$ON_TRAFO_TYPE_MASK	Transformations
\$P_ACTBFRAME	Determine current overall base frame
\$P_ACTFRAME	Determine current overall frame
\$P_AD	Determine tool parameters of the active tool
\$P_AXN1	Geometry axis 1
\$P_AXN2	Geometry axis 2
\$P_AXN3	Geometry axis 3
\$P_CYCFRAME	Cycle frame
\$P_DRYRUN	Dry run active

Command	Meaning
\$P_EP	Current end point in the WKS
\$P_F	Last programmed feed
\$P_F_TYPE	Feed type
\$P_FZ	Last programmed feed FZ
\$P_GG	Active G-code each group
\$P_ISTEST	Simulation interpreter active?
\$P_LINENO	Current line number per program level
\$P_MAG	Magazine description
\$P_MC	Modal cycle active?
\$P_MSNUM	Active master spindle
\$P_OFFN	Programmed contour allowance
\$P_PATH	Program directory per program level
\$P_PFRAME	Determine current programmable frame
\$P_PROG	Program name per program level
\$P_S	Last programmed speed
\$P_S_TYPE	Speed type
\$P_SDIR	Spindle direction of rotation
\$P_SEARCH	Block pre-run active?
\$P_SEARCHL	Block pre-run type
\$P_SIM	Simulation interpreter active?
\$P_SMODE	Spindle operating mode
\$P_STACK	Number of the program on the stack
\$P_TC	Active tool holder
\$P_TOOL	Determine current cutting number
\$P_TOOLL	Determine active tool length
\$P_TOOLNO	Determine current tool number
\$P_TOOLR	Current tool radius
\$P_TRAFO	Active transformation
\$P_TRAFO_PARSET	Active transformation block
\$P_UIFRNUM	Determine active adjustable zero point offset
\$PI	Pi
\$SCS_CIRCLE_RAPID_FEED	Rapid traverse feed in mm/min for positioning on a circular path
\$SCS_DRILL_MID_MAX_ECCENT	Maximum center displacement center drilling
\$SCS_DRILL_SPOT_DIST	Spindle behaviour during MCALL drilling
\$SCS_DRILL_TAPPING_SET_GG12	Drilling precision stop behaviour
\$SCS_DRILL_TAPPING_SET_GG21	Drilling acceleration behaviour
\$SCS_DRILL_TAPPING_SET_GG24	Drilling pre-control
\$SCS_DRILL_TAPPING_SET_MC	Spindle behaviour during MCALL drilling
\$SCS_FUNCTION_MASK_DRILL_SET	Function mask drill
\$SCS_FUNCTION_MASK_MILL_SET	Mill function screen
\$SCS_FUNCTION_MASK_TECH_SET	Technology overview function screen
\$SCS_SUB_SPINDLE_REL_POS	Free movement position Z for counter-spindle
\$SCS_TURN_CONT_TRACE_ANGLE	Contour turning: Minimum angle for contour tracing
\$SCS_TURN_ROUGH_I_RELEASE_DIST",lp2Var::CreateConst(0.5));	Retraction distance machining during internal processing
\$SCS_TURN_ROUGH_O_RELEASE_DIST",lp2Var::CreateConst(1.);	Retraction distance machining during external processing



## G-commands

### G0, G1 straight line interpolation (cartesian)

G0: Move in rapid traverse, e.g. fast positioning  
 G1: Move with programmed feed F, e.g. processing the workpiece

**Format**

G0 X.. Y.. Z..  
 G1 X.. Y.. Z.. F

G0: Move in rapid traverse, e.g. fast positioning  
 G1: Move with programmed feed F, e.g. processing the workpiece

### G0, G1 straight line interpolation (polar)

**Format**

G0 AP.. RP..  
 G1 AP.. RP..

### Insert bevel, rounding

Bevels or roundings can be inserted between straight lines and curves in arbitrary combinations.

**Format**

G..	X..	Y..	Z..	CHR=..	Bevel
G..	X..	Y..	Z..	CHF=..	Bevel
G..	X..	Y..	Z..	RND=..	Rounding

**Bevel**

The bevel will be inserted after the block in which it is programmed.  
 The bevel is always on the working level (G17).  
 The bevel will be placed symmetrically in the contour corner.  
 CHR indicates the length of the bevel.  
 CHF indicates the length of the hypotenuse.


Example:  
 N30 G1 X.. Y.. CHR=5  
 N35 G1 X.. Y..

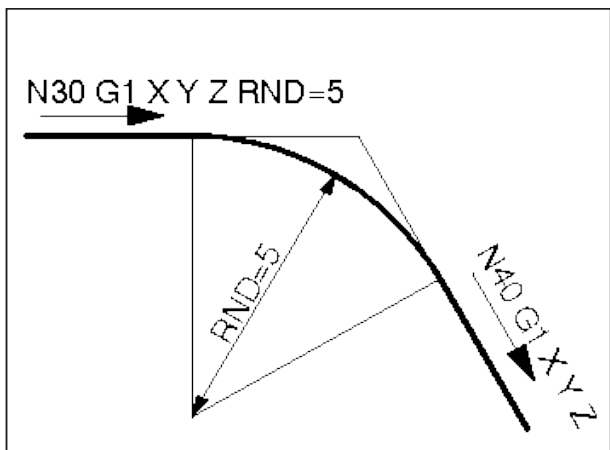
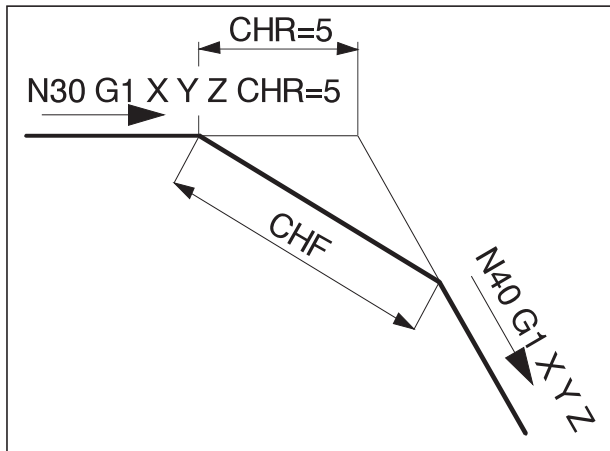
**Rounding**

The rounding will be inserted after the block in which it is programmed.  
 The rounding is always on the working level (G17).  
 The rounding is a curve and will be placed in tangential contact with the contour corner.  
 RND indicates the radius of the rounding.

Example:  
 N30 G1 X.. Y.. RND=5  
 N35 G1 X.. Y..

**Information:**  
 Before programming, the zero point of the workpiece coordinate system must be defined with G111.

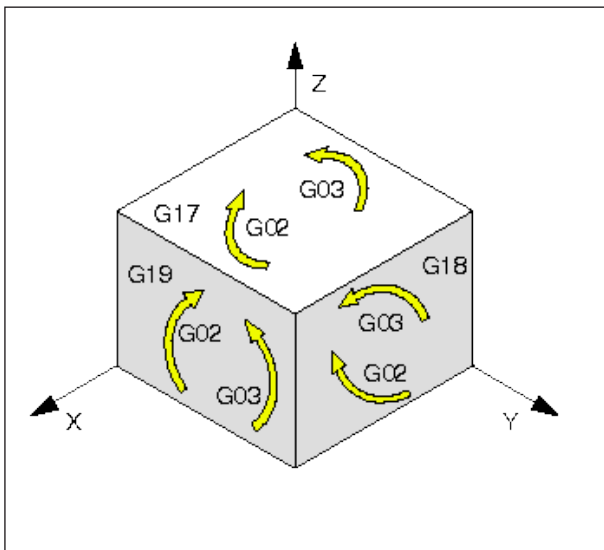




**Modal rounding RNDM**

At each following contour corner a rounding will be executed, until modal rounding is deselected with RNDM=0.

Example:  
 N30 G1 X.. Z.. RNDM=2 Switch on modal filleting. Radius of the rounding: 2 mm  
 N40 G1 X.. Y..  
 N120 RNDM=0 Switch off modal filleting.



**G2, G3, circle interpolation**

G2 in clockwise direction  
 G3 in counterclockwise direction

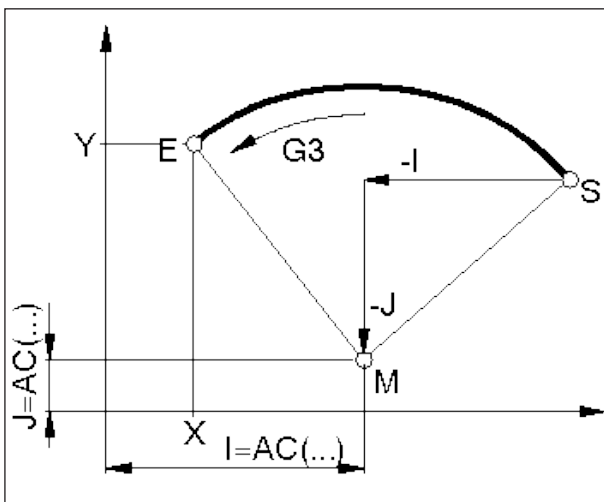
Representation of the circular movement for the various main levels.  
 For a circular movement the start and end points are in the same level.  
 If a change in the 3rd axis is programmed (e.g. the Z-axis for G17), a helical line is generated.

Helical line:  
 Programming a curve, start point and end point in Z different (G17).  
 If more than one circle pass is desired, the number of full circles must be indicated with TURN=.

**Programming with start point, end point, circle centre**

G2/G3 X.. Y.. Z.. I.. J.. K..

X, Y, Z End point E in cartesian coordinates  
 I, J, K Circle centre M in cartesian coordinates, relative to start point S

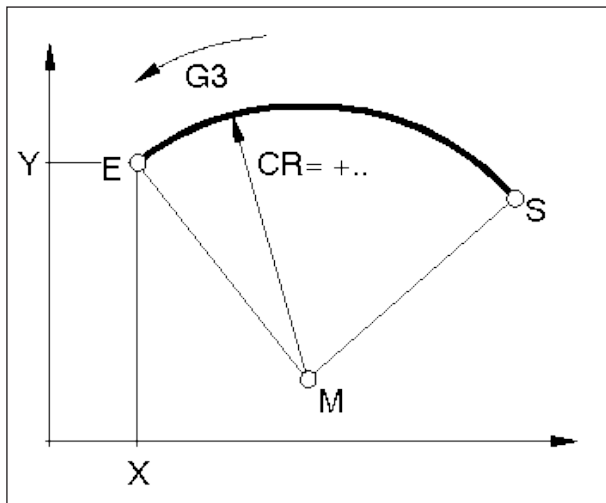


Start point  
 The start point is the point where the tool is when the G2/G3 call is made.

End point  
 The end point will be programmed with X, Y, Z.

Circle centre  
 The circle centre will be programmed incrementally from the start point with I, J, K or with I=AC(..), J=AC(..), K=AC(..) absolutely from the workpiece zero point.





**Programming with start point, end point, circle radius**

G2/G3 X.. Y.. Z.. CR=±..

X, Y, Z End point E in cartesian coordinates  
CR=± circle radius

**Start point**

The start point is the point where the tool is when the G2/G3 call is made.

**End point**

The end point will be programmed with X, Y, Z.

**Circle radius**

The circle radius will be indicated with CR. The symbol indicates whether the circle is larger or smaller than 180°.

CR=+ Angle smaller or the same as 180°

CR=- Angle larger than 180°.

Full circles cannot be programmed with CR.

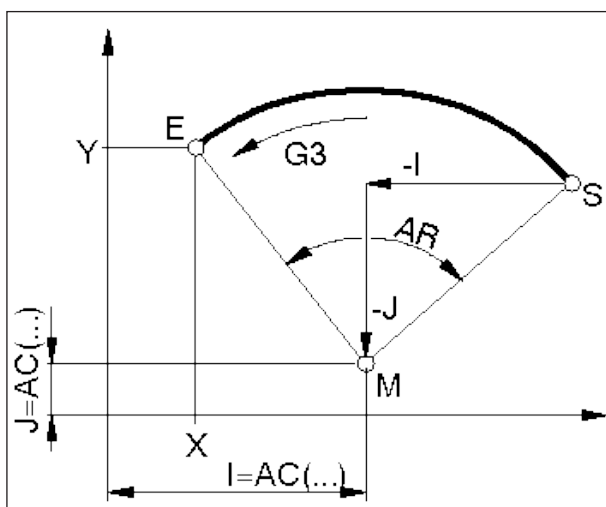
**Programming with start point, circle centre or end point, opening angle**

G2/G3 X.. Y.. Z.. AR=.. or  
G2/G3 I.. J.. K.. AR=..

X, Y, Z End point E in cartesian coordinates  
or

I, J, K Circle centre M in cartesian coordinates, relative to start point S

AR= Opening angle



**Start point**

The start point is the point where the tool is when the G2/G3 call is made.

**End point**

The end point will be programmed with X, Y, Z.

**Circle centre**

The circle centre will be programmed incrementally from the start point with I, J, K or with I=AC(..), J=AC(..), K=AC(..) absolutely from the workpiece zero point.

**Opening angle**

The opening angle must be smaller than 360°.

Full circles cannot be programmed with AR.

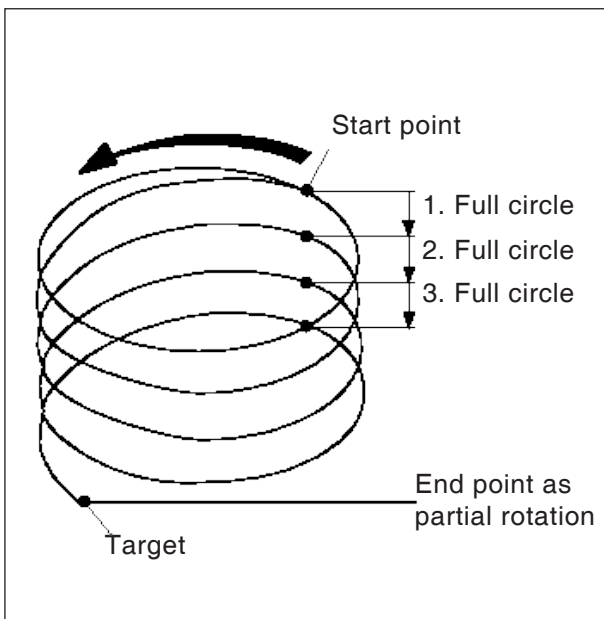
**Programming with polar coordinates**

G2/G3 AP=.. RP=..

AP= End point E polar angle,  
pole is circle centre

RP= Polar radius, at the same time circle  
radius

The pole of the polar coordinate system must be in the center of the circle (place previously on circle center with G111)



**Helical line interpolation**

G2/G3 X... Y... Z... I... K... TURN=

G2/G3 X... Y... Z... CR=... TURN=

G2/G3 AR=... I... J... K... TURN=

G2/G3 AR=... X... Y... Z... TURN=

G2/G3 AP... RP=... TURN=

X, Y, Z..... End point in cartesian coordinates  
I, J, K ..... Circle centre in cartesian

.....  
coordinates

CR= ..... Circle radius

AR= ..... Opening angle

AP= ..... Polar angle

RP= ..... Polar radius

TURN=Number of additional circle passes in the  
area from 0 to 999

For detailed explanations of the interpolation parameters see circle interpolation.

## G4 Dwell time

### Format

N... G4 F... ..... [sec]  
N... G4 S... ..... [R]

F Dwell time in seconds

S Dwell time in number of rotations of the main spindle

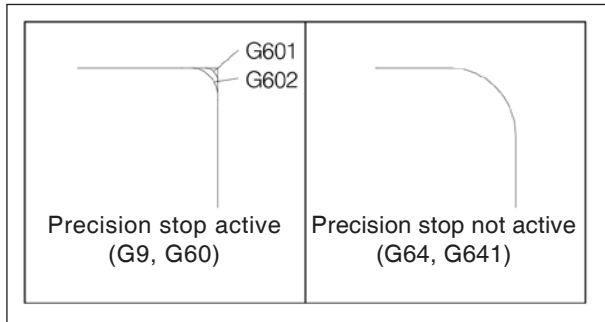
Clean the tool held in the last reached position - sharp edges - transitions, insertion base, precision stop.

### Notes

- The dwell time begins after the feed speed of the preceding block has reached "ZERO".
- Only in the block with G4 are S and F used for time details. a previously programmed feed F and spindle speed S are maintained.

### Example

N75 G04 F2.5 (dwell time = 2,5 sec)



## G9, G60, G601, G602, Precision stop

- G9 Precision stop, effective block-by-block
- G60 Precision stop, modally effective
- G601 Advance when fine position window is reached
- G602 Advance when rough position window is reached
- G602 Advance when interpolation end reached

G601/G602 effective only when G60 or G9 is active.

With the commands G64, G641 - Track control operation, G60 is deselected

G9/G60:

Activate G601 or G602.

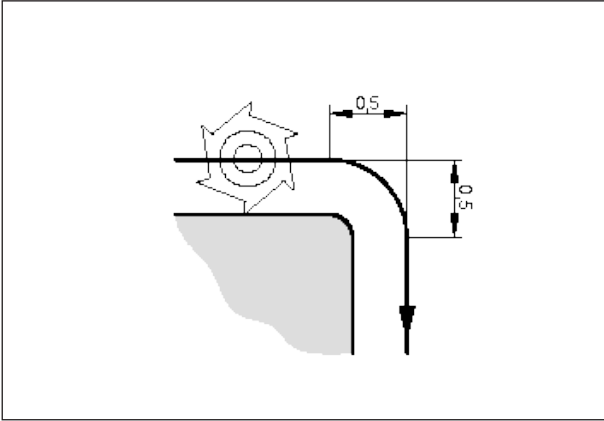
G9 is only effective in the block in which it is programmed. G60 is effective until it is deselected with G64 or G641.

G601, G602:

The next block will then only be executed if the block is executed with G9 or G60 and the slides are braked to a stop (short stop time at the end of the block).

In this way the corners will not be rounded and precise transitions achieved.

The target position may lie in a fine (G601) or rough (G602) tolerance field.



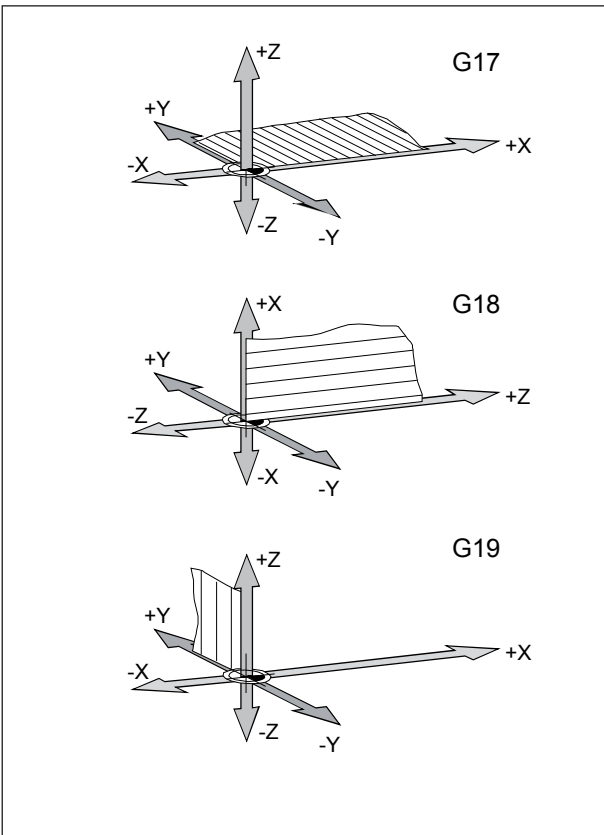
## G64 Path control mode

### G64 Path control mode

The contour will be created with as constant a path speed as possible. Shorter processing times and rounded corners are created.

In tangential contour transitions, the tool moves with as constant a path speed as possible; in corners, the speed is reduced correspondingly.

The larger the feed F is, the greater the smoothing down of the corners (contour error).



## G17, G18, G19 Level selection

### Format

N... G17/G18/G19

G17 XY-level

G18 ZX-level

G19 YZ-level

The work level is defined with G17-G19.

- The tool axis sits vertically on the work plane.
- The circle interpolation G2/G3/CIP takes place in the work level
- The polar coordinate interpolation takes place in the work level
- The tool radius correction G41/G42 takes place in the work level
- The infeed movements take place vertically on the work plane, e.g. for drilling cycles.

## G25, G26 Spindle speed limitation

### Format

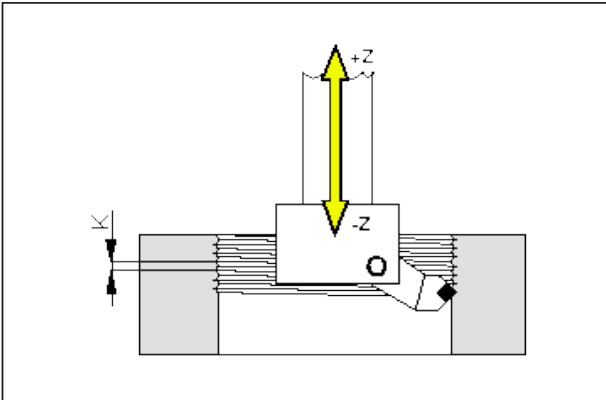
N... G25/G26 S...

G25/G26 allow a minimum and maximum speed to be defined for the spindle.

G25 and G26 must be written in a separate program block.

The spindle speed limitation with G25/G26 overwrites the values in the settings data and therefore is preserved after the program ends.

G25	Lower spindle speed limitation
G26	Upper spindle speed limitation
S	Minimum or maximum speed



## G33 Thread cutting

### Format

N... G33 Z... K...

K ..... Thread pitch in the Z-direction [mm]

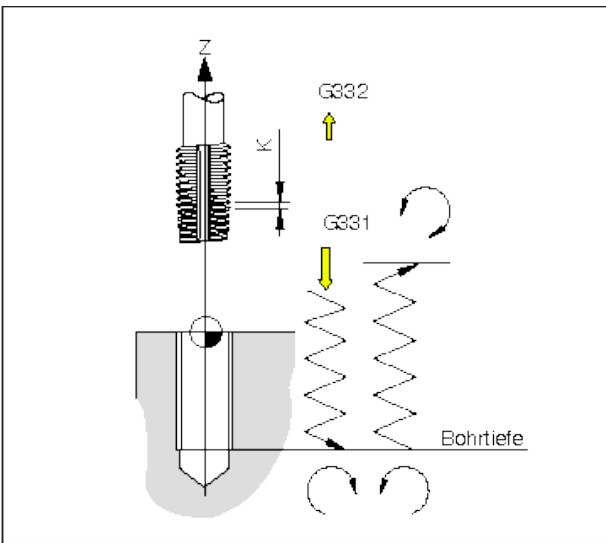
Z ..... Thread depth

Threads can be cut with an appropriate tool (turn-out tool or facing head).

The pitch (K) must be indicated in each case, corresponding to the main direction of the thread.

### Notes

- Feed and spindle speed influence are ineffective during G33 (100%).
- A corresponding thread undercut for movement in and out is to be provided.



## G331/G332 Thread tapping without compensation chuck

(only for machines with position-controlled C-axis)

### Format

N... G331 X... Z... K...

N... G331 X... Z... K...

X, Z ..... Drilling depth (end points)

K ..... Thread pitch

Drilling depth, thread pitch

Drilling in Z-direction, thread pitch K

### G331 Thread tapping:

The drill hole will be described by drill depth (end point of the thread) and thread pitch.

### G332 Retraction movement:

This movement will be described with the same pitch as the G331-movement. The spindle's change of direction takes place automatically.

### Information:

Before G331 the tool spindle must be positioned at a defined start point with SPOS.



## G63 Thread tapping without synchronisation

### Format

G63 X.. Y.. Z.. F.. S..

Drilling a thread with compensation chuck.

Programmed speed S, programmed feed F and pitch P of the tap must fit together:

$F \text{ [mm/min]} = S \text{ [rev/min]} \times P \text{ [mm/rev]}$  or

$F \text{ [mm/rev]} = P \text{ [mm/rev]}$

The plunge movement of the tap will be programmed with G63.

G63 works block by block. During G63 feed and spindle override are set to 100%.

The retraction movement (with reverse spindle direction) must also be programmed with G63.

Example:

Tap M5 (pitch P = 0.8 mm)

Speed S = 200, so F = 160

N10 G1 X0 Y0 S200 F1000 M3  
(approach start point)

N20 G63 Z-50 F160  
(thread tapping, drilling depth 50)

N30 G63 Z3 M4  
(retraction movement, reverse spindle direction of rotation)

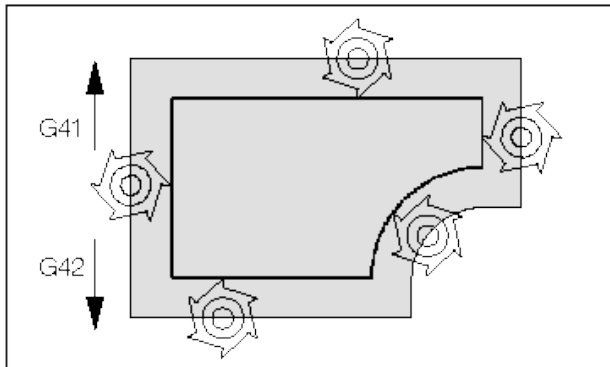


## Tool radius correction G40-G42

**G40** Tool radius correction OFF

**G41** Tool radius correction LEFT (down-cut milling)

**G42** Tool radius correction RIGHT (up-cut milling)



With G41/42 the tool moves on an equidistant path to the programmed contour. The path distance corresponds to the tool radius.

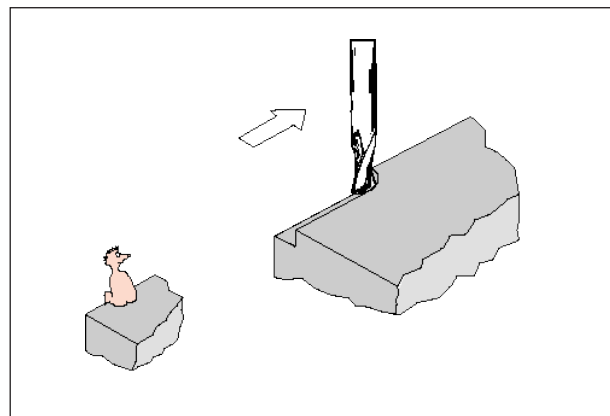
To define G41/42 (left/right of the contour) look in the feed direction.

### G40 Deselection tool radius correction

The tool radius correction is deselected by G40. The deselection (withdrawal movement) is only permitted in connection with a straight-line traverse movement (G00, G01).

G40 can be programmed in the same block as G00 or G01 or in the preceding block.

G40 is mostly defined in the retraction to the tool change point.



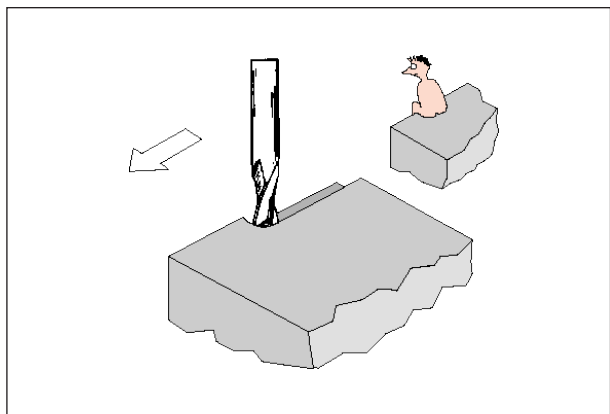
Definition G41 Tool radius correction left

### G41 Tool radius correction left

If the tool (seen in the feed direction) is to the **left** of the contour to be processed, G41 must be programmed.

#### Notes

- Directly switched between G41 and G42 is not allowed - prior deselection with G40.
- Selection (approach movement) in connection with G00 or G01 required.
- Change of tool correction is not possible when tool radius correction selected.



Definition G42 Tool radius correction right

### G42 Tool radius correction right

If the tool (seen in the feed direction) is to the **right** of the contour to be processed, G42 must be programmed.

For instructions see G41!

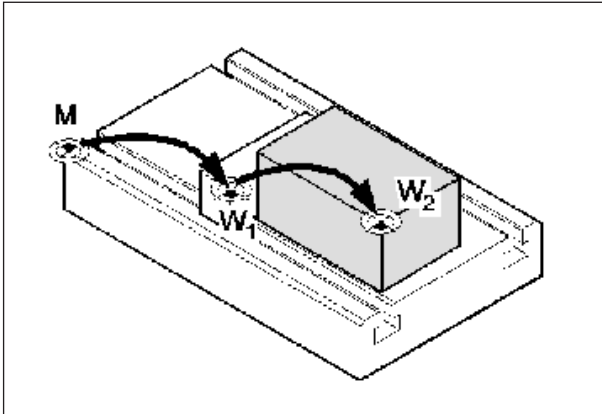
## Zero point offset G53-G57, G500-G599

G53 The zero point offsets are suppressed for one block.

G500 G54 - G599 are deselected.

G54-57 Preset zero point offsets.

G505-599 Preset zero point offsets.



Zero points are used to show the machine the position of the workpiece.

Typically with G54-G599 the shift to the measurement system takes place on an attachment point ( $W_1$ ) on the clamping device (saved permanently), the further shift to the workpiece zero point ( $W_2$ ) takes place with TRANS (variable).

## Inch-cased measurements G70, Metric measurements G71

You can enter the following measurements in inches or mm according to G70 / G71:

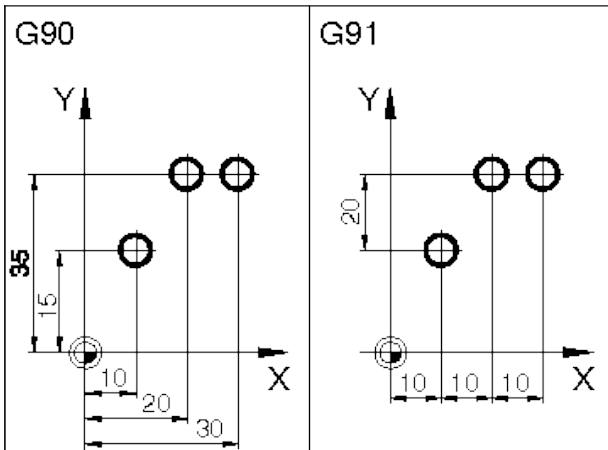
- Path information X, Y, Z
- Circle parameter I1, J1, K1, I, J, K, CR
- Thread pitch
- Programmable zero point offset TRANS, ATRANS
- Polar radius RP

All other details such as feeds, tool corrections or configurable zero point offsets will be calculated in the measurement unit that is preset in the machine data.



**Information:**

The overall zero point offset effective in a parts program is the sum of the base zero point offset + configurable zero point offsets + Frames.



**Work plane G17-G19**

The tool radius is effective in the work plane, the tool length vertically on the work plane.

Main work plane for vertical milling: G18 (XY)  
 When working with angle heads G18 (ZX), G19 (YZ), (see Chapter F tool programming)

**G90 absolute measurement input**

The measurement details are relative to the current zero point.  
 The tool moves **TO** a programmed position.

**G91 Chain measurement input**

The measurement details are relative to the last programmed position of the tool.  
 The tool traverses **AROUND** a route to the next position.

You can program individual axes independently of G90 / G91, absolutely or incrementally.

Examples:

G90  
 G0 X40 Y=IC(20)  
 Here the Y-value is indicated incrementally, although G90 absolute measurement input is active.

G91  
 G0 X20 Y=AC(10)  
 Here the Y-value is indicated absolutely, although G91 chain measurement input is active.

## Feed programming G94, G95

### General

- Feed details will not be influenced by G70/71 (inch-mm). The machine data setting applies.
- After each switch between G94/95 F must be re-programmed.
- The feed F applies only for path axes.

### Feed F in mm/min G94

Slide movement X, Y, Z:

The address F indicates the feed in mm/min.

Round axis movement A, B, C:

The address F indicates the feed in °/min.

**Main application for milling.**

### Feed F in mm/rev G95

Slide movement X, Y, Z:

The address F indicates the feed in mm/rev of the milling spindle.

Round axis movement A, B, C:

The address F indicates the feed in °/rev of the milling spindle.

Main application for rotation.

### Block-by-block feed FB

#### General

With the function "Block-by-block feed" a separate feed will be specified for an individual block. After this block the previously effective modal feed is active again.

#### Block-by-block feed FB G94

Feed in mm/min or inch/min or for round axes degrees/min

#### Block-by-block feed FB G95

Feed in mm/rev or inch/rev or for round axes °/rev

Example:

G0 X0 Y0 G17 F100 G94	Start position
G1 X10	Feed 100 mm/min
X20 FB=80	Feed 80 mm/min
X30	Feed is again 100 mm/min

### Tooth feed FZ

#### General

The cutting speed has a significant influence on the blade temperature and cutting forces. Therefore before a technical calculation of the feed speeds, a cutting speed must be defined.

This connection exists between the teeth feed (FZ), the revolution feed (F) and the number of cutting teeth (N):

$$F = FZ * N$$

F...revolution feed [mm/rev] or[inch/rev]

FZ...tooth feed [mm/tooth] or [inch/tooth]

N...Number of blades [number of teeth]

The number of blades is defined in the tool table in column N.

Example: Milling cutter with 5 teeth (N = 5)

G0 X100 Y50

G1 G95 FZ=0.02      Teeth feed 0.02 mm/tooth

T"Milling cutter3" D1 M6 .....  
Change tool and activate tool correction data block.

M3 S200              Spindle speed 200 rev/min

X20                  Mill with: FZ = 0.02 mm/tooth

Effective revolution feed:

$F = 0.02 \text{ mm/tooth} * 5 \text{ tooth/rev} = 0.1 \text{ mm/rev}$

or:  $F = 0.1 \text{ mm/rev} * 200 \text{ rev/min} = 20 \text{ mm/min}$



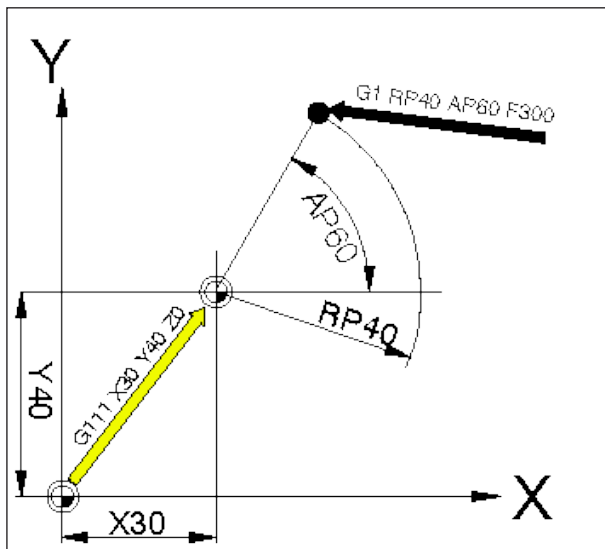
**Information:**

The tooth feed relates only to the path. Axis-specific programming is not possible.

## Polar coordinates G110-G112

With polar coordinate programming the positions are indicated with angle and radius, relative to the pole (origin of the polar coordinate system).

In NC blocks with polar end point data no cartesian coordinates such as interpolation parameters, axis addresses, etc., may be programmed for the selected work plane.



### Defining the pole

G110 pole details, relative to the last programmed tool position.

G111 pole details, relative to the current zero point of the workpiece coordinate system.

G112 pole details, relative to the last valid pole.

The pole can be indicated in orthogonal or polar coordinates.

X,Y,Z Coordinates of the pole (orthogonal)

RP Polar radius (= distance pole - target point)

AP Polar angle between pole target point and angle reference axis route (first-mentioned pole axis)

### Example

```
G111 X30 Y40 Z0
```

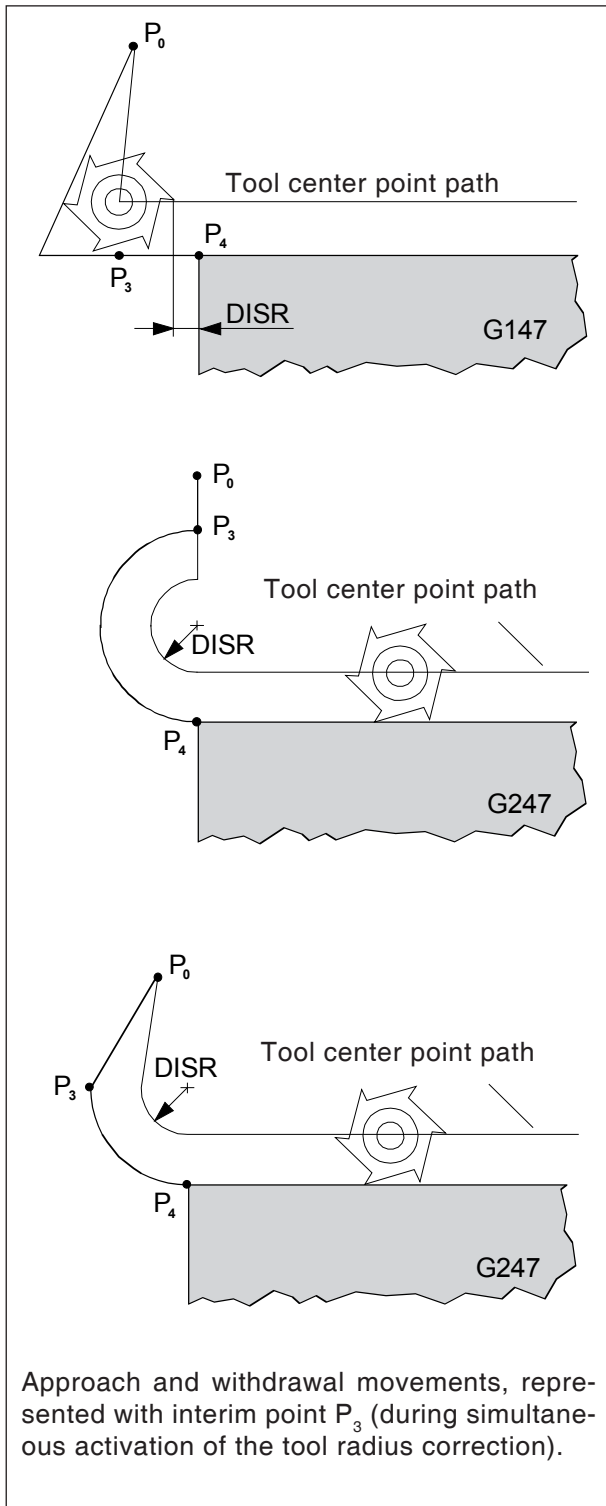
```
G1 RP=40 AP=60 F300
```

With G111 the pole will be placed on the absolute position 30/40/0.

With G1 the tool will be moved from its previous position to the polar position RP40/AP60.

The angle is relative to the abscissa .

## Gentle approach and withdrawal G140 - G341, DISR, DISCL



- G140 Approach and withdrawal mode
- G141 Approaching from left or withdrawing from left
- G142 Approaching from right or withdrawing from right
- G147 Approach in a straight line
- G148 Withdraw in a straight line
- G247 Approach in a quarter circle
- G248 Withdraw in a quarter circle
- G340 Approach and withdraw three-dimensionally (base setting)
- G341 Approach and withdraw in the plane
- G347 Approach with a semi-circle
- G348 Withdraw with a semi-circle
- G450 Approach and leave contour
- DISR

- Approach and withdrawal with straight lines, distance of the milling cutter tool edge from the start point of the contour
- Approach and withdraw with circles. Radius of the tool center point path
- DISCL Distance of the end point of the rapid traverse to the processing plane
- DISCL=AC details of the absolute position of the end point of the rapid traverse movement
- DISCL=0
- G340:  $P_1, P_2, P_3$  go together
- G341:  $P_2, P_3$  go together

This gentle approach and withdrawal function is used to tangentially approach the start point of a contour independently of the position of the point of departure.

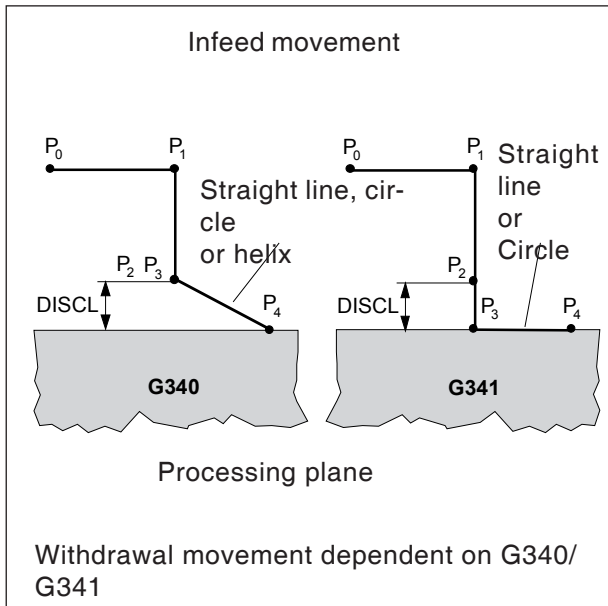
The movement to and fro consists of a maximum of 4 part movements:

- Start point of the movement ( $P_0$ )
- Interim points ( $P_1, P_2, P_3$ )
- End point ( $P_4$ )

The points  $P_0, P_3,$  and  $P_4$  are always defined. The interim points  $P_1$  and  $P_2$  may be inapplicable depending on the processing circumstances.

### Information:

Traverse movements with G0/G1 are to be programmed prior to gentle starting and withdrawal. Programming G0/G1 in the block is not possible.



**Selection of the approach or withdrawal direction**

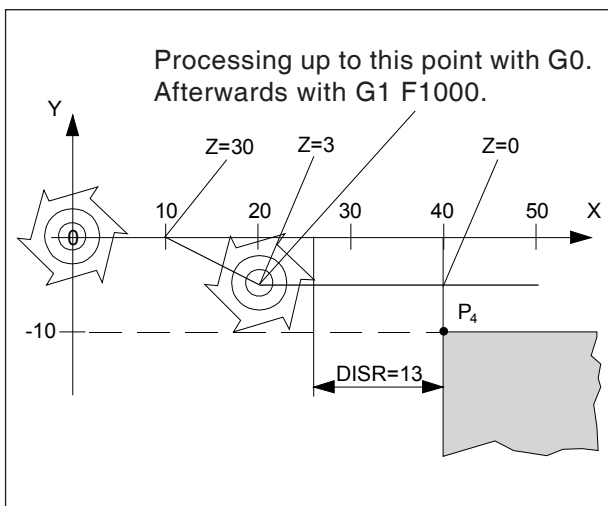
Definition of the approach and withdrawal direction using the tool radius correction

when the tool radius is positive:  
G41 active - Approach from the left  
G42 active - Approach from the right

**Division of the movement from start to end point (G340 and G341)**

The characteristic approach from P<sub>0</sub> to P<sub>4</sub> is shown in the adjacent image.

In the cases that go into the position of the active planes G17 to G19, any actively rotating FRAME will be taken into account



```
N10 G90 G0 X0 Y0 Z30 D1 T1
N20 X10
N30 G41 G147 DISCL=3 DISR=13 Z=0 F1000
N40 G1 X40 Y-10
N50 G1 X50
```

...  
...

N30/40 can be replaced by:

```
1.
N30 G41 G147 DISCL=3 DISR=13 X40 Y-10
ZO F1000
```

or

```
2.
N30 G41 G147 DISCL=3 DISR=13 F1000
N40 G1 X40 Y-10 ZO
```



## Collision monitoring NORM, KONT

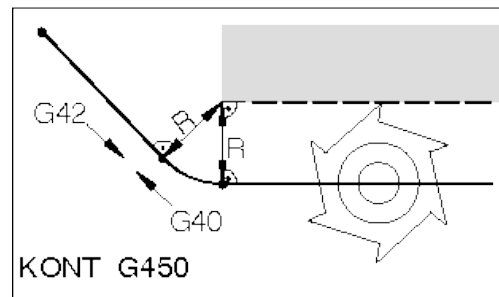
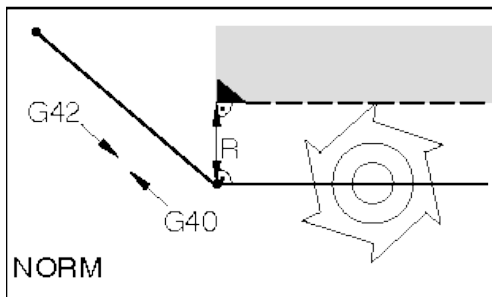
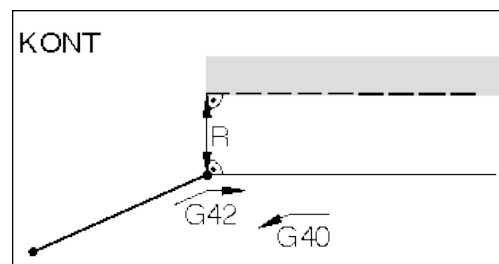
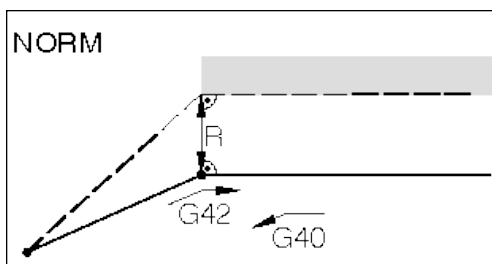
### Approach and leave contours NORM/KONT

**NORM:** The tool moves in a straight line and sits vertically on the contour point

If the start/end point are not on the same side of the contour as the first/last contour point, there will be a contour infringement.

**KONT:** The tool moves around the contour point as programmed under G450.

— — — Programmed tool path  
 ————— Actual tool path with correction



During approach and withdrawal with NORM there may be a contour infringement (black) if the start or end point lie behind the contour.

During approach or withdrawal with KONT the tool moves around the corner with curves (G450).

## Tool call-up

### Tool call-up

T.: Tool name in magazine

D.: Tool cut number

Each tool name T can be assigned up to 9 tool cut numbers D.

The tool blade numbers D do not refer to the individual blades (teeth) of the tooth, however, but rather the correction data assigned to this tool.

Up to 9 tool blade numbers can be assigned to a tool (e.g. a surface milling cutter tool can also be used a bevel milling cutter tool; two different points are measured on the same tool and thus 2 tool blade numbers created).

According to use, for example, T="Surface milling cutter" D1 M6

or

T="Surface milling cutter" D2 M6

will be programmed.

With the command T="..." D.. the tool correction values D will be called up; the tool has still not been changed.

The data for the tool correction (milling cutter, milling cutter radius, etc.) will be read from the tool correction storage.

### Tool change

M6: Change tool

With the command M6 all the movements required for the tool change will be carried out automatically.

To avoid collisions, the tool must previously be lifted from the workpiece (move clear).

#### Example

N50 G0 X200 Y120 Z80

Approach tool change position

N55 T"Drill" D2 M6

Call up tool name and tool blade, and change tool

N65 ...



#### Information:

If not blade number D is programmed, the control system will automatically select blade number D1.

## Programming examples for tool call-up

The tool call-up and the command "M6" for the changeover must always be in the same program lines

### Tool call-up

G54

T1 D1 M6

G97 S2500 M3  
G94 F580 M8

The tool T1 is **programmed with M6 in the same** line.  
T1 will be changed. Tool correction number D1 will be assigned.

G0 X0 Y0 Z5  
G1 Z0  
X50 Y50  
G0 Z50

T5 D2 M6

S3000 M3  
F180 M8

The tool T5 is **programmed with M6 in the same** line.  
T5 will be changed. Tool correction number D2 will be assigned.

G0 X0 Y0 Z5  
G1 Z-1  
X50 Y50

D1

The active and changed tool T5 will be assigned the tool correction number D1.

Z-2  
X0 Y0

G0 Z50  
M30

### Pre-positioning of the tool (only random tool system)

With random tool systems there is also the possibility of swivelling the next tool that should be changed in to the change position. This happens during the processing.

G54

T1 D1 M6  
G97 S2500 M3  
G94 F580 M8

G0 X0 Y0 Z5

T5

G1 Z0  
X50 Y50  
G0 Z50

Tool pre-selection for T5

The tool T5 swivels into the change position (movement of the tool drum).

While this happens, the processing with the active tool T1 is not interrupted.

T1 D1 M6  
S3000 M3  
F180 M8

The tool T5 will be changed. Tool correction number D1 will be assigned.

G0 X0 Y0 Z5  
G1 Z-1  
X50 Y50

D2

The tool T5 will be assigned the tool correction number D2.

Z-2  
X0 Y0

G0 Z50  
M30

#### Information:

To avoid errors when programming for the pre-positioning, proceed as follows:

- First of all program the parts program without pre-positioning of the tools (as for a non-random tool system).
- Then insert the commands for the pre-positioning (tool invocation) in the parts program from bottom to top.



## Cycle overview

The cycle groups with the Sinumerik Operate cycles defined within them are listed here.



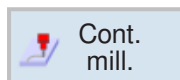
### Drilling

- Centering
- Drilling
- Reaming
- Long-hole drilling
- Boring
- Thread
- Positions



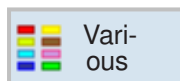
### Milling

- Face milling
- Pocket
- Spigot
- Slot
- Thread milling
- Engraving



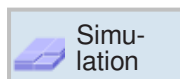
### Contour milling

- New contour
- Path milling
- Pre-drilling
- Pocket
- Spigot



### Various

- Raw part
- Sub-routine



### Simulation

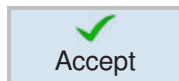
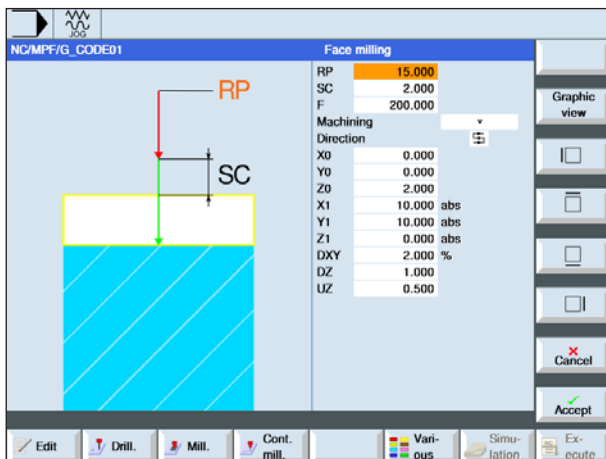
## Working with cycles

Processes that repeat often, and which include several processing steps, are saved in the control system as cycles. Some special functions are also available as cycles.

### Define cycle

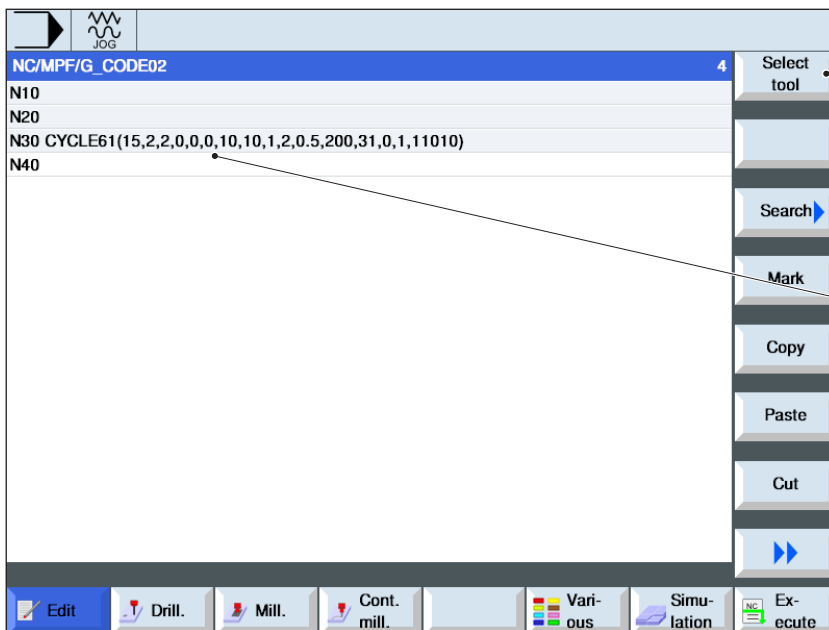
The softkey bar shows the different cycle groups.

- Select cycle group
- Select cycle
- Enter all required parameters



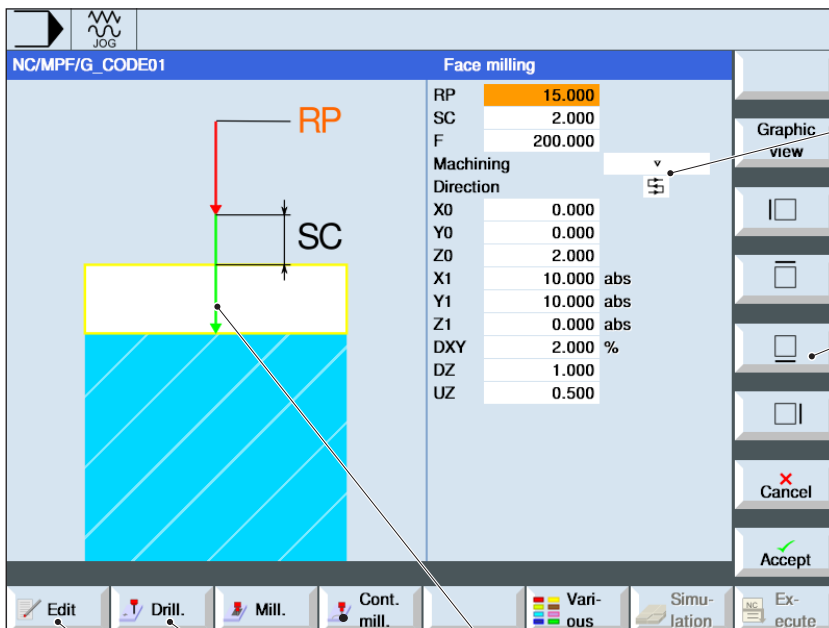
- Terminate input with this softkey.

### Geometry and technology data input



softkey for tool programming. With G-code programs a tool must be selected before invoking cycles.

Program view with command lines



Selection fields: Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

softkeys for additional functions

Coloured positioning movements:

- Red positioning movement = tool moves in rapid traverse.
- Green positioning movement = tool moves in processing infeed.

These softkeys show the cycle groups that are additionally available.

This softkey is used, for example to "Copy", "Paste" and "Delete" cycles.

## Invoking cycles

Invoking cycles is done in the following way:

Cycle (parameter 1, parameter 2, etc.)

In the overview screens and in the cycle description you see the parameters required in each case for the individual cycles.

In the call the parameters are registered only with their value (without identifier).

Therefore the sequence of parameters must be maintained, so that values are not misinterpreted. If a parameter is not required, an additional parameter must be set in its place.

**Information:**

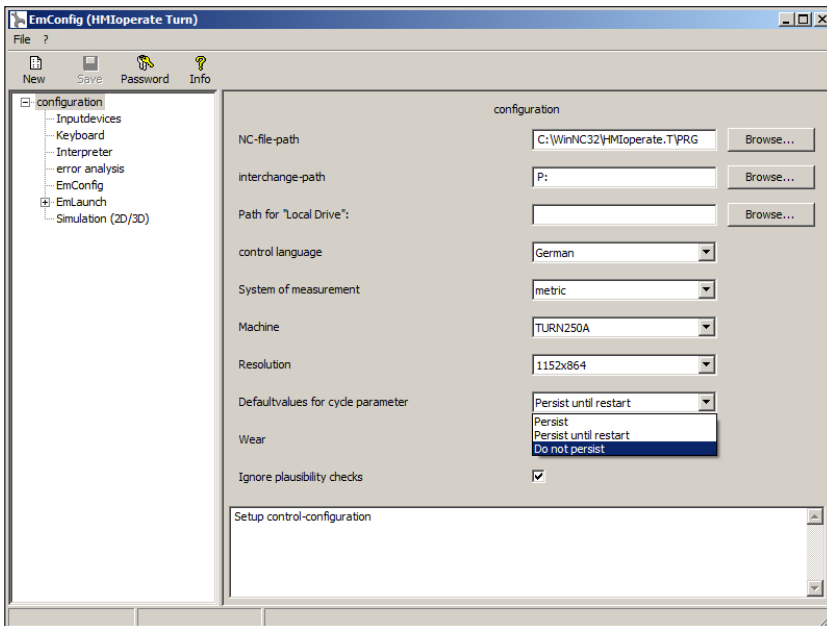
Cycles can also be called via MCALL. (see "Modal sub-program MCALL")



## Defaultvalues for cycle parameter

EMConfig is a configuration software for WinNC. EMConfig helps you to alter the settings of WinNC

Open EMConfig and select Configuration:



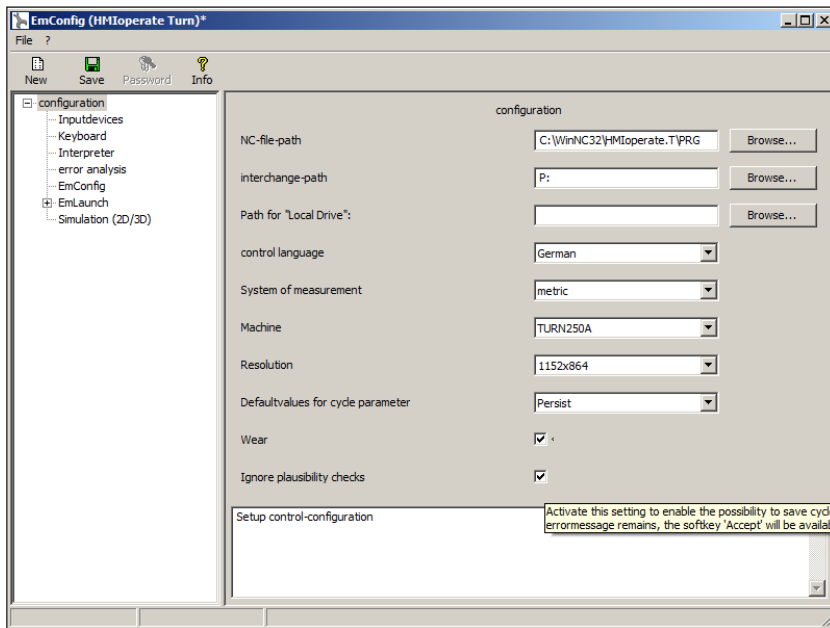
*Defaultvalues for cycle parameter*

The option defaultvalues for cycle parameter allows you the following settings:

**Note:**  
 If cycles are already programmed, the input values are stored and suggested as default values next time. As this can be inconvenient in training, it can be configured with EMConfig.

- **persist**  
 the latest parameter values persist even after a restart of the NC-control.
- **persist until restart**  
 the latest parameter values will be replaced by system default when restarting the NC-control.
- **do not persist**  
 cycle data will be replaced by system default when leaving the input mask.

## Ignore plausibility check for saving

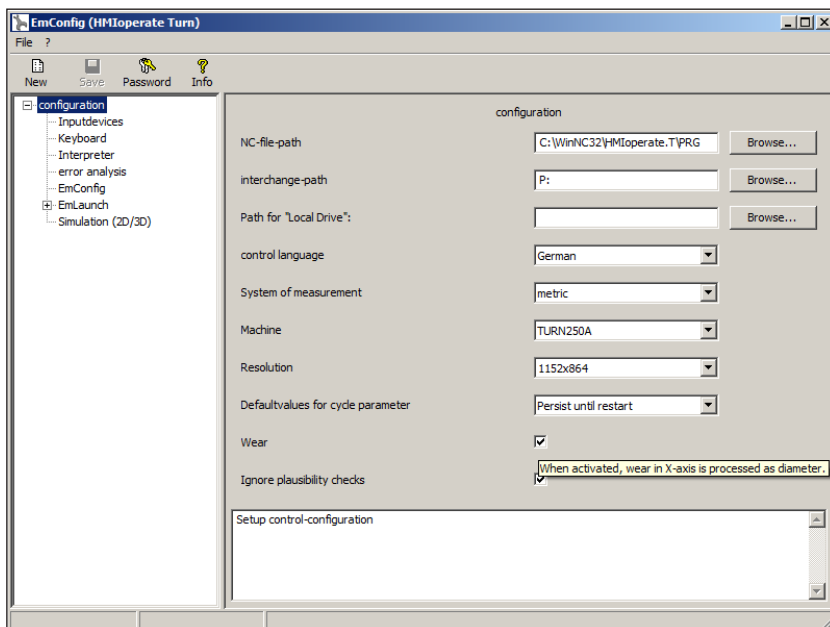


Use this checkbox to activate or deactivate the plausibility check for saving.

Activate this setting to be able to save cycles, despite an error message being present. The corresponding error messages certainly remain in existence, but the "Accept" softkey is available.

*Set plausibility check for saving*

## Set length tool wear



Use this checkbox to state tool wear length for rotating tools as diameter or as length.

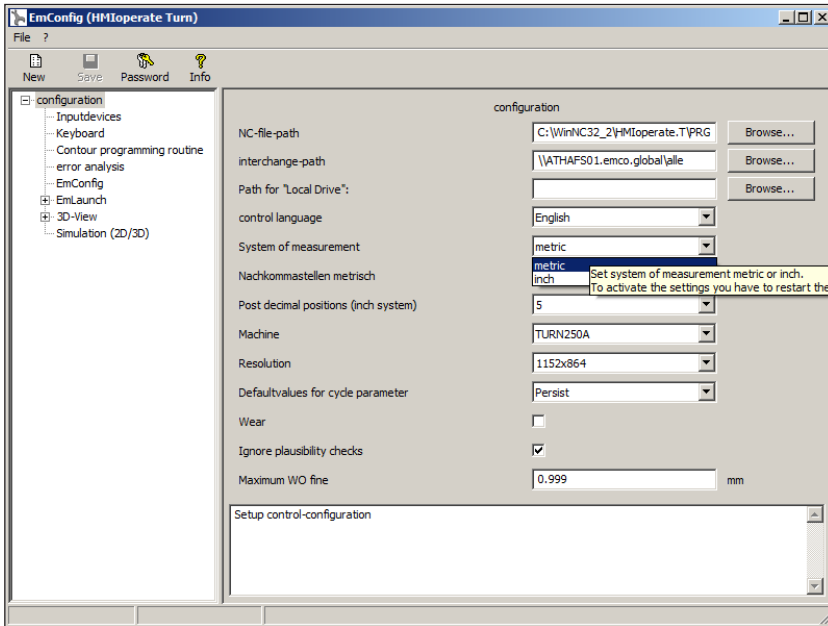
*Set wear as diameter or length*

### Instructions:

This setting is only valid for turning tools.



## Set system of measurement



With this checkbox the system of measurement for the control software can be set to metric or inch.

Set the system of measurement to metric or inch

**Note:**

Inch programs can not be used with metric control (and vice versa).



### Table of units

inch			
feet <sup>*)</sup>	inch	mm	m
1	12	304,5	0,304
inch <sup>°)</sup>	feet	mm	m
1	0,83	25,4	0,0254

metric			
m	mm	inch	feet
1	1000	39,37008	3,28084
mm	m	inch	feet
1	0,001	0,0393701	0,0032808

\*) **feet:** only for constant cutting speed

°) **inch:** standard input



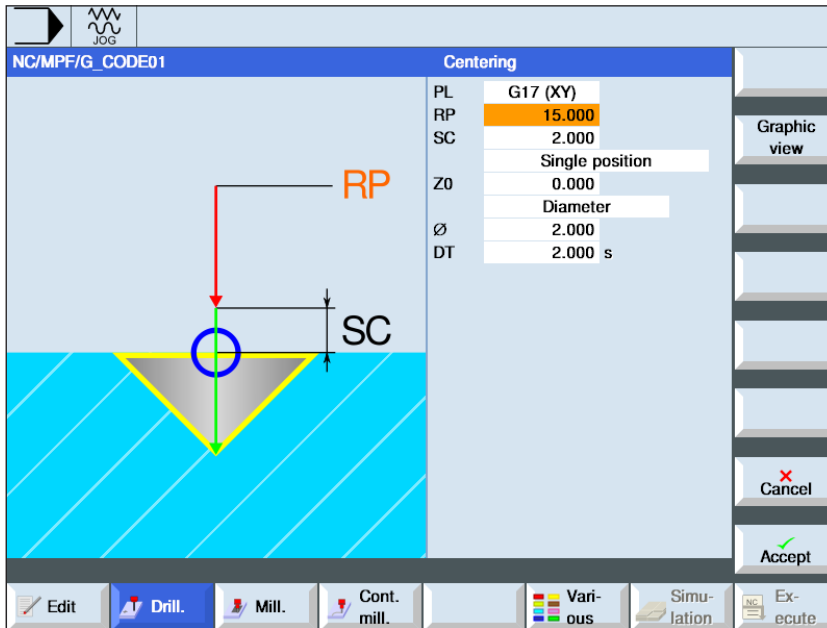


## Drilling

- Centering (CYCLE81)
- Drilling (CYCLE82)
- Reaming (CYCLE85)
- Deep hole drilling (CYCLE83)
- Boring (CYCLE86)
- Thread (CYCLE84)
- Positions (CYCLE802)



## Centering (CYCLE81)

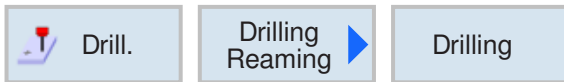


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

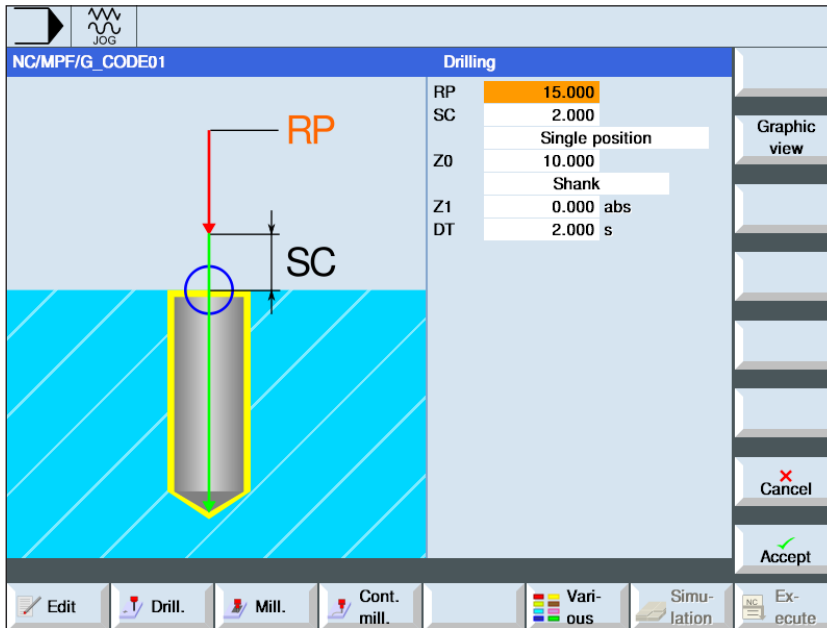
Parameters	Description	Unit
RP	Retract plane	mm
SC	Safety distance	mm
Processing position	<ul style="list-style-type: none"> <li>Individual position Drill hole to programmed position.</li> <li>Position template Position with MCALL.</li> </ul>	
Z0	Reference point Z	mm
Centering	<ul style="list-style-type: none"> <li>Diameter (centering relative to the diameter). The center drill angle indicated in the tool list will be taken into account.</li> <li>Tips (centering relative to the depth) The tool plunges to the programmed plunge depth.</li> </ul>	
Ø	The tool plunges until the diameter is reached.	mm
Z1	Drill depth (absolute) or depth related to Z0 (incremental). The tool plunges until Z1 is reached.	mm
DT	<ul style="list-style-type: none"> <li>Dwell time on the ground in seconds</li> <li>Dwell time on the ground in revolutions</li> </ul>	s R

**Cycle Description**

- 1** The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2** The tool centers with the programmed feed (F) till the depth (Z1) or the centering diameter ( $\emptyset$ ) is reached and lingers there (DT) - if indicated.
- 3** From the centering bottom the tool moves back to the retraction plane in rapid traverse after expiry of the dwell time (DT).



## Drilling (CYCLE82)



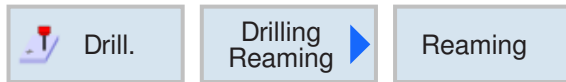
Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
SC	Safety distance	mm
Processing position	<ul style="list-style-type: none"> <li>Individual position Drill hole to programmed position.</li> <li>Position template Position with MCALL.</li> </ul>	
Z0	Reference point Z	mm
Drill depth	<ul style="list-style-type: none"> <li>Shaft (drill depth relative to the shaft). The drill plunges until the drill shaft reaches the programmed value Z1.</li> <li>Tip (drill depth relative to the tip) The drill plunges until the drill tip reaches the programmed value Z1.</li> </ul>	mm
Z1	Drill depth (absolute) or depth relative to Z0 (incremental). The tool plunges until Z1 is reached.	mm
DT	<ul style="list-style-type: none"> <li>Dwell time on the ground in seconds</li> <li>Dwell time on the ground in revolutions</li> </ul>	s R

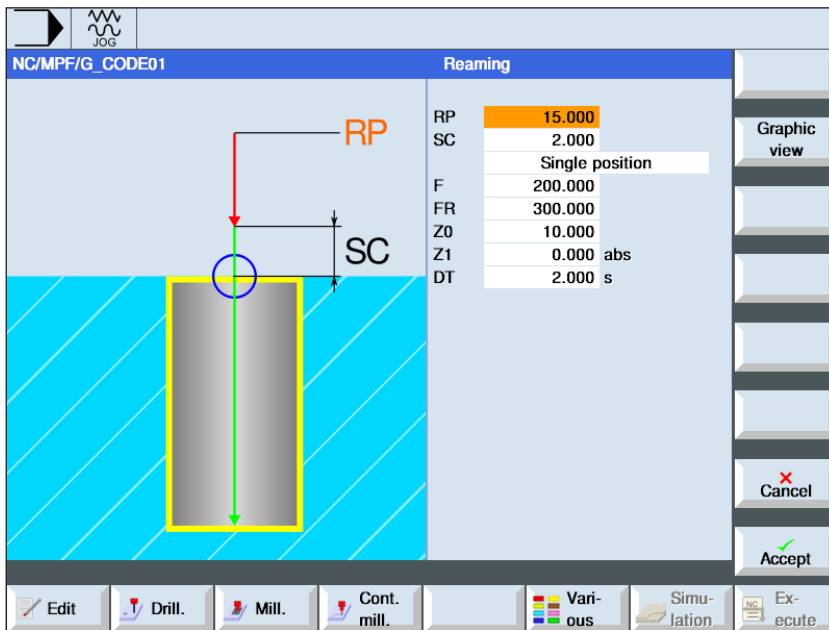


**Cycle Description**

- 1** The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2** The tool centers with the programmed feed (F) till the depth (Z1) is reached and dwells there (DT) - if indicated.
- 3** From the drill bottom the tool moves back to the retraction plane in rapid traverse after expiry of the dwell time (DT).



## Reaming (CYCLE85)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

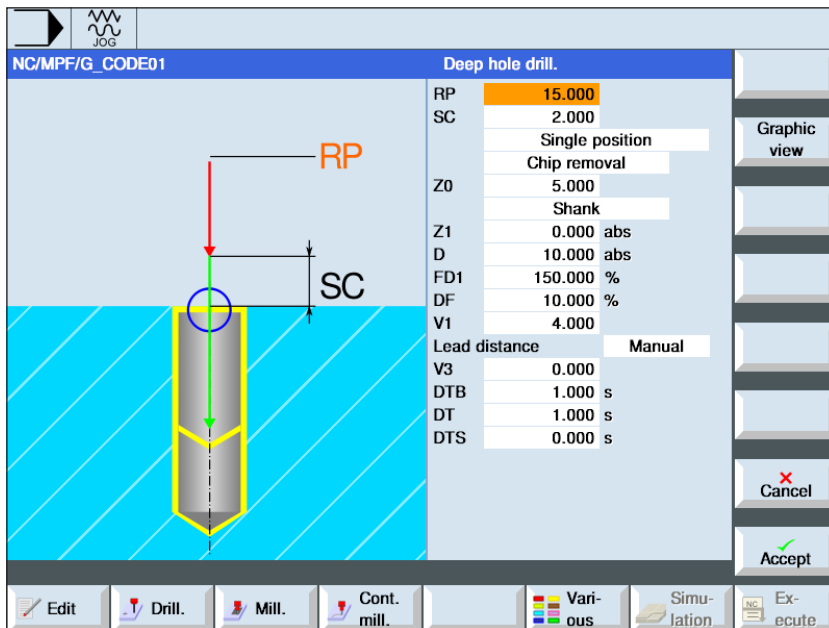
Parameters	Description	Unit
RP	Retract plane	mm
SC	Safety distance	mm
Processing position	<ul style="list-style-type: none"> <li>Individual position Drill hole to programmed position.</li> <li>Position template Position with MCALL.</li> </ul>	
F	Feed	mm/min mm/rev
FR	Feed during retraction	mm/min mm/rev
Z0	Reference point Z	mm
Z1	Drill depth (absolute) or depth relative to Z0 (incremental). The tool plunges until Z1 is reached.	mm
DT	<ul style="list-style-type: none"> <li>Dwell time on the ground in seconds</li> <li>Dwell time on the ground in revolutions</li> </ul>	s R

**Cycle Description**

- 1** The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2** The tool reams with the programmed feed (F) till the depth (Z1) is reached and dwells there (DT) - if indicated.
- 3** From the drill bottom the tool moves back to the retraction plane with retraction feed after expiry of the dwell time (DT).



## Deep hole drilling (CYCLE83)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
SC	Safety distance	mm
Processing position	<ul style="list-style-type: none"> <li>Individual position Drill hole to programmed position.</li> <li>Position template Position with MCALL.</li> </ul>	
Processing	<ul style="list-style-type: none"> <li>Chip clearing The drill moves completely out of the workpiece for chip clearing.</li> <li>Chip crushing The drill plunges until the drill tip reaches the programmed value Z1.</li> </ul>	
Z0	Reference point Z	mm
Z1	Drill depth (absolute) or drill depth (incremental) relative to Z0. The tool plunges until Z1 is reached.	mm
D	1. Drill depth (absolute) or drill depth (incremental) relative to Z0.	mm
FD1	Percentage rate for the feed during the first infeed	%
DF	Percentage rate for each additional infeed	mm %
V1	minimum depth infeed (only when DF indicated in %)	mm
V2	Retract amount after each processing (only when chip crushing selected)	mm
V3	Advanced stop distance (only when chip clearing and advanced stop distance manually selected)	mm
DTB	Dwell time at drill depth in seconds Dwell time at drill depth in revolutions	s R

Parameters	Description	Unit
DT	<ul style="list-style-type: none"> <li>• Dwell time on the ground in seconds</li> <li>• Dwell time on the ground in revolutions</li> </ul>	s R
DTS	<ul style="list-style-type: none"> <li>• Dwell time for chip clearing in seconds</li> <li>• Dwell time for chip clearing in revolutions</li> </ul>	s R

### Cycle Description

#### Chip crushing

- 1 The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2 The tool drills with the programmed spindle speed and the feed speed  $F = F * FD1[\%]$  up to 1. Infeed depth.
- 3 The tool moves back by the retraction amount (V2) for chip crushing. Then the tool drills with the programmed feed (F) to the next infeed depth. This will be repeated until the end drilling depth (Z1) is reached.
- 4 From the drill bottom the tool moves back to the retraction plane in rapid traverse (G0) after expiry of the dwell time (DT).

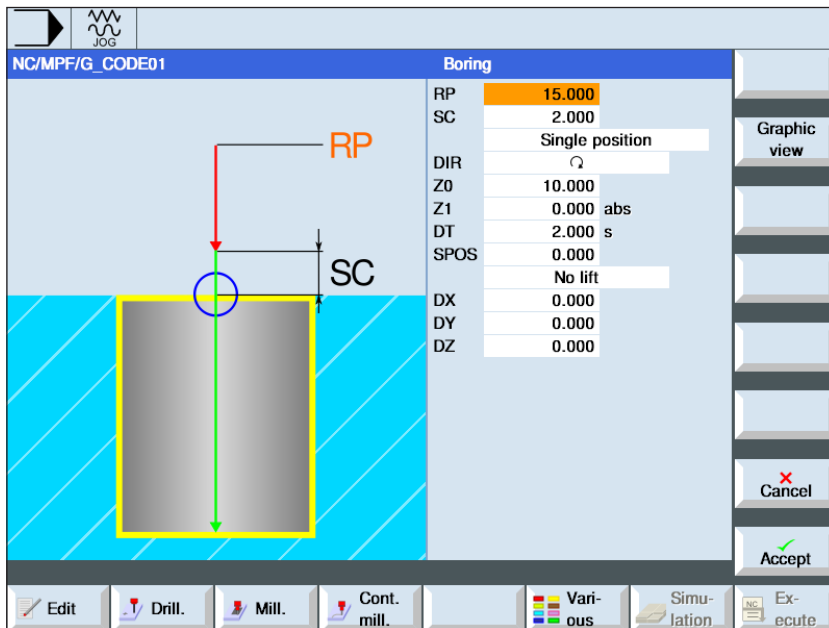
### Cycle Description

#### Chip clearing

- 1 The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2 The tool drills with the programmed spindle speed and the feed speed  $F = F * FD1[\%]$  up to 1. Infeed depth.
- 3 The tool moves out of the workpiece to the safety distance in rapid traverse for chip clearing.
- 4 The tool moves in rapid traverse (G0) to the last drilling depth, reduced by the advanced stop distance (V3).
- 5 Then there will be drilling to the next infeed depth.
- 6 Steps 3 to 5 will be repeated until the programmed end drilling depth (Z1) is reached.
- 4 From the drill bottom the tool moves back to the retraction plane in rapid traverse (G0) after expiry of the dwell time (DT).



### Boring (CYCLE86)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
SC	Safety distance	mm
Processing position	<ul style="list-style-type: none"> <li>Individual position Drill hole to programmed position.</li> <li>Position template Position with MCALL.</li> </ul>	
Z0	Reference point Z	mm
DIR	Direction of rotation <ul style="list-style-type: none"> <li> Direction of rotation right</li> <li> Direction of rotation left</li> </ul>	
Z1	Drill depth (absolute) or depth relative to Z0 (incremental). The tool plunges until Z1 is reached.	mm
DT	<ul style="list-style-type: none"> <li>Dwell time on the ground in seconds</li> <li>Dwell time on the ground in revolutions</li> </ul>	s R
SPOS	Measure spindle stop position manually in degrees and enter.	Degrees
Lift mode	<ul style="list-style-type: none"> <li>lift (only for machine with C-axis) The blade moves clear of the drill hole edge and then pulls back to the safety distance from the reference point and then positions on the retraction plane and drill hole center point.</li> <li>do not lift The blade does not move clear, but moves back to the retraction plane in rapid traverse.</li> </ul>	
DX DY DZ	Lift amount in X, Y and Z (incremental, only in lift mode "lift")	mm

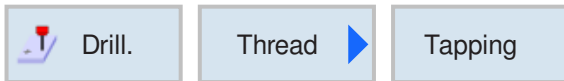
**Information:**

Clamp the tool in such a way that at the indicated angle SPOS the tool blade is clamped in the +X direction.

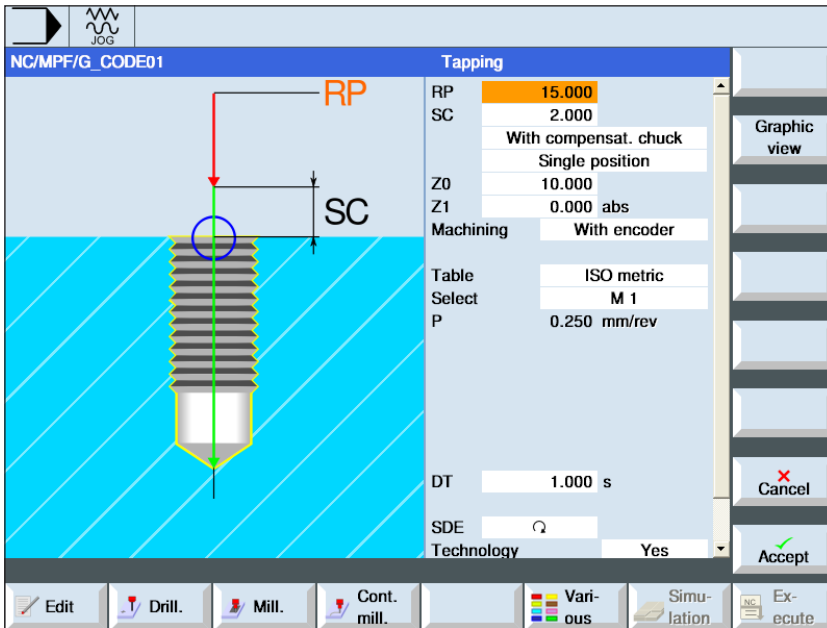


**Cycle Description**

- 1 The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2 The tool moves with the programmed feed (F) to the drill depth (Z1).
- 3 The tool dwells there (DT) - if indicated.
- 4 Oriented spindle stop at the spindle position programmed under SPOS. To program SPOS the spindle position must be measured manually.
- 5 In lift mode "lift" the tool moves clear of the edge of the drill hole by the lift amount (DX, DY, DZ) in direction -X/ -Y/ +Z.
- 6 The tool moves back to the safety distance in rapid traverse (G0).
- 7 The tool moves back in rapid traverse (G0) to the coordinates of the drill hole center on the retract plane.



## Tapping (CYCLE84, 840)






Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
SC	Safety distance	mm
Compensating chuck mode	<ul style="list-style-type: none"> <li>with compensating chuck: CYCLE840</li> <li>without compensating chuck: CYCLE84</li> </ul>	
Processing position	<ul style="list-style-type: none"> <li>Individual position Drill hole to programmed position.</li> <li>Position template Position with MCALL.</li> </ul>	
Z0	Reference point Z	mm
Z1	Thread length (incremental) or end point of the thread (absolute). The tool plunges until Z1 is reached.	mm
Processing (with compensating chuck)	<ul style="list-style-type: none"> <li>with transmitter Thread tapping with spindle transmitter</li> <li>without transmitter Thread tapping without spindle transmitter; later the selection: - Define "Lead" parameter.</li> </ul>	
Lead	<ul style="list-style-type: none"> <li>User input Lead comes from the input.</li> <li>active feed Lead comes from the feed.</li> </ul>	



Parameters	Description	Unit
Table	Thread selection table: <ul style="list-style-type: none"> <li>• None</li> <li>• ISO metric</li> <li>• Whitworth BSW</li> <li>• Whitworth BSP</li> <li>• UNC</li> </ul>	
Selection	Selection of the table value e.g.: <ul style="list-style-type: none"> <li>• M1; M5; etc. (ISO metric)</li> <li>• W1/8"; etc. (Whitworth BSW)</li> <li>• G 1 3/4"; etc. (Whitworth BSP)</li> <li>• N8 - 32 UNC; etc. (UNC)</li> </ul> (also see thread table with respective pitches)	
P	Display of the thread lead (only with table selection "none") <ul style="list-style-type: none"> <li>• in MODULE: <math>MODULE = \text{pitch}/\pi</math></li> <li>• in threads per inch: typical for tube threads. With the per inch input, in the first parameter field the whole number before the decimal point is entered and in the second and third field the number after the decimal point is entered as a fraction.</li> <li>• in mm/rev</li> <li>• in inch/rev</li> </ul> The thread lead is dependent on the tool used.	MODULE Threads/" mm/rev inch/rev
$\alpha S$	Start angle offset (only when thread tapping without compensation chuck)	Degrees
S	Spindle speed (only when thread tapping without compensation chuck)	Rev/min
Processing (without compensating chuck)	<ul style="list-style-type: none"> <li>• 1 cut The thread will be drilled in one cut, without interruption.</li> <li>• Chip crushing The drill pulls back by the retract amount (V2) for chip crushing.</li> <li>• Chip clearing The drill moves completely out of the workpiece.</li> </ul>	
D	maximum depth infeed	mm
Retract	Retract amount (only when "without compensation chuck" and "chip crushing" selected) <ul style="list-style-type: none"> <li>• manual With retract amount (V2) after each processing.</li> <li>• automatic Without retract amount (V2) after each processing. The tool will be pulled back by one revolution after each processing.</li> </ul>	
V2	Retract amount after each processing Amount by which the tool will be pulled back during chip crushing	mm
DT	Dwell time at final drill depth in seconds	s
SR	Spindle speed for retraction (only when "without compensating chuck" selected)	R/min

Parameters	Description	Unit
SDE	Direction of rotation after cycle end: <ul style="list-style-type: none"> <li>• </li> <li>• </li> <li>• </li> </ul>	
Technology	<ul style="list-style-type: none"> <li>• yes</li> <li>- Precision stop</li> <li>- Pilot control</li> <li>- Acceleration</li> <li>- Spindle</li> <li>• no</li> </ul>	
Precision stop	<ul style="list-style-type: none"> <li>• Behaviour as it was before the cycle invocation</li> <li>• G601: Block advance for fine precision stop</li> <li>• G602: Block advance for crude precision stop</li> <li>• G603: Block advance when target value is reached</li> </ul>	
Pilot control	<ul style="list-style-type: none"> <li>• Behaviour as it was before the cycle invocation</li> <li>• FFWON: with pilot control</li> <li>• FFWOF: without pilot control</li> </ul>	
Acceleration	<ul style="list-style-type: none"> <li>• Behaviour as it was before the cycle invocation</li> <li>• SOFT: jerk-limited acceleration of the axes</li> <li>• BRISK: sharp acceleration of the axes</li> <li>• DRIVE: reduced acceleration of the axes</li> </ul>	
Spindle	<ul style="list-style-type: none"> <li>• speed-controlled: Spindle with MCAL; speed-controlled mode</li> <li>• position-controlled: Spindle with MCALL; position-controlled mode</li> </ul>	

**Thread table**

ISO_METRIC		WHITWORTH_BSW		WHITWORTH_BSP		UNC	
M 1	0.250	W 1/16"	60.000	G 1/16"	28.000	N 1 - 64 UNC	64.000
M 1.2	0.250	W 3/32"	48.000	G 1/8"	28.000	N 2 - 56 UNC	56.000
M 1.6	0.350	W 1/8"	40.000	G 1/4"	19.000	N 3 - 48 UNC	48.000
M 2	0.400	W 5/32"	32.000	G 3/8"	19.000	N 4 - 40 UNC	40.000
M 2.5	0.450	W 3/16"	24.000	G 1/2"	14.000	N 5 - 40 UNC	40.000
M 3	0.500	W 7/32"	24.000	G 5/8"	14.000	N 6 - 32 UNC	32.000
M 3.5	0.600	W 1/4"	20.000	G 3/4"	14.000	N 8 - 32 UNC	32.000
M 4	0.700	W 5/16"	18.000	G 7/8"	14.000	N 10 - 24 UNC	24.000
M 4.5	0.750	W 3/8"	16.000	G 1"	11.000	N 12 - 24 UNC	24.000
M 5	0.800	W 7/16"	14.000	G 1 1/8"	11.000	1/4" - 20 UNC	20.000
M 6	1.000	W 1/2"	12.000	G 1 1/4"	11.000	5/16" - 18 UNC	18.000
M 8	1.250	W 9/16"	12.000	G 1 3/8"	11.000	3/8" - 16 UNC	16.000
M 10	1.500	W 5/8"	11.000	G 1 1/2"	11.000	7/16" - 14 UNC	14.000
M 12	1.750	W 3/4"	10.000	G 1 3/4"	11.000	1/2" - 13 UNC	13.000
M 14	2.000	W 7/8"	9.000	G 2"	11.000	9/16" - 12 UNC	12.000
M 16	2.000	W 1"	8.000	G 2 1/4"	11.000	5/8" - 11 UNC	11.000
M 18	2.500	W 1 1/8"	7.000	G 2 1/2"	11.000	3/4" - 10 UNC	10.000
M 20	2.500	W 1 1/4"	7.000	G 2 3/4"	11.000	7/8" - 9 UNC	9.000
M 22	2.500	W 1 3/8"	6.000	G 3"	11.000	1" - 8 UNC	8.000
M 24	3.000	W 1 1/2"	6.000	G 3 1/4"	11.000	1 1/8" - 7 UNC	7.000
M 27	3.000	W 1 5/8"	5.000	G 3 1/2"	11.000	1 1/4" - 7 UNC	7.000
M 30	3.500	W 1 3/4"	5.000	G 3 3/4"	11.000	1 3/8" - 6 UNC	6.000
M 33	3.500	W 1 7/8"	4.500	G 4"	11.000	1 1/2" - 6 UNC	6.000
M 36	4.000	W 2"	4.500	G 5"	11.000	1 3/4" - 5 UNC	5.000
M 39	4.000	W 2 1/4"	4.000	G 6"	11.000	2" - 4 1/2 UNC	4.500
M 42	4.500	W 2 1/2"	4.000			2 1/4" - 4 1/2 UNC	4.500
M 45	4.500	W 2 3/4"	3.500			2 1/2" - 4 UNC	4.000
M 48	5.000	W 3"	3.500			2 3/4" - 4 UNC	4.000
M 52	5.000	W 3 1/4"	3.250			3" - 4 UNC	4.000
M 56	5.500	W 3 1/2"	3.250			3 1/4" - 4 UNC	4.000
M 60	5.500	W 3 3/4"	3.000			3 1/2" - 4 UNC	4.000
M 64	6.000	W 4"	3.000			3 3/4" - 4 UNC	4.000
M 68	6.000					4" - 4 UNC	4.000

Thread table with leads

**Cycle Description****CYCLE840 with compensating chuck**

- 1 The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2 The tool moves with the programmed speed (S) to the thread depth (Z1). The feed will be calculated inside the cycle from speed (S) and thread lead (P).
- 3 After reaching the thread depth (Z1) the spindle stops and reverses direction.
- 4 The tool dwells at the final drill depth.
- 5 The tool moves back to the safety distance in rapid traverse with G1.
- 6 Again reverse of direction of rotation or spindle stop.
- 7 The tool moves back in rapid traverse (G0) to the coordinates of the drill hole center on the retraction plane.

**Cycle Description****CYCLE84 without compensation chuck 1 cut**

- 1 The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2 The spindle will be synchronised and activated with the programmed speed (S) (dependent on %S).
- 3 With spindle-feed-synchronisation, the tool drills to depth (Z1).
- 4 After reaching the thread depth (Z1) the spindle stops and dwells at the drill depth.
- 5 Once the dwell time has expired, the direction of rotation is reversed.
- 6 The tool moves back to the safety distance with spindle speed for the return (SR) (dependent on %S).
- 7 Spindle stop.
- 8 The tool moves back in rapid traverse (G0) to the coordinates of the drill hole center on the retraction plane.

**Information:**

When single block processing (SBL) is active, the thread tapping will be carried out without block interruption.



**Cycle Description**

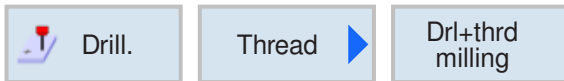
**Chip clearing**

- 1 The tool drills with the programmed speed (S) (dependent on %S) to the 1st infeed depth (maximum depth infeed D).
- 2 Spindle stop.
- 3 The tool moves out of the workpiece for chip clearing with spindle speed for the return (SR) (dependent on %S).
- 4 A spindle stop takes place and the dwell time is observed.
- 5 The tool drills with spindle depth (S) to the next infeed depth.
- 6 Repeat steps 2 to 5 until the programmed end drilling depth (Z1) is reached.
- 7 The tool moves out of the workpiece with spindle speed for the return (SR) (dependent on %S). The spindle stops and the tool moves back in rapid traverse (G0) to the coordinates of the drill hole center on the retraction plane.

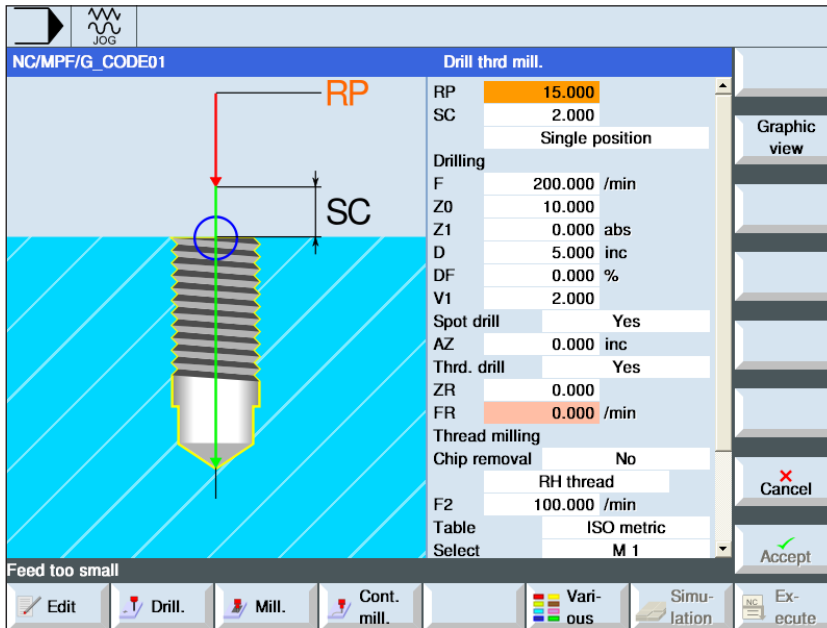
**Cycle Description**

**Chip crushing**

- 1 The tool drills with the programmed speed (S) (dependent on %S) to the 1st infeed depth (maximum depth infeed D).
- 2 A spindle stop takes place and the dwell time is observed.
- 3 The tool moves back by the return amount (V2) for chip crushing.
- 4 The tool drills with spindle depth (S) to the next infeed depth.
- 5 Repeat steps 2 to 4 until the programmed end drilling depth (Z1) is reached.
- 7 The tool moves out of the workpiece with spindle speed for the return (SR) (dependent on %S). The spindle stops and the tool moves back in rapid traverse (G0) to the coordinates of the drill hole center on the retraction plane.



## Thread mill drilling (CYCLE78)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
SC	Safety distance	mm
Processing position	<ul style="list-style-type: none"> <li>Individual position Drill hole to programmed position.</li> <li>Position template Position with MCALL.</li> </ul>	
F	Drill feed	mm/min mm/rev
Z0	Reference point Z	mm
Z1	Thread length (incremental) or end point of the thread (absolute).	mm
D	maximum depth infeed <ul style="list-style-type: none"> <li><math>D \geq Z1</math>: an infeed to final drilling depth.</li> <li><math>D &lt; Z1</math>: Several infeeds with chip clearing.</li> </ul>	
DF	<ul style="list-style-type: none"> <li>Percentage rate for each additional infeed</li> <li>DF=100: Infeed amount remains the same</li> <li>DF&lt;100: Infeed amount will be reduced in the direction final drilling depth Z1.</li> <li>Example: last infeed 5 mm; DF 80%</li> <li>next infeed = <math>5 \times 80\% = 4.0</math> mm</li> <li>next but one infeed = <math>4.0 \times 80\% = 3.2</math> mm etc.</li> <li>Amount for each additional infeed</li> </ul>	% mm

Parameters	Description	Unit
V1	<p>minimum infeed (only with DF "Percentage for each additional infeed").                      If the infeed amount is very small, a minimum depth infeed (V1) can be programmed.</p> <ul style="list-style-type: none"> <li>• V1 &lt; Infeed amount (DF): It will be infed by the infeed amount.</li> <li>• V1 &gt; Infeed amount (DF): It will be fed in with the value programmed under V1.</li> </ul>	mm
Boring	<p>Boring with reduced feed</p> <ul style="list-style-type: none"> <li>• yes</li> <li>• no</li> </ul> <p>The reduced drill feed results from:                      Drill feed F1 &lt; 0.15 mm/rev: Bore feed = 30% of F1                      Drill feed F1 &gt; 0.15 mm/rev: Bore feed = 30% of F1</p>	
AZ	Bore depth with reduced drill feed (incremental) (only when boring "yes")	
Through-drilling	<p>Remaining drill depth with drill feed</p> <ul style="list-style-type: none"> <li>• yes</li> <li>• no</li> </ul>	
ZR	Remaining drill depth with through-drilling (only when through-drilling "yes")	mm
FR	Drill feed for remaining drill depth (only when through-drilling "yes")	mm/mm mm/rev
Chip clearing	<p>Chip clearing before thread milling</p> <ul style="list-style-type: none"> <li>• yes</li> <li>• no</li> </ul> <p>Move back to the tool surface for chip clearing before thread milling.</p>	
Thread's direction of rotation	<ul style="list-style-type: none"> <li>• Right-hand thread</li> <li>• Left-hand thread</li> </ul>	
F2	Infeed depth thread milling	mm/min mm/tooth
Table	<p>Thread selection table:</p> <ul style="list-style-type: none"> <li>• None</li> <li>• ISO metric</li> <li>• Whitworth BSW</li> <li>• Whitworth BSP</li> <li>• UNC</li> </ul>	
Selection	<p>Selection of the table value e.g.:</p> <ul style="list-style-type: none"> <li>• M1; M5; etc. (ISO metric)</li> <li>• W1/8"; etc. (Whitworth BSW)</li> <li>• G 1 3/4"; etc. (Whitworth BSP)</li> <li>• N8 - 32 UNC; etc. (UNC)</li> </ul> <p>(also see thread table with respective pitches)</p>	

Parameters	Description	Unit
P	<p>Display of the thread lead (only with table selection "none")</p> <ul style="list-style-type: none"> <li>• in MODULE: <math>\text{MODULE} = \text{pitch}/\pi</math></li> <li>• in threads per inch: As is typical for example with pipe threads. With the per inch input, in the first parameter field the whole number before the decimal point is entered and in the second and third field the number after the decimal point is entered as a fraction.</li> <li>• in mm/rev</li> <li>• in inch/rev</li> </ul> <p>The thread lead is dependent on the tool used.</p>	<p>MODULE Threads/" mm/rev inch/rev</p>
Z2	<p>Retraction amount before thread milling (incremental) With Z2 the thread depth is defined in the direction of the tool axis. In this, Z2 is relative to the tool tip.</p>	
∅	Nominal diameter	
Milling direction	<ul style="list-style-type: none"> <li>• Down-cut: Mill thread in one revolution.</li> <li>• Up-cut: Mill thread in one revolution.</li> <li>• Down-cut - Up-cut: Mill thread in 2 revolutions, in which a down-cut rough-milling with a defined extent is carried out followed by a finish-milling with mill feed FS in the up-cut.</li> </ul>	
FS	Finishing feed rate (only when "Up-cut - Down-cut selected")	<p>mm/min mm/tooth</p>



### Cycle Description

- 1 The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance.
- 2 The tool drills with drill feed (F1) to the first drilling depth (maximum infeed depth D). If the final drilling depth (Z1) has still not been reached, the tool moves in rapid traverse (G0) for chip clearing back to the workpiece surface. Then positions the tool with rapid traverse (G0) to 1 mm above the previously reached drilling depth, in order to drill further with the next infeed with drill feed (F1). From the 2nd infeed the parameter (percentage rate or amount for each additional infeed DF) will be taken into account.
- 3 When through-drilling if another feed is desired during retraction (FR), the remaining drill depth (ZR) is drilled with this feed.
- 4 The tool moves to the start position for the thread milling.
- 5 The thread milling (up-cut, down-cut or down-cut + up-cut) will be carried out with infeed depth (F2). The inward and outward movement of the milling cutter takes place in a semi-circle with simultaneous infeed in the tool axis.



## Position and position template

When programming processing cycles there is an option to enter positions or position templates.

A position or position template will only be created after the processing cycle.

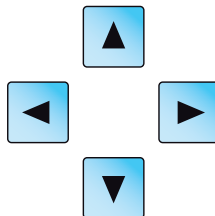
Positions or position templates allow several drill or threading operations of the same diameter to be executed together in a cycle. The defined position or a position template will be saved in the cycle list. Various templates are available for this purpose:

- Arbitrary positions
- Positioning on a line, a grid or a frame
- Positioning on full or partial circle

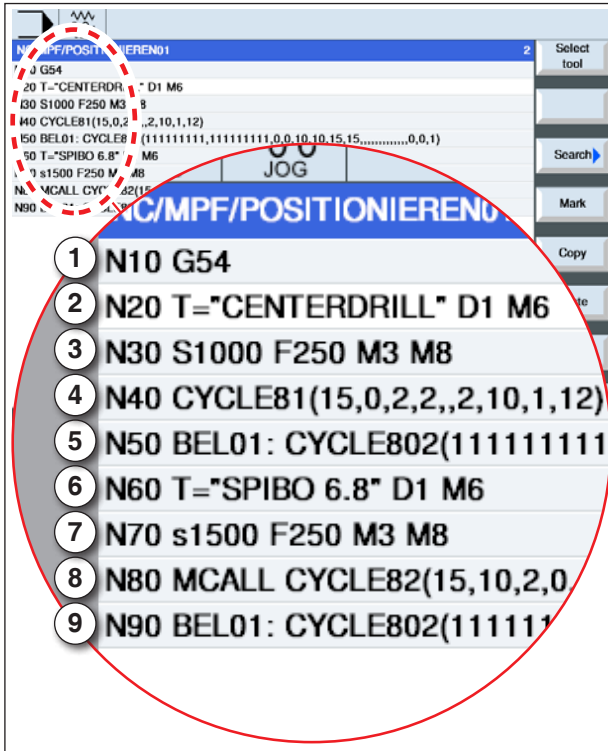


Several position templates can be programmed successively. They will be covered in the programmed sequence.

The previously programmed technologies and the subsequently programmed positions will be automatically chained.



If there are more cycles than are shown in the window, use the cursor keys to move through the list.



Example for linking processing cycles with position templates

**Link representation of position templates with G-code cycles:**

A complete processing cycle consists of the processing cycle (1) and the associated position template (2).

The programming sequence must be observed:

**Example:**

- 1 Call up preset zero point offset (G54).
- 2 Call up centering tool with cutting number 1 and swing in with M6.
- 3 Define speed (S) and feed (F) and milling cutter's direction of rotation. Activate coolant with M8.
- 4 There should be an initial centering before the creation of several drill holes.  
Program centering cycle (Cycle81) with processing position "Position template MCALL".
- 5 Program position template for centering cycle.
- 6 Carry out tool change if needed.
- 7 Define speed (S) and feed (F) and milling cutter's direction of rotation. Activate coolant with M8.
- 8 Program drilling cycle (Cycle82) with processing position "Position template MCALL".
- 9 Program position template for drilling cycle or repeat previous position template.

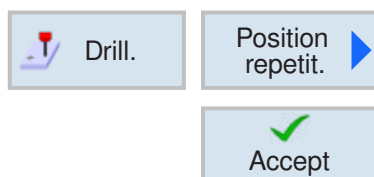
**Cycle Description**

- 1 The control system positions the programmed tool. Processing always begins at the reference point.
- 2 Within a position template and when approaching the next position template there will be a movement back to the retract plane and then the new position or the new position template will be approached in rapid traverse (G0).
- 3 With technological follow-up operations (e.g. Centering - Drilling - Thread-tapping), after calling up the next tool (e.g. drill), the particular drilling cycle is to be programmed and immediately afterwards the calling up of the position template to be executed.

**Repeat positions**

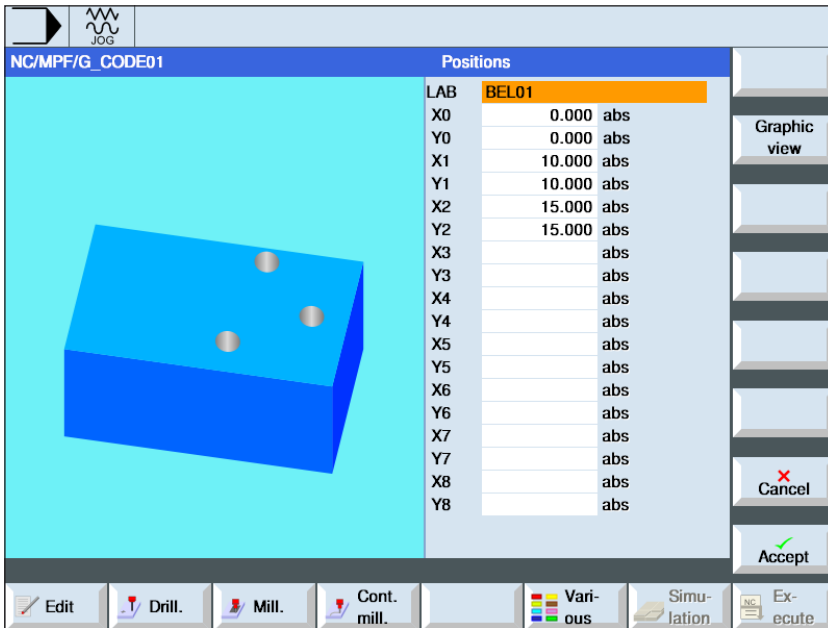
Press softkey for repeated approach of already programmed positions.

- Repeat jump mark for position indicate and confirm.



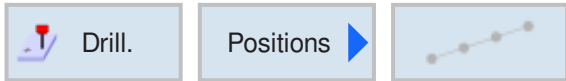


### Arbitrary positions (CYCLE802)

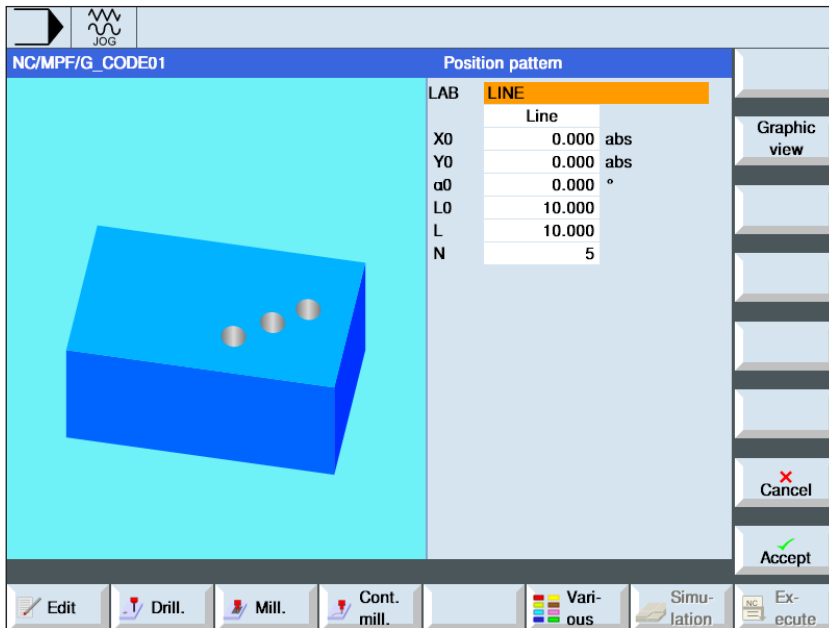


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
LAB	Repeat jump mark for position	
X0 Y0	X-coordinate of the 1st position (absolute) Y-coordinate of the 1st position (absolute)	mm
X1...X8 Y1...Y8	X-coordinates of the respective position (absolute or incremental) Y-coordinates of the respective position (absolute or incremental)	mm



**Position template line (HOLES1), grid or frame (CYCLE801)**

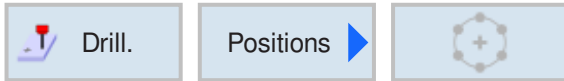


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

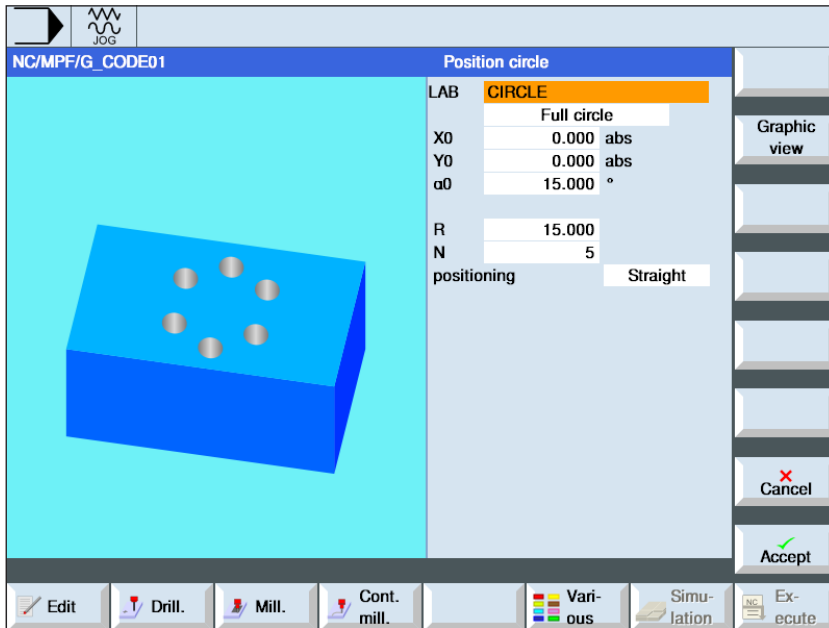
Parameters	Description	Unit
LAB	Repeat jump mark for position	
Position template	<ul style="list-style-type: none"> <li>Line (HOLES1)</li> <li>Grid (CYCLE801)</li> <li>Frame (CYCLE801)</li> </ul>	
X0 Y0	Coordinate of the reference point (absolute).	mm
alpha0	Angle of the line, relative to the X-axis Positive angle: Line will be rotated counter-clockwise. Negative angle: Line will be rotated clockwise.	degrees
L0	Distance of 1st position to reference point (only when "Position template line" selected)	mm
L	Distance between the positions - (only when "Position template line" selected)	mm
N	Number of positions - (only when "Position template line" selected)	
L1 L2	Spacing of lines and gaps - (only when "Position template grid or frame" selected)	mm
N1 N2	Number of lines and gaps - (only when "Position template grid or frame" selected)	

**Cycle Description**

- 1 The processing always starts the nearest corner of the frame or grid or at the end of the row. The position template frame will be processed further in the counter-clockwise direction.



### Position template circle (HOLES2)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
LAB	Repeat jump mark for position	
Circle template	<ul style="list-style-type: none"> <li>• Full circle</li> <li>• Partial circle</li> </ul>	
X0 Y0	Coordinate of the reference point (absolute).	mm
$\alpha_0$	Start angle for first position Positive angle: Full circle will be rotated counter-clockwise. Negative angle: Full circle will be rotated clockwise.	degrees
$\alpha_1$	Angle of advance (only when "Circle template partial circle" selected) After the first drill hole is finished, all further positions will be positioned onward by this angle. Positive angle, further positions will be rotated in the counter-clockwise direction. Negative angle: further positions will be rotated in the counter-clockwise direction.	Degrees
R	Radius	mm
N	Number of positions 3000	
Positioning	Positioning movement between the positions <ul style="list-style-type: none"> <li>• Straight Next position will be approached in rapid traverse (G0) in a straight line.</li> <li>• Circle Next position will be approached on a circular path with the programmed feed (FP).</li> </ul>	

#### Cycle Description

- 1 The circle template will be processed further in the counter-clockwise direction.

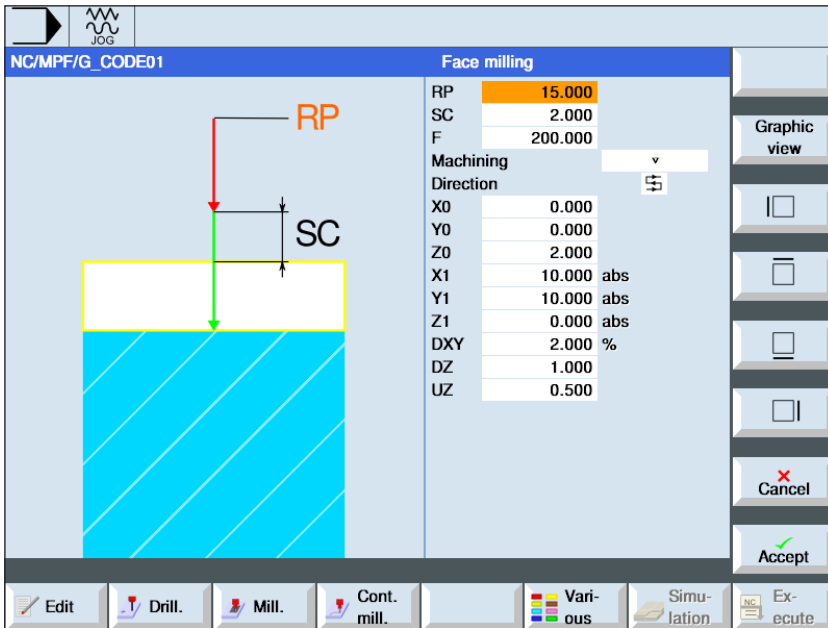


## Milling

- Face milling (CYCLE61)
- Pocket (POCKET3, POCKET4)
- Spigot (CYCLE76, CYCLE77, CYCLE79)
- Multi-edge (CYCLE79)
- Slot (SLOT1, SLOT2, CYCLE899)
- Thread milling (CYCLE70)
- Engraving (CYCLE60)



## Face milling (CYCLE61)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
SC	Safety distance	mm
F	Feed	mm/min
Processing	<ul style="list-style-type: none"> <li>▾ Roughing</li> <li>▾ ▾ ▾ Finishing</li> </ul>	
Direction	alternating processing direction <ul style="list-style-type: none"> <li></li> <li></li> </ul> same processing direction <ul style="list-style-type: none"> <li></li> <li></li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point: 1 Corner point in X and Y Height of the raw part	mm mm
X1 Y1 Z1	2 Corner point in X and Y (absolute) or 2 Corner point in X and Y relative to X0 and Y0 (incremental) Height of the finished part (absolute) or height of the finished part relative to Z0 (incremental)	
DXY	<ul style="list-style-type: none"> <li>maximum level infeed</li> <li>Maximum plane infeed in %, as a proportion of the plane infeed (mm) to the flute end-mill (mm)</li> </ul>	mm %
DZ	Maximum depth infeed (only for roughing)	mm
UZ	Finishing pass depth	mm



**Cycle Description**

- 1 With vertical processing the start point is always above or below.  
The control system shows the start and end point.
- 2 The processing takes place from the outside.

**Roughing:**

The surface will be milled.  
The tool moves over the workpiece edge.

**Finishing:**

The surface will only be milled once.  
The tool moves to the X/Y plane for safety distance. Then the milling cutter moves freely.  
For finishing the same finishing pass as for roughing must be registered. The finishing pass will be used when positioning the tool for free movement.

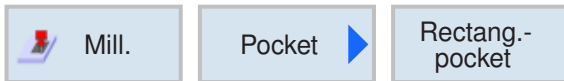
The depth infeed will always be carried out outside of the workpiece.  
During surface milling the effect milling cutter diameter for a milling cutter tool is stored in the tool table.

**Select boundaries**

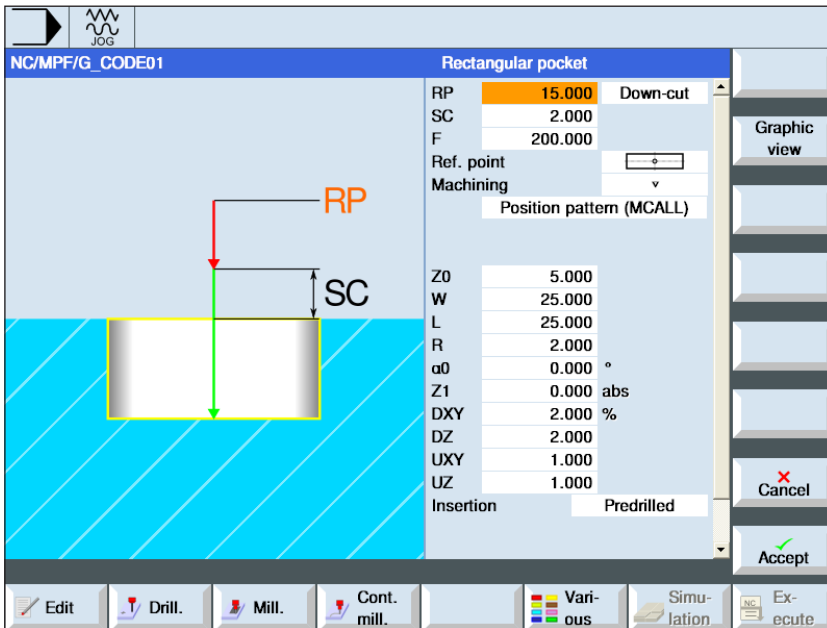
For each desired movement press the corresponding softkey. The limits are shown by the control system.



- left
- top
- bottom
- right



## Rectangular pocket (POCKET3)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

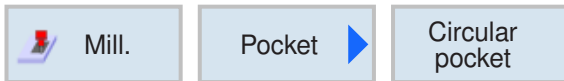
Parameters	Description	Unit
RP	Retract plane	mm
SC	Safety distance	mm
F	Feed	mm/min
Reference point	<ul style="list-style-type: none"> <li> (centre)</li> <li> (bottom left)</li> <li> (bottom right)</li> <li> (top left)</li> <li> (top right)</li> </ul>	
Processing	<ul style="list-style-type: none"> <li>▽ Roughing</li> <li>▽▽ Finishing</li> <li>▽▽▽ Edge finishing</li> <li>Chamfer</li> </ul>	
Processing position	<ul style="list-style-type: none"> <li>Position template Mill rectangular pocket at the programmed position (X0, Y0, Z0).</li> <li>Individual position Position with MCALL</li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point: (only for "single position") Reference point in X, Y and Z	mm
W	Width of the pocket	mm
L	Length of the pocket	mm

Parameters	Description	Unit
R	Corner radius	mm
$\alpha_0$	Angle	Degrees
Z1	Depth relative to Z0 (incremental) or pocket depth (absolute) (only if ▽, ▽▽▽ or ▽▽▽ Edge)	mm
DXY	<ul style="list-style-type: none"> <li>• maximum level infeed</li> <li>• Plane infeed %, as a proportion of the plane infeed (mm) to the flute end mill (mm); (only if ▽, ▽▽▽ or ▽▽▽ edge)</li> </ul>	mm %
DZ	maximum depth infeed (only with roughing); (only if ▽, ▽▽▽ or ▽▽▽ Edge)	mm
UXY	Finishing pass plane (only if ▽, ▽▽▽ or ▽▽▽ edge)	mm
UZ	Finishing pass depth; (only if ▽, ▽▽▽ or ▽▽▽ edge)	mm
Plunge mode	<p>(only if ▽, ▽▽▽ or ▽▽▽ edge)</p> <ul style="list-style-type: none"> <li>• vertical: Plunge vertically on pocket center The calculated current infeed depth will be executed in the pocket center in one block. The milling cutting tool must cut via the center or it must be pre-drilled.</li> <li>• helical: Plunging on spiral path The center of the milling cutter moves on the spiral path defined by the radius and the depth per revolution (helical path). Once the depth for the infeed has been reached, another full circle will be executed, in order to overcome the angular path of the plunge.</li> <li>• swinging: Plunge swinging on center axis of the rectangular pocket axis The center of the milling cutter swings on a straight line back and forth till the depth infeed is reached. Once the depth has been reached, the path will be executed again without the in-feed, in order to overcome the angular path of the plunge.</li> </ul>	
FZ	Infeed depth (only when vertical)	mm/min mm/tooth
EP	Maximum lead of the helix (only with helical plunging)	mm/rev
ER	Radius of the helix (only with helical plunging) The radius may not be larger than the milling cutting tool radius, as otherwise material remains.	mm
EW	Maximum plunge angle (only with swinging plunging)	Degrees
Clearing	<p>(only for roughing)</p> <ul style="list-style-type: none"> <li>• Complete processing The right corner pocket will be milled from the complete material.</li> <li>• Re-working A smaller right corner pocketed or a drill hole is already available. This can be enlarged in one or more axes. Then the parameters AZ, W1 and L1 must be programmed.</li> </ul>	
AZ	Depth of the pre-processing (only when re-working)	mm
W1	Width of the pre-processing (only when re-working)	mm
L1	Length of the pre-processing (only when re-working)	mm

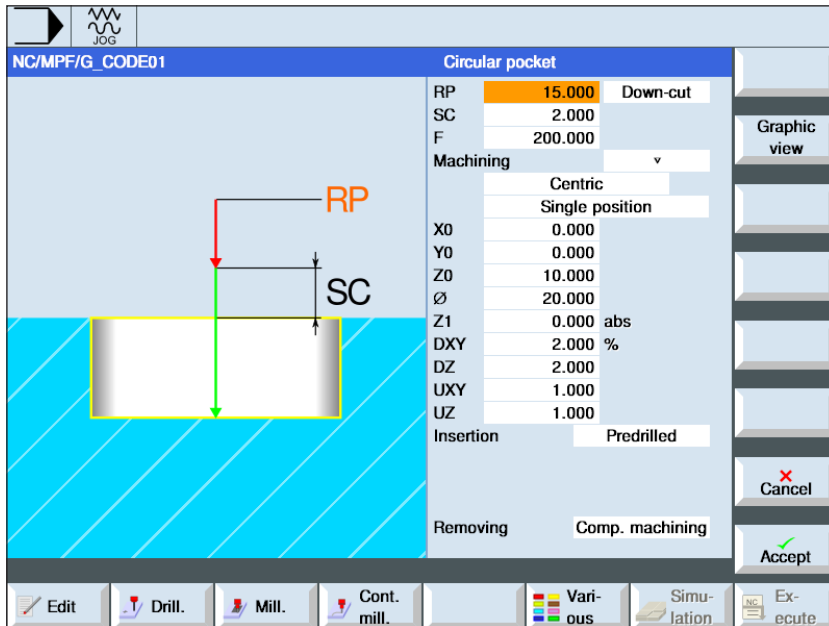
Parameters	Description	Unit
FS	Bevel width for chamfering - (only for chamfering)	mm
ZFS	Tool tip plunge depth (absolute or incremental) (only for chamfering)	mm

### Cycle Description

- 1 The control system positions the tool in rapid traverse (G0) at the retraction plane height on the rectangular pocket center point and at the safety distance.
- 2 The tool mills into the material according to the selected strategy.
- 3a Processing ▽ Roughing  
During roughing the processing will be from the centre out of the individual levels of the rectangular pocket until the depth Z1 is reached.
- 3b Processing ▽ ▽ Finishing  
During finishing the edge will always be processed first. In the process the rectangular pocket edge will be approached in the quarter circle in which it joins the corner radius. In the last infeed the bottom will be finished from the center.
- 3c Processing ▽ ▽ ▽ Edge finishing  
Edge finishing takes place as with finishing. Only the last infeed (bottom finishing) is absent.
- 3d Processing Chamfering  
During chamfering the edge on the top of the rectangular pocket will be breached.
- 4 The processing of the right corner pocket always takes place from inwards to outwards with the selected processing type.
- 5 The tool moves back to the safety distance in rapid traverse (G0).



## Circular pocket (POCKET4)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
SC	Safety distance	mm
F	Feed	mm/min
Processing	<ul style="list-style-type: none"> <li>▽ Roughing</li> <li>▽▽▽ Finishing</li> <li>▽▽▽ Edge finishing</li> <li>• Chamfer</li> </ul>	
Processing type	<ul style="list-style-type: none"> <li>• planar Planar processing of circular pocket</li> <li>• helical Helical processing of circular pocket</li> </ul>	
Processing position	<ul style="list-style-type: none"> <li>• Individual position A circular pocket will be milled at the programmed position (X0, Y0, Z0).</li> <li>• Position template Several circular pockets will be milled on a position template (e.g. full circle, partial circle, grid, etc.).</li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point = center point of the circular pocket: (only for "single position") Reference point in X, Y and Z	mm
Ø	Diameter of the pocket	mm
Z1	Pocket depth (absolute) or depth related to Z0 (incremental) (only if ▽, ▽▽▽ or ▽▽▽ edge)	mm

Parameters	Description	Unit
DXY	<ul style="list-style-type: none"> <li>• maximum plane infeed</li> <li>• maximum level infeed as a percentage of the milling cutter diameter (only when ▽, ▽▽▽ or ▽▽▽ edge)</li> </ul>	mm %
DZ	Maximum depth infeed (only if ▽, ▽▽▽ or ▽▽▽ edge)	mm
UXY	Finishing pass plane (only if ▽, ▽▽▽ or ▽▽▽ edge)	mm
UZ	Finishing pass depth (only if ▽, ▽▽▽ or ▽▽▽ edge)	mm
Plunging	<p>(only if "planar", ▽, ▽▽▽ or ▽▽▽ edge)</p> <ul style="list-style-type: none"> <li>• vertical: Plunge vertically on pocket center The calculated infeed depth will be executed vertically in the pocket center. Feed: Infeed as programmed under FZ. When plunging vertically on the pocket center the milling cutting tool must cut via the center or it must be pre-drilled.</li> <li>• helical: Plunging on spiral path The center of the milling cutter moves with the processing feed on the spiral path defined by the radius and the depth per revolution (helical path). Once the depth for the infeed has been reached, another full circle will be executed, in order to overcome the angular path of the plunge.</li> </ul>	
FZ	Infeed depth	mm/min mm/tooth
EP	Maximum pitch of the helix (only with helical plunging)	mm/rev
ER	Radius of the helix (only with helical plunging) The radius may not be larger than the milling cutting tool radius, as otherwise material remains.	mm
Clearing	<ul style="list-style-type: none"> <li>• Complete processing The circular pocket should be milled from the whole material (e.g. cast part).</li> <li>• Re-working If a circular pocket or a drill hole already exists, it will be enlarged. The parameters AZ, and Ø1 must be programmed.</li> </ul>	
FS	Bevel width for chamfering (only for chamfering)	mm
AZ	Depth of the pre-processing (only when re-working)	mm
Ø1	Diameter of the pre-processing (only when re-working)	mm

**Cycle Description****Planar plunge mode**

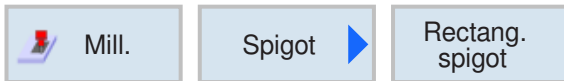
- 1 The control system positions the tool in rapid traverse (G0) at the retract plane height on the rectangular pocket center point and at the safety distance.
- 2 The tool mills into the material according to the selected strategy.
- 3a Processing ▾ Roughing  
During roughing the processing will be from the centre out of the individual planes of the circular pocket until the depth Z1 is reached.
- 3b Processing ▾ ▾ Finishing  
During finishing the edge will always be processed first. In the process the pocket edge will be approached in the quarter circle in which it joins the corner radius. In the last infeed the bottom will be finished from the center.
- 3c Processing ▾ ▾ Edge finishing  
Edge finishing is performed like the finishing. The last infeed (bottom finishing) is not applicable.
- 4 The processing of the circular pocket always takes place from inwards to outwards with the selected processing type. The material will be cleared away ("by plane").
- 5 The tool moves back to the safety distance in rapid traverse (G0).

**Cycle Description****Helical plunge mode**

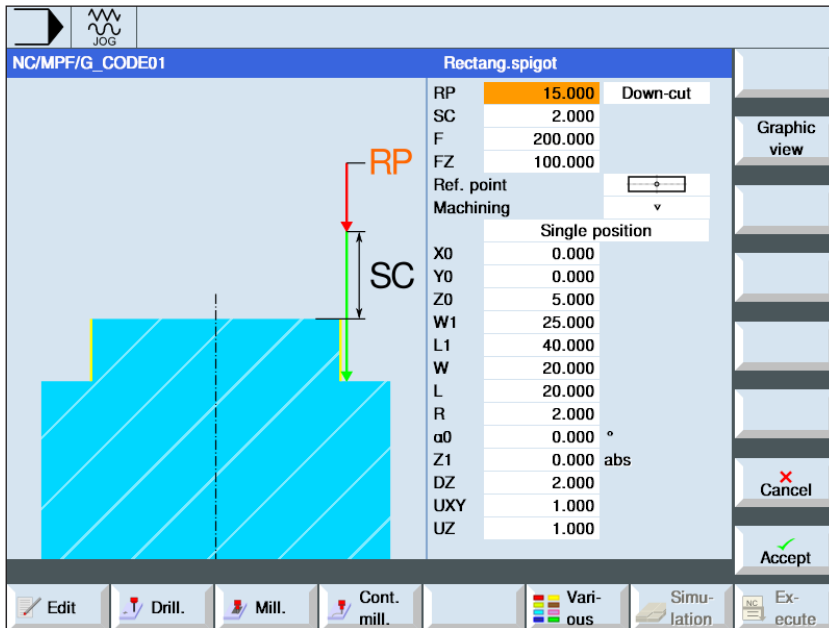
- 1 The control system positions the tool in rapid traverse (G0) at the retract plane height on the rectangular pocket center point and at the safety distance.
- 2 The tool feeds in to the first processing diameter and mills into the material according to the selected strategy.
- 3a Processing ▾ Roughing  
During roughing the circular pocket will be processed with top-down helical movements. a full circle will be performed at the pocket depth to remove the remaining material. The tool will be moved freely from the pocket edge and bottom in the quadrant and pulled back to the safety distance in rapid traverse. This sequence repeats in a shell-like way from inside to outside, until the circular pocket is fully processed.
- 3b Processing ▾ ▾ Finishing  
When finishing the edge will be processed first with a helical movement to the bottom. a full circle will be performed at the pocket depth to remove the remaining material. The bottom will be milled out in a spiral shape from outside to inside. From the pocket centre there will be a pull-back in rapid traverse to the safety distance.
- 3c Processing ▾ ▾ Edge finishing  
When finishing the edge will be processed first with a helical movement to the bottom. a full circle will be executed at the pocket depth to remove the remaining material. The tool will be moved freely from the pocket edge and bottom in the quadrant and pulled back to the safety distance in rapid traverse.
- 4 The processing of the circular pocket takes place with the selected processing type to the pocket depth or to the pocket depth with finishing pass.
- 5 The tool moves back to the safety distance in rapid traverse (G0).







## Rectangular spigot (CYCLE76)



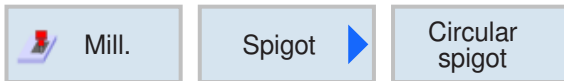
Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
Milling direction	<ul style="list-style-type: none"> <li>• Down-cut Milling</li> <li>• Up-cut milling</li> </ul>	
SC	Safety distance	mm
F	Feed	mm/min
FZ	Infeed depth	mm/min
Reference point	<ul style="list-style-type: none"> <li>•  (centre)</li> <li>•  (bottom left)</li> <li>•  (bottom right)</li> <li>•  (top left)</li> <li>•  (top right)</li> </ul>	
Processing	<ul style="list-style-type: none"> <li>• ▾ Roughing</li> <li>• ▾ ▾ Finishing</li> <li>• Chamfer</li> </ul>	
Processing position	<ul style="list-style-type: none"> <li>• Individual position Mill rectangular pocket at the programmed position (X0, Y0, Z0).</li> <li>• Position template Mill rectangular spigot on a position template.</li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point: (only for "single position") Reference point in X, Y and Z	mm
W	Spigot width	mm
L	Spigot length	mm

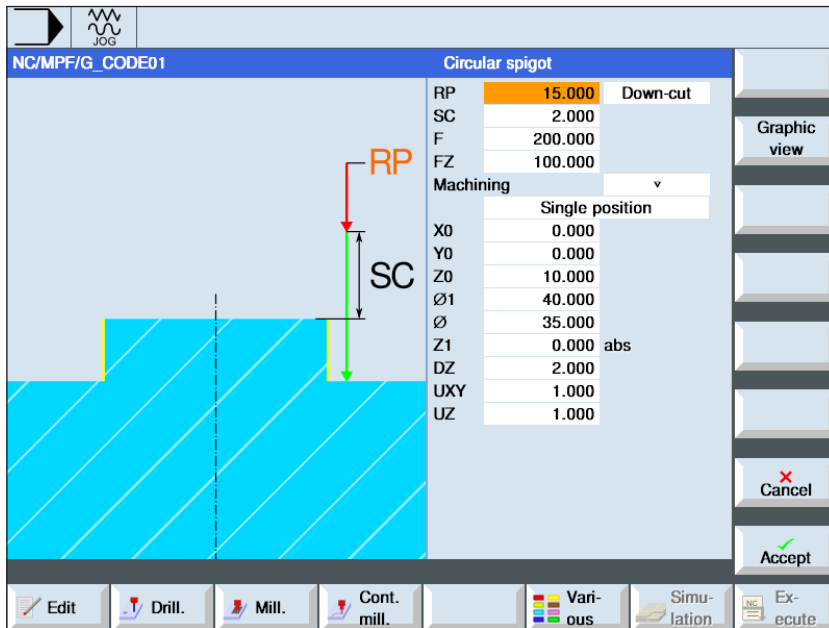
Parameters	Description	Unit
R	Corner radius	mm
$\alpha 0$	Angle	Degrees
Z1	Slot depth (absolute) or depth relative to Z0 (incremental) (only if $\nabla$ , $\nabla\nabla\nabla$ , or $\nabla\nabla\nabla\nabla$ )	mm
DZ	maximum depth infeed (only if $\nabla$ or $\nabla\nabla\nabla$ )	mm
UXY	Finishing pass plane at the length (L) of the circular spigot and the width (W) of the circular spigot. Smaller circular spigot dimensions will be achieved by calling the cycle again and programming it with reduced finishing pass. (only if $\nabla$ or $\nabla\nabla\nabla$ )	mm
UZ	Finishing pass depth (only if $\nabla$ or $\nabla\nabla\nabla$ )	mm
W1	Width of the raw part spigot (only when $\nabla$ or $\nabla\nabla\nabla$ )	mm
L1	Length of the raw part spigot (only when $\nabla$ or $\nabla\nabla\nabla$ )	mm
FS	Bevel width for chamfering (only for chamfering)	mm
ZFS	Tool tip plunge depth (only when chamfering)	mm

### Cycle Description

- 1 The control system positions the tool in rapid traverse (G0) at the retract plane height and at the safety distance. The start point lies on the positive X-axis rotated by  $\alpha 0$ .
- 2 The tool approaches the spigot contour in the semi-circle with processing feed. First the infeed to the processing depth takes place, then the movement in the plane. The rectangular spigot will be processed in the clockwise or counter-clockwise direction according to the programmed direction of rotation for processing (up-cut milling/down-cut milling).
- 3a Processing  $\nabla$  Roughing  
When roughing the rectangular spigot will be bypassed, until the programmed finishing pass is reached.
- 3b Processing  $\nabla\nabla\nabla$  Finishing  
During finishing the rectangular spigot will be bypassed, until depth Z1 is reached.
- 3c Processing Chamfering  
During chamfering the edge on the top of the rectangular spigot will be breached.
- 4 Once the rectangular spigot has been bypassed once, the tool leaves the contour in the semi-circle and the infeed to the next processing plane takes place.
- 5 The rectangular spigot will again be approached in the semi-circle and bypassed once. This will be repeated until the programmed spigot depth is reached.
- 6 The tool moves back to the safety distance in rapid traverse (G0).



## Circular spigot (CYCLE77)



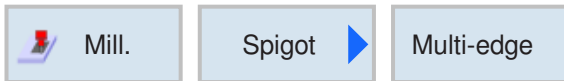
Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
Milling direction	<ul style="list-style-type: none"> <li>• Down-cut Milling</li> <li>• Up-cut milling</li> </ul>	
SC	Safety distance	mm
F	Feed	mm/min
FZ	Infeed depth	mm/min
Processing	<ul style="list-style-type: none"> <li>• ▾ Roughing</li> <li>• ▾ ▾ Finishing</li> <li>• Chamfer</li> </ul>	
Processing position	<ul style="list-style-type: none"> <li>• Individual position Mill circular spigot at the programmed position (X0, Y0, Z0).</li> <li>• Position template Mill circular spigot on a position template.</li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point: (only for "single position") Reference point in X, Y and Z	mm
Ø	Spigot diameter	mm
R	Corner radius	mm
α0	Angle	Degrees
Z1	Slot depth (absolute) or depth relative to Z0 (incremental) (only if ▾, ▾ ▾ ▾, or ▾ ▾ ▾ ▾)	mm

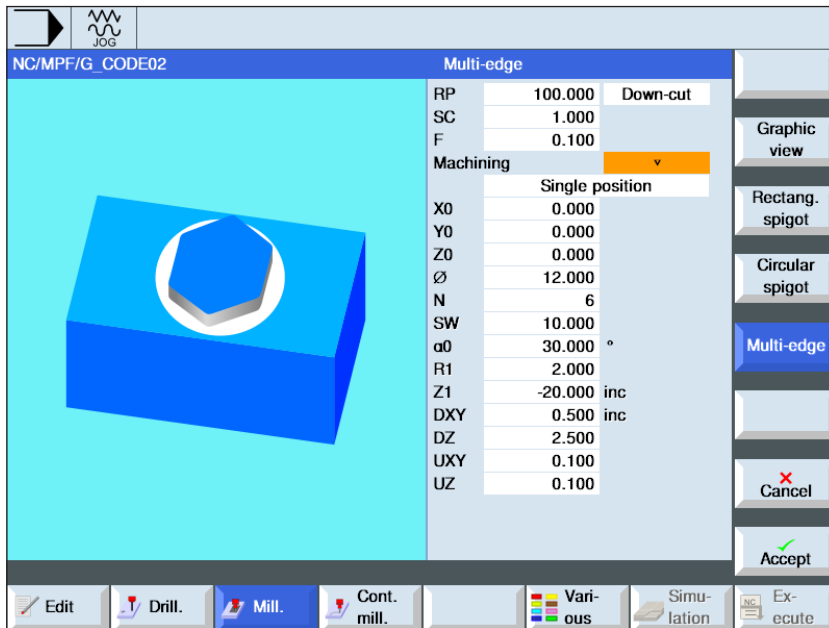
Parameters	Description	Unit
DZ	maximum depth infeed (only if ▽ or ▽ ▽ ▽)	mm
UXY	Finishing pass plane at the length (L) of the circular spigot and the width (W) of the circular spigot. Smaller circular spigot dimensions will be achieved by calling the cycle again and programming it with reduced finishing pass. (only if ▽ or ▽ ▽ ▽)	mm
UZ	Finishing pass depth (only if ▽ or ▽ ▽ ▽)	mm
Ø1	Diameter of the raw part spigot (only when ▽ or ▽ ▽ ▽)	mm
FS	Bevel width for chamfering (only for chamfering)	mm
ZFS	Tool tip plunge depth (only when chamfering)	mm

### Cycle Description

- 1 The control system positions the tool in rapid traverse (G0) at the retract plane height and at the safety distance. The start point is always on the positive X-axis.
- 2 The tool approaches the spigot contour in the semi-circle with processing feed. First the infeed to the processing depth takes place, then the movement in the plane. The circular spigot will be processed in the clockwise or counter-clockwise direction according to the programmed direction of rotation for processing (up-cut milling/down-cut milling).
- 3a Processing ▽ Roughing  
When roughing the rectangular spigot will be bypassed, until the programmed finishing pass is reached.
- 3b Processing ▽ ▽ ▽ Finishing  
During finishing the rectangular spigot will be bypassed, until depth Z1 is reached.
- 3c Processing Chamfering  
During chamfering the edge on the top of the rectangular spigot will be breached.
- 4 Once the rectangular spigot has been bypassed once, the tool leaves the contour in the semi-circle and the infeed to the next processing depth takes place.
- 5 The circular spigot will again be approached in the semi-circle and bypassed once. This will be repeated until the programmed spigot depth is reached.
- 6 The tool moves back to the safety distance in rapid traverse (G0).



## Multi-edge (CYCLE79)



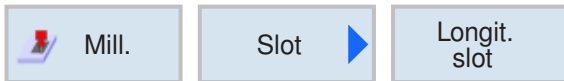
Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
Milling direction	<ul style="list-style-type: none"> <li>• Down-cut Milling</li> <li>• Up-cut milling</li> </ul>	
SC	Safety distance	mm
F	Feed	mm/min
FZ	Infeed depth	mm/min
Processing	<ul style="list-style-type: none"> <li>• ▾ Roughing</li> <li>• ▾ ▾ Finishing</li> <li>• ▾ ▾ ▾ Edge finishing</li> <li>• Chamfer</li> </ul>	
Processing position	<ul style="list-style-type: none"> <li>• Individual position Mill multi edge spigot at the programmed position (X0, Y0, Z0).</li> <li>• Position template Mill multi edge spigot on a position template</li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point: (only for "single position") Reference point in X, Y and Z	mm
Ø	Spigot diameter	mm
N	Number of edges	mm
SW or L	Width across flats or edge length	
α0	Angle of rotation	Degrees
R1 or FS1	Rounding radius or chamfer width	
Z1	Multi-edge depth (absolute) or depth in relation to Z0 (incremental) (only for ▾, ▾ ▾ or ▾ ▾ ▾ edge)	mm

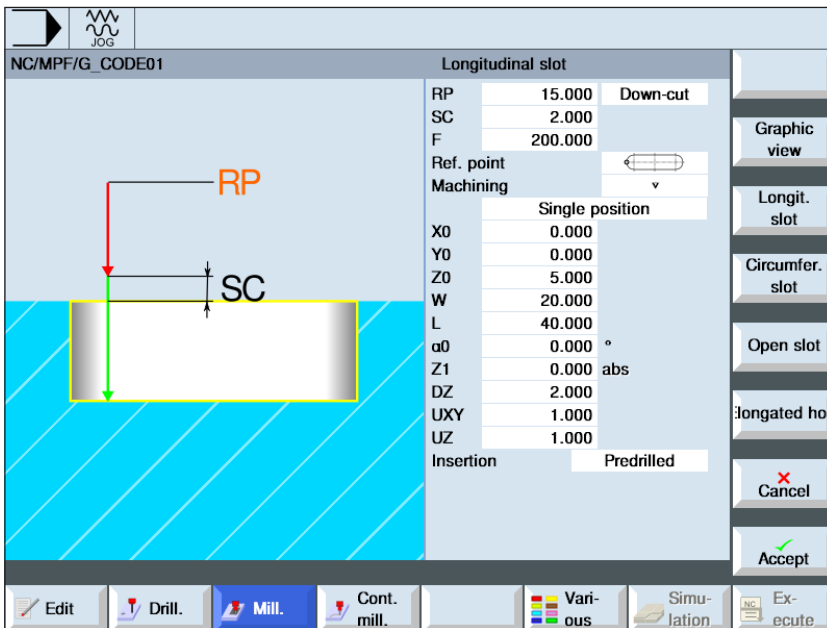
Parameters	Description	Unit
DXY	<ul style="list-style-type: none"> <li>Maximum plane infeed</li> <li>Maximum plane infeed as a percentage of the milling cutter diameter (only for ▽ or ▽ ▽ ▽)</li> </ul>	mm %
DZ	Maximum depth infeed (only for ▽ or ▽ ▽ ▽)	mm
UXY	Plane finishing allowance. (only for ▽, ▽ ▽ ▽ or ▽ ▽ ▽ edge)	mm
UZ	Depth finishing allowance (only for ▽ or ▽ ▽ ▽)	mm
FS	Chamfer width for chamfering (for chamfering only)	mm
ZFS	Insertion depth of tool tip - (for chamfering only)	mm %

### Cycle Description

- 1 The control system positions the tool in rapid traverse (G0) at the retract plane height and at the safety distance. The start point is always on the positive X-axis.
- 2 The tool approaches the spigot contour in the quarter circle with processing feed. First the infeed to the processing depth takes place, then the movement in the plane. The multi-edge will be processed in the clockwise or counter-clockwise direction according to the programmed direction of rotation for processing (up-cut milling/down-cut milling).
- 4 Once the multi-edge has been bypassed once, the tool leaves the contour in the quarter circle and the infeed to the next processing depth takes place.
- 5 The multi-edge will again be approached in the semi-circle and bypassed once. This will be repeated until the programmed spigot depth is reached.
- 6 The tool moves back to the safety distance in rapid traverse (G0).



## Longitudinal slot (SLOT1)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
Milling direction	<ul style="list-style-type: none"> <li>Down-cut Milling</li> <li>Up-cut milling</li> </ul>	
SC	Safety distance	mm
F	Feed	mm/min
Reference point	<ul style="list-style-type: none"> <li> (left edge)</li> <li> (inside left)</li> <li> (centre)</li> <li> (inside right)</li> <li> (right edge)</li> </ul>	
Processing	<ul style="list-style-type: none"> <li>▽ Roughing</li> <li>▽▽ Finishing</li> <li>▽▽▽ Edge finishing</li> <li>Chamfer</li> </ul>	
Processing position	<ul style="list-style-type: none"> <li>Individual position Mill groove at the programmed position (X0, Y0, Z0).</li> <li>Position template Mill several grooves at the programmed position template (e.g. partial circle, grid, line).</li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point: (only for "single position") Reference point in X, Y and Z	mm
W	Width of the groove	mm
L	Length of the groove	mm

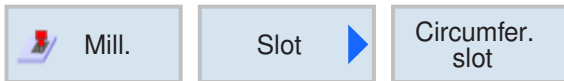


Parameters	Description	Unit
$\alpha 0$	Angle	Degrees
Z1	Groove depth (absolute) or depth relative to Z0 (incremental) (only if ▽, ▽▽▽, or ▽▽▽edge)	mm
DXY	<ul style="list-style-type: none"> <li>• maximum level infeed</li> <li>• maximum level infeed as a percentage of the milling cutter diameter (only when ▽, ▽▽▽, or ▽▽▽Edge)</li> </ul>	mm %
DZ	maximum depth infeed (only when ▽, ▽▽▽, or ▽▽▽Edge)	mm
UXY	Finishing pass plane (only when ▽, ▽▽▽, or ▽▽▽edge)	mm
UZ	Finishing pass depth (only when ▽, ▽▽▽, or ▽▽▽edge)	mm
Plunging	<p>(only if ▽, ▽▽▽ or ▽▽▽ edge)</p> <ul style="list-style-type: none"> <li>• pre-drilled: Approach the reference point brought forward by the safety distance with G0.</li> <li>• vertical: Plunge vertically on longitudinal slot center: It will be moved to the center of the pocket at the infeed depth. With this setting the milling cutting tool must cut via the center.</li> <li>• helical: Plunging on spiral path: The center of the milling cutter moves on the spiral path defined by the radius and the depth per revolution (helical path). Once the depth for the infeed has been reached, another full longitudinal groove will be executed, in order to overcome the angular path of the plunge.</li> <li>• swinging: Plunge swinging on the center axis of the longitudinal groove: The center of the milling cutter swings on a straight line back and forth till it reaches the depth infeed. Once the depth has been reached, the path will be executed again without the depth infeed, in order to overcome the angular path of the plunge.</li> </ul>	
FZ	Infeed depth (only with vertical plunging)	mm/min mm/tooth
EP	Helix pitch	mm/rev
ER	Radius of the helix	mm
EW	Maximum plunge angle (only with swinging plunging)	Degrees
FS	Bevel width for chamfering (only for chamfering)	mm
ZFS	Tool tip plunge depth (only when chamfering)	mm

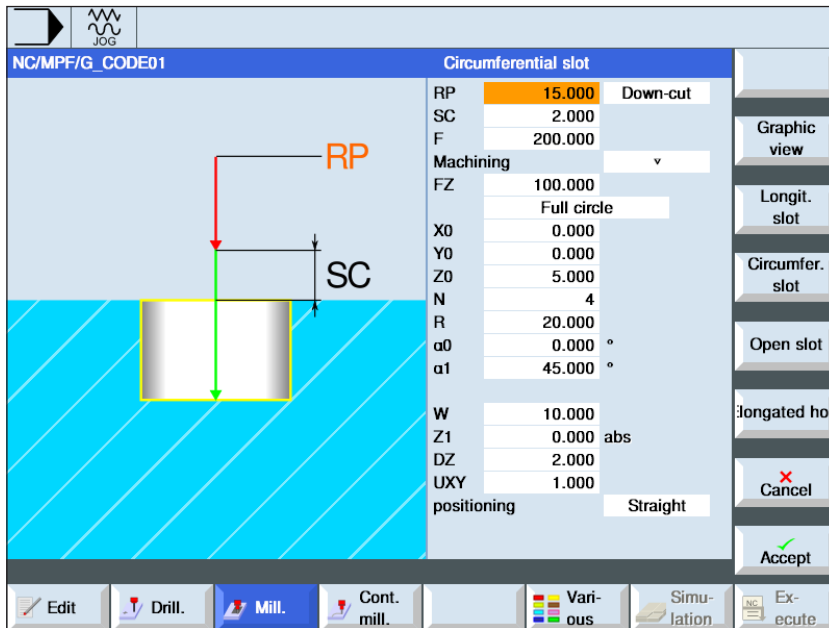
**Cycle Description**

- 1** The control system positions the tool in rapid traverse (G0) at the retract plane height and at the safety distance. The start point lies on the positive X-axis rotated by  $\alpha 0$ .
- 2** The tool mills into the material according to the selected strategy.
- 3** The processing of the longitudinal groove always takes place with the selected processing type from inside to outside.
  - 3a** Processing ▾ Roughing  
During roughing the processing will be from the centre out of the individual planes of the groove until the depth Z1 is reached.
  - 3b** Processing ▾ ▾ ▾ Finishing  
During finishing the edge will always be processed first. In the process the slot edge will be approached in the quarter circle in which it joins the corner radius. In the last infeed the bottom will be finished from the center.
  - 3c** Processing ▾ ▾ ▾ Edge finishing  
Edge finishing takes place as with finishing. Only the last infeed (bottom finishing) is absent.
  - 3d** Processing Chamfering  
During chamfering the edge on the top of the longitudinal slot will be breached.
- 4** The tool moves back to the safety distance in rapid traverse (G0).





## Circumferential slot (SLOT2)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
Milling direction	<ul style="list-style-type: none"> <li>• Down-cut Milling</li> <li>• Up-cut milling</li> </ul>	
SC	Safety distance	mm
F	Feed	mm/min
Processing	<ul style="list-style-type: none"> <li>• ▾ Roughing</li> <li>• ▾ ▾ ▾ Finishing</li> <li>• ▾ ▾ ▾ Edge finishing</li> <li>• Chamfer</li> </ul>	
FZ	Infeed depth	mm/min
Circle template	<ul style="list-style-type: none"> <li>• Full circle The circumferential slots will be positioned on a full circle. The distance from one circumferential slot to the next circumferential slot is always the same and will be calculated by the control system.</li> <li>• Partial circle The circumferential slots will be positioned on a partial circle. The distance from one circumferential slot to the next circumferential slot can be defined by the angle <math>\alpha_2</math>.</li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point: Reference point in X, Y and Z	mm
N	Number of slots	mm
R	Radius of the circumferential slot	mm

Parameters	Description	Unit
$\alpha 0$	Start angle	Degrees
$\alpha 1$	Opening angle of the groove	Degrees
$\alpha 2$	Angle of advance (only with partial circle)	Degrees
W	Width of the groove	mm
Z1	Groove depth (absolute) or depth relative to Z0 (incremental) (only if $\nabla$ , $\nabla\nabla\nabla$ , or $\nabla\nabla\nabla$ edge)	mm
DZ	maximum depth infeed (only when $\nabla$ , $\nabla\nabla\nabla$ , or $\nabla\nabla\nabla$ Edge)	mm
FS	Bevel width for chamfering (only for chamfering)	mm
ZFS	Tool tip plunge depth (only when chamfering)	mm
UXY	Finishing pass plane (only when $\nabla$ , $\nabla\nabla\nabla$ , or $\nabla\nabla\nabla$ edge)	mm
Positioning	Positioning movement between the slots: <ul style="list-style-type: none"> <li>• Straight line: Next position will be approached in rapid traverse in a straight line.</li> <li>• Circle: Next position will be approached on a circular path with the programmed feed FP.</li> </ul>	

**Information:**  
 Enter to create a circumferential slot for number (N)=1 and opening angle ( $\alpha 1$ ) = 360°.



**Cycle Description**

**1** The control system positions the tool in rapid traverse (G0) at the retract plane height on the center point of the half circle at the slot end and at the safety distance. The start point lies on the positive X-axis rotated by  $\alpha 0$ .

With the last feed there will be finished from the center point of the semi-circle at the slot end from the center.  
 Minimum diameter of the milling tool:  $1/2$  Slot width  $W \leq$  milling cutter tool

**2** The tool mills into the material with the processing feed according to the selected strategy. The max. infeed in the Z-direction as well as the finishing pass will be taken into account.

**3c** Processing  $\nabla\nabla\nabla$  Edge finishing  
 Edge finishing takes place as with finishing. Only the last infeed (bottom finishing) is absent.  
 Minimum diameter of the milling tool: Finishing pass  $UXY \leq$  milling cutter tool diameter

**3a** Processing  $\nabla$  Roughing  
 During roughing the individual planes of the slot will be processed from the centre point of the half circle at the slot end until the depth Z1 is reached.  
 Minimum diameter of the milling tool:  $1/2$  Slot width  $W -$  Finishing pass  $UXY \leq$  Milling cutting tool diameter

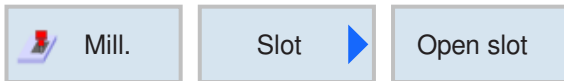
**3d** Processing Chamfering  
 During chamfering the edge on the top of the circular slot will be breached.

**3b** Processing  $\nabla\nabla\nabla$  Finishing  
 During finishing the edge will always be processed first, until depth Z1 is reached. In the process the slot edge will be approached in the quarter circle in which it joins the radius.

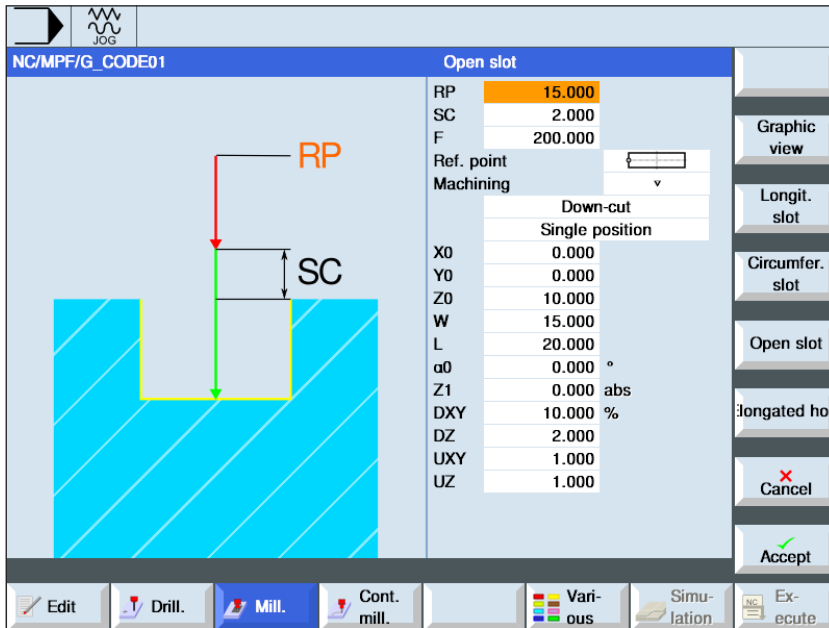
**4** Once the first circumferential slot is finished, the tool moves to the retract level in rapid traverse.

**5** The following circumferential slot will be approached on a straight line or circular path and then milled.

**6** The tool moves back to the safety distance in rapid traverse (G0).



## Open slot (CYCLE899)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
SC	Safety distance	mm
F	Feed	mm/min
Reference point	<ul style="list-style-type: none"> <li> (left edge)</li> <li> (center)</li> <li> (right edge)</li> </ul>	
Processing	<ul style="list-style-type: none"> <li>▽ Roughing</li> <li>▽▽ Pre-finishing</li> <li>▽▽▽ Finishing</li> <li>▽▽▽ Bottom finishing</li> <li>▽▽▽ Edge finishing</li> <li>Chamfering</li> </ul>	
Milling direction	<ul style="list-style-type: none"> <li>Down-cut Milling</li> <li>Up-cut milling</li> <li>Down-cut/up-cut milling</li> </ul>	
Technology	<ul style="list-style-type: none"> <li>Trochoidal milling Circular movement of the milling cutter tool through the slot and back again.</li> <li>Plunge milling</li> <li>Sequential drilling movements along the tool axis.</li> </ul>	

Parameters	Description	Unit
Processing position	<ul style="list-style-type: none"> <li>Individual position Mill slot at the programmed position (X0, Y0, Z0).</li> <li>Position template Mill several slots on a programmed position template (e.g.: full circle or grid).</li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point: Reference point in X, Y and Z	mm
W	Width of the groove	mm
L	Length of the groove	mm
$\alpha_0$	Width of the groove	Degrees
Z1	Slot depth (absolute) or depth relative to Z0 (incremental) (only if $\nabla$ , $\nabla\nabla$ , or $\nabla\nabla\nabla$ )	mm
DXY	<ul style="list-style-type: none"> <li>maximum plane infeed</li> <li>Position template maximum level infeed as a percentage of the milling cutter diameter (only when <math>\nabla</math>)</li> </ul>	mm
DZ	maximum depth infeed	mm
UXY	Finishing pass plane (slot edge)	mm
UZ	Finishing pass depth (slot bottom)	mm
FS	Bevel width for chamfering (only for chamfering)	mm
ZFS	Tool tip plunge depth (only when chamfering)	mm

**General limit conditions:**

- 1/2 Slot width  $W \leq$  milling cutter tool
- Finishing edge finishing pass  $UXY \leq$  milling cutting tool diameter
- Chamfer tip angle must be registered in tool table.

**Limit conditions for trochoidal milling:**

- Roughing: 1/2 Slot width  $W -$  Finishing pass  $UXY \leq$  Milling cutting tool diameter
- Slot width: at least 1.15 x milling cutting tool diameter + finishing pass at most 2 x milling cutting tool diameter + 2 x finishing pass
- Radial infeed: at least 0.02 x milling cutting tool diameter at most 0.25 x milling cutting tool diameter
- Maximum infeed depth  $\leq$  Cutting height of the milling cutting tool

**Limit conditions for plunge milling:**

- Roughing: 1/2 Slot width  $W -$  Finishing pass  $UXY \leq$  Milling cutting tool diameter
- Maximum radial infeed: The maximum infeed is dependent on the cutting width of the milling cutter tool.
- Increment: The sideways increment results from the desired slot width, the milling cutting tool diameter and the finishing pass.
- Retraction: The retraction takes place with withdrawal at an angle of  $45^\circ$ , if the wrap angle is less than  $180^\circ$ . Otherwise a vertical retraction takes place as with drilling.
- Withdrawal: The withdrawal takes place vertically in relation to the wrapped surface.
- Safety distance: Move the safety distance beyond the end of the workpiece to avoid rounding of the slot walls at the ends.

The cutting width of the milling cutter tool for the maximum radial infeed cannot be tested.

**Cycle Description****Trochoidal milling**

1 The control system positions the tool in rapid traverse (G0) at the start point in front of the groove and at the safety distance. The start point lies on the positive X-axis rotated by  $\alpha 0$ .

2 The tool feeds in to the cut depth.

3 The processing of the open slot always takes place with the selected processing type over the complete slot length.

**3a Processing ▽ Roughing**

The roughing is carried out with a circular movement of the mill cutting tool. During these movements the milling cutter tool will be continually fed further into the plane. If the milling cutter tool has traced the entire slot, the milling cutter tool also moves back in a circular movement and in this way drops to the next level (infeed depth) in the Z-direction. This procedure repeats until the preset slot depth plus finishing pass is reached.

**3b Processing ▽ ▽ Finishing**

If there is too much residual material on the slot walls, superfluous corners will be cleared away to the finishing pass.

**3c Processing ▽ ▽ ▽ Finishing**

When finishing the walls the milling cutter tool moves along the slot walls, in which, as with roughing in the Z-direction, also against is feed in step by step. In this the milling cutter tool moves over the slot start and slot end by the safety distance, in order to guarantee that the slot wall has an even surface over the entire length of the slot.

**3c Processing ▽ ▽ ▽ Bottom finishing**

In bottom finishing the milling cutter tool moves into the finished slot once and once back.

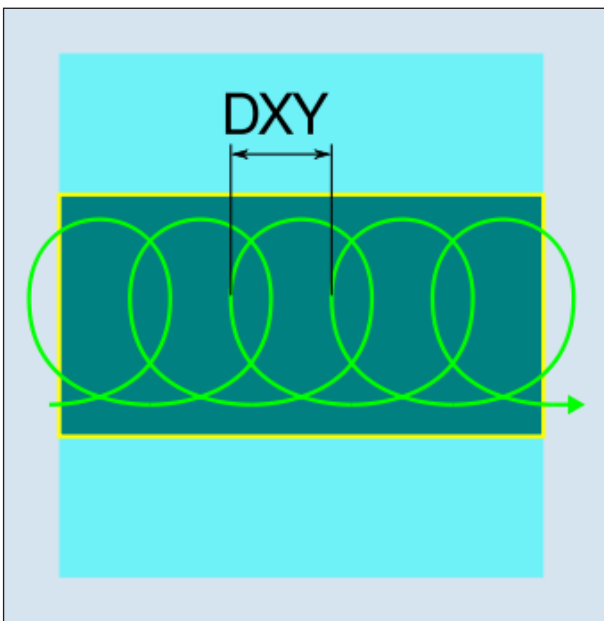
**3e Processing ▽ ▽ ▽ Edge finishing**

Edge finishing takes place as with finishing. Only the last infeed (bottom finishing) is absent.

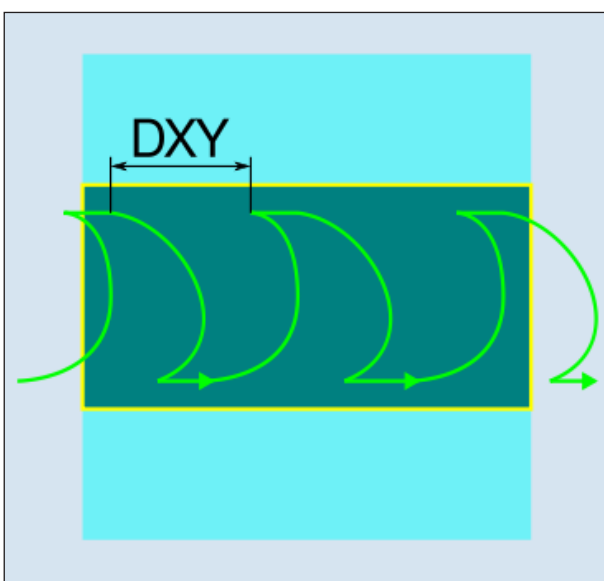
**3f Processing Chamfering**

During chamfering the edge on the top of the slot will be breached.

4 The tool moves back to the safety distance in rapid traverse (G0).



Down-cut or up-cut milling - plunge milling



Down-cut milling/Up-cut milling - trochoidal milling

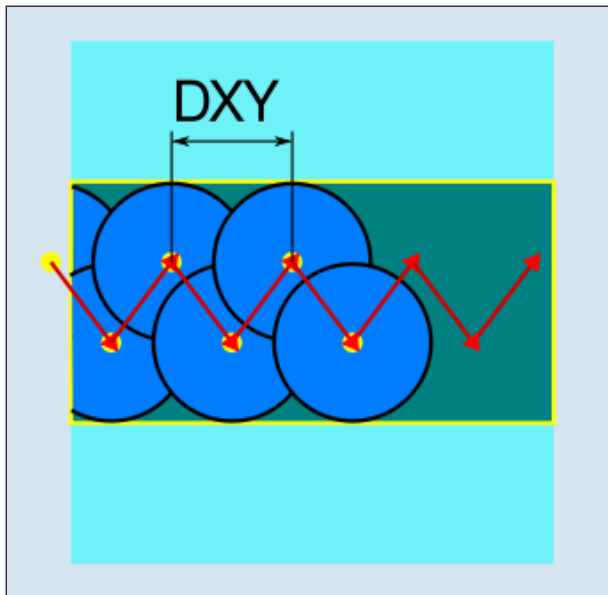


**Cycle Description**

**Plunge milling**

- 1 The control system positions the tool in rapid traverse (G0) at the start point in front of the groove and at the safety distance. The start point lies on the positive X-axis rotated by  $\alpha 0$ .
- 2 The processing of the open slot always takes place with the selected processing type over the complete slot length.

**3a Processing ▽ Roughing**



*Down-cut or up-cut - plunge milling*

The roughing of the slot takes place sequentially along the slot through vertical plunge movements of the milling cutter tool with work feed. Afterwards there is a withdrawal and a position movement to the next plunge point. There will be alternate plunging on the left and right wall, along the slot, displaced by the infeed amount in each case. The first plunge movement takes place at the edge of the slot with a milling cutter operation of a half infeed minus the safety distance. (Thus in the open air if the safety distance is larger than the infeed.) For this cycle the maximum width of the slot must be smaller than the double width of the milling cutter + finishing pass. After each plunging movement the milling cutter also lifts up by the safety distance at working feed. This happens according to possibility in the so-called retract procedure, i.e. when the milling cutter tool has a contact angle of less than  $180^\circ$  it lifts under  $45^\circ$  in the opposite direction of the angle bisector of the contact angle from the bottom. Then the milling cutter moves over the material.

**3b Processing ▽ ▽ Pre-finishing**

If there is too much residual material on the slot walls, superfluous corners will be cleared away to the finishing pass.

**3c Processing ▽ ▽ ▽ Finishing**

When finishing the walls the milling cutter tool moves along the slot walls, in which, as with roughing in the Z-direction, also against is feed in step by step. In this the milling cutter tool moves over the slot start and slot end by the safety distance, in order to guarantee that the slot wall has an even surface over the entire length of the slot.

**3c Processing ▽ ▽ ▽ Bottom finishing**

In bottom finishing the milling cutter tool moves into the finished slot once and once back.

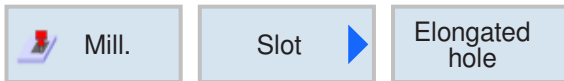
**3e Processing ▽ ▽ ▽ Edge finishing**

Edge finishing takes place as with finishing. Only the last infeed (bottom finishing) is absent.

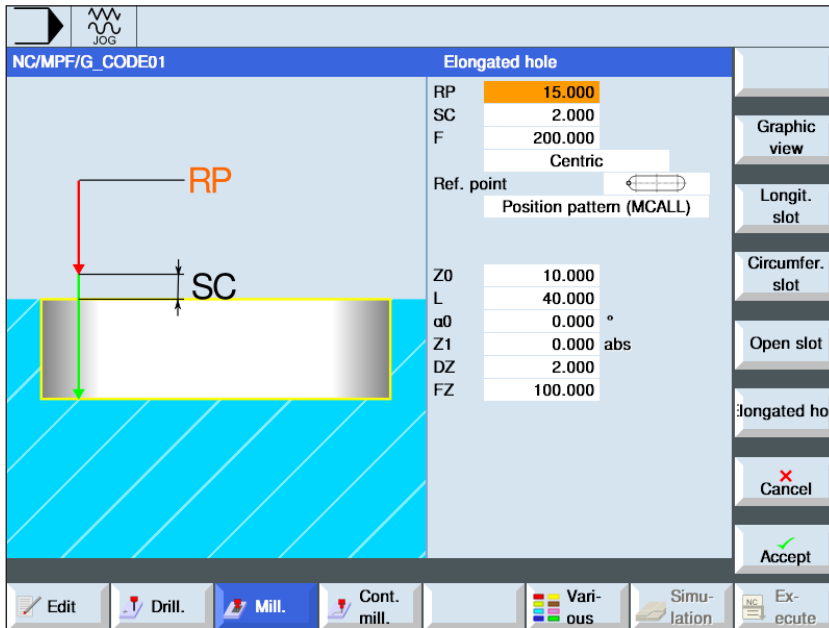
**3f Processing Chamfering**

During chamfering the edge on the top of the slot will be breached.



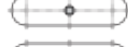
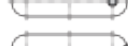
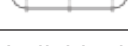
- 4 The tool moves back to the safety distance in rapid traverse (G0).



## Elongated hole (LONGHOLE)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
SC	Safety distance	mm
F	Feed	mm/min
Processing type	<ul style="list-style-type: none"> <li>planar It will be moved to the center of the pocket at the infeed depth. With this setting the milling cutting tool must cut via the center.</li> <li>swinging Plunge swinging on the center axis of the longitudinal groove: The center of the milling cutter swings on a straight line back and forth till it reaches the depth infeed. Once the depth has been reached, the path will be executed again without the depth infeed, in order to overcome the angular path of the plunge.</li> </ul>	
Reference point	<ul style="list-style-type: none"> <li> (left edge)</li> <li> (inside left)</li> <li> (centre)</li> <li> (inside right)</li> <li> (right edge)</li> </ul>	
Processing position	<ul style="list-style-type: none"> <li>Individual position Mill elongated hole at the programmed position (X0, Y0, Z0).</li> <li>Position template Mill several elongated holes at the programmed position template (e.g. partial circle, grid, line).</li> </ul>	

Parameters	Description	Unit
X0 Y0 Z0	The positions relate to the reference point: (only for "single position") Reference point in X, Y and Z	mm
L	Length of the elongated hole	mm
$\alpha 0$	Angle	degrees
Z1	Elongated hole depth (absolute) or depth related to Z0 (incremental)	mm
DZ	maximum depth infeed	mm
FZ	Infeed depth	mm/min

**Information:**

The cycle can only be processed with a milling tool that is fitted with an end tooth cutting via the center.

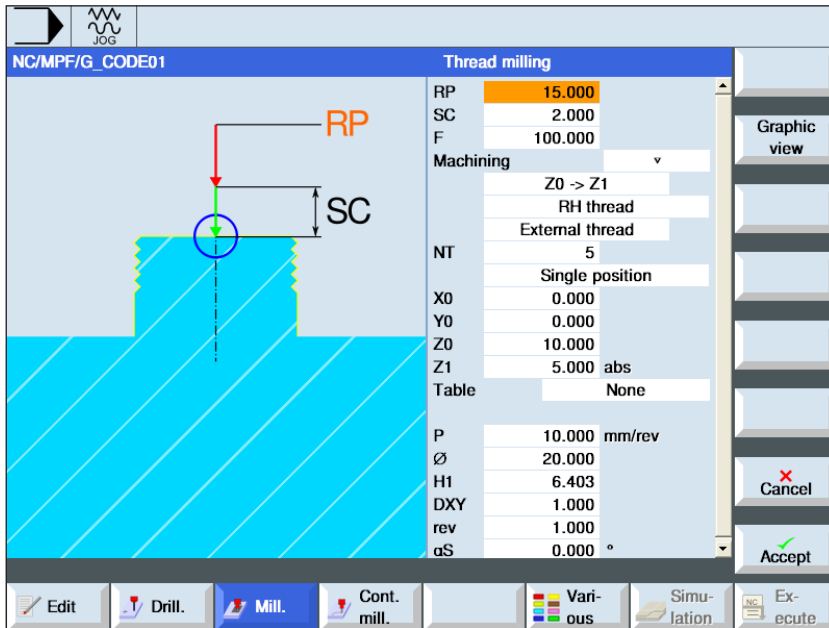


**Cycle Description**

- 1** The control system positions the tool with rapid traverse (G0) at the start position for the cycle. In both axes of the current plane the next end point of the first longitudinal hole to be processed at the height of the retract plane (RC) will be approached in the tool axis. Afterwards there will be a drop to the reference point brought forward by the safety distance (SC).
- 2** Each longitudinal hole will be milled out in a swinging movement. The processing in the plane takes place with G1 and the programmed feed value. At each reversal point the infeed to the next processing depth calculated inside the cycle takes place with G1 and the feed, until the end depth is reached.
- 3** The tool moves back to the retract plane in rapid traverse (G0). The next longitudinal hole will be approached by the shortest path.
- 4** After the processing of the last longitudinal hole is finished, the tool will move to the position last reached in the processing plan to the retract plane with G0.



### Thread milling (CYCLE70)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
SC	Safety distance	mm
F	Feed	mm/min
Processing	<ul style="list-style-type: none"> <li>▾ Roughing</li> <li>▾ ▾ ▾ Finishing</li> </ul>	
Processing direction	<ul style="list-style-type: none"> <li>• Z0 → Z1 Top-down processing</li> <li>• Z1 → Z0 Bottom-up processing</li> </ul>	
Thread's direction of rotation	<ul style="list-style-type: none"> <li>• Right-hand thread A right-hand thread will be milled.</li> <li>• Left-hand thread A left-hand thread will be milled.</li> </ul>	
Position of the thread	<ul style="list-style-type: none"> <li>• Internal thread An internal thread will be milled.</li> <li>• External thread An external thread will be milled.</li> </ul>	
NT	Number of teeth per blade Single or multi-tooth milling inserts can be used. The required movements will be executed by the cycle internally in such a way that upon reaching the thread end position the tip of the lower tooth of a milling insert matches the programmed end position. Depending on the blade geometry a clearance path at the bottom of the workpiece has to be taken into account.	

Parameters	Description	Unit
Processing position	<ul style="list-style-type: none"> <li>Individual position Mill elongated hole at the programmed position (X0, Y0, Z0).</li> <li>Position template Mill several elongated holes at the programmed position template (e.g. partial circle, grid, line).</li> </ul>	
X0 Y0 Z0	The positions are relative to the reference point: (only for "single position") Reference point in X, Y and Z	mm
Z1	End point of the thread (absolute) or thread length (incremental)	mm
Table	Thread selection table: <ul style="list-style-type: none"> <li>None</li> <li>ISO metric</li> <li>Whitworth BSW</li> <li>Whitworth BSP</li> <li>UNC</li> </ul>	
Selection	Selection of the table value e.g.: <ul style="list-style-type: none"> <li>M1; M5; etc. (ISO metric)</li> <li>W1/8"; etc. (Whitworth BSW)</li> <li>G 1 3/4"; etc. (Whitworth BSP)</li> <li>N8 - 32 UNC; etc. (UNC)</li> </ul> (also see thread table with respective pitches)	
P	Display of the thread lead (only with table selection "none") <ul style="list-style-type: none"> <li>in MODULE: MODULE = pitch/<math>\pi</math></li> <li>in threads per inch: typical for tube threads.</li> </ul> With the per inch input, in the first parameter field the whole number before the decimal point is entered and in the second and third field the number after the decimal point is entered as a fraction. <ul style="list-style-type: none"> <li>in mm/rev</li> <li>in inch/rev</li> </ul> The thread lead is dependent on the tool used.	MODULE Threads/" mm/rev inch/rev
∅	Nominal diameter, Example: Nominal diameter of M12 = 12 mm	mm
H1	Thread depth	mm
$\alpha$ S	Start angle	Degrees
R	Finishing pass in X and Y	mm

**Thread table**

ISO_METRIC		WHITWORTH_BSW		WHITWORTH_BSP		UNC	
M 1	0.250	W 1/16"	60.000	G 1/16"	28.000	N 1 - 64 UNC	64.000
M 1.2	0.250	W 3/32"	48.000	G 1/8"	28.000	N 2 - 56 UNC	56.000
M 1.6	0.350	W 1/8"	40.000	G 1/4"	19.000	N 3 - 48 UNC	48.000
M 2	0.400	W 5/32"	32.000	G 3/8"	19.000	N 4 - 40 UNC	40.000
M 2.5	0.450	W 3/16"	24.000	G 1/2"	14.000	N 5 - 40 UNC	40.000
M 3	0.500	W 7/32"	24.000	G 5/8"	14.000	N 6 - 32 UNC	32.000
M 3.5	0.600	W 1/4"	20.000	G 3/4"	14.000	N 8 - 32 UNC	32.000
M 4	0.700	W 5/16"	18.000	G 7/8"	14.000	N 10 - 24 UNC	24.000
M 4.5	0.750	W 3/8"	16.000	G 1"	11.000	N 12 - 24 UNC	24.000
M 5	0.800	W 7/16"	14.000	G 1 1/8"	11.000	1/4" - 20 UNC	20.000
M 6	1.000	W 1/2"	12.000	G 1 1/4"	11.000	5/16" - 18 UNC	18.000
M 8	1.250	W 9/16"	12.000	G 1 3/8"	11.000	3/8" - 16 UNC	16.000
M 10	1.500	W 5/8"	11.000	G 1 1/2"	11.000	7/16" - 14 UNC	14.000
M 12	1.750	W 3/4"	10.000	G 1 3/4"	11.000	1/2" - 13 UNC	13.000
M 14	2.000	W 7/8"	9.000	G 2"	11.000	9/16" - 12 UNC	12.000
M 16	2.000	W 1"	8.000	G 2 1/4"	11.000	5/8" - 11 UNC	11.000
M 18	2.500	W 1 1/8"	7.000	G 2 1/2"	11.000	3/4" - 10 UNC	10.000
M 20	2.500	W 1 1/4"	7.000	G 2 3/4"	11.000	7/8" - 9 UNC	9.000
M 22	2.500	W 1 3/8"	6.000	G 3"	11.000	1" - 8 UNC	8.000
M 24	3.000	W 1 1/2"	6.000	G 3 1/4"	11.000	1 1/8" - 7 UNC	7.000
M 27	3.000	W 1 5/8"	5.000	G 3 1/2"	11.000	1 1/4" - 7 UNC	7.000
M 30	3.500	W 1 3/4"	5.000	G 3 3/4"	11.000	1 3/8" - 6 UNC	6.000
M 33	3.500	W 1 7/8"	4.500	G 4"	11.000	1 1/2" - 6 UNC	6.000
M 36	4.000	W 2"	4.500	G 5"	11.000	1 3/4" - 5 UNC	5.000
M 39	4.000	W 2 1/4"	4.000	G 6"	11.000	2" - 4 1/2 UNC	4.500
M 42	4.500	W 2 1/2"	4.000			2 1/4" - 4 1/2 UNC	4.500
M 45	4.500	W 2 3/4"	3.500			2 1/2" - 4 UNC	4.000
M 48	5.000	W 3"	3.500			2 3/4" - 4 UNC	4.000
M 52	5.000	W 3 1/4"	3.250			3" - 4 UNC	4.000
M 56	5.500	W 3 1/2"	3.250			3 1/4" - 4 UNC	4.000
M 60	5.500	W 3 3/4"	3.000			3 1/2" - 4 UNC	4.000
M 64	6.000	W 4"	3.000			3 3/4" - 4 UNC	4.000
M 68	6.000					4" - 4 UNC	4.000

Thread table with leads

**Cycle Description****Internal thread**

- 1 The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2 Approach start point of the inward circular arc in the current plane with rapid traverse.
- 3 Infeed with rapid traverse to a start point in the tool axis calculated internally by the control system.
- 4 Inward arc movement at thread diameter at programmed feed to an inward arc calculated internally by the control system, taking into account the finishing pass and maximum infeed depth.
- 5 Thread milling on a spiral path in the clockwise direction or in the counter-clockwise direction (dependent on left-hand/right-hand thread, with number of blade teeth in a milling insert  $(NT) \geq 2$  only 1 revolution, displaced in the Z-direction).
- 6 Outwards movement on a circular path with the same direction of rotation and the programmed feed.
- 7 With a programmed number of thread pitches per blade  $NT > 2$  the tool will be infeed by the number  $NT-1$  in the Z-direction (displaced). Repeat points 4 to 7 until the programmed thread depth is reached.
- 8 If the plane infeed is smaller than the thread depth, points 3 to 7 will be repeated until the thread depth + programmed extent is reached.
- 9 The tool moves back in rapid traverse (G0) to the coordinates of the thread center on the retraction plane.

**Limit conditions for internal thread milling:**

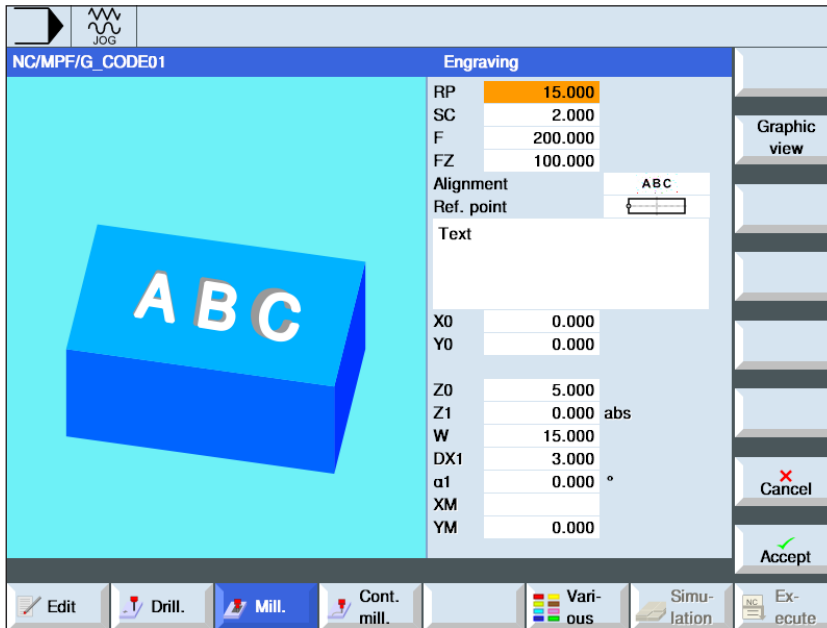
During internal thread milling the milling cutting tool diameter may not exceed the following value:  
Milling cutter diameter < (Nominal diameter - 2x thread depth H1)

**Cycle Description****External thread**

- 1 The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point.
- 2 Approach start point of the inward circular arc in the current plane with rapid traverse.
- 3 Infeed with rapid traverse to a start point in the tool axis calculated internally by the control system.
- 4 Inward arc movement at thread diameter at programmed feed to an inward arc calculated internally by the control system, taking into account the finishing pass and maximum infeed depth.
- 5 Thread milling on a spiral path in the clockwise direction or in the counter-clockwise direction (dependent on left-hand/right-hand thread, with  $(NT) \geq 2$  only 1 revolution, displaced in the Z-direction).
- 6 Outwards movement on a circular path with the opposite the set direction of rotation and the programmed feed.
- 7 With a programmed number of thread pitches per blade  $NT > 2$  the tool will be infeed by the number  $NT-1$  in the Z-direction (displaced). Repeat points 4 to 7 until the programmed thread depth is reached.
- 8 If the plane infeed is smaller than the thread depth, points 3 to 7 will be repeated until the thread depth + programmed extent is reached.
- 9 The tool moves back in rapid traverse (G0) to the coordinates of the thread center on the retraction plane.



## Engraving (CYCLE60)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
SC	Safety distance	mm
F	Feed	mm/min
FZ	Infeed depth	mm/min
Alignment	<ul style="list-style-type: none"> <li>•  (linear alignment)</li> <li>•  (curved alignment)</li> <li>•  (curved alignment)</li> </ul>	
Reference point	<ul style="list-style-type: none"> <li>•  (bottom left)</li> <li>•  (bottom right)</li> <li>•  (top left)</li> <li>•  (top right)</li> <li>•  (left edge)</li> <li>•  (center)</li> <li>•  (right edge)</li> </ul>	
Engraving text	max. 100 characters	
X0 Y0 Z0	Reference point in X, Y and Z	mm

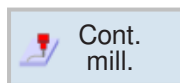


Parameters	Description	Unit
R	Reference polar length (only for curved alignment)	mm
$\alpha 0$	Reference polar angle (only for curved alignment)	Degrees
Z1	Engraving depth (absolute) or depth related to Z0 (incremental)	mm
W	Symbol height	mm
DX1 $\alpha 2$	Character spacing or opening angle (only for curved alignment)	mm Degrees
DX1 DX2	Character spacing or overall width (only for linear alignment)	mm
$\alpha 1$	Text alignment (only for linear alignment)	Degrees
XM YM	Centre point in X and Y (only for curved alignment)	mm
YM LM	Center point length and polar angle (only for curved alignment)	mm

#### Cycle Description

- 1 The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the start point.
- 2 The tool moves with infeed FZ to the processing depth Z1 and mills the symbol.
- 3 The tool pulls back to the safety distance in rapid traverse and moves in a straight line to the next symbol.
- 4 Steps 2 and 3 will be repeated until the whole text has been milled.
- 5 The tool moves back in rapid traverse (G0) to the coordinates of the thread center on the retraction plane.





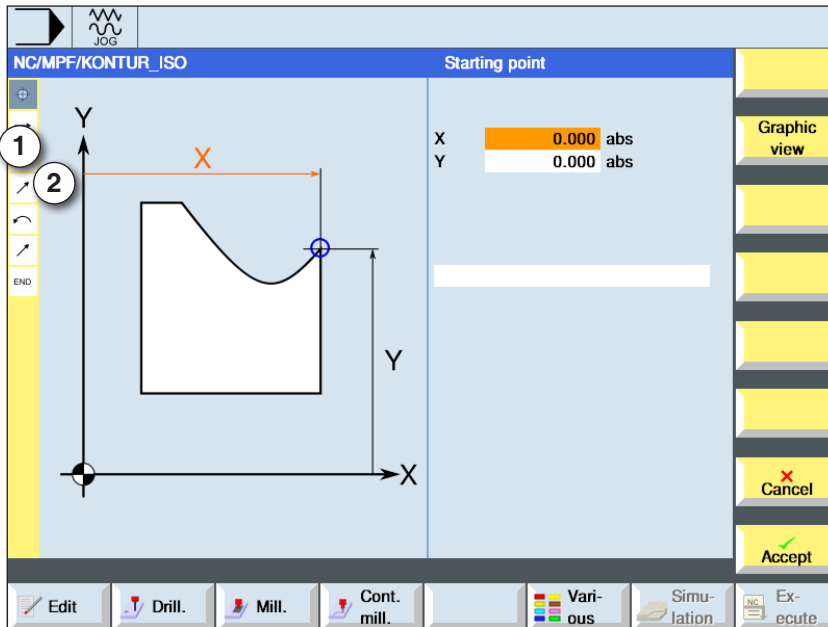
## Contour milling

- New contour
- Contour call (CYCLE62)
- Path milling (CYCLE72)
- Rough drill (CYCLE64)
- Pocket (CYCLE63)
- Spigot (CYCLE63)



## Create new contour

- Enter program name and confirm with softkey. If the program name already exists an error message comes up with the requests to enter a new name.



### Information:

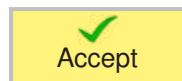
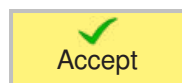
The individual contour elements of a contour will be shown symbolically in the indicated sequence on the left alongside the graphic window (1).

On the far left the individual cycles of a program are symbolically represented in the indicated sequence (1).

1 Contour elements

- Then the start point of the contour will be entered.
- If applicable, enter additional commands in the form of G-Code.
- Press softkey to apply the cycle in the workpiece program.

Enter individual contour elements and apply with softkey:



Straight line element in X

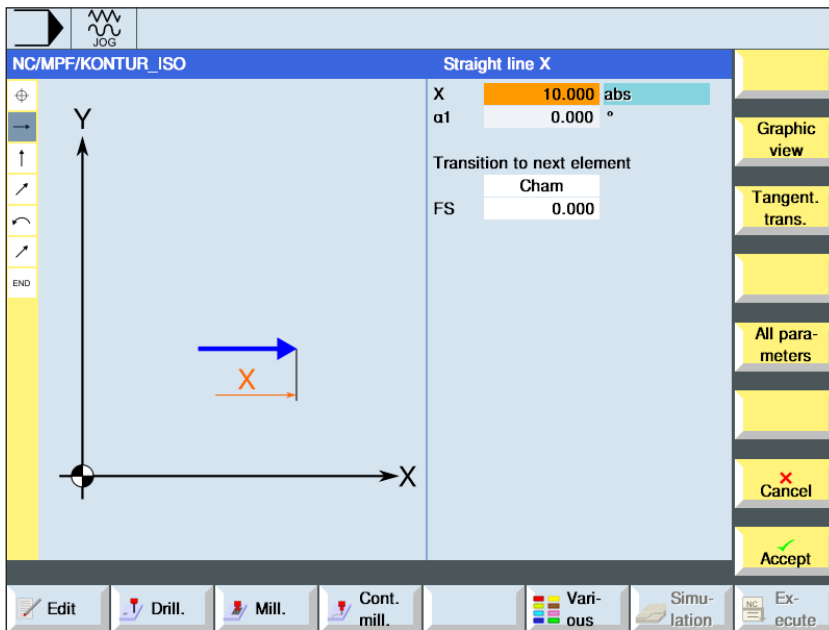
Straight line element in Y

Straight line element in XY

Circular element



### Contour element straight line X

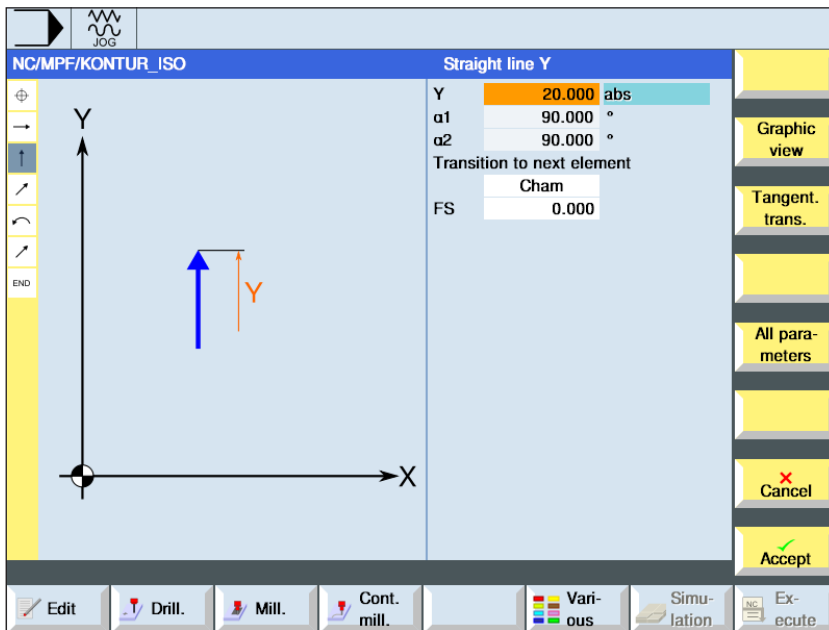


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
X	End point X (absolute or incremental)	mm
$\alpha 1$	Start angle e.g. to X-axis	Degrees
$\alpha 2$	Angle to previous element	Degrees
Transition to succeeding element	Type of transition <ul style="list-style-type: none"> <li>• Radius</li> <li>• Bevel</li> </ul>	
R	Transition to succeeding element - Radius	mm
F	Transition to succeeding element - Bevel	mm
Additional commands	Additional G-code commands	



### Contour element straight line Y

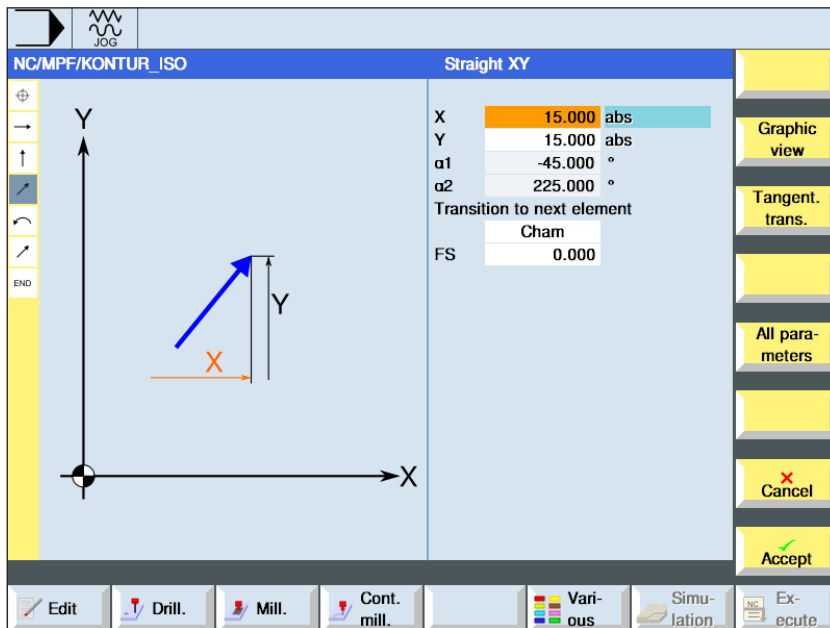


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Y	End point Y (absolute or incremental)	mm
$\alpha 1$	Start angle e.g. to Y-axis	Degrees
$\alpha 2$	Angle to previous element	Degrees
Transition to succeeding element	Type of transition • Radius • Bevel	
R	Transition to succeeding element - Radius	mm
F	Transition to succeeding element - Bevel	mm
Additional commands	Additional G-code commands	



### Contour element straight line XY

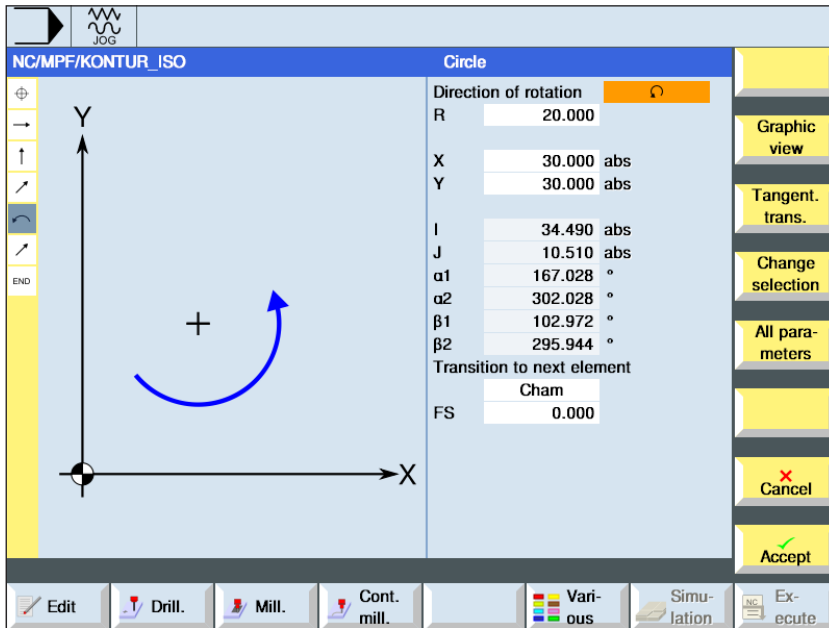


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
X	End point X (absolute or incremental)	mm
Y	End point Y (absolute or incremental)	mm
L	Length	mm
$\alpha 1$	Start angle e.g. to X-axis	Degrees
$\alpha 2$	Angle to previous element	Degrees
Transition to succeeding element	Type of transition <ul style="list-style-type: none"> <li>• Radius</li> <li>• Bevel</li> </ul>	
R	Transition to succeeding element - Radius	mm
F	Transition to succeeding element - Bevel	mm
Additional commands	Additional G-code commands	



### Contour element circle

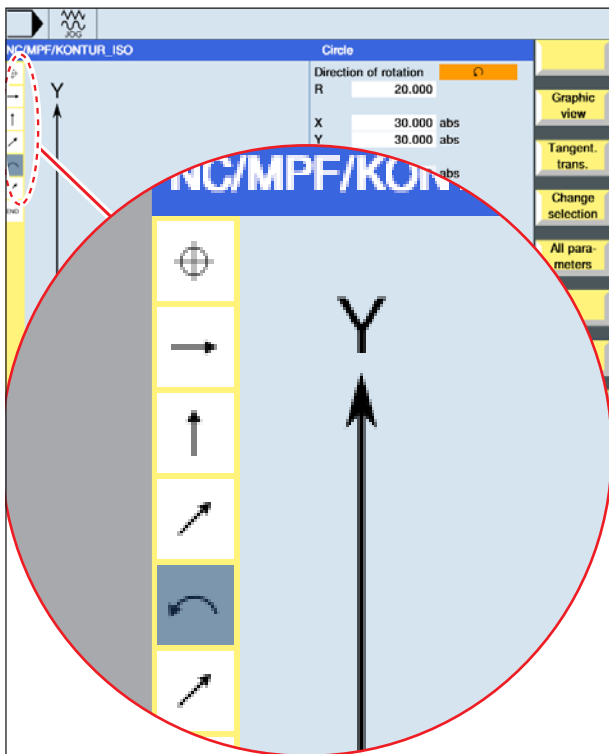


Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Direction of rotation	<ul style="list-style-type: none"> <li> Direction of rotation right</li> <li> Direction of rotation left</li> </ul>	
R	Radius	mm
X Y	Coordinates of the end points in X and Y (absolute or incremental)	mm
I J	Coordinates of the circle centre in I and J (absolute or incremental)	mm
$\alpha 1$	Start angle to X-axis	Degrees
$\alpha 2$	Angle to previous element	Degrees
$\beta 1$	End angle to Z-axis	Degrees
$\beta 2$	Opening angle	Degrees
Transition to succeeding element	Type of transition <ul style="list-style-type: none"> <li>• Radius</li> <li>• Bevel</li> </ul>	
R	Transition to succeeding element - Radius	mm
F	Transition to succeeding element - Bevel	mm
Additional commands	Additional G-code commands	



<div style="border: 1px solid black; background-color: #ffffcc; padding: 5px; width: fit-content; margin-bottom: 10px;">Graphic view</div>	<p><b>Other functions:</b></p> <ul style="list-style-type: none"> <li>• Change view This softkey switches between the graphics window and the input screen.</li> </ul>
<div style="border: 1px solid black; background-color: #ffffcc; padding: 5px; width: fit-content; margin-bottom: 10px;">Tangent. trans.</div>	<ul style="list-style-type: none"> <li>• Tangent to previous element Program the transition to the previous element as a tangent.</li> </ul>
<div style="border: 1px solid black; background-color: #ffffcc; padding: 5px; width: fit-content; margin-bottom: 10px;">Dialog select</div>	<ul style="list-style-type: none"> <li>• Dialog selection If two different contour options result from previously entered parameters, one of them must be selected. Apply the selection contour option with the softkey.</li> </ul>
<div style="border: 1px solid black; background-color: #ffffcc; padding: 5px; width: fit-content; margin-bottom: 10px;">Dialog accept</div>	
<div style="border: 1px solid black; background-color: #ffffcc; padding: 5px; width: fit-content; margin-bottom: 10px;">Change selection</div>	<ul style="list-style-type: none"> <li>• Select dialog concerned When a dialogue selection has already been made this softkey changes the selected solution again.</li> </ul>
<div style="border: 1px solid black; background-color: #ffffcc; padding: 5px; width: fit-content; margin-bottom: 10px;">All parameters</div>	<ul style="list-style-type: none"> <li>• Display additional parameters If additional parameters should be shown for individual contour elements, e.g. to enter additional commands.</li> </ul>
<div style="border: 1px solid black; background-color: #ffffcc; padding: 5px; width: fit-content; margin-bottom: 10px;">Close contour</div>	<ul style="list-style-type: none"> <li>• Close contour The contour will be closed from the current position with a straight line to the start point.</li> </ul>



### Symbol representation of the contour elements:

Contour element	Symbol	Meaning
Start point		Start point of the contour
Straight up Straight down		Straight line in 90° grid
Straight left Straight right		Straight line in 90° grid
Straight line anywhere		Straight line with arbitrary pitch
Curve right Curve left		Circle
Contour termination	END	End of the contour description

The contour element can accept different line types and colours:

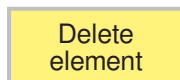
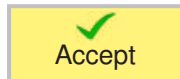
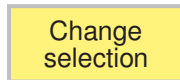
- Black: Programmed contour
- Orange: Current contour element
- Line-dot-dot: Partially-defined element

The scaling of the coordinate system adapts to the change of the entire contour.

## Change contour

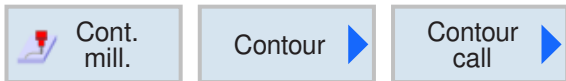
### Change contour element

- Open the program to be processed.
- Use the cursor to select the program block in which the contour should be changed. The individual contour elements will be listed.
- Position cursor at the point to insert or change.
- Select the desired contour element with the softkey.
- Enter parameter in the input screen or delete the element and select a new element.
  - Press softkey. The desired contour element will be inserted or changed on the contour.

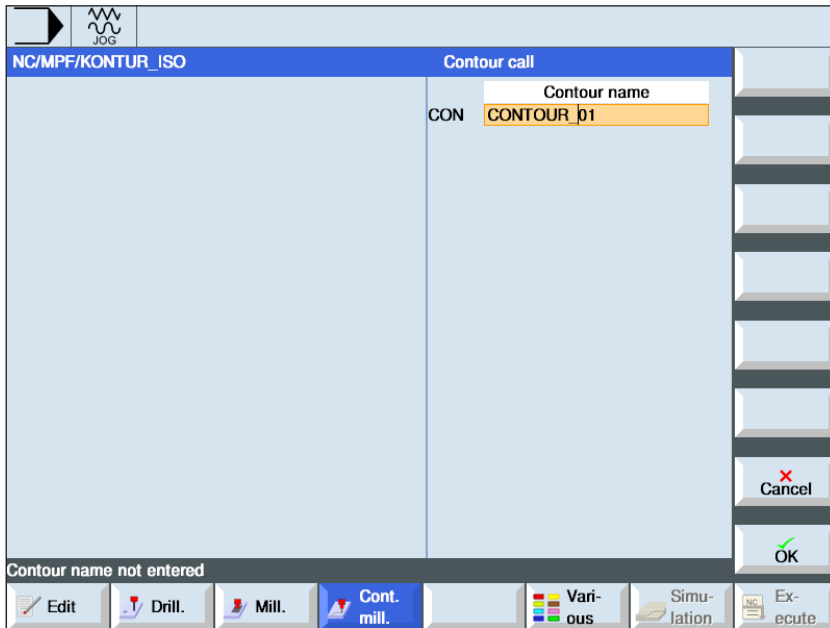


### Delete contour element

- Open the program to be processed.
- Position cursor on the contour element that should be deleted.
- Press softkey.
- Press softkey.



## Contour call (CYCLE62)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Contour selection	<ul style="list-style-type: none"> <li>Contour name</li> <li>Label</li> <li>Sub-routine</li> <li>Labels in the sub-program</li> </ul>	
Contour name	CON: Contour name	
Labels	<ul style="list-style-type: none"> <li>LAB1: Label 1</li> <li>LAB2: Label 2</li> </ul>	
Sub-routine	PRG: Sub-routine	
Labels in the Sub-routine	<ul style="list-style-type: none"> <li>PRG: Sub-routine</li> <li>LAB1: Label 1</li> <li>LAB2: Label 2</li> </ul>	

### Cycle Description

When a contour is called up, a reference to the selected contour is created. The following selection options exist for calling up the contour:

**1 Contour name**

The contour is in the main program to be called up.

**2 Labels**

The contour is in the main program to be called up and is restricted by the label indicated.

**3 Sub-routine**

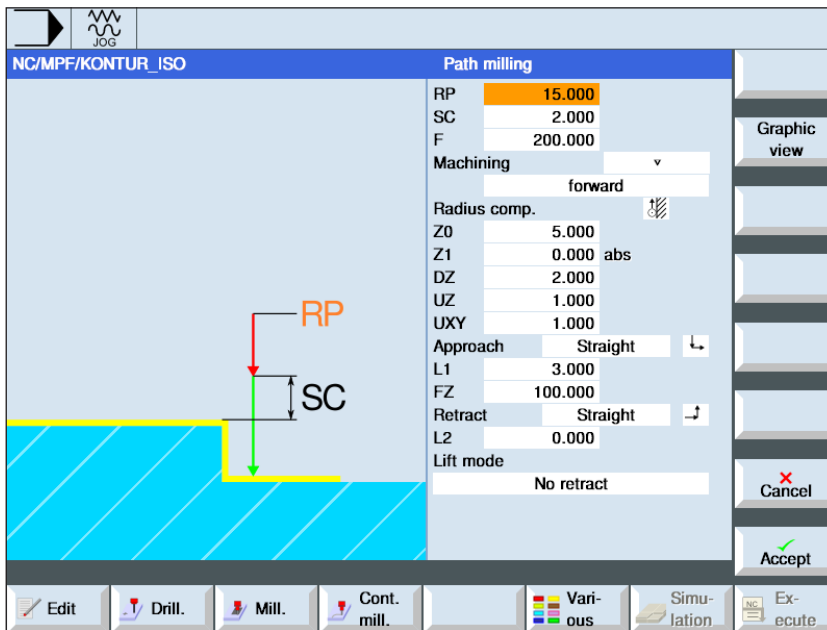
The contour is in a sub-program in the same tool.

**4 Labels in the sub-program**

The contour is in a sub-program and is restricted by the label indicated.







## Path milling (CYCLE72)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
RP	Retract plane	mm
SC	Safety distance	mm
F	Feed	mm/min
Processing	<ul style="list-style-type: none"> <li>▾ Roughing</li> <li>▾ ▾ ▾ Finishing</li> <li>Chamfering</li> </ul>	
Processing direction	<ul style="list-style-type: none"> <li>forwards: The processing takes place in the programmed contour direction.</li> <li>backwards: The processing takes place against the programmed contour direction.</li> </ul>	
Radius correction	<ul style="list-style-type: none"> <li> left (processing left from the contour)</li> <li> right (processing right from the contour)</li> <li> off</li> </ul> <p>A programmed contour can also be programmed on the centre point path. In this, movement in or out is possible in a straight line or vertically. Moving in and out vertically can also, for example, be used with closed contours.</p>	
Z0	Reference point Y (absolute or incremental)	mm
Z1	Final depth (absolute) or final depth relative to Z0 (incremental) (only if ▾, or ▾ ▾ ▾)	mm
DZ	maximum depth infeed (only if ▾, or ▾ ▾ ▾)	mm
UZ	Finishing pass plane (only when ▾)	mm
FS	Bevel width for chamfering (incremental) (only for chamfering)	mm

Parameters	Description	Unit
ZFS	Tool tip plunge depth (absolute or incremental) (only for chamfer)	mm
UXY	Finishing pass plane (only when □)	mm
Approach mode	<p>Approach mode level</p> <ul style="list-style-type: none"> <li>• Straight line: Slope in space</li> <li>• Quarter circle: Part of a spiral (only when path milling left and right of the contour)</li> <li>• Half-circle: Part of a spiral (only when path milling left and right of the contour)</li> <li>• Vertical: Vertical to path (only for path milling on the center point path)</li> </ul>	
Approach strategy	<ul style="list-style-type: none"> <li>•  axially</li> <li>•  three-dimensionally (only when approaching "Quarter circle, semi-circle or straight line")</li> </ul>	
R1	Approach radius	mm
L1	Approach length	mm
Withdraw mode	<p>Withdraw mode plane</p> <ul style="list-style-type: none"> <li>• Straight line: Slope in space</li> <li>• Quarter circle: Part of a spiral (only when path milling left and right of the contour)</li> <li>• Half-circle: Part of a spiral (only when path milling left and right of the contour)</li> <li>• Vertical: Vertical to path (only for path milling on the center point path)</li> </ul>	
Withdrawal strategy	<ul style="list-style-type: none"> <li>•  axially</li> <li>•  three-dimensionally (only when approaching "Quarter circle, semi-circle or straight line")</li> </ul>	
R2	Withdraw radius	mm
L2	Withdraw length	mm
Lift mode	<p>When several depth infeeds are required, indicate retraction height to which the tool should pull back between the individual infeeds (during transition from end of the contour to the start). Lift mode before renewed infeed</p> <ul style="list-style-type: none"> <li>• Z0 + safety distance</li> <li>• by safety distance</li> <li>• on RP...retraction plane</li> <li>• no retraction</li> </ul>	
FR	Retraction plan for interim positioning - (not during lifting mode "no retraction")	

**Approach and withdrawal mode**

The contour can be approached or withdrawn from in a quarter circle, semi-circle or straight line.

- For the quarter-circle or semi-circle the radius of the milling cutting tool center point must be indicated.
- With straight lines the distance from the external edge of the milling cutter to the contour start point or contour end point must be indicated.

Mixed programming is also possible, e.g. approach in quarter circle.

Withdraw in semi-circle.

**Strategy for approach/withdrawal**

You can selected between planar approach/withdrawal and three-dimensional approach/withdrawal:

- Planar approach:  
first the depth and then the processing plane will be approached.
- Three-dimensional approach:  
the depth and processing plane will be approached simultaneously.
- Withdrawal takes place in the reverse order.

Mixed programming is possible, e.g. approaching in the processing plane, withdrawing three-dimensionally.

**Path milling on the center point path**

A programmed contour can also be processed on the centre point path, if the radius correction was switched off. In this, movement in or out is possible in a straight line or vertically. Vertical approach/withdrawal can be used, for example, with closed contours.

**Programming of the contour cycle with the associated contour:**

A complete contour cycle consists of the associated contour and the processing cycle.

The programming sequence must be observed:

**1** The contour will be created first and the processing cycle afterwards (e.g.: path milling). The control system links both program parts with a symbolic bracket (3) in the cycle list.

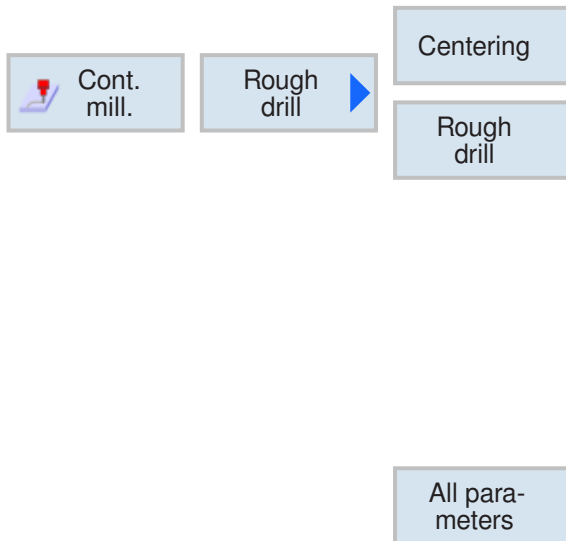
**2** Program contour call-up(CYCLE62).  
Select the contour to be processed.

**3** Path milling (roughing)  
The contour will be processed taking the indicated approach and withdrawal strategies into account.

**4** Path milling (finishing)  
If a finishing pass was programmed during roughing, the contour will be processed again.

**5** Path milling (chamfering)  
If an edge breach is anticipated, the workpiece will be milled with a special tool.





## Pre-drill contour pocket (CYCLE64)

Alongside pre-drilling the centering option also exists with this cycle. For this centering or pre-drilling programs generated from the cycle are called up.

During clearing of contour pockets, when a milling cutting tool cannot plunge in the center, it is necessary to pre-drill. The number and the positions of the pre-drillings required depends on special circumstances such as e.g. type of contours, tool, plane infeed, finishing pass.

Using this softkey you can enter additional parameters.

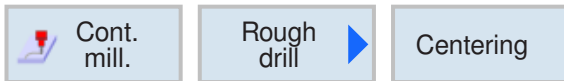
Additional parameters are helpful if several pockets are being drilled and unnecessary tool changes should be avoided. In this way all pockets can initially be pre-drilled and then cleared.

The parameters must correspond to the parameters of the associated clearing step.

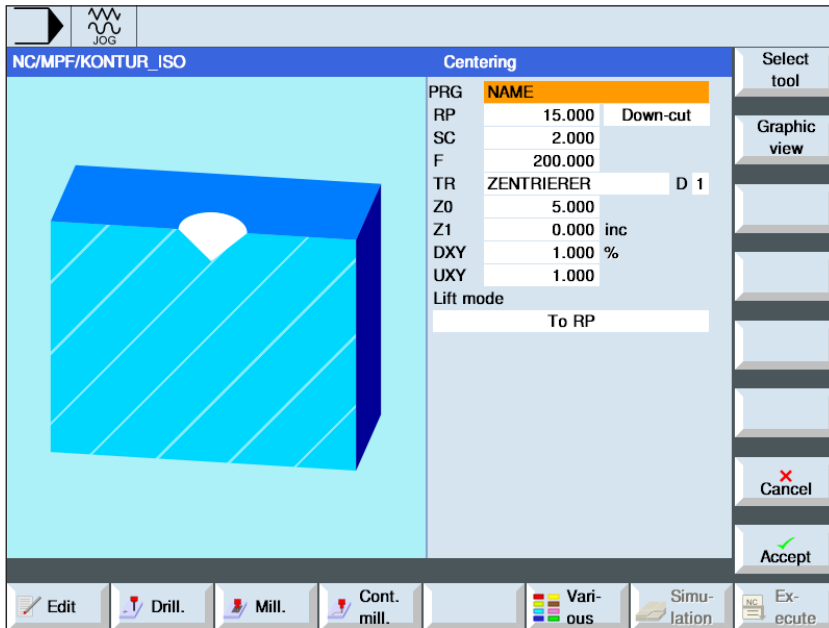
### Programming

- 1 Contour pocket 1
- 2 Centering
- 3 Contour pocket 2
- 4 Centering
- 5 Contour pocket 1
- 6 Rough drill
- 7 Contour pocket 2
- 8 Rough drill
- 9 Contour pocket 1
- 10 Clearing
- 11 Contour pocket 2
- 12 Clearing

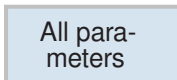
When a pocket is being fully processed (centering, pre-drilling and clearing directly after one another), and the additional parameters for centering/pre-drilling have not been filled out, the cycle applies these parameter values from the Clearing processing step (roughing).



## Centering (CYCLE64)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.



Using this softkey you can enter additional parameters.

Additional parameters are helpful if several pockets are being drilled and unnecessary tool changes should be avoided. In this way all pockets can initially be pre-drilled and then cleared.

Parameters	Description	Unit
PRG	Name for the program to be generated	
RP	Retract plane	mm
Milling direction	<ul style="list-style-type: none"> <li>Down-cut Milling</li> <li>Up-cut milling</li> </ul>	
SC	Safety distance	mm
F	Feed	mm/min
TR	Reference tool. Tool used in the "clearing" processing step. Used to determine the plunge position.	
Z0	Reference point	
Z1	Depth relative to Z0 (incremental)	
DXY	<ul style="list-style-type: none"> <li>maximum plane infeed</li> <li>maximum plane infeed as a percentage of the milling cutting tool diameter</li> </ul>	mm %
UXY	Finishing pass plane	

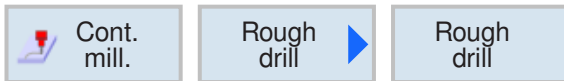
Parameters	Description	Unit
Lift mode	<p>If several plunge points are required during processing, the retraction height can be programmed.</p> <ul style="list-style-type: none"><li>• on the retraction plane</li><li>• Z0 + safety distance</li></ul> <p>During the transition to the next plunge point the tool pulls back to this height. If there are no elements larger than Z0 in the pocket area, Z0 + safety distance can be programmed as lift mode.</p>	mm

#### Programming of the centering cycle with the associated contour:

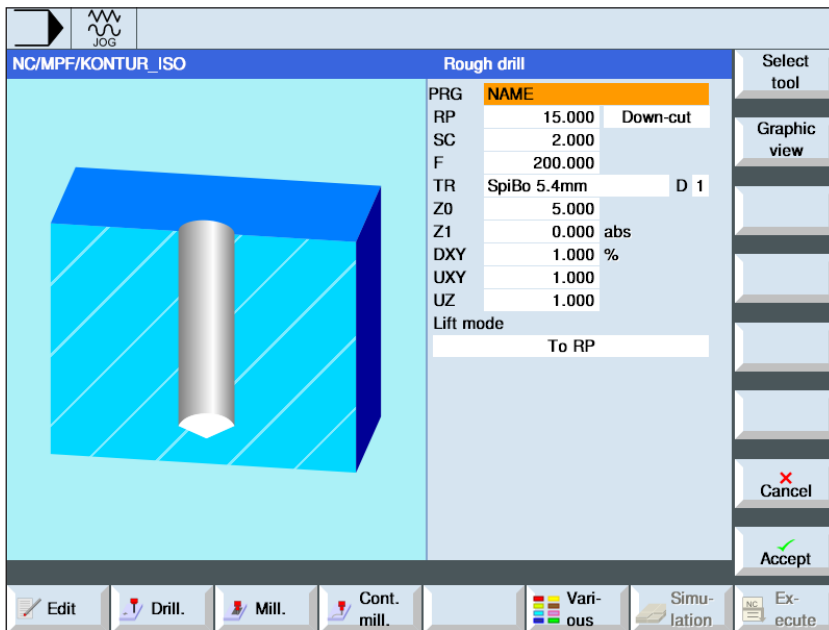
A complete contour cycle consists of the associated contour and the processing cycle.

The programming sequence must be observed:

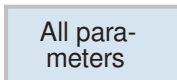
- 1** The contour will be created first and the processing cycle afterwards (e.g.:Centering(Cycle64)).  
The control system links both program parts with a symbolic bracket (3) in the cycle list.
- 2** Program contour call-up(CYCLE62).  
Select the contour to be processed.
- 3** Centering(CYCLE64)  
The contour will be processed taking the indicated parameter into account.



## Rough drill (CYCLE64)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.



Using this softkey you can enter additional parameters.

Additional parameters are helpful if several pockets are being drilled and unnecessary tool changes should be avoided. In this way all pockets can initially be pre-drilled and then cleared.

Parameters	Description	Unit
PRG	Name for the program to be generated	
RP	Retract plane	mm
Milling direction	<ul style="list-style-type: none"> <li>Down-cut Milling</li> <li>Up-cut milling</li> </ul>	
SC	Safety distance	mm
F	Feed	mm/min
TR	Reference tool. Tool used in the "clearing" processing step. Used to determine the plunge position.	
Z0	Reference point	
Z1	Pocket depth (absolute) or depth related to Z0 (incremental)	
DXY	<ul style="list-style-type: none"> <li>Maximum plane infeed</li> <li>maximum plane infeed as a percentage of the milling cutting tool diameter</li> </ul>	mm %
UXY	Finishing pass plane	
UZ	Finishing pass depth	

Parameters	Description	Unit
Lift mode	<p>If several plunge points are required during processing, the retraction height can be programmed.</p> <ul style="list-style-type: none"><li>• on the retraction plane</li><li>• Z0 + safety distance</li></ul> <p>During the transition to the next plunge point the tool pulls back to this height. If there are no elements larger than Z0 in the pocket area, Z0 + safety distance can be programmed as lift mode.</p>	mm

#### **Programming of the pre-drilling cycle with the associated contour:**

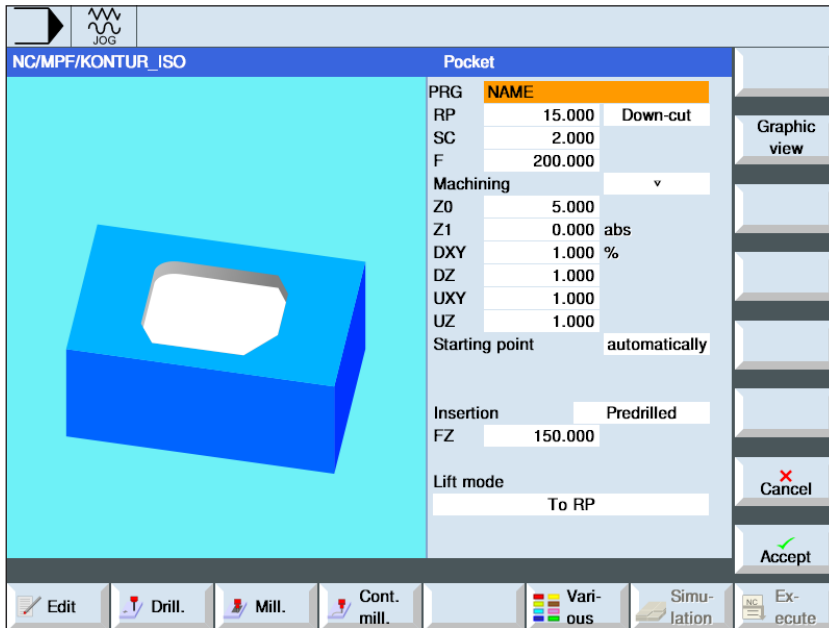
A complete contour cycle consists of the associated contour and the processing cycle.

The programming sequence must be observed:

- 1** The contour will be created first and the processing cycle afterwards (e.g.:Pre-drilling(Cycle64)). The control system links both program parts with a symbolic bracket (3) in the cycle list.
- 2** Program contour call-up(CYCLE62).  
Select the contour to be processed.
- 3** Pre-drilling(CYCLE64)  
The contour will be processed taking the indicated parameter into account.



## Pocket milling (CYCLE63)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
PRG	Name for the program to be generated	
RP	Retract plane	mm
Milling direction	<ul style="list-style-type: none"> <li>• Down-cut Milling</li> <li>• Up-cut milling</li> </ul>	
SC	Safety distance	mm
F	Feed	mm/min
Processing	<ul style="list-style-type: none"> <li>• ▾ Roughing</li> <li>• ▾ ▾ Bottom finishing</li> <li>• ▾ ▾ ▾ Edge finishing</li> <li>• Chamfering</li> </ul>	
Z0	Reference point Z	
Z1	Pocket depth (absolute) or depth relative to Z0 (incremental) (only if ▾, ▾ ▾ ▾ bottom, or ▾ ▾ ▾ edge)	mm
DXY	<ul style="list-style-type: none"> <li>• Maximum plane infeed</li> <li>• maximum plane infeed as a percentage of the milling cutting tool diameter (only if ▾, or ▾ ▾ ▾ bottom)</li> </ul>	mm %
DZ	maximum depth infeed (only if ▾, or ▾ ▾ ▾ edge)	mm
UXY	Finishing pass plane (only if ▾, ▾ ▾ ▾ bottom, or ▾ ▾ ▾ edge )	mm
UZ	Finishing pass depth (only if ▾, or ▾ ▾ ▾ bottom)	mm
Start point	<ul style="list-style-type: none"> <li>• manual Start point will be specified manually</li> <li>• automatically Start point will be calculated automatically (only if ▾, or ▾ ▾ ▾ bottom)</li> </ul>	

Parameters	Description	Unit
XS YS	Coordinates of the start point in X and Y (only with start point "manual")	
Plunging	(only ▽, or ▽ ▽ ▽ bottom) <ul style="list-style-type: none"> <li>vertical: Plunge vertically on pocket center: The calculated current infeed depth will be executed in the pocket center in one block. With this setting the milling cutting tool must cut via the center or it must be pre-drilled.</li> <li>helical: Plunging on spiral path: The center of the milling cutter moves on the spiral path defined by the radius and the depth per revolution (helical path). Once the depth for the infeed has been reached, another full circle will be executed, in order to overcome the angular path of the plunge.</li> <li>swinging: Plunge swinging on the center axis of the longitudinal groove: The center of the milling cutter swings on a straight line back and forth till the depth infeed is reached. Once the depth has been reached, the path will be executed again without the depth infeed, in order to overcome the angular path of the plunge.</li> </ul>	
FZ	Infeed depth (only when plunging vertically and ▽)	mm/min mm/tooth
EP	Maximum pitch of the helix - (only with helical plunging)	mm/rev
ER	Radius of the helix (only with helical plunging) The radius may not be larger than the milling cutting tool radius, as otherwise material remains.	mm
EW	Maximum plunge angle (only with swinging plunging)	Degrees
Lift mode before renewed infeed	If several plunge points are required during processing, the retraction height can be programmed. <ul style="list-style-type: none"> <li>on the retraction plane</li> <li>Z0 + safety distance</li> </ul> During the transition to the next plunge point the tool pulls back to this height. If there are no elements larger than Z0 in the pocket area, Z0 + safety distance can be programmed as lift mode. (only if ▽, ▽ ▽ ▽ bottom, or ▽ ▽ ▽ edge)	mm
FS	Bevel width for chamfering (only for chamfering)	mm
ZFS	Tool tip plunge depth (only when chamfering)	mm



**Information:**

With manual input the start point can also be outside the pocket. This can, for example, be sensible when clearing a pocket that is open at the side. The processing then begins without plunging with a straight line movement into the open side of the pocket.

**Contours for pockets or islands**

Contours for pockets or islands must be closed, i.e. start and end point of the contour are identical. Pockets can be milled that are contained inside one or more islands. The islands may also be partly outside the pocket or intersect with one another. The first indicated contour will be interpreted as a pocket contour, all the others as islands.

**Calculate start point automatically / enter manually**

The optimal point for plunging can be calculated automatically using "Start point automatic". "Start point manual" defines the plunge point in the parameter screen. If it emerges from the pocket contour, the islands and the milling cutting tool diameter that there must be plunging at various points, the manual input defines only the first plunge point. The others will be calculated automatically.

**Processing**

The processing of contour pockets with islands/raw part contour with spigots will be programmed as follows:

Example:

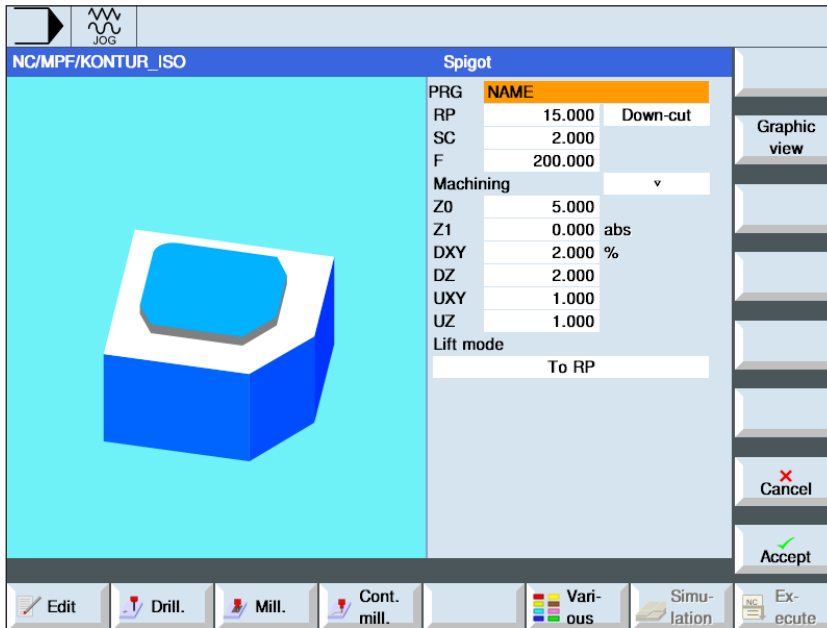
- 1 Enter pocket contour/raw part contour
- 2 Enter island/spigot contour
- 3 Program contour call for pocket contour/raw part contour or island/spigot contour.
- 4 Program centering (only possible with pocket contour)
- 5 Program pre-drilling (only possible with pocket contour)
- 6 Clear/process pocket/spigot - roughing.
- 7 Clear/process remaining material - roughing.







### Spigot milling (CYCLE63)



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
PRG	Name for the program to be generated	
RP	Retract plane	mm
Milling direction	<ul style="list-style-type: none"> <li>• Down-cut Milling</li> <li>• Up-cut milling</li> </ul>	
SC	Safety distance	mm
F	Feed	mm/min
Processing	<ul style="list-style-type: none"> <li>• ▾ Roughing</li> <li>• ▾ ▾ Bottom finishing</li> <li>• ▾ ▾ ▾ Edge finishing</li> <li>• Chamfering</li> </ul>	
Z0	Reference point Z	
Z1	Spigot depth (absolute) or depth relative to Z0 (incremental) (only if ▾, ▾ ▾ ▾ bottom, or ▾ ▾ ▾ edge)	mm
DXY	<ul style="list-style-type: none"> <li>• maximum plane infeed</li> <li>• maximum plane infeed as a percentage of the milling cutting tool diameter (only if ▾, or ▾ ▾ ▾ bottom)</li> </ul>	mm %
DZ	maximum depth infeed (only if ▾, or ▾ ▾ ▾ edge)	mm
UXY	Finishing pass plane (only if ▾, ▾ ▾ ▾ bottom, or ▾ ▾ ▾ edge )	mm
UZ	Finishing pass depth (only if ▾, or ▾ ▾ ▾ bottom)	mm

Parameters	Description	Unit
Lift mode before renewed infeed	<p>If several plunge points are required during processing, the retraction height can be programmed.</p> <ul style="list-style-type: none"> <li>• on the retraction plane</li> <li>• Z0 + safety distance</li> </ul> <p>During the transition to the next plunge point the tool pulls back to this height. If there are no elements larger than Z0 in the pocket area, Z0 + safety distance can be programmed as lift mode. (only if ▽, ▽▽▽ bottom, or ▽▽▽ edge)</p>	mm
FS	Bevel width for chamfering (only for chamfering)	mm
ZFS	Tool tip plunge depth (only when chamfering)	mm

### Contours for pockets or islands

Contours for pockets or islands must be closed, i.e. start and end point of the contour are identical. Pockets can be milled that are contained inside one or more islands. The islands may also be partly outside the pocket or intersect with one another. The first indicated contour will be interpreted as a pocket contour, all the others as islands.

### Calculate start point automatically / enter manually

The optimal point for plunging can be calculated automatically using "Start point automatic". "Start point manual" defines the plunge point in the parameter screen. If it emerges from the pocket contour, the islands and the milling cutting tool diameter that there must be plunging at various points, the manual input defines only the first plunge point. The others will be calculated automatically.

### Contours for spigots

Contours for spigots must be closed. The start and end point of the contour are identical. Several spigots can be defined that can also intersect with one another. The first indicated contour will be interpreted as a raw part contour, all the others as spigots.

### Processing

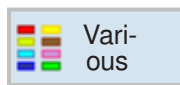
The processing of contour pockets with islands/ raw part contour with spigots will be programmed as follows:

Example:

1. Enter pocket contour/raw part contour
2. Enter island/spigot contour
3. Centering (only possible with pocket contour)
4. Pre-drilling (only possible with pocket contour)
5. Clear/process pocket/spigot - roughing
6. Clear/process remaining material - roughing

**Cycle Description****Chip crushing**

- 1** The control system positions the tool in the spindle axis in rapid traverse (G0) to the safety distance above the reference point. The start point will be calculated by the cycle.
- 2** The tool first feeds in to the processing depth and then approaches the spigot contour side-ways in the quarter circle with processing feed.
- 3** The spigot will be cleared in parallel to the contour from outside to in. The direction will be defined by the processing direction of rotation (up-cut milling or down-cut milling).
- 4** Once the spigot in one plane has been cleared, the tool leaves the contour in the quarter-circle and the infeed to the next processing depth takes place.
- 5** The spigot will again be approached in the quarter circle cleared in parallel to the contour from outside to in.
- 6** Steps 4 to 5 will be repeated until the programmed spigot depth is reached.
- 7** The tool moves back to the safety distance in rapid traverse (G0).



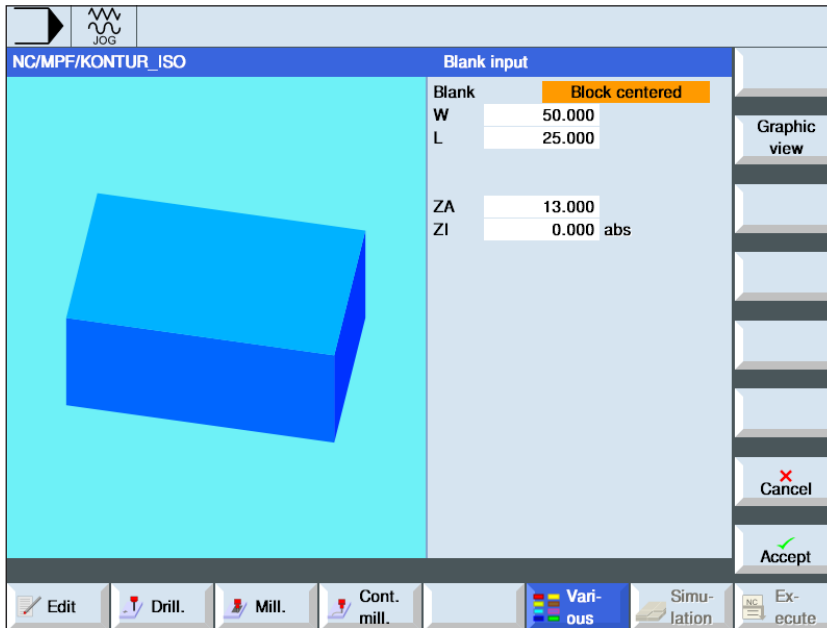
## Various

- Raw part
- Sub-routine



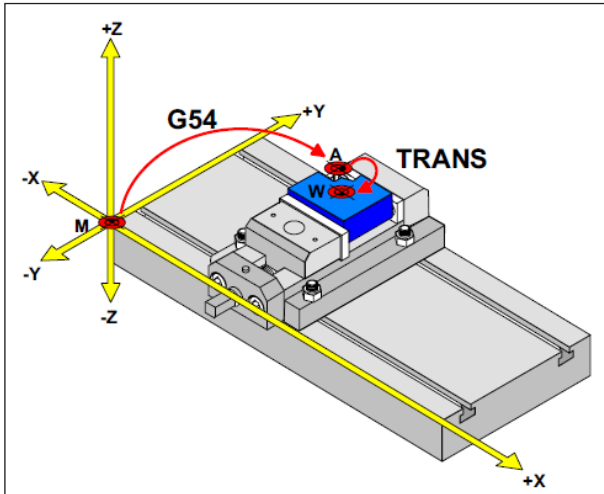


### Raw part data



Using the "Select" button parameters and/or units can optionally be changed. To do this move the cursor to the appropriate field and press button.

Parameters	Description	Unit
Raw part	<ul style="list-style-type: none"> <li>• Cuboid center</li> <li>• Cuboid</li> <li>• Tube</li> <li>• Cylinder</li> <li>• Polygon</li> </ul>	
X0 Y0	1. Corner point in X, Y	mm
X1 Y1	2. Corner point in X,Y (absolute), or relative to X0, Y0 (incremental)	mm
ZA	Start measurement	mm
ZI	End measurement	mm
XA	External diameter (only for tube or cylinder)	
XI	Internal diameter (only for tube or cylinder)	
N	Number of edges (only with polygon)	
L	Edge length (only with polygon)	
W	Width of the raw part (only with cuboid center)	
L	Length of the raw part (only with cuboid center)	
SW or L	Width across flats or edge length - (only if N corner)	



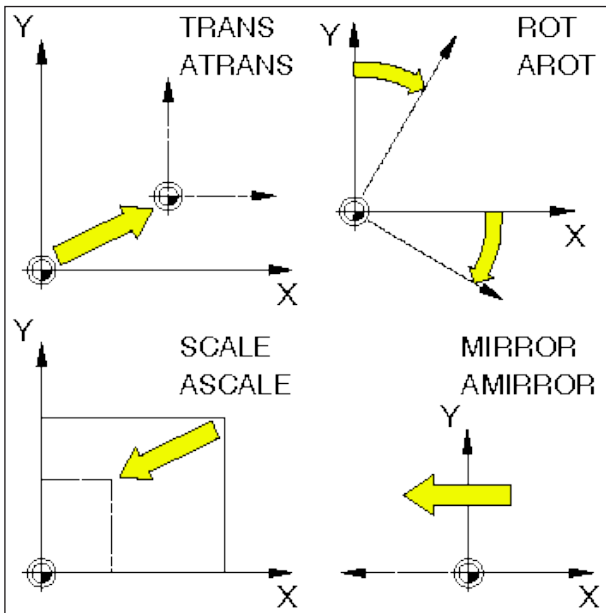
In the following situation the raw part must be described from the stop point A

## Raw part definition

When a program with a stop point (e.g. G54) and a transformation (TRANS / ATRANS ) is used to machine to the actual workpiece zero point, the raw part definition must be described from the stop point.

M= Machine zero point  
A= Stop point  
W= Workpiece zero point



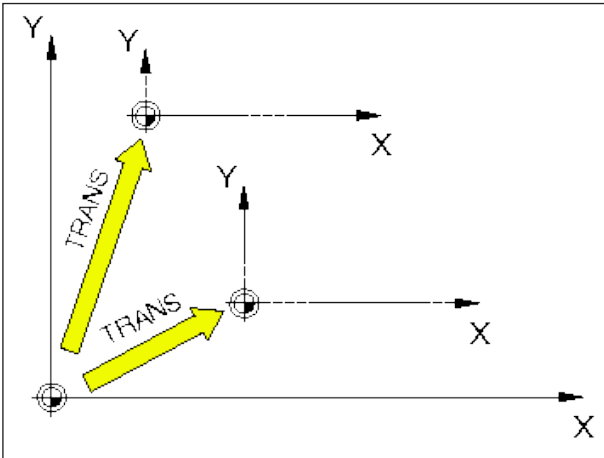


## Frames

With Frames the current coordinate system can be changed.

- Shift coordinate system: TRANS, ATRANS
- Rotate coordinate system: ROT, AROT
- Scale or warp coordinate system: SCALE, ASCALE
- Mirror coordinate system: MIRROR, AMIRROR

The Frame instructions are each programmed in their own NC block and executed in the programmed sequence.



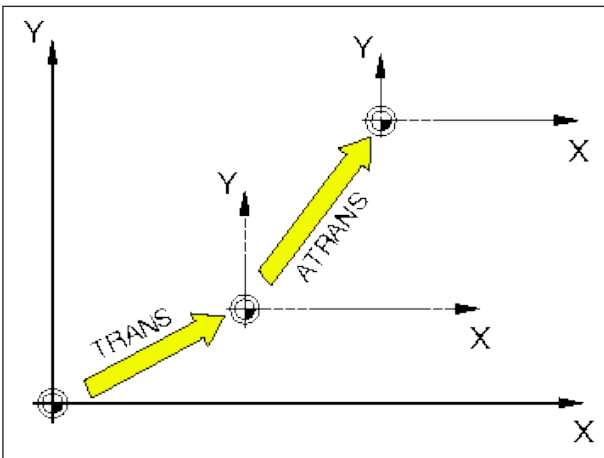
*TRANS is always relative to the current zero point G54 - G599.*

## Zero point offset TRANS, ATRANS

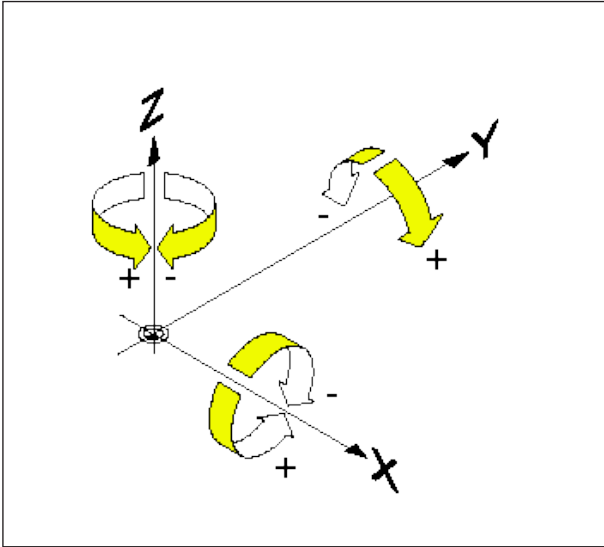
**TRANS** Absolute zero point offset, relative to the current zero point G54-G599. (TRANS deletes all previously set programmable Frames (TRANS, ATRANS, ROT, AROT, ...)).

**ATRANS** Additive zero point offset, relative to the currently set (G54-G599) or programmable (TRANS/ATRANS) zero point.

You program a shift that builds on the already existing Frames (TRANS, ATRANS, ROT, AROT, ...) with ATRANS.



*ATRANS is relative to the last valid zero point G54 - G599, TRANS.*



## Rotate coordinate system ROT, AROT

With ROT/AROT the coordinate system will be rotated around the geometry axes X, Y, Z or in the current working plane G17, G18, G19.

For contours whose main axes are rotated in relation to the geometry axes, there are programming simplifications.

### Format:

ROT/AROT X.. Y.. Z..

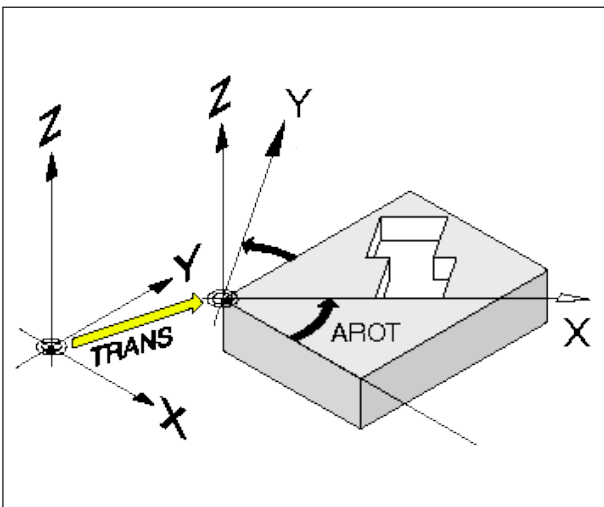
ROT/AROT RPL=..

**ROT** Absolute rotation, relative to the current zero point G54-G599.  
(ROT deletes all previously set programmable Frames (TRANS, ATRANS, ROT, AROT, ...)).

**AROT** Additive rotation, relative to the currently set (G54-G599) or programmable (TRANS/ATRANS) zero point.  
You program a rotation that builds on the already existing Frames (TRANS, ATRANS, ROT, AROT, ...) with AROT.

X, Y, Z rotation in space (in degrees); geometry axis around which the rotation will occur.

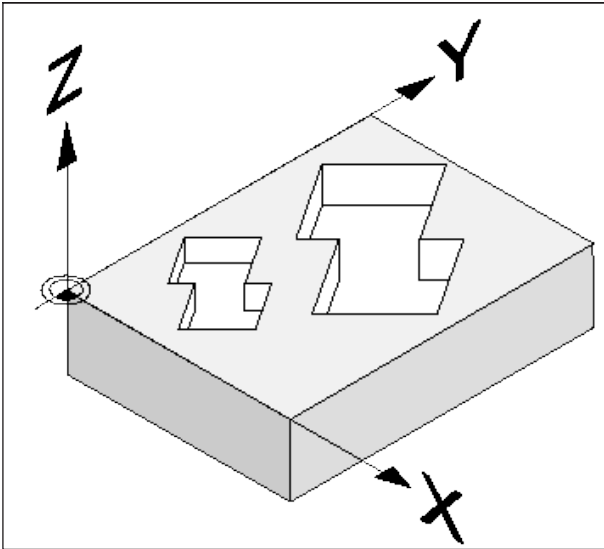
RPL= Rotation in the current plane (G17) (in degrees).



### Example:

For easier programming of the contour alongside, the coordinate system should be rotated by 30°. The existing zero point offset TRANS should be maintained.

```
N.. G17
N.. TRANS ...
N..
N60 AROT Z30
or
N60 AROT RPL=30
```



## Scale SCALE, ASCALE

With SCALE/ASCALE each axis X, Y, Z will have its own scale factor indicated.

When different factors are entered for X, Y, Z the contour will be warped.

### Format:

SCALE/ASCALE X.. Y.. Z..

If a shift is programmed with ATRANS after SCALE/ASCALE, this shift will also be scaled.

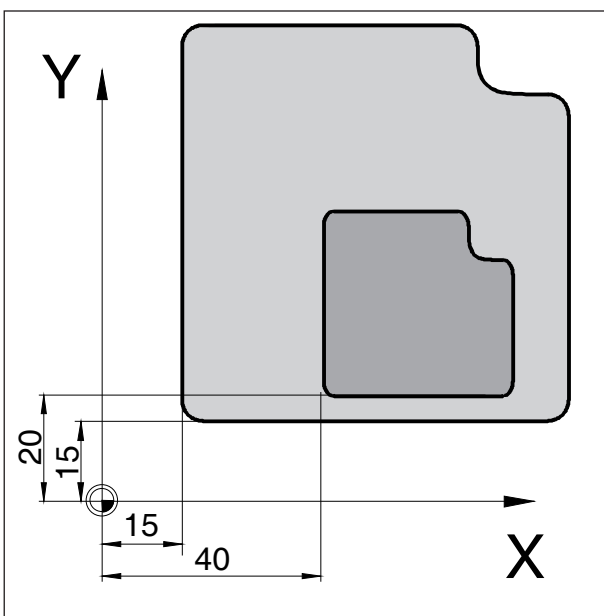
**SCALE** Absolute scale, relative to the current zero point G54-G599.

SCALE deletes all previously set programmable Frames (TRANS, ATRANS, ROT, AROT, ...).

With SCALE without axis input the mirroring (and all other Frames) will be deselected.

**AMIRROR** Additive scale, relative to the currently set or programmed coordinate system. You program a scale factor change that builds on already existing Frames (TRANS, ATRANS, ROT, AROT, etc.) with ASCALE.

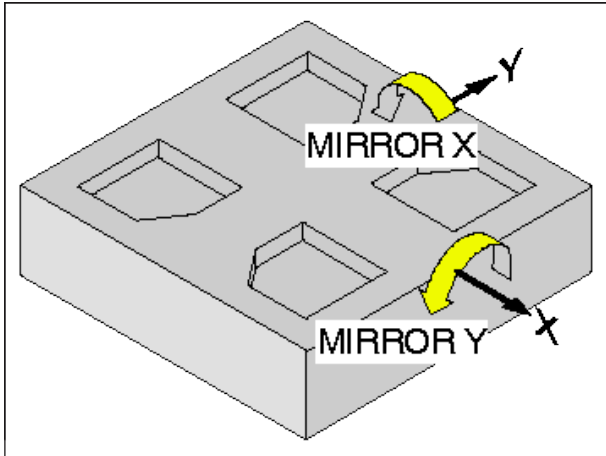
X, Y, Z scale factor for the particular axis.



### Example

Adjoining contour is programmed in the sub-program L10. It occurs twice, in different sizes and warped.

N.. G54	Zero point
N35 TRANS X15 Y15	Abs. shift
N40 L10	Large contour
N45 TRANS X40 Y20	Abs. shift
N55 ASCALE X0.5 Y0.5	Scale factor
N60 L10	Small contour
N75 SCALE	Delete Frames



## Mirror coordinate system MIRROR, AMIRROR

With MIRROR/AMIRROR the coordinate system will be mirrored around the geometry axes X, Y, Z.

### Format:

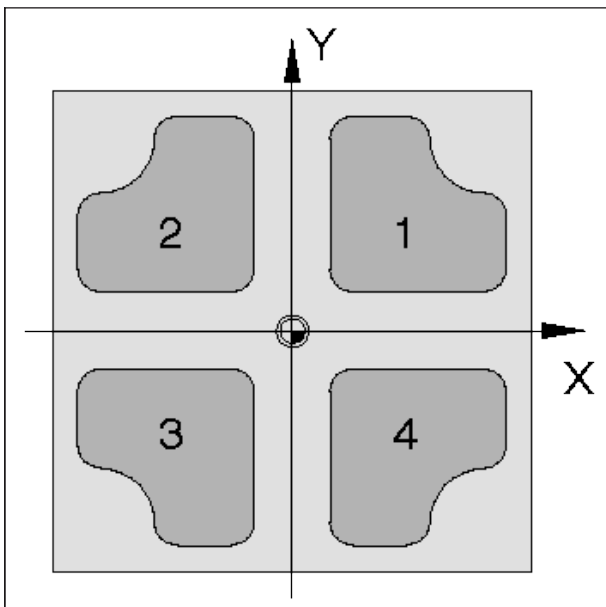
MIRROR/AMIRROR X.. Y.. Z..

If you mirror a contour, the circular direction of rotation G2/G3 and the tool radius correction G41/G42 will be converted automatically.

**MIRROR** Absolute mirroring, relative to the current zero point G54-G599.  
(MIRROR deletes all previously set programmable Frames (TRANS, AT-RANS, ROT, AROT, ...)).  
With MIRROR without axis input the mirroring (and all other Frames) will be deselected.

**AMIRROR** Additive mirroring, relative to the currently set or programmable coordinate system.  
You program a mirroring that builds on the already existing Frames (TRANS, ATRANS, ROT, AROT, ...) with AMIRROR.

X, Y, Z indication of the geometry axis around which the mirroring will take place. The number value indicates the distance of the mirror axis to the zero point, e.g. X0.



### Example

Contour 1 is programmed in the sub-program L10. The three additional contours will be generated by mirroring. The workpiece zero point G54 is in the workpiece center.

N..	G54	Workpiece zero point
N40	L10	Contour top right
N45	MIRROR X0	Mirroring around Y
N40	L10	Contour top left
N55	AMIRROR Y0	add. Mirroring around X
N40	L10	Contour bottom left
N65	MIRROR Y0	Mirroring around X
N70	L10	Contour bottom right
N75	MIRROR	Mirroring off

## TRACYL

Is used for contour milling at the surface area.

The cylinder surface curve transformation provides the following capabilities:

- Longitudinal grooves on cylindrical bodies,
- Transverse grooves on cylindrical bodies,
- Any other groove shapes on cylindrical bodies.

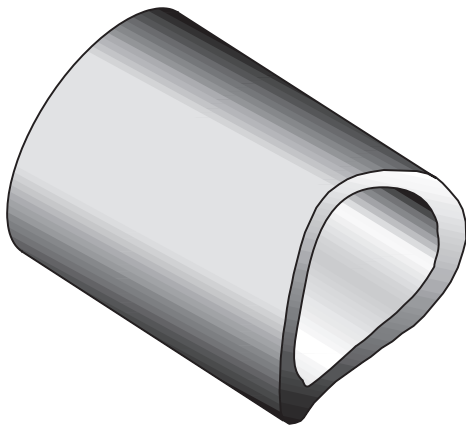
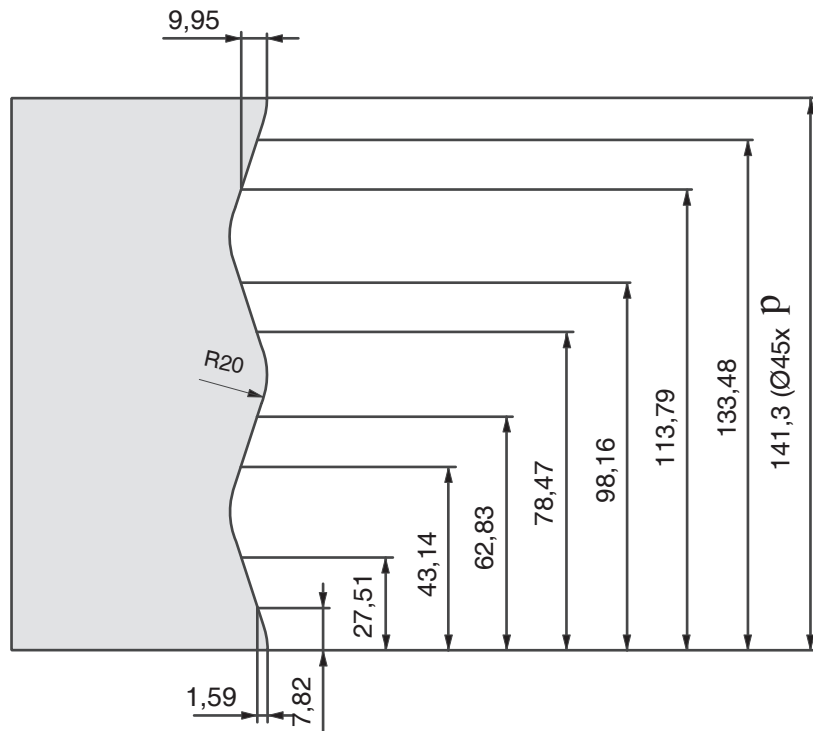
The shape of the grooves is programmed with reference to the processed level cylinder surface area.

Selection:

general TRACYL( )

Deselection:

general TRAFOOF



```

G54
TRANS X64.5
T"FRÄSER2" D1 M6
S2000 F200 M3 M8
G0 X10 Y0 Z20
TRACYL(45)
G55
TRANS X61.5
M11
G0 Y0
G1 X0 G42
G3 X-1.591 Y7.871 CR=20
G1 X-9.952 Y27.508
G2 X-9.952 Y43.142 CR=20
G1 X-1.591 Y62.833
G3 X-1.591 Y78.467 CR=20
G1 X-9.952 Y98.158
G2 X-9.952 Y113.483 CR=20
G1 X-1.591 Y133.483
G3 X0 Y141.3 CR=20
G1 X10 G40
TRAFOOF
M10
G54
TRANS X64.5
G0 X60 Y60 Z60
M30
    
```





## Sub-routines

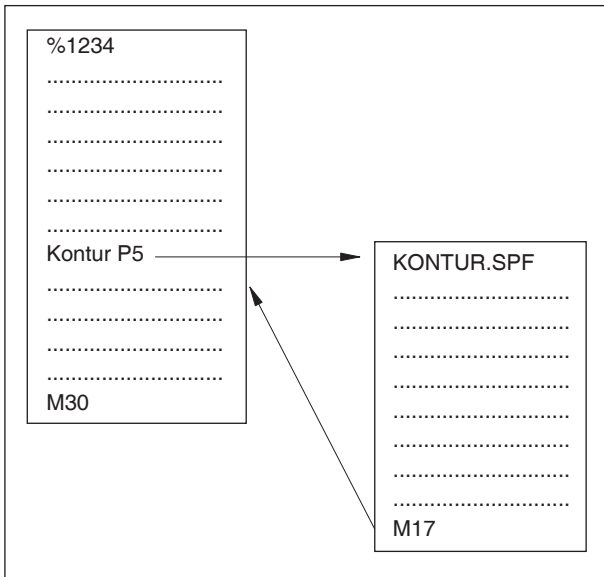
Functional sequences to be repeated several times can be entered as sub-programs.

The sub-programs are invoked by name.

R-parameters can be passed to sub-programs.

### Sub-routine call in parts program

e.g.: MILL1 P1  
 MILL1 Sub-routine number  
 P1 Number of sub-program runs  
 (max. 99)



Program run with a sub-program

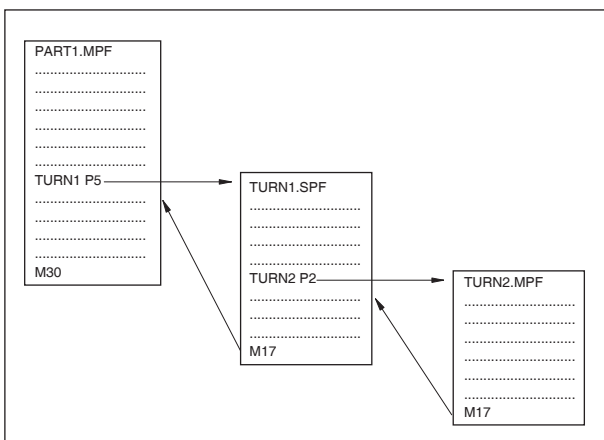
### Sub-routine end with M17

e.g.: N150 M17

### Sub-routine nesting

Sub-routines can be stacked 30-fold. The automatic block pre-run is possible up to the eleventh sub-program level.

Cycles also count like sub-programs, i.e. for example a drilling cycle can be called from the 29th sub-program level at maximum.



Nesting sub-programs

**Information:**

Sub-routine calls must always be programmed in their own NC blocks.



**Sub-routines with passing of parameters**

Program start, PROC

A sub-program that when the program is running should be passed parameters from the calling program, will be identified with the keyword PROC.

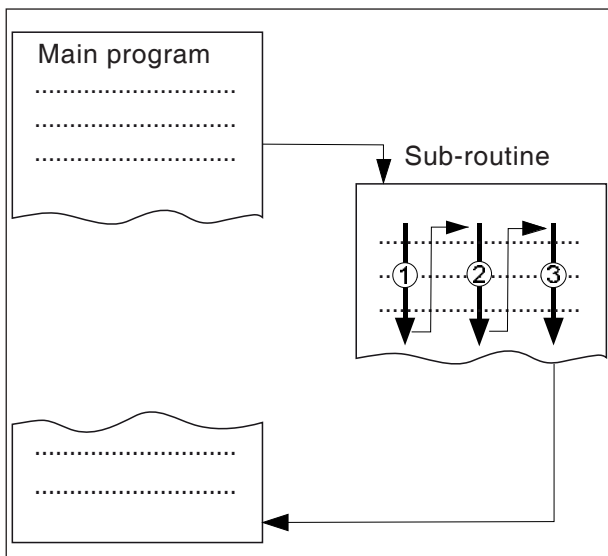
Program end M17, RET

The command M17 identifies the sub-program end and the jump back to the main program. The command RET represents the sub-program end without interrupting the path control operation.

**Sub-routine program with SAVE mechanism**

This function saves current settings (operating data) when the sub-program is called. Upon return to the old program the old state is re-established automatically.

For this in the programming the command SAVE must be programmed in addition to PROC.

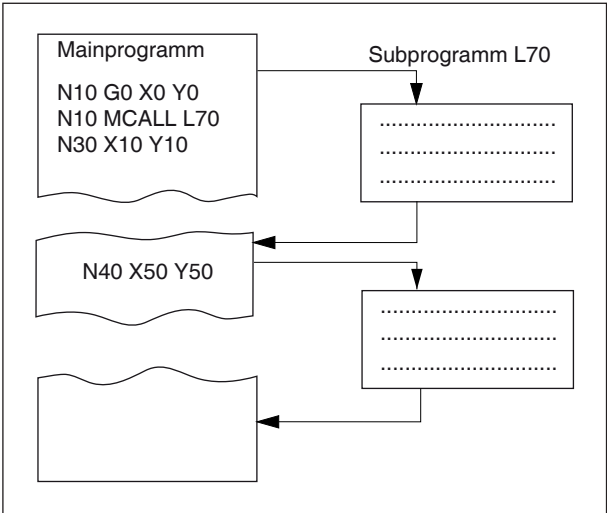


**Sub-routine with program repetition, P**

If a program should be executed several times in succession, the desired number of program repetitions can be programmed in address P in the block of the sub-program call.

Parameters will only be changed when the program is called. For later repetitions the parameters remain unchanged.

**Information:**  
 Only one MCALL call can be active at the same time in a program run. Parameters are only passed once in an MCALL call



### Modal sub-program MCALL

With this function the sub-program will be called automatically and executed after every block with path movement. For this reason the calling of sub-programs that can be executed in different workpiece positions may be automated. For example to create hole patterns.

Example

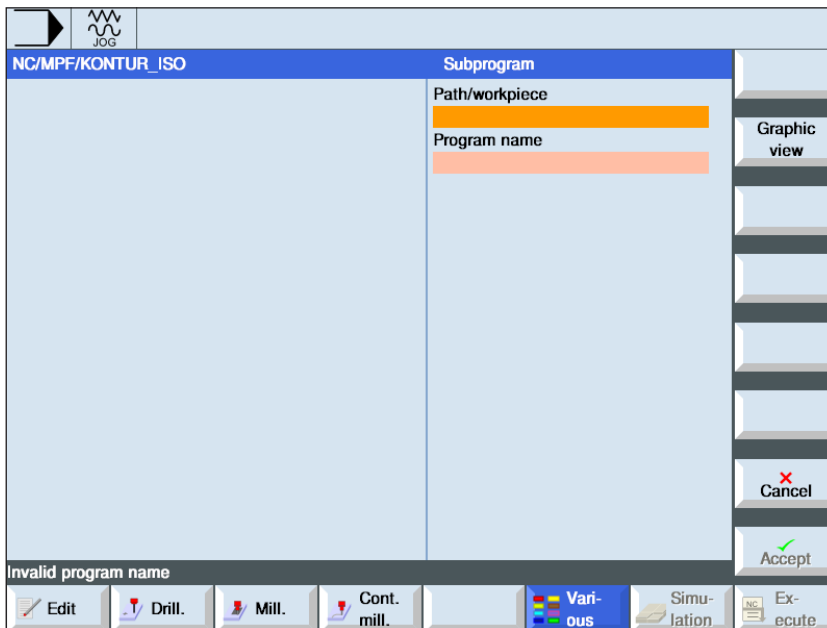
```

N10 G0 X0 Y0
N20 MCALL L70
N30 X10 Y10
N40 X50 Y50
    
```

**Switch off modal sub-program calling**  
 With MCALL without sub-program call or by programming a new modal sub-program call for a new sub-program.



## Invoke sub-program



If the desired sub-program is not in the same directory as the main program, the sub-program's path must be indicated.

Parameters	Description
Path/workpiece	Sub-routine's path, if the desired sub-program is not in the same directory as the main program.
Program name	Name of the sub-program that should be inserted.

If the same processing steps are required when programming various workpieces, these processing steps can be defined as a separate sub-program. This sub-program can then be invoked in arbitrary programs. This prevents the need to program the same processing steps multiple times. The control system does not distinguish between main programs and sub-programs. This means that a "normal" work step or G-code program can be called in another work step program as a sub-program. In turn, a sub-program can be called from the sub-program.

The sub-program must be stored in its own directory "XYZ" or in the directories "Part programs" or "Sub-routines".

It should be noted that when calling the sub-program ShopMill evaluates the settings from the program header. These settings also remain effective once the sub-program has finished. If you want to reactivate the settings from the program header of the main program, you can perform the desired settings in the main program after calling the sub-program.

## Program jumps

### Unconditional program jumps

Format

Label:  
GOTOB LABEL  
or  
GOTOF LABEL  
Label:

GOTOB Jump instruction with reverse jump target (in the direction of the program start)

GOTOF Jump instruction with forward jump target (in the direction of the program end)

LABEL Target (marking inside a program)  
LABEL: Jump target

**Information:**

The unconditional / conditional jump must always be programmed in its own NC block.

The sequence of programs operating as standard (main program, sub-program, cycles, etc.) can be changed by program jumps. Jump targets can be approached within a program using GOTOF or GOTOB.

The program continues execution with the instruction that directly follows the jump target.

### Conditional program jump

Format:

Label:  
IF expression GOTOB LABEL  
or  
IF expression GOTOF LABEL  
LABEL:

IF conditions

GOTOB Jump instruction with reverse jump target (in the direction of the program start)

GOTOF Jump instruction with forward jump target (in the direction of the program end)

LABEL Target (marking inside a program)  
LABEL: Jump target

Jump conditions can be formulated using the IF instruction. The jump to the jump target only takes place if the condition was fulfilled.

## Programming messages MSG

Messages can be programmed to give the operator information about the current processing situation during program execution.

A message will be generated in an NC program by writing the keyword "MSG" in round brackets "()" and the message text inside quote marks.

A message can be deleted with "MSG()".

### Information:

A message text may consist of a maximum of 130 characters and will be shown in 2 lines (2x 65 characters).



Example:

```
N10 MSG ("Contour roughing")
N20 X... Y...
N ...
N90 MSG ()
```

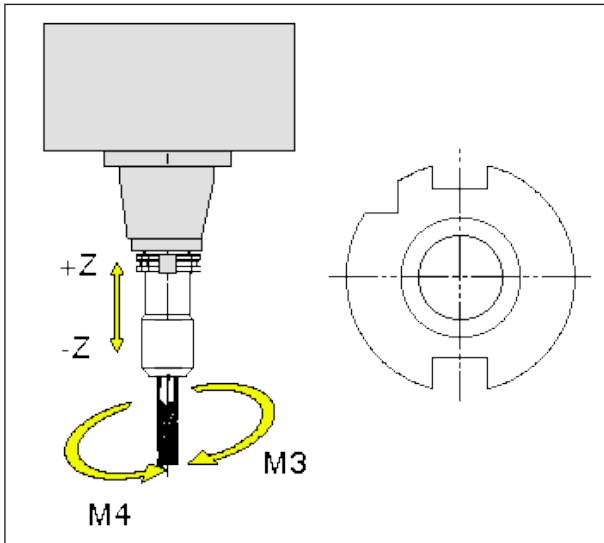
Alongside messages, alarms can also be set in an NC program. These will be shown in the screen display in a separate field. An alarm is always associated with a reaction from the control system, according to the alarm category.

Alarms are programmed by writing the keyword "SETAL" in round brackets following the alarm number. Alarms must always be programmed in a single block.

Example:

```
N100 SETAL (65000)..... ;set alarm 65000
```

## Spindle ON M3 / M4, Speed S, Spindle STOP M5, Spindle position SPOS



### Direction of rotation view

View the spindle from +Z in direction -Z, to indicate the direction of rotation.

**M3**.. in the clockwise direction Right-hand rotation

**M4**.. counter-clockwise rotation Left-hand rotation

**M5**.. Spindle stop

### Programming the speed

The speed is programmed with the address S.

Example:

N20 M3 S2000

Spindle ON in clockwise direction of rotation (right-hand rotation) with 2000 rpm

### Position spindle

With SPOS the milling spindle will be held at the programmed angle position.

Format:

SPOS=...[°]

## A-axis (divider)

For milling during the cylinder mantle transformation the A-axis and the tool slides must be moved in a specific relationship with one another.

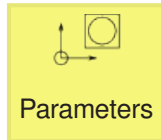
The A-axis divider and thus always a round axis, which is operated like a typical linear axis and can be programmed.

The A-axis input is always in degrees.

e.g. G0 A90



# F: Tool programming



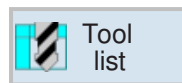
## Tool management

All the tool data, the tool wear and the magazine places are shown here.

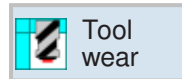
All lists show the same tools sorted in the same way. When switching between the lists the cursor remains on the same tool in the same image extract.

The lists differ in the parameters shown and the configuration of the softkey.

The following lists are available for selection:



- Tool list  
Here all parameters and functions for creating and setting up tools are shown.



- Tool wear  
All parameters and functions required during ongoing operations, e.g. wear and monitoring functions, are shown here.



- Magazine  
This contains the parameters and functions related to the magazine or magazine place concerning the tools/magazine places.

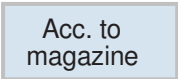
Symbol		Description
<b>Tool type</b>		
Red cross	✘	The tool is blocked from use. Block is selected in the tool wear in the "G" column.
Yellow triangle - Tip downwards	▽	The pre-warning limit is reached.
Yellow triangle - Tip upwards	△	The tool is in a special state. Move cursor on to the identified tool. A tooltip gives a short description.
Green frame	□	The tool is pre-selected.
<b>Magazine/place number</b>		
Green double-arrow	↔	The magazine place is currently on the tool change point (loading position).
Red cross	✘	The magazine place is blocked. Block is selected in the magazine in the "G" column.

A rectangular button with a light blue background and a thin grey border. The word "Sort" is centered in black text, followed by a small blue right-pointing triangle.

## Sorting function

When working with many tools with large magazines, or several, it can be helpful to show the tools sorted according to different criteria. This allows specific tools to be found in the list more quickly.

The following sorting functions are available for selection:

A rectangular button with a light blue background and a thin grey border. The text "Acc. to magazine" is centered in black.

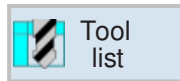
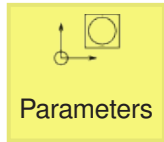
- Sort according to magazine  
This softkey sorts all tools according to magazine places.

A rectangular button with a light blue background and a thin grey border. The text "Acc. to name" is centered in black.

- Sort according to name  
This softkey sorts all tools according to their names.

A rectangular button with a light blue background and a thin grey border. The text "Acc. to type" is centered in black.

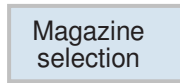
- Sort according to type  
This softkey sorts all tools according to their type.



## Tool list

The tool list shows all parameters and functions required to create and set up tools. Each tool is identified uniquely by the tool name.

Loc.	Type	Tool name	D	Length	Ø			
1		CENTERDRILL	1	0.000	0.000	0.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2		DIEMILL_TAPER	1	0.000	0.000	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3		SPIBO 6.8	1	106.021	6.800	140.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4		NC ANB. 12MM 90*	1	80.960	12.000	90.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5		CUTTER	1	0.000	0.000	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6		DRILL	1	0.000	0.000	0.0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7								
8		DRL_THRD_MILL	1	0.000	0.000	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9		3D_TASTER Uhr	1	154.411	0.000		<input checked="" type="checkbox"/>	<input type="checkbox"/>
10								
11								
12								
13								
14								
15								
16								



The tools with place numbers are assigned to the respective magazine places. Tools without place numbers are located in the tool pool below the consecutively numbered magazine places.

The softkey enables fast switching between spindle place, magazine place 1 and tool pool.

Parameters	Description
Place	
Type	Tool type
Tool name	The tool is identified by the name. The tool name can be entered as text or number.
D	Cutting number
Radius	Tool radius
Ø	Tool diameter
Tip angle or pitch	Point angle with type 200 - twist drill, type 220 - centralizer and type 230 - counter-sinking cutter; Thread lead for type 240 - thread tap;
N	Number of teeth
	Spindle direction of rotation <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Spindle rotates right (M3)</li> <li><input checked="" type="checkbox"/> Spindle rotates left (M4)</li> <li><input checked="" type="checkbox"/> Spindle is switched off</li> </ul>
	Coolant 1 and 2 can be switched on and off.

## Principle of tool management

All tools are not only stored in the tool magazine, but also saved by the control system in a place table. In this place table, alongside the tool name, the position of the tool in the tool magazine is also saved.

### Instructions:

- Machines that support random tool management can also be reset to a non-random tool management (e.g.: Concept MILL 250). See the corresponding WinNC description, Section "X EmConfig".
- During programming and when manually invoking the tools only the name of the tool from the control system's tool database is to be taken into account, **not** the place number.
- A tool change procedure should never be interrupted (Reset button, EMERGENCY STOP, etc.) to prevent a clearance movement and re-referencing of the tool change system.

### Non-random tool management

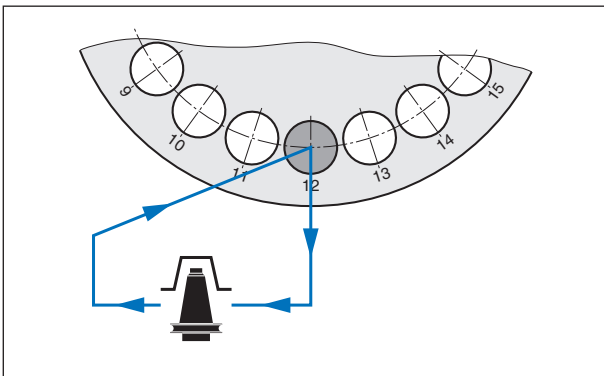
In a "non-random" system with every tool change the tool will be placed back again in the place in the magazine from which it was taken. Place number and tool name are always permanently linked with one another.

### Random tool management

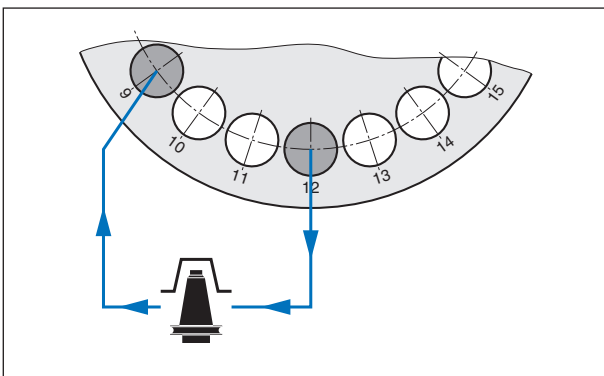
The tool released from the milling spindle during the tool change is stored in the place in the magazine from which the new tool was taken. In the position table the place number of the tool changes with every tool change. The management is "random".

### Advantage:

Faster tool change because the tool does not have to be placed back in its original position.



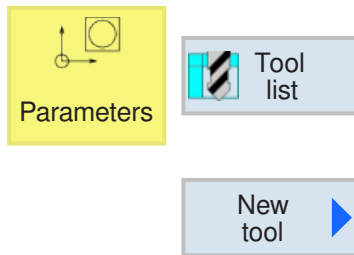
Non-random principle



Random principle

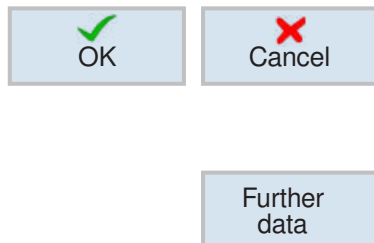
random Tool management		non random Tool management
Activated	Deactivated	

Different types of tool management



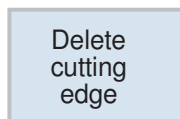
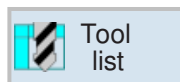
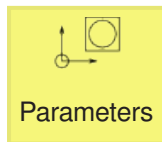
New tool		
Type	Identifier	Tool position
120	- End mill	
140	- Facing tool	
145	- Thread cutter	
200	- Twist drill	
220	- Center drill	
240	- Tap	
710	- 3D probe	
711	- Edge finder	
110	- Ball nose end mill	
111	- Conical ball end	
121	- End mill corner rounding	
155	- Bevelled cutter	
156	- Bevelled cutter corner	
157	- Tap. die-sink. cutter	
160	- Drill&thread cut.	

Available tool types



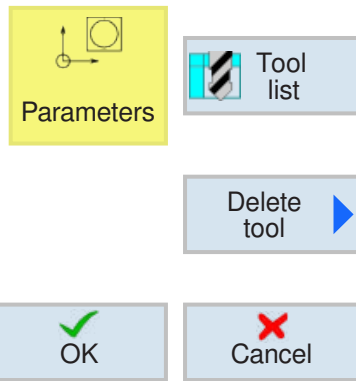
## Create new tool

- 1 Position cursor on an empty magazine place or on a free line below the tool places.
- 2 Press softkey.
- 3 Select desired tool from the list with the cursor.
- 4 Confirm or cancel tool type selection with softkey.
- 5 **Define** unambiguous tool name (e.g.: Surface miller 2).
- 6 Use the softkey to define additional data such as: with some tools the external radius and tool angle.



## Create/Delete tool blades

- 1 Position cursor on the tool for which a blade should be created.
- 2 Press softkey.
- 3 Press softkey. The new blade will be stored with consecutive numbering below the tool.
- 4 To delete blades position the cursor on the blade and press softkey.

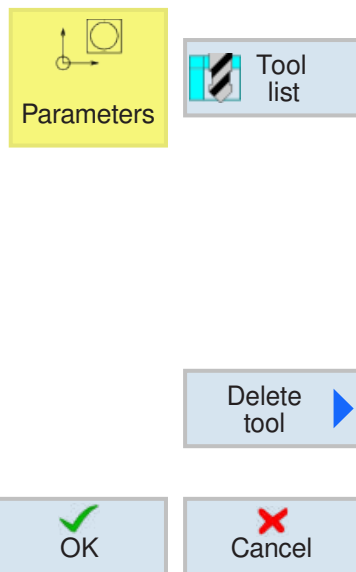


## Delete tool with non-random tool system

- 1 Position cursor on tool that should be deleted.
- 2 Press softkey.
- 3 Confirm or cancel deletion process with softkey.

### Instructions:

If a tool is deleted, all associated blades will be deleted at the same time!



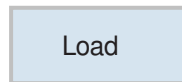
## Delete tool with random tool system

- 1 Position cursor on tool that should be deleted.
- 2 Press softkey.  
Tools loaded on a tool place must be unloaded prior to the deletion process. The delete softkey is only active for unloaded tools.
- 3 Press softkey.
- 4 Confirm or cancel deletion process with softkey.

### Instructions:

If a tool is deleted, all associated blades will be deleted at the same time!





## Tool loaded with non-random tool system

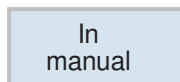
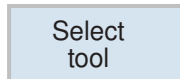
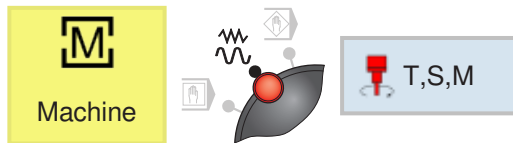
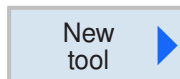
Tools will be loaded or unloaded virtually from the tool pool of the tool list into or from the magazine.

- 1 Position cursor on an already created tool in the tool pool. The tool pool is in the tool list below the consecutively numbered magazine places.
- 2 Fasten tool in the milling spindle manually.
- 3 Press softkey. An already loaded and thus occupied spindle or magazine place must first be unloaded before loading again.
- 4 The previously loaded tool list will be shown in the tool list on the selected place.





**Information:**  
The number of magazine places is dependent on the particular machine design.



**Information:**  
Switching tools to another magazine place is described further back in this section.

## Tool loaded with random tool system

### Variant A: Tool is still not created

A tool will be created virtually and clamped physically in the spindle. During loading the tool will be fastened in the milling spindle and afterwards swivelled to a free magazine place.

- 1 Position cursor on an empty magazine place.
- 2 Press softkey.
- 3 Select desired tool from the list with the cursor.
- 4 Confirm or cancel tool type selection with softkey.
- 5 **Define** unambiguous tool name (e.g.: Surface miller 2).
- 5 Switch to the TSM window.
- 6 Using the softkey, select the previously created tool from the tool list.
- 7 Press softkey.
- 8 Fasten tool in the milling spindle manually.
- 9 Press NC-Start button. This confirms that the tool which had previously been fitted manually matches the tool created in the tool table and was clamped in the spindle.
- 10 The previously loaded tool list will be shown in the tool list on the spindle place.

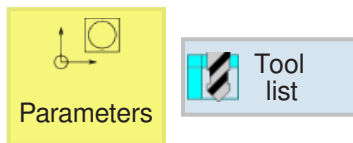
**Information:**

The number of magazine places is dependent on the particular machine design.



Load

Spindle

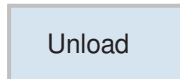
**Information:**

Switching tools to another magazine place is described further back in this section.

**Variant B: Tool is already created and in the tool pool**

Tools that have already been created virtually will be loaded from the tool pool into the magazine. During loading the tool will be fastened in the milling spindle and afterwards swivelled to a magazine place.

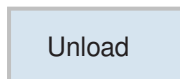
- 1 Position cursor on an already created tool in the tool pool. The tool pool is in the tool list below the consecutively numbered magazine places.
- 2 Fasten tool in the milling spindle manually.
- 3 Press softkey. An already loaded and thus occupied spindle or magazine place must first be unloaded before loading again.
- 4 Press softkey to load a tool directly into the spindle or a free magazine place.
- 5 Fasten tool in the milling spindle manually.
- 6 The previously loaded tool list will be shown in the tool list on the spindle place.



## Tool unloaded with non-random tool system

During unloading the tool will be removed from the magazine and placed in the tool pool below the consecutively numbered magazine places.

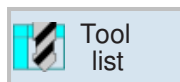
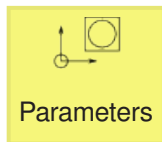
- 1 Position cursor on the tool to be unloaded in the spindle or on the magazine place.
- 2 Press softkey.
- 3 The tool remains on the tool place physically and can be removed from there.
- 4 The tool's tool data will be transferred to the tool pool and will not be lost. If the tool is used again later, simply fit and load the tool again in the corresponding magazine place. This avoids the needs to create the tool data again. However, the tool data in the tool pool can be deleted at any time.



## Tool unloaded with random tool system

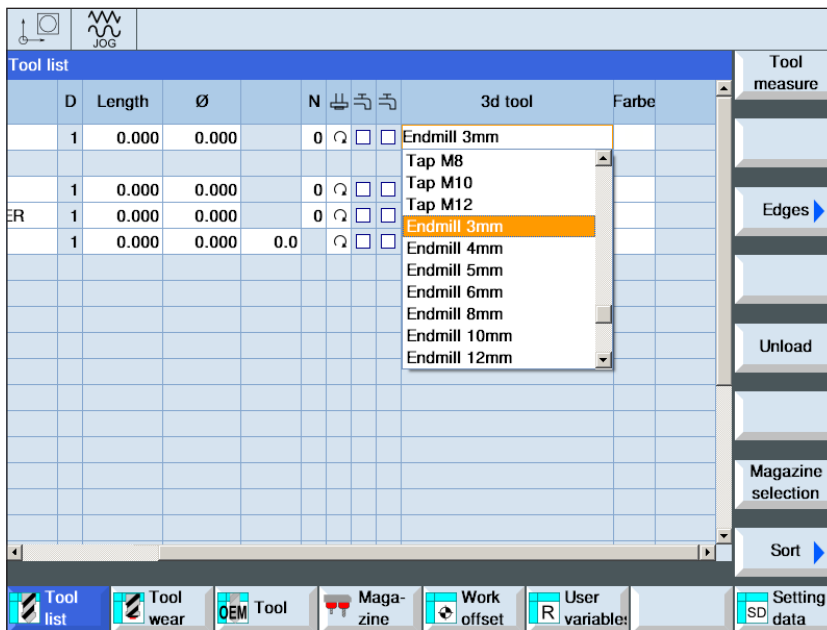
During unloading the tool will be removed from the magazine and placed in the tool pool below the consecutively numbered magazine places.

- 1 Position cursor on the tool to be unloaded in the spindle or on the magazine place.
- 2 Press softkey.
- 3 The tool will be swivelled into the spindle and can be manually removed from there.
- 4 The tool's tool data will be transferred to the tool pool and will not be lost. If the tool is used again later, simply fit and load the tool again in the corresponding magazine place. This avoids the needs to create the tool data again. However, the tool data in the tool pool can be deleted at any time.

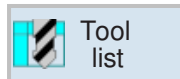
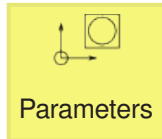


## 3D tool

3D tools from the tool manager can be imported into the tool list. An independent color assignment for the individual tools can be made.

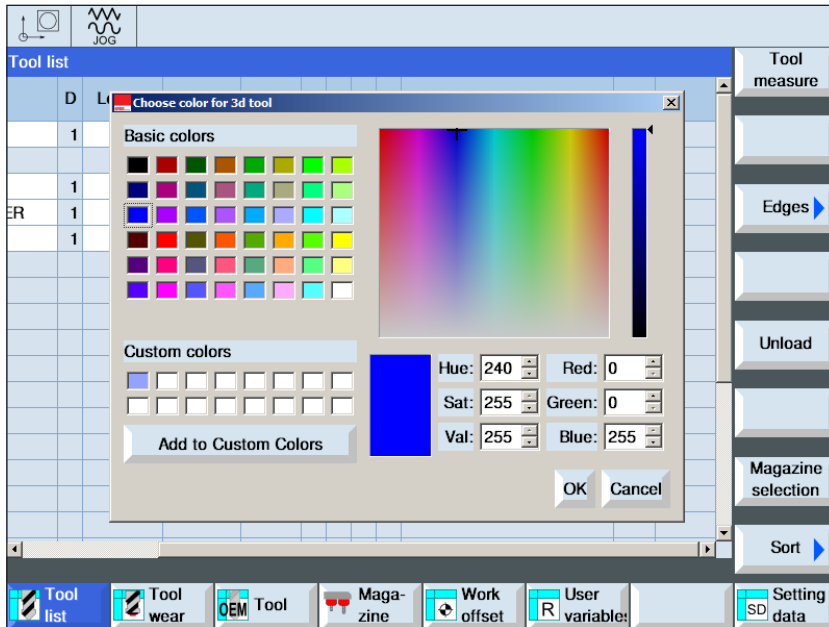


- 1 Move the scroll bar to the right to display the 3D tools.
- 2 Double-click the 3D tool to activate the tool selection (drop down menu). Press the space bar to scroll in the tool selection.
- 3 To deactivate a tool, the blank line (at the very top) must be selected in the drop down menu.



## Color select

Colors can be assigned to tools in order to display them better in the simulation.

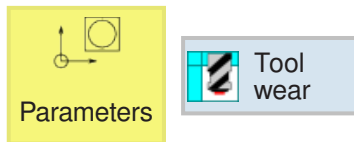


- 1 Move the scroll bar to the right to display the Color selection.
- 2 Double-click the color selection (alternatively use the space bar) to open the color selection window.
- 3 Predefined colors are stored as basic colors, user defined colors as custom colors.
  - Create Custom colors:  
Move the mouse in the colored area to the required color and click to select. Alternatively the values for R,G,B can be entered manually.
  - By clicking "Add to Custom Colors" a new color is added.
- 4 To deselect a color, select black.
- 5 Confirm with OK or quit with Cancel.



**Instructions:**

If no color is selected, it is taken over from the 3D tool manager. Otherwise a selected color has priority.



## Tool wear

Tool wear out when they are in use for a long time. This wear can be measured and recorded in the tool wear list. The control system then takes this data into account when calculating the tool length or radius correction. This ensures that the precision remains even during tool processing.

The tool's working life can be monitored automatically via piece count, shutdown time or wear. When tools should no longer be used, they can be blocked (column "G").

Loc.	Type	Tool name	D	ΔLength	ΔRadius	D
		SpiBo 5.4mm	1	0.000	0.000	<input type="checkbox"/>
		CENTERDRILL	1	0.000	0.000	<input checked="" type="checkbox"/>
2		DIEMILL_TAPER	1	0.000	0.000	<input type="checkbox"/>
3		SPIBO 6.8	1	0.000	0.000	<input type="checkbox"/>
4		NC ANB. 12MM 90°	1	6.000	0.000	<input type="checkbox"/>
5		CUTTER	1	0.000	0.000	<input type="checkbox"/>
6		DRILL	1	0.000	0.000	<input type="checkbox"/>
7						
8		DRL_THRD MILL	1	0.000	0.000	<input type="checkbox"/>
9		3D_TASTER Uhr	1	0.000	0.000	<input type="checkbox"/>
10						
11						
12						
13						
14						
15						
16						

Parameters	Description
Place	Magazine/place number <ul style="list-style-type: none"> <li>Magazine place numbers First the magazine number and then the place number in the magazine will be indicated. If only one magazine is available, only the place number will be shown.</li> <li>BS Loading point in the loading magazine</li> <li> Spindle place as symbol (with e.g.: chain magazine)</li> </ul>
Type	Tool type Specific tool correction data will be released according to the tool type (represented as a symbol).
Tool name	The tool is identified by the name. The tool name can be entered as text or number.
D	Cutting number
Δ Length	Length wear
Δ Radius	Radius wear
G	Tool block The tool is blocked for use if the control box is active. At the same time the red cross  will be shown in the "Tool type" column.

**Information:**

- The data for "Length" (L) and "Radius" (R) indicate the dimensions of the tool. These are defined when measuring the tool. The data " $\Delta$  Length" and "D Radius" indicate the correction factor the control system must take into account to compensate for the tool wear. The control system adds the value of the correction factor " $\Delta$  Length" to the length (L) and the correction factor " $\Delta$  Radius" to the radius (R) in order to obtain the actual tool length and tool radius that it must use.
- Values between -1 and 1 must be indicated for the tool wear.
- Directly after a tool measurement the tool wear values are automatically reset to the value 0. If tool data is only entered by hand the tool wear values do not change!



## Magazine

In the magazine list tools with their magazine-related data will be shown.

Actions that relate to the magazine and magazine places can be carried out. Individual magazine places can be defined as fixed places (column "P") for tools, or blocked for further use (column "G").

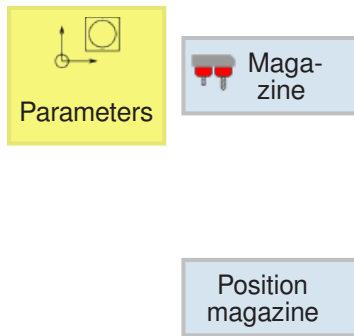
Fixed places (column P) can only be selected in machines with random tool management. Tools in fixed places do not participate in the random loading and unloading.

In machines with non-random tool management generally all magazine places are simultaneously fixed places.

Loc.	Type	Tool name	D	D	L
		SpiBo 5.4mm	1	<input type="checkbox"/>	<input type="checkbox"/>
1		CENTERDRILL	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2		DIEMILL_TAPER	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3		SPIBO 6.8	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4		NC ANB. 12MM 90°	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
5		CUTTER	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
6		DRILL	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7				<input type="checkbox"/>	<input type="checkbox"/>
8		DRL_THRD_MILL	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
9		3D_TASTER Uhr	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>
10				<input type="checkbox"/>	<input type="checkbox"/>
11				<input type="checkbox"/>	<input type="checkbox"/>
12				<input type="checkbox"/>	<input type="checkbox"/>
13				<input type="checkbox"/>	<input type="checkbox"/>
14				<input type="checkbox"/>	<input type="checkbox"/>
15				<input type="checkbox"/>	<input type="checkbox"/>
16				<input type="checkbox"/>	<input type="checkbox"/>

Parameters	Description
Place	<p>Magazine/place number</p> <ul style="list-style-type: none"> <li>Magazine place numbers</li> </ul> <p>First the magazine number and then the place number in the magazine will be indicated. If only one magazine is available, only the place number will be shown.</p> <ul style="list-style-type: none"> <li>BS Loading point in the loading magazine</li> <li> Spindle place as symbol (with e.g.: chain magazine)</li> </ul>
Type	<p>Tool type</p> <p>Specific tool correction data will be released according to the tool type (represented as a symbol).</p>
Tool name	The tool is identified by the name. The tool name can be entered as text or number.
D	Cutting number
D	<p>Magazine place block</p> <p>The magazine place is blocked when the control box is active. At the same time the red cross  will be shown in the "Magazine place" column.</p>
L	<p>Fixed place coding</p> <p>The tool is permanently assigned to this magazine place.</p> <p>For machines with non-random tool management, all tools not in the tool pool are assigned a fixed tool place.</p> <p>For machines with random tool management tools can be assigned to a fixed workplace by selection.</p>

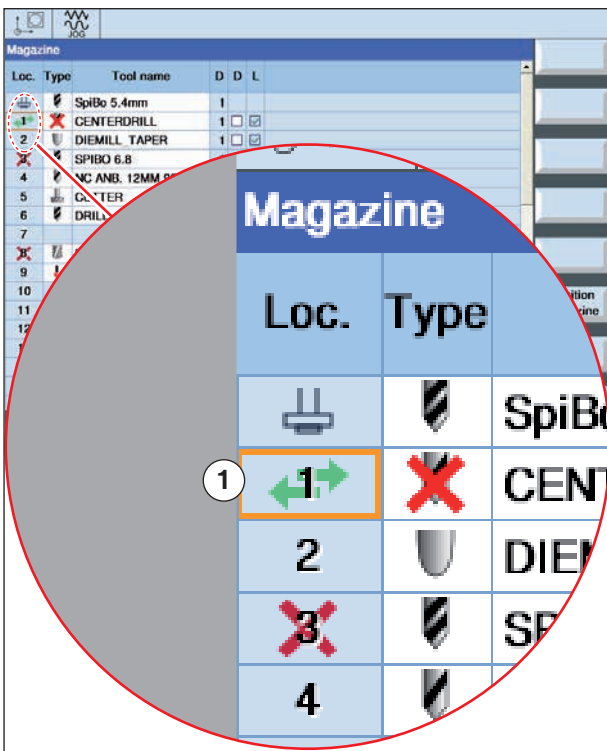




## Position magazine

Magazine places can be positioned directly at the loading point.

- 1 Position cursor on the magazine place that can be swivelled directly on to the loading point.
- 2 Press softkey. The magazine place will be swivelled on to the loading point.
- 3 The green double arrow (1) on the magazine place shows that this magazine place is currently on this tool change point (loading position).

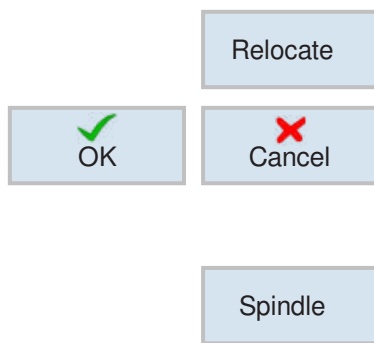


Magazine place is currently on the tool change point



**Instructions:**

- Switching tools is only possible in machines with active, random tool systems.
- Switching a tool is only possible if the fixed place coding P (1) is deselected in the magazine list.



## Changing tool with random tool system

Within magazines, tools can be switched directly to another magazine place. The tools do not have to be first unloaded from the magazine in order to then be loaded on to another place. When changing an empty place to which the tool can be changed will be automatically suggested by the control system. An empty magazine place can also be indicated directly however.

1 Position cursor on the tool that should be switched to another magazine place.

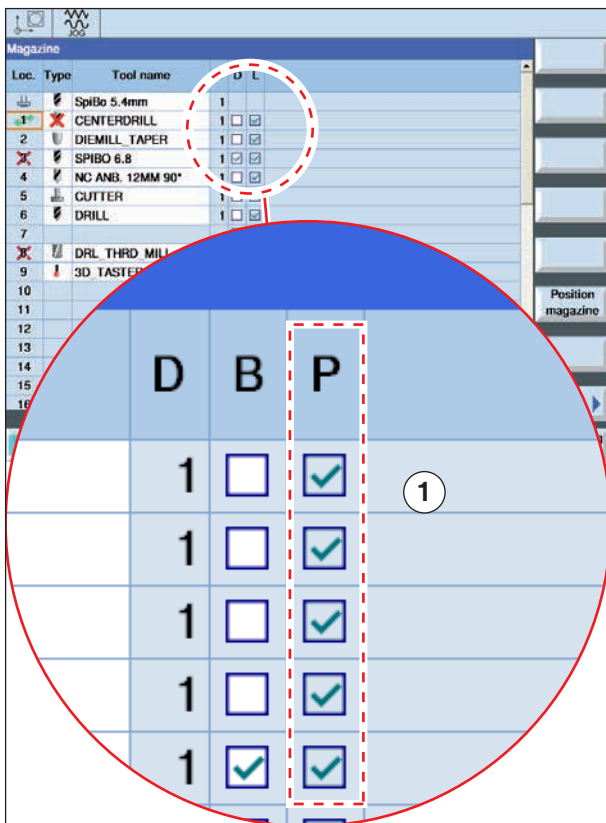
2 Press softkey.

3a Select target place and confirm. The control system suggests a free target place.

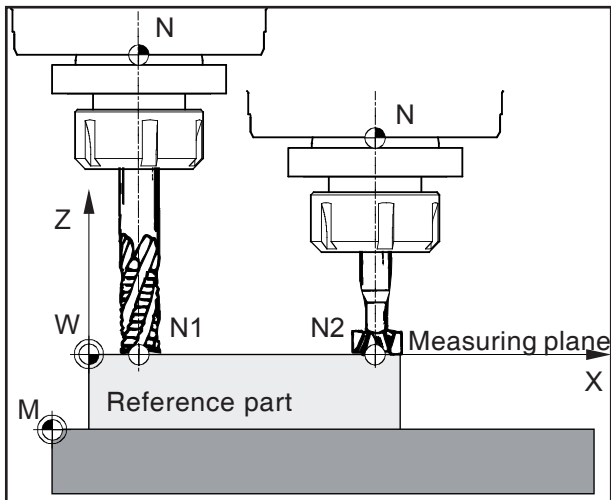
OR

3b Alternatively, it can also be changed directly on the spindle.

4 The tool will be switched on the indicated magazine place or in the spindle.



Fixed place coding P is deselected



## Measuring tool

For measuring the tools an arbitrary workpiece (reference part) will be used. The surface of the workpiece will be defined as the measuring plane. The tools to be measured scratch against the measuring plane one after another. The Z value at the point of contact (relative to the tool) will be defined with the value  $Z=0$ .

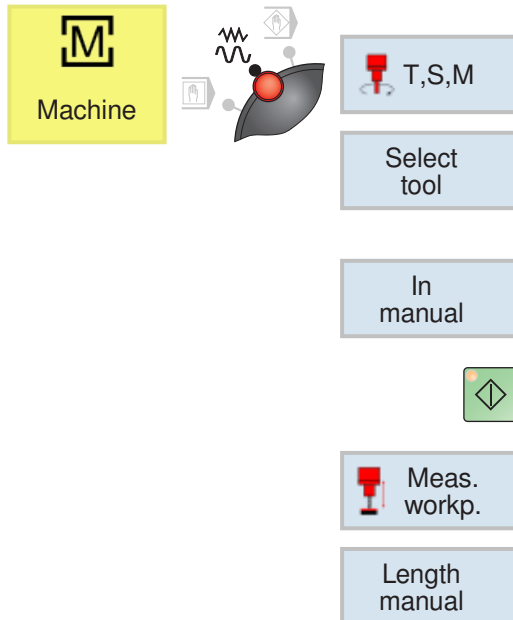
**Purpose:** If an already measured tool (tool with tool holder) traverses to  $Z=0$  after being newly clamped, the tool is exactly at the used-defined measuring plane.

A distinction is made between the following tool measurement methods:

- Measuring length of the tool with scratch method
- Measuring radius of the tool with scratch method
- Calibrate fixed point
- Tool measurement by hand

**Instructions:**

Measuring tools is only possible with an active tool.

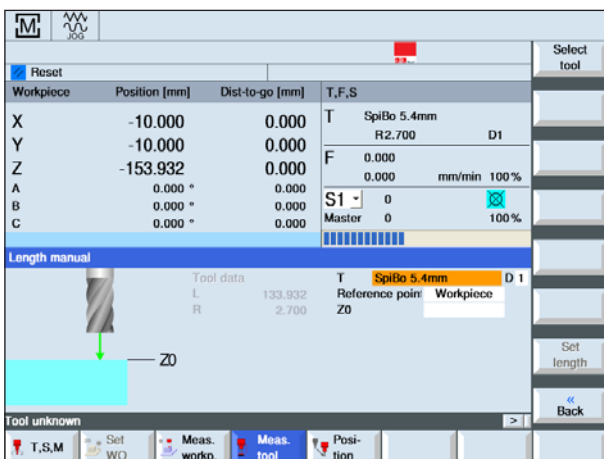


**Measuring length of the tool with scratch method**

**Precondition:**

The tool to be measured has already been created in the tool list and is physically located on a magazine place or in the spindle. The created tool should now be measured.

- 1 Switch to the TSM window.
- 2 Using the softkey, select the already created tool from the tool list.
- 3 Press softkey.
- 4 Press NC-Start button.
- 5 Press softkey.
- 6 Press softkey.



7a Scratching the reference part (e.g.: workpiece) in the Z-axis.

OR

7b Traversing the tool on a fixed point (e.g.: load cell) in the Z-axis (see "Calibrate fixed point").

8 Press softkey. The control system applies the measured tool length in the tool list.

**Information:**

Directly after the tool measurement the tool wear values are automatically reset to the value 0.

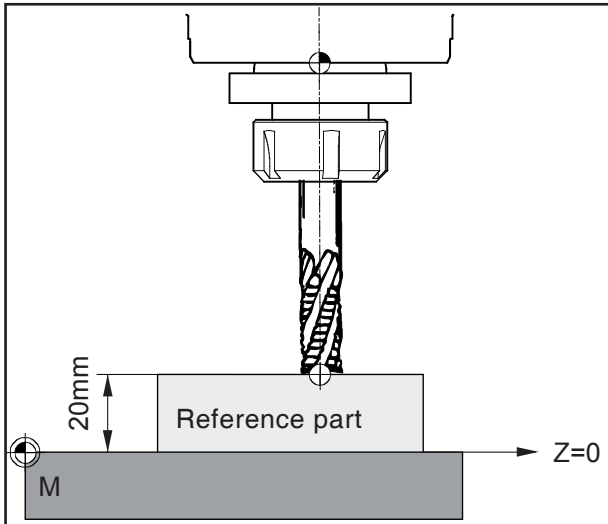
Set Length

**Variants of Tool Measurement With Scratching**

The measuring plane ( $Z=0$ ) can also be defined arbitrarily at another position in the work area.

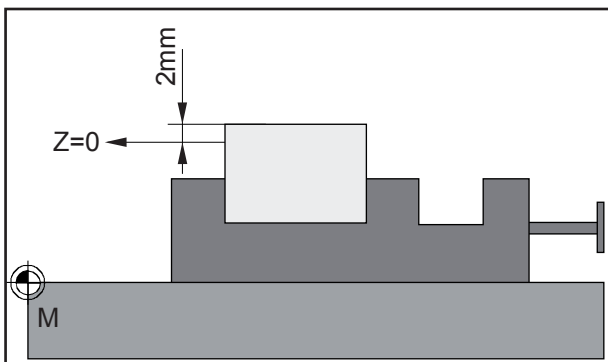
**Example 1:**

The reference part (workpiece) has a precisely defined height (e.g.: 20mm).  
 If during the tool scratch measurement, the Z-value of the reference part is defined with "Z0=20" instead of with "0", the position  $Z=0$  lies at the machine table.



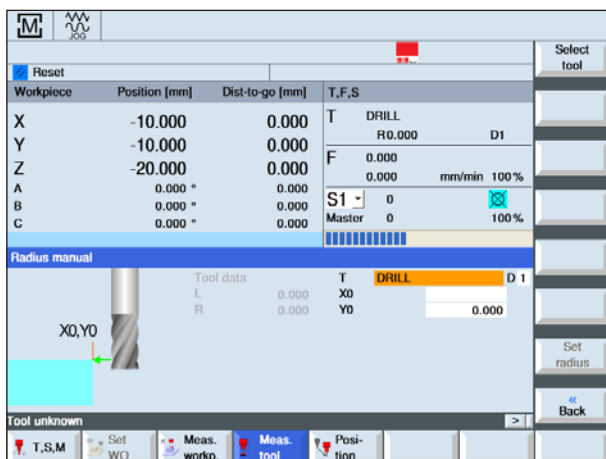
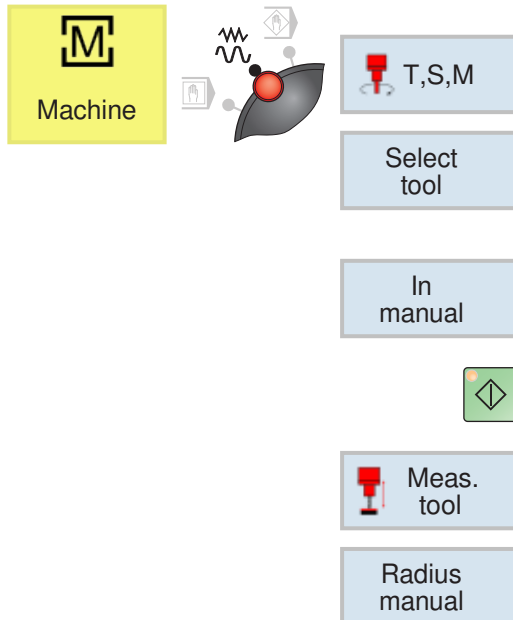
**Example 2:**

The reference part (workpiece) is a still unprocessed workpiece with a dimension of 2 mm.  
 If during the tool scratch measurement, the Z-value of the reference part is saved with "Z0=2", the position  $Z=0$  lies on the surface of the finished workpiece.



**Instructions:**

Measuring tools is only possible with an active tool.



Set  
radius

**Information:**

Directly after the tool measurement the tool wear values are automatically reset to the value 0.

**Measuring radius of the tool with scratch method****Precondition:**

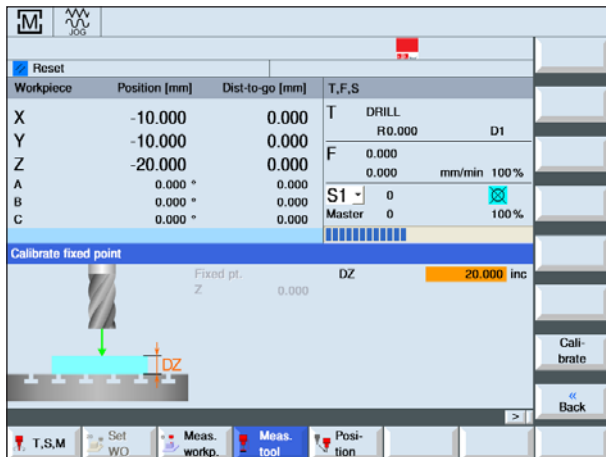
The tool to be measured has already been created in the tool list and is physically located on a magazine place or in the spindle. The created tool should now be measured.

- 1 Switch to the TSM window.
- 2 Using the softkey, select the already created tool from the tool list.
- 3 Press softkey.
- 4 Press NC-Start button.
- 5 Press softkey.
- 6 Press softkey.
- 7 Scratching the reference part (e.g.: workpiece) in the X and Y-axis.
- 8 Press softkey. The control system calculates the tool radius and applies this in the tool list.

## Calibrate fixed point

When measuring the tool length with the scratch method a fixed point can be used as a reference point.

For this the position of the fixed point in relation to the machine zero point must have been determined previously.

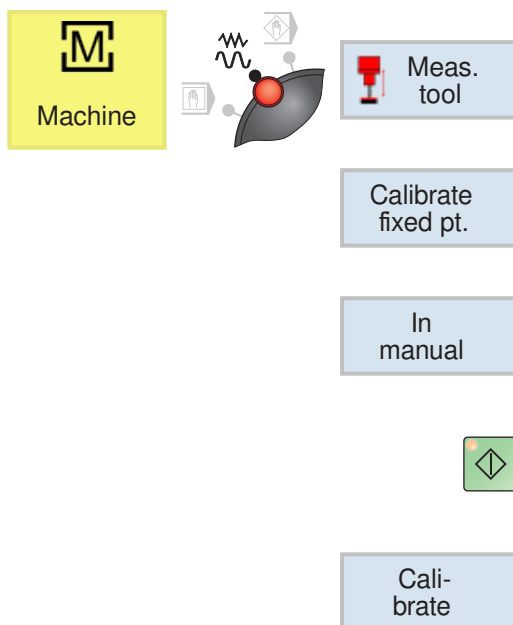


### Calibrate fixed point with load cell

For example a mechanical load meter can be used as the fixed point. Fit the load to the machine table in the machine's processing area. Enter zero as distance (DZ).

### Calibrate fixed point with distance gauge

But an arbitrary fixed point on the machine can also be used with a distance gauge. Enter the thickness of the plate as distance (DZ). To calibrate the fixed point use either a tool with fixed length (i.e. the tool length must be registered in the tool list) or the spindle nose directly.



### Calibrate fixed point with spindle nose variant:

- 1 Switch to the tool measurement window.
- 2 Press softkey.
- 3 Measure the thickness of the plate (DZ) by hand and enter it.
- 4 Traverse with spindle nose in Z-direction until the spindle nose touches the plate surface.
- 3 Press softkey. The control system calculates the fixed point from the current spindle position. The fixed point can be used for a subsequent measurement of tools with the scratch method.

## **Tool measurement by hand**

The tool measurements can also be measured with another measuring machine. The values obtained can then be entered into the tool table by hand.



# G: Program sequence

**Instructions:**

During the program sequence the tool data for the tools used may not be changed.

## Preconditions

### Set zero points

The zero points used must be measured and entered.

### Tools

The tools used must be measured and entered. The tools must be in the corresponding positions (t) in the tool changer.

### Reference point

The reference point must be approached in all axes.

### Machine

The machine must be ready for operation. The workpiece must be securely clamped. Loose parts (spanners, etc.) must be removed from the work area to avoid collisions. The machine doors must be closed at the start of the program.

### Alarms

There must be no alarms pending.



## NC Start

This button switches from "JOG" mode to "AUTO" mode and starts the NC program run.

For the NC program run to be started, a Sinumerik Operate program must be open. The file name of the currently open Sinumerik Operate program is shown in the center of the simulation window.



## NC Reset

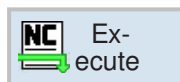
This button switches from "AUTO" mode to "JOG" mode, cancels the NC program run and resets to the start state.



## NC Stop

This button stops the NC program run. The simulation can be continued with this "NC-Start" button.

## Program start, program stop



- Select a program for execution.



- Press the "NC-Start" button.



- Stop program with "NC-Stop", continue with "NC-Start".



- Cancel program with "NC-Reset".

## Repositioning

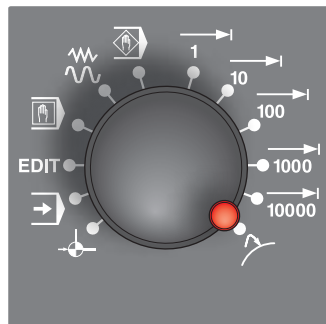


If a program interruption occurs in automatic mode, e.g. after a tool break, in this way the tool can be moved away from the contour in manual mode.

To avoid later collisions the axes must be moved to a safe position.

The coordinates of the interruption position will be saved.

The travel difference between the axes that has been brought about in manual mode is shown in the current values window. This travel difference is called "Repos shift".



### Continue program execution:

- Select operating mode REPOS. Thus the tool can again be brought to the contour of the work-piece.
- Select each axis to be moved one after the other and move to the cancellation position.
- Continue the processing in automatic mode again with "NC-Start".



# H: Alarms and Messages

## Machine Alarms 6000 - 7999

These alarms will be triggered by the machines. There are different alarms for the different machines. The alarms 6000 - 6999 normally must be confirmed with RESET. The alarms 7000 - 7999 are messages which normally will disappear when the releasing situation is finished.

### PC MILL 50 / 55 / 100 / 105 / 125 / 155 Concept MILL 55 / 105 / 155

#### **6000: EMERGENCY OFF**

The EMERGENCY OFF key was pressed. Remove the endangering situation and restart machine and software.

#### **6001: PLC-CYCLE TIME EXCEEDING**

Contact EMCO Service.

#### **6002: PLC - NO PROGRAM CHARGED**

Contact EMCO Service.

#### **6003: PLC - NO DATA UNIT**

Contact EMCO Service.

#### **6004: PLC - RAM MEMORY FAILURE**

Contact EMCO Service.

#### **6005: OVERHEAT BRAKEMODUL**

Main drive was braked too often, large changes of speed within a short time. E4.2 active

#### **6006: OVERLOAD BRAKE RESISTOR**

see 6005

#### **6007: SAFETY CIRCUIT FAULT**

Axis and main drive contactor with machine switched off not disabled. Contactor got stuck or contact error. E4.7 was not active during switch-on.

#### **6008:MISSING CAN SUBSCRIBER**

Check fuses or EMCO customer service.  
Contact EMCO Service.

#### **6009: SAFETY CIRCUIT FAULT**

A running CNC program will be interrupted, the auxiliary drives will be stopped, the reference position will be lost.

#### **6010: DRIVE X-AXIS NOT READY**

The step motor board is defective or too hot, a fuse or cabling is defective.

A running program will be stopped, the auxiliary drives will be switched off, the reference position will be lost.

Check fuses or contact EMCO service.

#### **6011: DRIVE Y-AXIS NOT READY**

see alarm 6010.

#### **6012: DRIVE Z-AXIS NOT READY**

see alarm 6010.

#### **6013: MAIN DRIVE NOT READY**

Main drive power supply defective, main drive too hot, fuse defective.

A running program will be stopped, the auxiliary drives will be switched off.

Check fuses or contact EMCO Service.

#### **6014: NO MAIN SPINDLE SPEED**

This will be released, when the spindle speed is lower than 20 rpm because of overload.

Alter cutting data (feed, infeed, spindle speed).

The CNC program will be aborted, the auxiliary drives will be stopped.

#### **6019: VICE TIME EXCEED**

The electric vice has not reached a stop position within 30 seconds.

The control or the clamping device board are defective, the vice is stuck. Adjust the proximity switches of the stop position.

#### **6020: VICE FAILURE**

When the electric vice is closed, the signal "clamping device clamped" of the clamping device board has failed.

The control, the clamping device board or the wiring are defective.

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**6022: CLAMPING DEVICE BOARD DEFECTIVE**

The signal "clamping device clamped" is constantly released, although no command has been given.

Replace the board.

**6024: MACHINE DOOR OPEN**

The door was opened while a machine movement. The program will be aborted.

**6027: DOOR LIMIT SWITCH DEFECTIVE**

The limit switch of the automatic door is displaced, defective, wrong cabled.

Contact EMCO service.

**6028: DOOR TIMEOUT**

The automatic door sticks, the pressured air supply is insufficient, the limit switch is displaced. Check door, pressured air supply, limit switch or contact EMCO service.

**6030: NO PART CLAMPED**

No workpiece inserted, vice cheek displaced, control cam displaced, hardware defective.

Adjust or contact EMCO service.

**6040: TOOL TURRET INDEX FAILURE**

After WZW procedure drum pressed down by Z-axis. Spindle position wrong or mechanical defect. E4.3=0 in lower state

**6041: TOOL CHANGE TIMEOUT**

Tool drum sticks (collision?), main drive not ready, fuse defective, hardware defective.

A running CNC program will be stopped.

Check for collisions, check fuses or contact EMCO service.

**6043-6046: TOOL DISK POSITION FAULT**

Position error of main drive, error of position supervising (inductive proximity switch defective or disadjusted, drum allowance), fuse defective, hardware defective.

The Z axis could have been slipped out of the tothing while the machine was switched off.

A running CNC program will be stopped.

Contact EMCO service.

**6047: TOOL DISK UNLOCKED**

Tool drum turned out of locked position, inductive proximity switch defective or disadjusted, fuse defective, hardware defective.

A running CNC program will be interrupted.

Contact EMCO service.

When the tool drum is turned out of locked position (no defect), act as following:

Turn the drum into locking position manually

Change into MANUAL (JOG) mode.

Turn the key switch. Traverse the Z slide upwards, until the alarm disappears.

**6048: DIVIDING TIME EXCEEDED**

Dividing head sticks, insufficient pressured air supply, hardware defective.

Check for collision, check pressured air supply or contact EMCO service.

**6049: INTERLOCKING TIME EXCEEDED**

see alarm 6048

**6050: M25 AT RUNNING MAIN SPINDLE**

Cause: Programming mistake in NC program.

A running program will be aborted.

The auxilliary drives will be switched off.

Remedy: Correct NC program

**6064: DOOR AUTOMATIC NOT READY**

Cause: pressure failure automatic door  
automatic door sticks mechanically  
limit switch for open end position defective  
security print circuits defect  
cabling defective  
fuses defective

A running program will be aborted.

The auxilliary drives will be switched off.

Remedy: service automatic door

**6069: CLAMPING FOR TANI NOT OPEN**

When opening the clamping pressure switch does not fall within 400ms. Pressure switch defective or mechanical problem. E22.3

**6070: PRESSURE SWITCH FOR TANI MISSING**

When closing the clamping pressure switch does not respond. No compressed air or mechanical problem. E22.3

**6071: DIVIDING DEVICE NOT READY**

Servo Ready Signal from frequency converter missing. Excess temperature drive TANI or frequency converter not ready for operation.

**6072: VICE NOT READY**

Attempt to start the spindle with an open vice or without clamped workpiece.

Vice sticks mechanically, insufficient compressed air supply, compressed air switch defective, fuse defective, hardware defective.

Check the fuses or contact EMCO service.

**6073: DIVIDING DEVICE NOT READY**

Cause: locking switch defective  
cabling defective  
fuses defective

A running program will be aborted.

The auxiliary drives will be switched off.

Remedy: service automatic dividing device  
lock the dividing device

**6074: DIVIDING TIME EXCEEDED**

Cause: dividing device sticks mechanically  
locking switch defective  
cabling defective  
fuses defective  
insufficient compressed-air supply.

A running program will be aborted.

The auxiliary drives will be switched off.

Remedy: Check for collision, check the compressed-air supply or contact the EMCO service.

**6075: M27 AT RUNNING MAIN SPINDLE**

Cause: Programming mistake in NC program.

A running program will be aborted.

The auxiliary drives will be switched off.

Remedy: Correct NC program

**6110: 5TH AXIS NOT CONNECTED**

Cause: 4th/5th axis was selected in EMConfig, but not connected electrically.

Remedy: Connect 4th/5th axis or deselect in EM-Config.

**6111: 5TH AXIS CONNECTED**

Cause: 4th/5th axis was deselected in EMConfig, but is electrically connected.

Remedy: Remove 4th/5th axis from machine or select in EMConfig.

**6112: MOTOR PROTECTION RELEASED**

Cause: A motor protection switch has triggered. A possibly active NC program is stopped immediately.

Remedy: Check the device connected to the motor protection switch and switch on again. If recurring, contact EMCO service department.

**7000: INVALID TOOL NUMBER PROGRAMMED**

The tool position was programmed larger than 10. The CNC program will be stopped.

Interrupt program with RESET and correct the program.

**7001: NO M6 PROGRAMMED**

For an automatic tool change you also have to program a M6 after the T word.

**7007: FEED STOP!**

The axes have been stopped by the robotics interface (robotics entry FEEDHOLD).

**7016: SWITCH ON AUXILIARY DRIVES**

The auxiliary drives are off. Press the AUX ON key for at least 0.5 sec. (to avoid accidentally switching on) to switch on the auxiliary drives.

**7017: REFERENCE MACHINE**

Approach the reference point.

When the reference point is not active, manual movements are possible only with key switch at position "setting operation".

**7018: TURN KEY SWITCH**

With NC-Start the key switch was in position "setting operation".

NC-Start is locked.

Turn the key switch in the position "automatic" to run a program.

**7020: SPECIAL OPERATION MODE ACTIVE**

Special operation mode: The machine door is opened, the auxiliary drives are switched on, the key switch is in position "setting operation" and the consent key is pressed.

Manual traversing the axes is possible with open door. Swivelling the tool turret is not possible with open door. Running a CNC program is possible only with standing spindle (DRYRUN) and SINGLE block operation.

For safety: If the consent key is pressed for more than 40 sec. the function of this key is interrupted, the consent key must be released and pressed again.

**7021: INITIALIZE TOOL TURRET**

The tool turret operating was interrupted.

No traversing operation is possible.

Press tool turret key in JOG operation. Message occurs after alarm 6040.

**7022: INITIALIZE TOOL TURRET!**

see 7021

**7023: WAITING TIME MAIN DRIVE!**

The LENZE frequency converter has to be separated from the mains supply for at least 20 seconds before you are allowed to switch it on again. This message will appear when the door is quickly opened/ closed (under 20 seconds).

**7038: LUBRICATION SYSTEM FAULT**

The pressure switch is defective or gagged.

NC-Start is locked. This can be reset only by switching off and on the machine.

Contact EMCO service.

**7039: LUBRICATION SYSTEM FAULT**

Not enough lubricant, the pressure switch is defective.

NC-Start is locked.

Check the lubricant and lubricate manually or contact EMCO service.

**7040: MACHINE DOOR OPEN**

The main drive can not be switched on and NC-Start can not be activated (except special operation mode)

Close the machine to run a program.

**7042: INITIALIZE MACHINE DOOR**

Every movement and NC-Start are locked.

Open and close the machine door to initialize the safety circuits.

**7043: PIECE COUNT REACHED**

A predetermined number of program runs was reached. NC-Start is locked. Reset the counter to continue.

**7050: NO PART CLAMPED**

After switching on or after an the vice is neither at the open position nor at the closed position.

NC-Start is locked.

Traverse the vice manually on a valid end position.

**7051: DIVIDING HEAD NOT LOCKED!**

Either the dividing head is in an undefined position after the machine has been switched on, or the locking signal after a dividing process is missing.

Initiate the dividing process, check, respectively adjust the proximity switch for locking.

**7054: VICE OPEN**

Cause: the workpiece is not clamped

When switching on the main spindle with M3/M4 alarm 6072 (vice not ready) will be released.

Remedy: Clamp

**7055: OPEN TOOL CLAMPING SYSTEM**

A tool is clamped in the main spindle and the control does not recognize the corresponding T number.

Eject the tool from the main spindle when the door is open by means of the PC keys "Strg" and " 1 ".

**7056: SETTING DATA INCORRECT**

An invalid tool number is stored in the setting data.

Delete the setting data in the machine directory xxxxx.pls.

**7057: TOOLHOLDER OCCUPIED**

The clamped tool cannot be positioned in the tool turret since the position is occupied.

Eject the tool from the main spindle when the door is open by means of the PC keys "Strg" and " 1 ".

**7058: RETRACTING THE AXES**

The position of the tool turret arm cannot be clearly defined during the tool change.

Open the machine door, push the tool turret magazine backwards to the stop. Move the milling head in the JOG mode upwards to the Z reference switch and then traverse the reference point.

**7087: MOTOR PROTECTION HYDRAULIC CLAMPING RELEASED!**

Hydraulic motor is defective, stiff, circuit breaker is set incorrectly.

Replace motor or check circuit breaker and replace if necessary.

**7090: ELECTRICAL CABINET OVERRIDE SWITCH ACTIVE**

The cabinet door can only be opened when the key switch is switched on without raising an alarm.

Switch off key switch.

**7107: MOTOR PROTECTION RELEASED**

A motor protection switch has triggered. A possibly running NC program will be completed. A new NC start will be prevented.

Check the device connected to the motor protection switch and switch on again. If recurring, contact EMCO service department.

**7270: OFFSET COMPENSATION ACTIVE !**

Only with PC-MILL 105

Offset compensation activated by the following operation sequence.

- Reference point not active
  - Machine in reference mode
  - Key switch in manual operation
  - Press STRG (or CTRL) and simultaneously 4
- This must be carried out if prior to the tool change procedure spindle positioning is not completed (tolerance window too large)

**7271: COMPENSATION FINISHED, DATA SAVED !**

see 7270





**PC TURN 50 / 55 / 105 / 120 / 125 / 155**  
**Concept TURN 55 / 60 / 105 / 155 /**  
**250 / 260 / 460**  
**Concept MILL 250**  
**EMCOMAT E160**  
**EMCOMAT E200**  
**EMCOMILL C40**  
**EMCOMAT FB-450 / FB-600**

**6000: EMERGENCY OFF**

The EMERGENCY OFF key was pressed.  
 The reference position will be lost, the auxiliary drives will be switched off.  
 Remove the endangering situation and restart machine and software.

**6001: PLC-CYCLE TIME EXCEEDING**

The auxiliary drives will be switched off.  
 Contact EMCO Service.

**6002: PLC - NO PROGRAM CHARGED**

The auxiliary drives will be switched off.  
 Contact EMCO Service.

**6003: PLC - NO DATA UNIT**

The auxiliary drives will be switched off.  
 Contact EMCO Service.

**6004: PLC - RAM MEMORY FAILURE**

The auxiliary drives will be switched off.  
 Contact EMCO Service.

**6005: K2 OR K3 NOT DE-ENERGIZED**

Turn machine on/off. Defective security board.

**6006 EMERGENCY-OFF RELAY K1 NOT DE-ENERGIZED**

Turn machine on/off. Defective security board.

**6007 SAFETY CIRCUIT FAULT****6008: MISSING CAN SUBSCRIBER**

The PLC-CAN board is not identified by the control.  
 Check the interface cable and the power supply of the CAN board.

**6009: SAFETY CIRCUIT FAULT****6010: DRIVE X-AXIS NOT READY**

The step motor board is defective or too hot, a fuse is defective, over- or undervoltage from mains.

A running program will be stopped, the auxiliary drives will be switched off, the reference position will be lost.

Check fuses or contact EMCO service.

**6011: DRIVE Z-AXIS NOT READY**

see 6010.

**6012: DRIVE Z-AXIS NOT READY**

see 6010.

**6013: MAIN DRIVE NOT READY**

Main drive power supply defective or main drive too hot, fuse defective, over- or undervoltage from mains.

A running program will be stopped, the auxiliary drives will be switched off.

Check fuses or contact EMCO Service.

**6014: NO MAIN SPINDLE SPEED**

This alarm will be released, when the spindle speed is lower than 20 rpm because of overload. Alter cutting data (feed, infeed, spindle speed).

The CNC program will be aborted, the auxiliary drives will be switched off.

**6015: NO DRIVEN TOOL SPINDLE SPEED**

see 6014.

**6016: AUTOMATIC TOOL TURRET SIGNAL COUPLED MISSING****6017: AUTOMATIC TOOL TURRET SIGNAL UNCOUPLED MISSING**

In the tool turret that can be coupled, the position of the coupling and uncoupling magnet is monitored by means of two proximity switches. It has to be made sure that the coupling is in the rear stop position so that the tool turret can get to the next tool position. Equally, during operation with driven tools the coupling has to be safe in the front stop position.

Check and adjust the cables, the magnet and the stop position proximity switches.

**6018: AS SIGNALS, K4 OR K5 NOT DE-ENERGIZED**

Turn machine on/off. Defective security board.

**6019: POWER SUPPLY MODULE NOT READY**

Turn machine on/off. Power supply module, defective axis controller 6020 AWZ drive failure turn machine on/off, defective axis controller.

**6020: DRIVEN TOOL DRIVE MALFUNCTION**

The driven tool power supply defective or the driven tool drive is too hot, fuse defective, mains overvoltage or undervoltage. A running CNC program will be aborted, the auxiliary drives will be stopped. Check the fuses or contact EMCO service.

**6021: COLLET TIME OUT**

During closing of the clamping device the pressure switch has not reacted within one second.

**6022: CLAMPING DEVICE BOARD DEFECTIVE**

The signal "clamping device clamped" is constantly released, even though no command has been given. Replace the board.

**6023: COLLET PRESSURE MONITORING**

The pressure switch turns off when the clamping device is closed (compressed air failure for more than 500ms).

**6024: MACHINE DOOR OPEN**

The door was opened while a machine movement. The program will be aborted.

**6025: GEARBOX COVER NOT CLOSED**

The gearbox cover was opened while a machine movement. A running CNC program will be aborted. Close the cover to continue.

**6026: MOTOR PROTECTION COOLANT PUMP RELEASED**

**6027: DOOR LIMIT SWITCH DEFECTIVE**

The limit switch of the automatic door is displaced, defective, wrong cabled. Contact EMCO service.

**6028: DOOR TIMEOUT**

The automatic door sticks, the pressured air supply is insufficient, the limit switch is displaced. Check door, pressured air supply, limit switch or contact EMCO service.

**6029: TAILSTOCK QUILL TIME EXCEED**

The tailstock quill does not reach a final position within 10 seconds.

Adjust the control and the stop position proximity switches, or the tailstock quill is stuck.

**6030: NO PART CLAMPED**

No workpiece inserted, vice cheek displaced, control cam displaced, hardware defective. Adjust or contact EMCO service.

**6031: QUILL FAILURE**

**6032: TOOL CHANGE TIMEOUT**

see alarm 6041.

**6033: TOOL TURRET SYNC ERROR**

Hardware defective. Contact EMCO service.

**6037: CHUCK TIMEOUT**

The pressure switch does not react within one second when the clamping device is closed.

**6039: CHUCK PRESSURE FAILURE**

The pressure switch turns off when the clamping device is closed (compressed air failure for more than 500ms).

**6040: TOOL TURRET INDEX FAILURE**

The tool turret is in no locked position, tool turret sensor board defective, cabling defective, fuse defective.

A running CNC program will be stopped. Swivel the tool turret with the tool turret key, check fuses or contact EMCO service.

**6041: TOOL CHANGE TIMEOUT**

Tool drum sticks (collision?), fuse defective, hardware defective.

A running CNC program will be stopped. Check for collisions, check fuses or contact EMCO service.

**6042: TOOL TURRET OVERHEAT**

Tool turret motor too hot. With the tool turret a max. of 14 swivel procedures a minute may be carried out.

**6043: TOOL CHANGE TIMEOUT**

Tool drum sticks (collision?), fuse defective, hardware defective.

A running CNC program will be stopped. Check for collisions, check fuses or contact EMCO service.

**6044: BRAKING RESISTANCE - MAIN DRIVE OVERLOADED**

Reduce number of speed changes in the program.

**6045: TOOL TURRET SYNC MISSING**

Hardware defective.  
Contact EMCO service.

**6046: TOOL TURRET ENCODER FAULT**

Fuse defective, hardware defective.  
Check fuses or contact EMCO service.

**6048: CHUCK NOT READY**

Attempt to start the spindle with open chuck or without clamped workpiece.  
Chuck sticks mechanically, insufficient pressured air supply, fuse defective, hardware defective.  
Check fuses or contact EMCO service.

**6049: COLLET NOT READY**

see 6048

**6050: M25 DURING SPINDLE ROTATION**

With M25 the main spindle must stand still (consider run-out time, evtl. program a dwell)

**6055: NO PART CLAMPED**

This alarm occurs when with rotating spindle the clamping device or the tailstock reach the end position. The workpiece has been pushed out of the chuck or has been pushed into the chuck by the tailstock. Check clamping device settings, clamping forces, alter cutting data.

**6056: QUILL NOT READY**

Attempt to start the spindle or to move an axis or to swivel the tool turret with undefined tailstock position.  
Tailstock is locked mechanically (collision), insufficient pressured air supply, fuse defective, magnetic switch defective.  
Check for collisions, check fuses or contact EMCO service.

**6057: M20/M21 DURING SPINDLE ROTATION**

With M20/M21 the main spindle must stand still (consider run-out time, evtl. program a dwell)

**6058: M25/M26 DURING QUILL FORWARD**

To actuate the clamping device in an NC program with M25 or M26 the tailstock must be in back end position.

**6059: C-AXIS SWING IN TIMEOUT**

C-axis does not swivel in within 4 seconds.  
Reason: not sufficient air pressure, and/or mechanics stuck.

**6060: C-AXIS INDEX FAILURE**

When swivelling in the C-axis the limit switch does not respond.  
Check pneumatics, mechanics and limit switch.

**6064: AUTOMATIC DOOR NOT READY**

Door sticks mechanically (collision), insufficient pressured air supply, limit switch defective, fuse defective.  
Check for collisions, check fuses or contact EMCO service.

**6065: LOADER MAGAZINE FAILURE**

Loader not ready.  
Check if the loader is switched on, correctly connected and ready for operation and/or disable loader (WinConfig).

**6066: CLAMPING DEVICE FAILURE**

No compressed air at the clamping device  
Check pneumatics and position of the clamping device proximity detectors.

**6067: NO COMPRESSED AIR**

Turn the compressed air on, check the setting of the pressure switch.

**6068: MAINDRIVE OVERTEMPERATURE****6070: LIMIT SWITCH TAILSTOCK SLEEVE ACTIVE**

Cause: The axis arrived in the tailstock sleeve.  
Remedy: Drive the travel off the tailstock sleeve.

**6071: LIMIT SWITCH X AXIS ACTIVE**

Cause: The axis arrived to the end switch.  
Remedy: Drive the axis off the end switch again.

**6072: LIMIT SWITCH Z AXIS ACTIVE**

see 6071

**6073: CHUCK GUARD OPEN**

Cause: The chuck guard is open.  
Remedy: Close the chuck guard.

**6074: NO FEEDBACK FROM USB-PLC**

Turn machine on/off. Check cabling, defective USB board.

**6075: AXIS LIMIT SWITCH TRIGGERED**

see 6071

**6076: DRIVE Y-AXIS NOT READY**

see 6010

**6077 VICE NOT READY**

Cause: Loss of pressure in clamping system.  
Remedy: Check pressurised air and air ducts.

**6078 MOTOR PROTECTION TOOL MAGAZINE RELEASED**

Cause: Swing intervals are too short.  
Remedy: Raise swing intervals.

**6079 MOTOR PROTECTION TOOL CHANGER RELEASED**

see 6068

**6080 PRESSURE SWITCH FOR TANI MISSING**

Cause: The pressure switch fails to active when the clamping closes. No pressurised air or mechanical problem.  
Remedy: Check pressurised air.

**6081 CLAMPING FOR TANI NOT OPEN**

see 6080

**6082 FAULT AS/SIGNAL**

Cause: Active Safety-Signal X/Y-controller is faulty.  
Remedy: Delete alarm using the RESET key and/or switch the machine on/off. If this error reoccurs, contact EMCO.

**6083 FAULT AS/SIGNAL**

Cause: Active Safety-Signal main spindle/Z-controller is faulty.  
Remedy: Delete alarm using the RESET key and/or switch the machine on/off. If this error reoccurs, contact EMCO.

**6084 FAULT AS/SIGNAL UE-MODUL**

Cause: Active Safety-Signal Uncontrolled power supply module is faulty.  
Remedy: Delete alarm using the RESET key and/or switch the machine on/off. If this error reoccurs, contact EMCO.

**6085 N=0 RELAY NOT DE-ENERGIZED**

Cause: Rotation zero relay did not drop.  
Remedy: Delete alarm using the RESET key and/or switch the machine on/off. If this error reoccurs, contact EMCO (replace relay).

**6086 DIFFERENT DOOR-SIGNALS FROM USBPLC AND ACC-PLC**

Cause: ACC-PLC and USBSPS receive different door status reports.  
Remedy: Delete alarm using the RESET key. If this error reoccurs, contact EMCO.

**6087 DRIVE A-AXIS NOT READY**

see 6010

**6088 PROTECT SWITCH DOOR CONTROL UNIT RELEASED**

Cause: Door drive overload.  
Remedy: Cancel alarm with RESET button or switch machine on/off. If the problem occurs several times, contact EMCO (replace motor, drive).

**6089 DRIVE B-AXIS NOT READY**

see 6010

**6090 CHIP CONVEYOR CONTACTOR NOT DE-ENERGIZED**

Cause: Chip conveyor guard not down.  
Remedy: Cancel alarm with RESET button or switch machine on/off. If the problem occurs several times, contact EMCO (replace guard).

**6091 AUTOMATIC DOOR CONTACTOR NOT DE-ENERGIZED**

Cause: Automatic door guard not down.  
Remedy: Cancel alarm with RESET button or switch machine on/off. If the problem occurs several times, contact EMCO (replace guard).

**6092 EMERGENCY-OFF EXTERNAL**

**6093 FAULT AS/SIGNAL A-AXIS**

Cause: Active Safety-Signal A control element faulty.  
Remedy: Cancel alarm with RESET button or switch machine on/off. If the problem occurs several times, contact EMCO.

**6095 OVERHEATING IN THE SWITCHGEAR CABINET**

Cause: Temperature monitoring responded.  
Remedy: Check switchgear cabinet filter and fan, raise triggering temperature, switch machine on and off.

**6096 SWITCHGEAR CABINET DOOR OPEN**

Cause: Switchgear cabinet door opened without key switch release.  
Remedy: Close switchgear cabinet door, switch machine off and on.

**6097 EMERGENCY-OFF TEST REQUIRED**

Cause: Functional test of Emergency off.  
 Remedy: Press EMERGENCY-OFF button on the control panel and unlock again. Press Rest-button to acknowledge the emergency stop state.

**6098 FLOAT SWITCH HYDRAULIC MISSING**

Effect: Auxiliary units are switched off.  
 Meaning: The hydraulic float switch has released.  
 Remedy: Refill hydraulic oil.

**6099 PROX. SWITCH SPINDLE-BRAKE 1 MISSING**

Effect: Feed stop, Read in lock  
 Meaning: M10 Spindle brake on → Inductive proximity switch stays 0.  
 M11 Spindle brake off → Inductive proximity switch stays 1.  
 Remedy: Check inductive proximity switch, check magnetiv valve spindle brake.

**6100 LOW PRESSURE QUILL**

Effect: Auxiliary units are switched off.  
 Meaning: At the moment of a spindle start command the tailstock pressure was not built up or the pressure dropped while spindle run.  
 Remedy: Check clamping device pressure and pressure switch.  
 Check program.

**6101 QUILL -B3 OR -B4 MISSING**

Effect: Feed stop, Read in lock  
 Meaning: The magnetic valve for the movement of the quill was activated, but the switches -B3 and -B4 does not alter its status.  
 Remedy: Check switches, magnetic valves.

**6102 QUILL POSITION ALARM (PART MOVED?)**

Effect: Feed stop, Read in lock  
 Meaning: The tailstock target position was overtravelled in AUTOMATIC mode.  
 Remedy: Check tailstock target position, check technology (clamping device pressure higher, tailstock pressure lower)

**6103 QUILL NO BACKPOSITION**

Effect: Feed stop, Read in lock  
 Meaning: The magnetic valve for the tailstock was activated, but the switch for "tailstock back" stays 0.  
 Remedy: Check magnetic valve, check switch.

**6104 LOW PRESSURE CLAMPING EQUIPMENT 1**

Effect: Auxiliary units are switched off.  
 Meaning: At the moment of a spindle start command the clamping pressure was not built up or the clamping pressure dropped while spindle run.  
 Remedy: Check clamping device pressure and pressure switch.  
 Check program.

**6105 CLAMPING EQUIPMENT 1 NOT OPEN**

Effect: Feed stop, Read in lock  
 Meaning: The analogous proximity switch for clamping device 1 was not actuated.  
 Remedy: Adjust inductive proximity switch (see "Machine Description - chapter "C Programming and operation").

**6106 CLAMPING EQUIPMENT 1 NOT CLOSED**

Effect: Feed stop, Read in lock  
 Meaning: The pressure switch for "clamping device closed" does not switch.  
 Remedy: Check pressure switch

**6107 LIMIT SWITCH CLAMPING EQUIPMENT 1**

Effect: Auxiliary units are switched off.  
 Remedy: Adjust clamping device (do not clamp in end position of the clamping system - see "Machine Description, chapter C Programming and Operation").

**6108 PARTS CATCHER FORWARD MISSING**

Effect: Feed stop, Read in lock  
 Meaning: The magnetic valve for "collection tray forward/backward" was activated, but the switch for "collection tray forward/backward" does not alter its status.  
 Remedy: Check switches, magnetic valves.

**6109 PARTS CATCHER ROTATE IN MISSING**

Effect: Feed stop, Read in lock  
 Meaning: The magnetic valve for "collection tray in/out" was activated, but the switch for "collection tray in/out" does not alter its status.  
 Remedy: Check switch, magnetic valve.

**6900 USBPLC not available**

Cause: USB communication with the safety board could not be established.  
 Remedy: Switch the machine off and on again. Please contact the EMCO after-sales service in case the error occurs repeatedly.

**6901 Error emergency-off relay USBPLC**

Cause: USBPLC EMERGENCY-OFF relay error.  
 Remedy: Switch the machine off and on again.  
 Please contact the EMCO after-sales service in case the error occurs repeatedly.

**6902 Error standstill monitoring X**

Cause: Unauthorized movement of the X axis in the current operating condition.  
 Remedy: Delete the alarm with the RESET button and switch the machine off and on again.  
 Please contact the EMCO after-sales service in case the error occurs repeatedly.

**6903 Error standstill monitoring Z**

Cause: Unauthorized movement of the Z axis in the current operating condition.  
 Remedy: Delete the alarm with the RESET button and switch the machine off and on again.  
 Please contact the EMCO after-sales service in case the error occurs repeatedly.

**6904 Error alive circuit PLC**

Cause: Error in the connection (Watchdog) of the safety board with the PLC.  
 Remedy: Delete the alarm with the RESET button and switch the machine off and on again. Please contact the EMCO after-sales service in case the error occurs repeatedly.

**6906 Error overspeed spindle**

Cause: The main spindle speed exceeds the maximum permissible value for the current operating condition.  
 Remedy: Delete the alarm with the RESET button and switch the machine off and on again. Please contact the EMCO after-sales service in case the error occurs repeatedly.

**6907 Error enable pulses ER-module**

Cause: ACC-PLC did not shutdown the input/negative feeder-module.  
 Remedy: Delete the alarm with the RESET button and switch the machine off and on again.  
 Please contact the EMCO after-sales service in case the error occurs repeatedly.

**6908 Error standstill monitoring main drive**

Cause: Unexpected warm up of the main spindle in the operating condition.  
 Remedy: Delete the alarm with the RESET button and switch the machine off and on again.  
 Please contact the EMCO after-sales service in case the error occurs repeatedly.

**6909 Error main drive enable without spindle start**

Cause: The release of the control unit of the main spindle was given by the ACC-PLC without the spindle-start key being pressed.  
 Remedy: Delete the alarm with the RESET button and switch the machine off and on again.  
 Please contact the EMCO after-sales service in case the error occurs repeatedly.

**6910 Error standstill monitoring Y**

Cause: Unauthorized movement of the Y axis in the current operating condition.  
 Remedy: Delete the alarm with the RESET button and switch the machine off and on again.  
 Please contact the EMCO after-sales service in case the error occurs repeatedly.

**6911 Error standstill axes**

Cause: Unauthorized movement of the axis in the current operating condition.  
 Remedy: Delete the alarm with the RESET button and switch the machine off and on again.  
 Please contact the EMCO after-sales service in case the error occurs repeatedly.

**6912 Error overspeed axis**

Cause: The feed of the axes exceeds the maximum permissible value for the current operating condition.  
 Remedy: Delete the alarm with the RESET button and switch the machine off and on again.  
 Please contact the EMCO after-sales service in case the error occurs repeatedly.

**6913 Error overspeed X**

Cause: The feed of the X axis exceeds the maximum permissible value for the current operating condition.  
 Remedy: Delete the alarm with the RESET button and switch the machine off and on again.  
 Please contact the EMCO after-sales service in case the error occurs repeatedly.

**6914 Error overspeed Y**

Cause: The feed of the Y axis exceeds the maximum permissible value for the current operating condition.  
 Remedy: Delete the alarm with the RESET button and switch the machine off and on again.  
 Please contact the EMCO after-sales service in case the error occurs repeatedly.

**6915 Error overspeed Z**

Cause: The feed of the Y axis exceeds the maximum permissible value for the current operating condition.

Remedy: Delete the alarm with the RESET button and switch the machine off and on again. Please contact the EMCO after-sales service in case the error occurs repeatedly.

**6916 ERROR: X-INDUCTIVE PROXIMITY SWITCH DEFECT**

Cause: No signal is delivered by X axis Bero.

Remedy: Delete alarm using the RESET key. If this error reoccurs, contact EMCO.

**6917 ERROR: Y-INDUCTIVE PROXIMITY SWITCH DEFECT**

Cause: No signal is delivered by Y axis Bero.

Remedy: Delete alarm using the RESET key. If this error reoccurs, contact EMCO.

**6918 ERROR: Z-INDUCTIVE PROXIMITY SWITCH DEFECT**

Cause: No signal is delivered by Z axis Bero.

Remedy: Delete alarm using the RESET key. If this error reoccurs, contact EMCO.

**6919 ERROR: SPINDLE-INDUCTIVE PROXIMITY SWITCH DEFECT**

Cause: No signal is delivered by main spindle Bero.

Remedy: Delete alarm using the RESET key. If this error reoccurs, contact EMCO.

**6920 INVERSION OF X-DIRECTION TOO LONG "1"**

Cause: The change in direction of X axis was being sent to USBSPS for more than three seconds.

Remedy: Delete alarm using the RESET key. Avoid driving back and forth using the manual wheel. If this error reoccurs, contact EMCO.

**6921 INVERSION OF Y-DIRECTION TOO LONG "1"**

Cause: The change in direction of Y axis was being sent to USBSPS for more than three seconds.

Remedy: Delete alarm using the RESET key. Avoid driving back and forth using the manual wheel. If this error reoccurs, contact EMCO.

**6922 INVERSION OF Z-DIRECTION TOO LONG "1"**

Cause: The change in direction of Z axis was being sent to USBSPS for more than three seconds.

Remedy: Delete alarm using the RESET key. Avoid driving back and forth using the manual wheel. If this error reoccurs, contact EMCO.

**6923 DIFFERENT DOOR-SIGNALS FROM USBPLC AND ACC-PLC**

Cause: ACC-PLC and USBSPS receive different door status reports.

Remedy: Delete alarm using the RESET key. If this error reoccurs, contact EMCO.

**6924 ERROR ENABLE PULSES MAIN DRIVE**

Cause: The pulse release on the main spindle control element was interrupted by the USBSPS, as the PLC did not shut it down in a timely fashion.

Remedy: Cancel alarm with RESET button. If the problem occurs several times, contact EMCO.

**6925 GRID PROTECTION ERROR!**

Cause: Grid protection does not drop out in current operating state, or does not engage.

Remedy: Clear alarm with emergency off button and restart the machine. Contact EMCO Customer Service if the error occurs on several occasions.

**6926 MOTOR PROTECTION ERROR!**

Cause: Motor protection drops out in current operating state.

Remedy: Clear alarm with emergency off button and restart the machine. Contact EMCO Customer Service if the error occurs on several occasions.

**6927 EMERGENCY OFF ACTIVE ERROR!**

Cause: Emergency off button was pressed.

Remedy: Restart the machine.

**6928 TOOL CHANGER SHUTDOWN MONITORING ERROR**

Cause: Unauthorised tool changer movement in the current operating state.

Remedy: Clear alarm with emergency off button and restart the machine. Contact EMCO Customer Service if the error occurs on several occasions.

**6929 MACHINE DOOR CLOSING/LOCKING ERROR**

Cause: State of the door lock not plausible or door closure unserviceable.

Remedy: Clear alarm with emergency off button and restart the machine. Contact EMCO Customer Service if the error occurs on several occasions.



**6930 BEROS MAIN SPINDLE PLAUSIBILITY ERROR**

Cause: Beros main spindle signal different.  
 Remedy: Clear alarm with emergency off button and restart the machine. Contact EMCO Customer Service if the error occurs on several occasions.

**6931 MAIN DRIVE QUICK STOP FUNCTION PLAUSIBILITY ERROR**

Cause: Main drive actuator does not confirm the quick stop function in the current operating state.  
 Remedy: Clear alarm with emergency off button and restart the machine. Contact EMCO Customer Service if the error occurs on several occasions.

**6999 USB-EXTENSION FOR ROBOTIK NOT AVAILABLE**

Cause: The USB extension for robotics cannot be addressed by ACC.  
 Remedy: Contact EMCO.

**7000: INVALID TOOL NUMBER PROGRAMMED**

The tool position was programmed larger than 8. The CNC program will be stopped. Interrupt program with RESET and correct the program.

**7007: FEED HOLD**

In the robotic mode a HIGH signal is at input E3.7. Feed Stop is active until a low signal is at E3.7.

**7016: SWITCH ON AUXILIARY DRIVES**

The auxiliary drives are off. Press the AUX ON key for at least 0.5 sec. (to avoid accidentally switching on) to switch on the auxiliary drives (also a lubricating pulse will be released).

**7017: REFERENCE MACHINE**

Approach the reference point.  
 When the reference point is not active, manual movements are possible only with key switch at position "setting operation".

**7018: TURN KEY SWITCH**

With NC-Start the key switch was in position "setting operation".  
 NC-Start is locked.  
 Turn the key switch in the position "automatic" to run a program.

**7019: PNEUMATIC LUBRICATION MONITORING!**

Refill pneumatic oil

**7020: SPECIAL OPERATION MODE ACTIVE**

Special operation mode: The machine door is opened, the auxiliary drives are switched on, the key switch is in position "setting operation" and the consent key is pressed.

Manual traversing the axes is possible with open door. Swivelling the tool turret is possible with open door. Running a CNC program is possible only with standing spindle (DRYRUN) and SINGLE block operation.

For safety: If the consent key is pressed for more than 40 sec. the function of this key is interrupted, the consent key must be released and pressed again.

**7021: TOOL TURRET NOT LOCKED**

The tool turret operating was interrupted. NC start and spindle start are locked. Press the tool turret key in the RESET status of the control.

**7022: COLLECTION DEVICE MONITORING**

Time exceed of the swivelling movement. Check the pneumatics, respectively whether the mechanical system is jammed (possibly a workpiece is jammed).

**7023: ADJUST PRESSURE SWITCH !**

During opening and closing of the clamping device the pressure switch has to turn off and on once.

Adjust the pressure switch. This alarm does not exist any more for versions starting with PLC 3.10.

**7024: ADJUST CLAMPING DEVICE PROXIMITY SWITCH !**

When the clamping device is open and the position stop control is active, the respective proximity switch has to feed back that the clamping device is "Open".

Check and adjust the clamping device proximity switch, check the cables.

**7025 WAITING TIME MAIN DRIVE !**

The LENZE frequency converter has to be separated from the mains supply for at least 20 seconds before you are allowed to switch it on again. This message will appear when the door is quickly opened/ closed (under 20 seconds).

**7026 PROTECTION MAIN MOTOR FAN RELEASED!**

**7038: LUBRICATION SYSTEM FAULT**

The pressure switch is defective or gagged. NC-Start is locked. This alarm can be reset only by switching off and on the machine. Contact EMCO service.

**7039: LUBRICATION SYSTEM FAULT**

Not enough lubricant, the pressure switch is defective. NC-Start is locked. Check the lubricant and lubricate manually or contact EMCO service.

**7040: MACHINE DOOR OPEN**

The main drive can not be switched on and NC-Start can not be activated (except special operation mode) Close the machine to run a program.

**7041: GEARBOX COVER OPEN**

The main spindle cannot be switched on and NC start cannot be activated. Close the gearbox cover in order to start a CNC program.

**7042: INITIALIZE MACHINE DOOR**

Every movement and NC-Start are locked. Open and close the machine door to initialize the safety circuits.

**7043: PIECE COUNT REACHED**

A predetermined number of program runs was reached. NC-Start is locked. Reset the counter to continue.

**7048: CHUCK OPEN**

This message shows that the chuck is open. It will disappear if a workpiece will be clamped.

**7049: CHUCK - NO PART CLAMPED**

No part is clamped, the spindle can not be switched on.

**7050: COLLET OPEN**

This message shows that the collet is open. It will disappear if a workpiece will be clamped.

**7051: COLLET - NO PART CLAMPED**

No part is clamped, the spindle can not be switched on.

**7052: QUILL IN UNDEFINED POSITION**

The tailstock is in no defined position. All axis movements, the spindle and the tool turret are locked. Drive the tailstock in back end position or clamp a workpiece with the tailstock.

**7053: QUILL - NO PART CLAMPED**

The tailstock reached the front end position. Traverse the tailstock back to the back end position to continue.

**7054: NO PART CLAMPED**

No part clamped, switch-on of the spindle is locked.

**7055: CLAMPING DEVICE OPEN**

This message indicates that the clamping device is not in clamping state. It disappears as soon as a part is clamped.

**7060 RETRACT SLEEVE LIMIT SWITCH !**

The axis arrived in the tailstock sleeve. Drive the travel off the tailstock sleeve.

**7061 RETRACT X AXIS LIMIT SWITCH !**

The axis arrived to the end switch. Drive the axis off the end switch again.

**7062 RETRACT Z AXIS LIMIT SWITCH !**

see 7061

**7063 OIL LEVEL CENTRAL LUBRICATION !**

Low oil level in central lubrication. Refill oil as per maintenance instructions to the machine.

**7064 CHUCK GUARD OPEN !**

The chuck guard is open. Close the chuck guard.

**7065 MOTOR PROTECTION COOLANT PUMP RELEASED !**

Overheated coolant pump. Check the coolant pump for ease of motion and presence of dirt. Ensure sufficient amount of coolant fluid in the coolant facility.

**7066 CONFIRM TOOL !**

To confirm the tool change, press T after the change has been completed.

**7067 MANUAL OPERATING MODE**

The Special Operation key switch is in the Set position (manual).

**7068 X AXIS HANDWHEEL ACTIVE**

The safety wheel is locked for manual travel movement. The safety wheel locking is monitored by contactless switches. With the manual wheel locked, the axis feed cannot be switched on. For automatic processing of a program, the manual wheel must be released again.

**7069 Y AXIS HANDWHEEL ACTIVE**

see 7068

**7070 Z AXIS HANDWHEEL ACTIVE**

see 7068

**7071 VERTICAL TOOL CHANGE**

The sheath for manual clamping of the tool holder is monitored by a switch. The switch reports a unaccepted socket wrench or a sheath which was left open. Remove the socket wrench after clamping the tool and close the sheath.

**7072 HORIZONTAL TOOL CHANGE**

The turning knob for manual tool clamping on the horizontal spindle is monitored by a switch. The switch reports a tightened turning knob. The spindle gets locked. Release the turning knob after clamping the tool.

**7073 RETRACT Y AXIS LIMIT SWITCH !**

see 7061

**7074 CHANGE TOOL**

Clamp programmed tool.

**7076: SWIVEL UNIT VOR MILLING HEAD UNLOCKED**

The milling head is not fully swung. Fix the milling head mechanically (the end switch must be pushed).

**7077: ADJUST TOOL TURRET**

No valid machine data for tool change are available. Contact EMCO.

**7078: POCKET NOT IN HOME POSITION**

Cancel during tool change. Swing back tool recessed in setup operation.

**7079: TOOL ARM NOT IN HOME POSITION**

see 7079

**7080: INCORRECT TOOL CLAMPED !**

The tool cone lies beyond tolerance. The clamped tool is twisted by 180°. Bero tool clamping is displaced. Check the tool and clamp it again. If this problem occurs with more tools, contact EMCO.

**7082: MOTOR PROTECTION CHIP CONVEY-OR RELEASED**

The scrap belt is overloaded. Check the conveyor belt for ease of motion and remove jammed scrap.

**7083: MAGAZINE IS ACTIVE !**

A tool has been removed from the non-chaotic tool administration from the main spindle. Fill the tool drum.

**7084: VICE OPEN !**

The vice is not clamped. Clamp the vice.

**7085 ROUNDAXIS A MOVE TO 0 DEGRE !**

Cause: The MOC only shuts down if the A Round axis is at 0°.

When 4.5. is present, a round axis must be made each time before the machine is switched off.

Remedy: Move round axis to 0°.

**7088 SWITCHGEAR CABINET OVERHEATING**

Cause: Temperature monitoring responded.

Remedy: Check switchgear cabinet filter and fan, raise trigger temperature.

**7089 SWITCHGEAR CABINET DOOR OPEN**

Cause: Switchgear cabinet door open.

Remedy: Close switchgear cabinet door.

**7091 WAIT FOR USB-I2C SPS**

Cause: Communication with the USB-I2C PLC could not be established.

Remedy: If the message does not self-extinguish, switch off and on the machine. Please contact EMCO service when the message occurs permanently even after power off.

**7092 TEST STOP ACTIVE**

Cause: Safety test for monitoring the safety functions is active.

Remedy: Wait until the safety test is finished.

**7093 SET REFERENCE POINT**

Cause: The reference point acknowledge mode was activated by the operator.

**7094 SET X-REFERENCE POINT**

Cause: The reference value of the X axis was adopted to the acc.esd file.

**7095 SET Y-REFERENCE POINT**

Cause: The reference value of the Y axis was adopted to the acc.esd file.

**7096 SET Z-REFERENCE POINT**

Cause: The reference value of the Z axis was adopted to the acc.esd file.

**7097 FEED OVERRIDE 0**

Cause: The override switch (feed control) was set by the operator on 0%

**7098 SPINDLE-BRAKE 1 ACTIVE**

Effect: spindle stop.

**7099QUILL DRIVES FORWARD**

Effect: Feed stop, Read in lock

Meaning: M21 was programmed → pressure switch "tailstock in front position" is not yet 1.

Remedy: Disappears with pressure switch front position.

**7100 QUILL DRIVES BACKWARD**

Effect: Feed stop, Read in lock

Meaning: M20 was programmed → limit switch "tailstock back" is not yet 1

Remedy: Disappears with limit switch "backposition".

**7101 REFERENCE POINT TOOL TURRET MISSING**

Effect: Feed stop, Read in lock

Meaning: At NC start the tool turret is not referenced.

Remedy: Reference tool turret in JOG mode with tool turret key.

**7102 TOOL TURRET IN MOTION**

Effect: Tool turret swivels to the programmed position.

**7103 LIMIT-SWITCH CLAMPING EQUIPMENT 1**

Effect: Locking of NC start and main drive start, spindle stop S1

Meaning: The pick-up for the analogue value detects the clamping position as end position.

Remedy: Change clamping range of the clamping device (see "Machine Description - chapter C Programming and Operation").

**7104 QUILL IN INTERMEDIATE POSITION**

Effect: Feed hold / read in stop.

**7105 SET AWZ REFERENCE POINT**

Effect: The reference value of the AWZ motor was transferred to the acc.msds file.

**7900 INITIALIZE EMERGENCY OFF!**

Cause: The emergency off button must be initialized.

Remedy: Press and then release emergency off button.

**7901 INITIALIZE MACHINE DOORS!**

Cause: The machine doors must be initialized.

Remedy: Open the machine doors and close them again.

**7906 SET A-REFERENCE POINT**

Cause: The reference value of the A axis was adopted to the acc.esd file.

## Inputunit alarms 1700 - 1899

These alarms and messages are raised by the control keyboard.

### **1701 Error in RS232**

Cause: Serial port settings are invalid or the connection to the serial keyboard were interrupted.

Remedy: Check the settings of the serial interface and/or turn keyboard off/on and check the control cable connection.

### **1703 Ext. keyboard not available**

Cause: Connection with the external keyboard can not be made.

Remedy: Check the settings of the external keyboard and/or check the cable connection.

### **1704 Ext. keyboard: checksum error**

Cause: Error in the transmission.

Remedy: The connection to the keyboard is automatically restored. If this fails, turn off or on the keyboard.

### **1705 Ext. keyboard: general error**

Cause: The attached keyboard reported an error.

Remedy: Plug the keyboard off and on again. Contact EMCO Customer Service if the error occurs on several occasions.

### **1706 General USB error**

Cause: Error in the USB communication.

Remedy: Plug the keyboard off and on again. Contact EMCO Customer Service if the error occurs on several occasions

### **1707 Ext. Keyboard: no LEDs**

Cause: Fehlerhaftes LED-Kommando wurde an die Tastatur gesandt.

Remedy: EMCO-Service kontaktieren.

### **1708 Ext. Keyboard: unknown command**

Cause: Unknown command was sent to the keyboard.

Remedy: Contact EMCO Customer Service

### **1710 Installation of Easy2control is damaged!**

Cause: Incorrect installation of Easy2control

Remedy: Reinstall software and/or contact EMCO Customer Service

### **1711 Initialization of Easy2Control failed!**

Cause: Configuration file onscreen.ini for Easy2control is missing.

Remedy: Reinstall software and/or contact EMCO Customer Service.

### **1712 USB-Dongle for Easy2control could not be found!**

Cause: USB-Dongle for Easy2control is not connected. Easy2control is displayed but can not be operated.

Remedy: Connect USB-Dongle for Easy2control.

### **1801 Keytable not found!**

Cause: The file with the keytable couldn't be found.

Remedy: Reinstall software and/or contact EMCO Customer Service.

### **1802 Connection to keyboard lost**

Cause: Connection to the serial keyboard was interrupted.

Remedy: Turn keyboard off/on and check the cable connection.



## Axis Controller Alarms

### 8000 - 9000, 22000 - 23000, 200000 - 300000

#### 8000 Fatal Error AC

##### 8100 Fatal init error AC

Cause: Internal error

Remedy: Restart software or reinstall when necessary, report to EMCO, if repeatable.

##### 8101 Fatal init error AC

see 8101.

##### 8102 Fatal init error AC

see 8101.

##### 8103 Fatal init error AC

see 8101.

##### 8104 Fatal system error AC

see 8101.

##### 8105 Fatal init error AC

see 8101.

##### 8106 No PC-COM card found

Cause: PC-COM board can not be accessed (ev. not mounted).

Remedy: Mount board, adjust other address with jumper

##### 8107 PC-COM card not working

see 8106.

##### 8108 Fatal error on PC-COM card

see 8106.

##### 8109 Fatal error on PC-COM card

see 8106.

##### 8110 PC-COM init message missing

Cause: Internal error

Remedy: Restart software or reinstall when necessary, report to EMCO, if repeatable.

##### 8111 Wrong configuration of PC-COM

see 8110.

##### 8113 Invalid data (pccom.hex)

see 8110.

##### 8114 Programming error on PC-COM

see 8110.

##### 8115 PC-COM packet acknowledge missing

see 8110.

##### 8116 PC-COM startup error

see 8110.

##### 8117 Fatal init data error (pccom.hex)

see 8110.

##### 8118 Fatal init error AC

see 8110, ev. insufficient RAM memory

##### 8119 PC interrupt no. not valid

Cause: The PC interrupt number can not be used.

Remedy: Find out free interrupt number in the Windows95 system control (allowed: 5,7,10, 11, 12, 3, 4 und 5) and enter this number in WinConfig.

##### 8120 PC interrupt no. unmaskable

see 8119

##### 8121 Invalid command to PC-COM

Cause: Internal error or defective cable

Remedy: Check cables (screw it); Restart software or reinstall when necessary, report to EMCO, if repeatable.

##### 8122 Internal AC mailbox overrun

Cause: Internal error

Remedy: Restart software or reinstall when necessary, report to EMCO, if repeatable.

##### 8123 Open error on record file

Cause: Internal error

Remedy: Restart software or reinstall when necessary, report to EMCO, if repeatable.

##### 8124 Write error on record file

Cause: Internal error

Remedy: Restart software or reinstall when necessary, report to EMCO, if repeatable.

##### 8125 Invalid memory for record buffer

Cause: Insufficient RAM, record time exceeding.

Remedy: Restart software, ev. remove drivers etc. to gain more RAM, reduce record time.

##### 8126 AC Interpolation overrun

Cause: Ev. insufficient computer performance.

Remedy: Set a longer interrupt time in WinConfig. This may result in poorer path accuracy.

##### 8127 Insufficient memory

Cause: Insufficient RAM

Remedy: Close other programs, restart software, ev. remove drivers etc. to gain more RAM.

##### 8128 Invalid message to AC

Cause: Internal error

Remedy: Restart software or reinstall when necessary, report to EMCO, if repeatable.

##### 8129 Invalid MSD data - axisconfig.

see 8128.

##### 8130 Internal init error AC

see 8128.

##### 8130 Internal init error AC

see 8128.

**8132 Axis accessed by multiple channels**

see 8128.

**8133 Insufficient NC block memory AC**

see 8128.

**8134 Too much center points programmed**

see 8128.

**8135 No centerpoint programmed**

see 8128.

**8136 Circle radius too small**

see 8128.

**8137 Invalid for Helix specified**

Cause: Wrong axis for helix. The combination of linear and circular axes does not match.

Remedy: Program correction.

**8140 Maschine (ACIF) not responding**

Cause: Machine off or not connected.

Remedy: Switch on machine or connect.

**8141 Internal PC-COM error**

Cause: Internal error

Remedy: Restart software or reinstall when necessary, report to EMCO, if repeatable.

**8142 ACIF Program error**

Cause: Internal error

Remedy: Restart software or reinstall when necessary, report to EMCO, if repeatable.

**8143 ACIF packet acknowledge missing**

see 8142.

**8144 ACIF startup error**

see 8142.

**8145 Fatal init data error (acif.hex)**

see 8142.

**8146 Multiple request for axis**

see 8142.

**8147 Invalid PC-COM state (DPRAM)**

see 8142.

**8148 Invalid PC-COM command (CNo)**

see 8142.

**8149 Invalid PC-COM command (Len)**

see 8142.

**8150 Fatal ACIF error**

see 8142.

**8151 AC Init Error (missing RPG file)**

see 8142.

**8152 AC Init Error (RPG file format)**

see 8142.

**8153 FPGA program timeout on ACIF**

see 8142.

**8154 Invalid Command to PC-COM**

see 8142.

**8155 Invalid FPGA packet acknowledge**

see 8142 or hardware error on ACIF board (contact EMCO Service).

**8156 Sync within 1.5 revol. not found**

see 8142 or Bero hardware error (contact EMCO Service).

**8157 Data record done**

see 8142.

**8158 Bero width too large (referencing)**

see 8142 or Bero hardware error (contact EMCO Service).

**8159 Function not implemented**

Bedeutung: In normal operation this function can not be executed

**8160 Axis synchronization lost axis 3..7**

Cause: Axis spins or slide is locked, axis synchronisation was lost

Remedy: Approach reference point

**8161 X-Axis synchronization lost**

Step loss of the step motor. Causes:

- Axis mechanically blocked
- Axis belt defective
- Distance of proximity detector too large (>0,3mm) or proximity detector defective
- Step motor defective

**8162 Y-Axis synchronization lost**

see 8161

**8163 Z-Axis synchronization lost**

see 8161

**8164 Software limit switch max axis 3..7**

Cause: Axis is at traverse area end

Remedy: Retract axis

**8168 Software limit overtravel axis 3..7**

Cause: Axis is at traverse area end

Remedy: Retract axis

**8172 Communication error to machine**

Cause: Internal error

Remedy: Restart software or reinstall when necessary, report to EMCO, if repeatable. Check connection PC - machine, eventually eliminate distortion sources.

**8173 INC while NC program is running**

Remedy: Stop the program with NC stop or with Reset. Traverse the axis.

**8174 INC not allowed**

Cause: At the moment the axis is in motion.

Remedy: Wait until the axis stops and then traverse the axis.

**8175 MSD file could not be opened**

Cause: Internal error

Remedy: Restart software oder bei Bedarf neu installieren, report to EMCO, if repeatable.

**8176 PLS file could not be opened**

see 8175.



**8177 PLS file could not be accessed**

see 8175.

**8178 PLS file could not be written**

see 8175.

**8179 ACS file could not be opened**

see 8175.

**8180 ACS file could not be accessed**

see 8175.

**8181 ACS file could not be written**

see 8175.

**8183 Gear too high**

Cause: The selected gear step is not allowed at the machine.

**8184 Invalid interpolaton command****8185 Forbidden MSD data change**

see 8175.

**8186 MSD file could not be opened**

see 8175.

**8187 PLC program error**

see 8175.

**8188 Gear command invalid**

see 8175.

**8189 Invalid channel assignement**

see 8175.

**8190 Invalid channel within message**

see 8175.

**8191 Invalid jog feed unit**

Cause: The machine does not support the rotation feed in the JOG operating mode.

Remedy: Order a software update from EMCO.

**8192 Invalid axis in command**

see 8175.

**8193 Fatal PLC error**

see 8175.

**8194 Thread without length**

Cause: The programmed target coordinates are identical to the starting coordinates.

Remedy: Correct the target coordinates.

**8195 No thread slope in leading axis**

Remedy: Program thread pitch

**8196 Too many axis for thread**

Remedy: Program max. 2 axes for thread.

**8197 Thread not long enough**

Cause: Thread length too short.

With transition from one thread to the other the length of the second thread must be sufficient to produce a correct thread.

Remedy: Longer second thread or replace it by a linear interpolation (G1).

**8198 Internal error (to many threads)**

see 8175.

**8199 Internal error (thread state)**

Cause: Internal error

Remedy: Restart software or reinstall when necessary, report to EMCO, if repeatable.

**8200 Thread without spindle on**

Remedy: Switch on spindle

**8201 Internal thread error (IPO)**

see 8199.

**8201 Internal thread error (IPO)**

see 8199.

**8203 Fatal AC error (0-ptr IPO)**

see 8199.

**8204 Fatal init error: PLC/IPO running**

see 8199.

**8205 PLC Runtime exceeded**

Cause: Insufficient computer performance

**8206 Invalid PLC M-group initialisation**

see 8199.

**8207 Invalid PLC machine data**

see 8199.

**8208 Invalid application message**

see 8199.

**8212 Rotation axis not allowed**

see 8199.

**8213 Circle and rotation axis can't be interpolated****8214 Thread and rotation axis cant't be interpolated****8215 Invalid state**

see 8199.

**8216 No rotation axis for rotation axis switch**

see 8199.

**8217 Axis type not valid!**

Cause: Switching during the rotary axis operating mode when the spindle is running.

Remedy: Stop the spindle and switch over to the rotary axis operating mode.

**8218 Referencing round axis without selected round axis!**

see 8199.

**8219 Thread not allowed without spindle encoder!**

Cause: Thread cutting, respectively tapping is only possible with spindles with encoders.

**8220 Buffer length exceeded in PC send message!**

see 8199.

**8221 Spindle release although axis is no spindle!**

see 8199.

**8222 New master spindle is not valid**

Cause: The indicated master spindle is not valid when switching over to the master spindle.

Remedy: Correct the spindle number.

**8224 Invalid stop mode**

see 8199.

**8225 Invalid parameter for BC\_MOVE\_TO\_IO!**

Cause: The machine is not configured for touch probes. A traversing movement with rotary axis is not allowed during touch probe operating mode.

Remedy: Remove the rotary axis movement from the traversing movement.

**8226 Rotary axis switch not valid (MSD data)!**

Cause: The indicated spindle does not have a rotary axis.

**8228 Rotary axis switch not allowed while axis move!**

Cause: The rotary axis has moved during switching over to the spindle operating mode.

Remedy: Stop the rotary axis before switching.

**8229 Spindle on not allowed while rotary axis is active!****8230 Program start not allowed due to active spindle rotation axis!****8231 Axis configuration (MSD) for TRANSMIT not valid!**

Cause: Transmit is not possible at this machine.

**8232 Axis configuration (MSD) for TRACYL not valid!**

Cause: Tracyl is not possible at this machine.

**8233 Axis not available while TRANSMIT/TRACYL is active!**

Cause: Programming of the rotary axis is not allowed during Transmit/ Tracyl.

**8234 Axis control grant removed by PLC while axis interpolates!**

Cause: Internal error

Remedy: Delete error with reset and inform EMCO.

**8235 Interpolation invalid while axis control grant is off by PLC!**

see 8234.

**8236 TRANSMIT/TRACYL activated while axis or spindle moves!**

see 8234.

**8237 Motion through pole in TRANSMIT!**

Cause: It is not allowed to move through the coordinates X0 Y0 in Transmit.

Remedy: Alter the traversing movement.

**8238 Speed limit in TRANSMIT exceeded!**

Cause: The traversing movement gets too close to the coordinates X0 Y0. In order to observe the programmed feed rate, the maximum speed of the rotary axis would have to be exceeded.

Remedy: Reduce the feed rate. Set the value of the C-axis feed limitation in WinConfig, machine data settings / general machine data/ to 0.2. Thus, the feed rate will be automatically reduced near the coordinates X0 Y0.

The distance to the center is calculated with the following formula:

for CT155/CT325/CT450:

$$F[\text{mm/min}] * 0.0016 = \text{distance} [\text{mm}]$$

for CT250:

$$F[\text{mm/min}] * 0.00016 = \text{distance} [\text{mm}]$$

This applies for rapid traverse in transmit:

CT155/250/325: 4200 mm/min

CT450: 3,500 mm/min

**8239 DAU exceeded 10V limit!**

Cause: Internal error

Remedy: Start the software again or install it anew. Report the error to EMCO.

**8240 Function not valid during active transformation (TRANSMIT/TRACYL)!**

Cause: The Jog and INC operating mode are not possible during Transmit in X/C and during Tracyl in the rotary axis.

**8241 TRANSMIT not enabled (MSD)!**

Cause: Transmit is not possible at this machine.

**8242 TRACYL not enabled (MSD)!**

Cause: Tracyl is not possible at this machine.

**8243 Round axis invalid during active transformation!**

Cause: It is not allowed to program the rotary axis during Transmit/Tracyl.

**8245 TRACYL radius = 0!**

Cause: When selecting Tracyl, a radius of 0 was used.

Remedy: Correct the radius.

**8246 Offset alignment not valid for this state!**

see 8239.

**8247 Offset alignment: MSD file write protected!****8248 Cyclic supervision failed!**

Cause: The communication with the machine keyboard is interrupted.

Remedy: Start the software again or install it anew. Report the error to EMCO.

**8249 Axis motion check alarm!**

see 8239

**8250 Spindle must be rotation axis !**

see 8239

**8251 Lead for G331/G332 missing !**

Cause: The threading pitch is missing or the starting coordinates are identical to the target coordinates.

Remedy: Program the threading pitch.  
Correct the target coordinates.

**8252 Multiple or no linear axis programmed for G331/G332 !**

Remedy: Program exactly one linear axis.

**8253 Speed value for G331/G332 and G96 missing !**

Cause: No cutting speed has been programmed.

Remedy: Program the cutting speed.

**8254 Value for thread starting point offset not valid!**

Cause: The thread starting point offset is not within the range of 0 to 360°.

Remedy: Correct the thread starting point offset.

**8255 Reference point not in valid software limits!**

Cause: The reference point has been defined outside the software limit switches.

Remedy: Correct the reference points in WinConfig.

**8256 Spindle speed too low while executing G331/G332!**

Cause: During tapping the spindle speed has decreased. Perhaps the incorrect threading pitch was used or the core drilling is not correct.

Remedy: Correct the threading pitch. Adapt the diameter to the core drilling.

**8257 Real Time Module not active or PCI card not found!**

Cause: ACC could not be started correctly or the PCI card in the ACC was not recognized.

Remedy: Report the error to EMCO.

**8258 Error allocating Linux data!**

see 8257.

**8259 Current thread in sequence not valid!**

Cause: One block of a thread in sequence has been programmed without thread G33.

Remedy: Correct the program.

**8260 Change of leading axis within the thread sequence !**

Cause: Occurs if the thread run-out of the longitudinal thread is set so that it's not possible to reach the target point. with the required stopping distance

Remedy: The thread run-out should be at least as large as the pitch. this error also occurs. if the pitch of a thread chain is too large when changing the leading axis.

**8261 Missing thread in sequence !**

Cause: A successive thread has not been programmed for a thread in sequence, the number has to be in accordance with the SETTHREADCOUNT () that has been defined before.

Remedy: Correct the number of threads in the thread in sequence and add a thread.

**8262 Reference marks are not close enough !**

Cause: The settings of the linear scale have been changed or the linear scale is defective.

Remedy: Correct the settings. Contact EMCO.

**8263 Reference marks are too close together!**

see 8262.

**8265 No or wrong axis in axis switch command!**

Cause: Internal error.

Remedy: Please contact the EMCO after-sales service.

**8266 Invalid tool**

Cause: Programmed tool is not set in magazine.

Remedy: Correct tool number and/or load tool in magazine.

**8267 Speed difference to high**

Cause: Die Soll- und Istgeschwindigkeit der Achse weichen zu stark voneinander ab.

Remedy: Run the program again with reduced feed. If this does not remedy the problem, contact EMCO.

**8269 USBSPS and ACC speed values or override are different**

Cause: USBSPS and ACC have different rotations saved.

Remedy: Delete alarm using the RESET key. If this error reoccurs, contact EMCO.

**8270 Reference switch defective**

Cause: The reference switch did not switch within the specified range.

Remedy: Cancel alarm with RESET button. If the problem occurs several times, contact EMCO.

**8271 Tool load in locked place not possible**

Cause: There was an attempt to swing a tool into a locked place in the magazine.

Remedy: Choose a free, unlocked place in the magazine and then swing the tool into the magazine.

**8272 Old PLC version, update necessary**

Cause: The PLC version is too old to fully support randomised tool management.

Remedy: Update the PLC.

**8273 Spindle overload**

Cause: The spindle was overloaded and during processing the speed fell (to half of the target speed for more than 500ms).

Remedy: Cancel alarm with RESET button. Change the cut data (feed, speed, infeed).

**8274 Define tool before loading**

Cause: The tool must be defined in the tool list before it is possible to transfer the tool into the spindle.

Remedy: Create the tool in the tool list, then load.

**8275 Could not read position from absolute encoder**

Cause: The position of an absolute encoder could not be read.

Remedy: Turn off and on the machine. Contact EMCO service if the error occurs multiple times

**8276 Physical axis left the valid travel range**

Cause: An axis with absolute encoder is outside the valid range for travel.

Remedy: Turn off and on the machine. Contact EMCO service if the error occurs multiple times.

**8277 Sinamics drive package error active**

Cause: Error in Sinamics drive.

Remedy: Turn off and on the machine. Contact EMCO service if the error occurs multiple times.

**8278 Control not compatible with ACpn**

Cause: The WinNC control is incompatible with the ACpn machine.

Remedy: Install a WinNC control which is compatible with the ACpn.

**8279 Connection to drive got lost**

Cause: the connection between ACpn and CU320 was lost.

Remedy: Turn off and on the machine. Contact EMCO service if the error occurs multiple times

**8280 Reference point in setting data not equivalent with machine data, please check!**

Cause: The reference point saved in the AC setting data does not match the reference point in the machine data (ACC\_MSD).

Remedy: Measure the reference point of all axes anew and enter into EMConfig.

**8704 Feed override absent, REPOS is not executed**

Cause: The REPOS command is not executed because the feed override is set to 0%.

Remedy: Change the feed override and restart REPOS.

**8705 Tool sorting active**

Cause: The tools will be re-sorted with random tool management to facilitate non-random operation (tool 1 at place 1, tool 2 at place 2, etc.).

Remedy: Wait until sorting has finished. The controller will delete the report independently.

**8706 Check new controller - tool table**

Cause: The controller was changed with random tool management active.

Remedy: Check the tool or place table to clear the alarm.

**8707 Ending with auxiliary drives switched on not possible**

Cause: An attempt was made to end the controller, although the auxiliary drives are still switched on.

Remedy: Switch off the auxiliary drives and then end the controller.

**8710 Initiating communication with drives**

Cause: ACpn connects to the Sinamics drives

Remedy: Wait until the connection was established.

**8712 JOG in X and C deactivated during Transmit**

Cause: JOG in X and C is not possible at active Transmit.

**22000 Gear change not allowed**

Cause: Gear step change when the spindle is active.

Remedy: Stop the spindle and carry out a gear step change.

**22270 Feed too high (thread)**

Cause: Thread pitch too large / missing, Feed for thread reaches 80% of rapid feed

Remedy: Program correction, lower pitch or lower spindle speed for thread

**200000 to 300000 are specific to the drives and show up only in combination with the alarm # "8277 Sinamics error".****201699 - „(F) SI P1 (CU): Test of the shutdown path is necessary“**

Cause: A test of the shutdown path is necessary. The machine remains operational.

Remedy: The test is performed automatically during the next restart of the WinNC.

**235014 TM54F: Teststop necessary**

Cause: A teststop is necessary.

Remedy: Shutdown and restart the WinNC. The test is performed automatically during restart.



## Axis Controller Messages

### 8700 Execute REPOS in all axes before program start

Cause: After the program was stopped, the axes were manipulated with the hand wheel or with the jog keys and then a restart of the program was attempted.

Remedy: Before starting the program again, one should reposition the axes along the contour by executing "REPOS".

### 8701 No NCStop during offset align

Cause: The machine is currently executing an automatic offset adjustment. NC stop is not possible at this time.

Remedy: Wait until the offset adjustment is finished and then stop the program with NC stop.

### 8702 No NCStop during positioning after block search

Cause: The machine is currently finishing the block search operation and then it starts to go back to the last programmed position. No NC stop is possible in the meantime.

Remedy: Wait until positioning is finished and then stop the program with NC stop.

### 8703 Data record done

The recording of data is finished and the file record.acp has been copied to the installation folder.

### 8705 Feed-override missing, REPOS will not be executed

Cause: The spindle was overloaded and during processing the speed fell (to half of the target speed for more than 500ms).

Remedy: Cancel alarm with RESET button. Change the cut data (feed, speed, infeed).

### 8706 Tool sorting active

Cause: The tools were resorted during randomised tool management in order to enable non-randomised operation (tool 1 to place 1, tool 2 to place 2, etc.).

Remedy: Wait till the sorting is finished. The message will be deleted automatically by the control system.

### 8707 New control - please check tool table

Cause: The control system was changed when randomised tool management was active.

Remedy: Check the tool or place table to cancel the alarm.

### 8708 Switch off auxiliary drives for shutdown

Cause: There was an attempt to shut down the control system although the auxiliary drives are still switched on.

Remedy: Switch off the auxiliary drives and then shut down the control system.

### 8709 Insert tool in spindle for loading

Cause: During loading a tool must be physically available in the spindle.

Remedy: Clamp tool in the spindle. The message disappears.

## Control alarms 2000 - 5999

The alarms are released by the software.

**Fagor 8055 TC/MC**  
**Heidenhain TNC 426**  
**CAMConcept**  
**EASY CYCLE**  
**Sinumerik OPERATE**  
**Fanuc 31i**  
**Heidenhain TNC 640**

### 2200 Syntax error in line %s, column %s

Cause: Syntax error in the program code.

### 2001 Circle end point invalid

Cause: The start-middle point and middle-end point distances differ by more than 3 µm.

Remedy: Correct circular arc point.

### 2300 tracyl without corresponding round-axis invalid

Cause: Maybe the machine has no rotary axis.

### 3000 Traverse feed axis manually to position %s

Remedy: Move the axis manually to the required position.

### 3001 Tool T.. change!

Cause: A new tool was programmed in the NC program.

Remedy: Clamp the required tool in the machine.

### 4001 slot width too small

Cause: The tool radius is too large for the slot to be milled.

### 4002 slot length to small

Cause: The slot length is too small for the slot to be milled.

### 4003 length equal zero

Cause: Pocket length, pocket width, stud length, stud width are zero.

### 4004 slot width too big

Cause: The programmed slot width is larger than the slot length.

### 4005 depth equal zero

Cause: No machining takes place since no effective cutting depth has been defined.

### 4006 corner radius too big

Cause: The corner radius is too large for the size of the pocket.

### 4007 diameter too big

Cause: The remaining material (nominal diameter - diameter of the prebore) /2 is larger than the tool diameter.

### 4008 diameter too small

Cause: The tool diameter is too large for the intended bore.

Remedy: Enlarge the nominal diameter and use a smaller milling cutter.

### 4009 length too small

Cause: Width and length must be larger than the double tool radius.

### 4010 diameter less equal zero

Cause: The pocket diameter, the stud diameter, etc. must not be zero.

### 4011 blank diameter too big

Cause: The diameter of the machined pocket must be larger than the diameter of the premachined pocket.

### 4012 blank diameter too small

Cause: The diameter of the machined stud must be smaller than the diameter of the premachined stud.

**4013 start angle equal to end angle**

Cause: Start angle and end angle for hole pattern are identical.

**4014 tool radius 0 not permitted**

Cause: Tool radius zero is not permitted.

Remedy: Select a valid tool.

**4015 no outer contour defined**

Cause: The contour file indicated in the cycle was not found.

**4017 tool radius too big**

Cause: For the programmed machining, a tool being too large was selected. Therefore, machining is not possible.

**4018 allowance must not be 0**

Cause: There were programmed finishing operations without finishing offset.

**4019 too many iterations**

Cause: The contour definitions are too complex for the roughing-out cycle.

Remedy: Simplify the contour.

**4020 illegal radian correction**

Cause: An error has occurred during the programming of the radius compensation.

Remedy: Check the cycle parameters.

**4021 can't calculate parallel contour**

Cause: The control was not able to calculate the tool radius compensation.

Remedy: Check the programmed contour for plausibility. Maybe contact EMCO.

**4022 illegal contour definition**

Cause: The programmed contour is not suited to the selected machining.

Remedy: Check the programmed contour.

**4024 no contour definition**

Cause: The contour file being defined in the cycle has not been found.

**4025 internal calculation error**

Cause: An unexpected error has occurred during calculation of the cycle movements.

Remedy: Please inform the EMCO after-sales service.

**4026 allowance too big**

Cause: A part of the finishing offset (for several finishing passes) is larger than the total finishing offset.

Remedy: Correct the finishing offsets.

**4028 pitch 0 not permitted**

Cause: The thread was programmed with pitch zero.

**4029 undefined working mode**

Cause: Internal error (invalid machining type for the thread).

**4030 function not yet supported**

Cause: Roughing out with pockets is not implemented yet.

Remedy: Please inform the EMCO after-sales service.

**4031 value not permitted**

Cause: An invalid retracting direction was programmed during inside turning.

**4032 plunging must be defined**

Cause: For the programmed cycle no cutting depth has been programmed.

**4033 radius/chamfer too big**

Cause: The radius, respectively the chamfer, cannot be inserted in the programmed contour.

Remedy: Reduce the radius, respectively the chamfer.

**4034 diameter too big**

Cause: The programmed starting point and the machining diameter are contradictory.

**4035 diameter too small**

Cause: The programmed starting point and the machining diameter are contradictory.

**4036 unknown working direction**

Cause: Internal error.

Remedy: Please inform the EMCO after-sales service.

**4037 unknown working type**

Cause: Internal error.

Remedy: Please inform the EMCO after-sales service.

**4038 unknown sub cycle**

Cause: Internal error.

Remedy: Please inform the EMCO after-sales service.



**4039 rounding not possible**

Cause: The programmed radius contradicts the rest of the cycle parameters.

**4042 illegal tool width**

Cause: The tool width for the cutting-off cycle must be defined.

**4043 groove width too small**

Cause: Internal error.

Remedy: Please inform the EMCO after-sales service.

**4044 distance not defined**

Cause: The distance for the multiple grooving cycle must not be zero.

**4045 illegal allowance type**

Cause: Internal error.

Remedy: Please inform the EMCO after-sales service.

**4046 invalid speed**

Cause: The spindle speed must be nonzero.

**4047 invalid end point**

Cause: The programmed end point contradicts the rest of the cycle definition.

**4048 tool cut width too small**

Cause: The cutting edge is too small for the programmed cutting depth.

**4050 invalid distance**

Cause: The hole patterns do not tally with the selected distance.

**4052 working pattern not possible**

Cause: Error in the definition of the hole pattern. The number of bores is contradictory.

**4053 invalid start point**

Cause: Internal error.

Remedy: Please inform the EMCO after-sales service.

**4055 illegal working direction**

Cause: The machining direction is contradictory to the rest of the cycle definition.

**4057 plunging angle less equal zero**

Cause: The plunging angle must be between 0 and 90 degree.

**4058 chamfer too large**

Cause: The programmed chamfer is too large for the pocket cycle.

**4062 radius/chamfer too small**

Cause: The radius, respectively the chamfer, cannot be machined with the current tool radius.

**4066 invalid mill step**

Cause: The mill step must be greater than zero.

**4069 invalid angle**

Cause: An angle of zero degree is not permitted.

**4072 plunging too small**

Cause: For the cycle, a cutting depth has been selected that leads to extra-long machining time.

**4073 invalid clearance angle**

Cause: The clearance angle indicated for the tool cannot be machined.

Remedy: Correct the clearance angle for the tool.

**4074 contour-file not found**

Cause: The contour file indicated in the cycle has not been found.

Remedy: Please select the contour file for the cycle.

**4075 not machinable with selected tool**

Cause: The tool is too wide for the programmed groove.

**4076 reciprocating plunge cut impossible (initial move too short)**

Cause: The first movement of the contour is shorter than the double tool radius and cannot be therefore used for the swinging delivery.

Remedy: Extend the first movement of the contour.

**4077 wrong tool type in grooving or cut-off cycle**

Cause: The wrong tool type was used in the cutting cycle.

Remedy: Use only grooving and punch tools in the cutting cycles.

**4078 radius of helix too small**

Cause: The pitch of the helix is  $\leq 0$ .

Remedy: Program the radius  $> 0$ .

**4079 pitch of helix too small**

Cause: The radius of the helix is  $\leq 0$ .

Remedy: Program the pitch  $> 0$ .

**4080 radius of helix or tool too large**

Cause: The helical approach cannot be executed with the selected data for the helix and the current tool radius without a contour breach.

Remedy: Use a tool with a smaller radius or reduce the radius of the helix.

**4200 leaving movement is missing**

Cause: No movement after the tool radius compensation was deactivated in the current plane.

Remedy: Insert the departing movement in the current plane after having deactivated the tool radius compensation.

**4201 TPC off missing**

Cause: The tool radius compensation has not been deactivated.

Remedy: Deactivate the tool radius compensation.

**4202 TPC requires at least three movements**

Cause: The tool radius compensation requires at least 3 movements in the current plane in order to calculate the tool radius compensation.

**4203 approaching movement not possible**

Cause: It was not possible to calculate the approaching movement.

**4205 leaving movement not possible**

Cause: It was not possible to calculate the departing movement.

**4208 TPC curve could not be calculated**

Cause: It was not possible to calculate the tool radius compensation for the programmed contour.

**4209 switching the plane is not allowed when TPC is switched on**

Cause: The programmed plane must not be changed during the tool radius compensation.

Remedy: Remove the change of planes during the tool radius compensation.

**4210 tool path compensation already activated**

Cause: G41 is active and G42 was programmed or G42 is active and G41 was programmed.

Remedy: Switch tool radius compensation off with G40 before programming the radius compensation again.

**4211 Bottleneck detected**

Cause: In the radius correction calculation some parts of the contour were omitted, as too large a milling cutter tool was used.

Remedy: Use a smaller milling cutting tool to process the contour completely.

**4212 Infeed has been programmed twice during approach**

Cause: After the approach movement a second infeed has been programmed, without previously moving to the work plane.

Remedy: First program a movement to the work plane before programming a second infeed.

**5000 drill manually now****5001 contour has been adjusted to the programmed clearance angle**

Cause: The programmed contour was adapted to the programmed clearance angle. Maybe there will remain rest material that cannot be machined with this tool.

**5500 3D simulation: Internal error**

Cause: Internal error inside the 3D simulation.

Remedy: Restart the software or, if necessary, report the error to EMCO customer service.

**5502 3D simulation: Tool place invalid**

Cause: Tool place unavailable on the machine used.

Remedy: Correct tool call-up.

**5503 3D simulation: Chuck invalid owing to the unmachined part definition**

Cause: The distance from the front of the unmachined part is > the unmachined part length.

Remedy: Change the distance.

**5505 3D simulation: Unmachined part definition invalid**

Cause: Implausibility in the unmachined part geometry (e.g. expansion in one axis  $\leq 0$ , inside diameter > outside diameter, unmachined part contour not closed, etc.).

Remedy: Correct unmachined part geometry.

**5506 3D simulation: STL chuck file has auto-overcuts**

Cause: Error in the chuck description.

Remedy: Correct file.

**5507 3D simulation: Pole transit on TRANS-MIT!**

Cause: Travel comes too close to the X0 Y0 coordinates.

Remedy: Change travel.



# I: Control alarms Sinumerik Operate

## Control alarms 10000 - 66000

These alarms will be triggered by the control. These are the same alarms as they would appear on the original Sinumerik Operate control.

### 10001 Rotation invalid or scaling in the plane different:

**Declaration:** Coordinates: X0 Y0.

### 10002 Undefined tool created at magazine place %1, please check!

**Declaration:** There is a tool in the tool magazine place assignment that was not defined in the control system if it had been processed previously with a different control system. A new tool with the name CHECK\_TOOL%1 is generated.

**Remedy:** Check magazine and change tool name and data.

### 10003 Active tool %1 cannot be deleted or unloaded.

**Declaration:** The tool selected for deleting or unloading is active.

**Remedy:** Select a different tool.

### 10795 [Channel %1: ] Block %2 end point specification during angle programming contradictory

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** During programming of a straight line, both positions of the active plane and an angle were specified (the position of the end point is over-specified), or the position of the programmed coordinate cannot be reached with the specified angle. If a contour consisting of two straight lines is to be programmed with angles, it is possible to specify the two axis positions of the plane and an angle in the second block. The error can also occur if, due to a programming error, the preceding block cannot be interpreted as the first subblock of such a contour. A block is interpreted as the first block of a two-block contour if an angle, but not an axis of the active plane, was programmed, and if the block is not already the second block of a contour.

**Remedy:** Modify part program.

### 10800 [Channel %1: ] Block %3 axis %2 is not a geometry axis

**Parameters:** %1 = Channel number

%2 = Axis name, spindle number

%3 = Block number, label

**Definitions:** With an active transformation or a frame with a rotation component the geometry axes are needed for block preparation. If a geometry axis has previously been traversed as positioning axis, it retains its status of "positioning axis" until it is again programmed as a geometry axis. Because of the POSA motion beyond block boundaries, it is not possible to identify in the preprocessing run whether the axis has already reached its target position when the block is executed. This is, however, an unconditional requirement for calculating the ROT component of the frame or of the transformation. If geometry axes are used as positioning axes, then: 1. No rotation may be specified in the current overall frame. 2. No transformation may be selected.

**Remedy:** After selecting transformation or frame, reprogram the geometry axis now operating as positioning axis (e.g. with WAITP) in order to revert the status to "geometry axis."

### 10865 [Channel %1: ] Block %2 FZ active, but no tool offset, tool %3

**Parameters:** %1 = Channel number %2 = Axis name, spindle number %3 = Tool

**Explanation:** For the displayed traversing block a tooth feedrate is active, but no tool offset. Traversing can be performed after the error has been acknowledged. For calculation of the effective feedrate one tooth per revolution will be assumed.

**Remedy:** Check the NC program for correct tool selection and correct it, if required; then continue the program with NC start. Or: Continue the NC program with NC start. For calculation of the effective feedrate one tooth per revolution is assumed.

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**10866 [Channel %1: ] Block %2 FZ is active, but the number of teeth of the active D number %4 of tool %3 is zero.**

**Parameters:** %1 = Channel number %2 = Block number, label %3 = Identifier %4 = D number

**Explanation:** Tooth feedrate is active for the displayed traversing block, but a D number of 0 is selected with \$TC\_DPNT (number of teeth). Traversing can be performed after acknowledgement of the error. For calculation of the effective feedrate one tooth per revolution is assumed.

**Remedy:** Check the NC program for correct tool selection and correct it, if required; then continue the NC program with NC start. Or: Continue the NC program with NC start. The feedrate will be calculated assuming 1 tooth.

**10931 [Channel %1: ] Block %2 incorrect stock removal contour**

**Parameters:** %1 = Channel number %2 = Block number, label

**Definitions:** The following errors occurred in the subroutine for the contour during stock removal:

- Full circle
- Overlapping contour elements
- Wrong start position

**Remedy:** The errors listed above must be corrected in the subroutine for the stock removal contour.

**10932 [Channel %1: ] Block %2 preparation of contour has been restarted**

**Parameters:** %1 = Channel number %2 = Block number, label

**Definitions:** The first contour preparation/contour decoding run must be terminated with EXECUTE.

**Remedy:** Program the keyword EXECUTE to terminate the contour preparation in the part program before again calling up contour segmentation (keyword CONTPRON).

**10933 [Channel %1: ] Block %2 contour program does not contain enough contour blocks**

**Parameters:** %1 = Channel number %2 = Block number, label

**Definitions:** The contour program contains:

- Less than 3 contour blocks with CONTPRON
- No contour blocks with CONTDCON

**Remedy:** Increase the size of the program with the stock removal contour to include at least 3 NC blocks with movements in both axes of the current machining plane.

**12150 [Channel %1: ] Block %2 operation %3 not compatible with data type**

**Parameters:** %1 = Channel number

%2 = Block number, label

%3 = String (violating operator)

**Explanation:** The data types are not compatible with the required operation (within an arithmetic expression or in a value assignment).

Example 1:

```
Arithmetic operation
N10 DEF INT OTTO
N11 DEF STRING[17] ANNA
N12 DEF INT MAX
```

:

```
N50 MAX = OTTO + ANNA
```

Example 2:

```
Value assignment
N10 DEF AXIS DRILL
N11 DEF INT OTTO
```

:

```
N50 OTTO = DRILL
```

**Remedy:** Press the NC Stop key and select the function "Correction block" with the softkey PROGRAM CORRECT. The correction pointer positions on the incorrect block.

Alter the definition of the variables used such that the required operations can be executed.

**12190 [Channel %1: ] Block %2 variable of type ARRAY has too many dimensions**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Array with variables of type STRING may be no more than 1-dimensional, and with all other variables no more than 2-dimensional.

**Remedy:** Press the NC Stop key and select the function "Correction block" with the softkey PROGRAM CORRECT. The correction pointer positions on the incorrect block. Correct the array definition, with multi-dimensional arrays define a second 2-dimensional array if necessary and operate it with the same field index.

**12300 [Channel %1: ] Block %2 call-by-reference parameter missing on**

subroutine call %3

**Parameters:** %1 = Channel number

%2 = Block number, label

%3 = Source string

**Explanation:** In the subroutine definition, a formal REF parameter (call-by-reference parameter) has been specified

with no actual parameter assigned to it.

The assignment takes place in the subroutine call on the basis of the position of the variable name

and not on the basis of the name!

Example:

Subroutine: (2 call-by-value parameters X and Y,  
1 call-by-reference parameter Z)

```
PROC XYZ (INT X, INT Y, VAR INT Z)
```

```
:
```

```
M17
```

```
ENDPROC
```

Main program:

```
N10 DEF INT X
```

```
N11 DEF INT Y
```

```
N11 DEF INT Z
```

```
:
```

```
N50 XYZ (X, Y); REF parameter Z missing
```

or

```
N50 XYZ (X, Z) ; REF parameter Z missing!
```

**Remedy:** Press the NC Stop key and select the function "Correction block" with the softkey PROGRAM CORRECT. The correction pointer positions on the incorrect block. Assign a variable to all REF parameters (call-by-reference parameters) of the subroutine when calling. No variable must be assigned to "normal" formal parameters (call-by-value parameters), as these are defaulted with 0.

### 12320 [Channel %1: ] Block %2 parameter %3 is no variable

**Parameters:** %1 = Channel number %2 = Block number, label %3 = Source string

**Explanation:** A constant or the result of a mathematical expression has been assigned to a REF parameter instead of a variable at the time of the subroutine call, even though only variable identifiers are allowed. Examples: N10 XYZ (NAME\_1, 10, OTTO) or N10 XYZ (NAME\_1, 5 + ANNA, OTTO)

**Remedy:** Press the NC Stop key and select the function "Correction block" with the softkey PROGRAM CORRECT. The correction pointer positions on the incorrect block. Remove the constant or the mathematical expression from the NC block.

### 12330 [Channel %1: ] Block %2 type of parameter %3 incorrect

**Parameters:** %1 = Channel number %2 = Block number, label %3 = Source string

**Explanation:** When calling a procedure (a subroutine) it is found that the type of the actual parameter cannot be converted into the type of the formal parameter. There are two possible cases:

- Call-by-reference parameter: Actual parameter and formal parameter must be of precisely the same type, e.g. STRING, STRING.

- Call-by-value parameter: Actual parameter and formal parameter can in principle be different providing conversion is basically possible. In the present case, however, the types are generally not compatible, e.g. STRING -> REAL.

Overview of type conversions:

- from REAL to: REAL: yes, INT: yes\*, BOOL: yes1), CHAR: yes\*, STRING: -, AXIS: -, FRAME: -
- from INT to: REAL: yes, INT: yes, BOOL: yes1), CHAR: if value 0 ...255, STRING: -, AXIS: -, FRAME: -
- from BOOL to: REAL: yes, INT: yes, BOOL: yes, CHAR: yes, STRING: -, AXIS: -, FRAME: -
- from CHAR to: REAL: yes, INT: yes, BOOL: yes1), CHAR: yes, STRING: yes, AXIS: -, FRAME: -
- from STRING to: REAL: -, INT: -, BOOL: yes2), CHAR: only if 1 character, STRING: yes, AXIS: -, FRAME: -
- from AXIS to: REAL: -, INT: -, BOOL: -, CHAR: -, STRING: -, AXIS: yes, FRAME: -
- from FRAME to: REAL: -, INT: -, BOOL: -, CHAR: -, STRING: -, AXIS: -, FRAME: yes

1) Value <> 0 corresponds to TRUE, value ==0 corresponds to FALSE.

2) String length 0 => FALSE, otherwise TRUE.

\*) At type conversion from REAL to INT fractional values that are >=0.5 are rounded up, others are rounded down.

**Remedy:** Press the NC Stop key and select the function "Correction block" with the softkey PROGRAM CORRECT. The correction pointer positions on the incorrect block. Check transfer parameters of the subroutine call and define the application accordingly as call-byvalue or call-by-reference-parameter.

### 12340 [Channel %1: ] Block %2 number of parameters too high %3

**Parameters:** %1 = Channel number %2 = Block number, label %3 = Source string

**Explanation:** When calling a function or a procedure (predefined or user-defined) more parameters were transferred than defined. Predefined functions and procedures: The number of parameters has been set permanently in the NCK. User-defined functions and procedures: The number of parameters is established by type and name in the definition.

**Remedy:** Press the NC Stop key and select the function "Correction block" with the softkey PROGRAM CORRECT. The correction pointer positions on the incorrect block. Check whether the correct procedure/function has been called. Program the number of parameters in accordance with the procedure/function.

**12360 [Channel %1: ] Block %2 dimension of parameter %3 incorrect**

**Parameters:** %1 = Channel number %2 = Block number, label %3 = Source string

**Explanation:** The following possibilities of error must be checked:

- The current parameter is an array, but the formal parameter is a variable
- The current parameter is a variable, but the formal parameter is an array

**Remedy:** Press the NC Stop key and select the function "Correction block" with the softkey PROGRAM CORRECT. The correction pointer positions on the incorrect block. Correct the NC part program in accordance with the cause of error as listed above.

**12400 [Channel %1: ] Block %2 field %3 element does not exist**

**Parameters:** %1 = Channel number %2 = Block number, label %3 = Source string

**Explanation:** The following causes are possible:

- Impermissible index list; an axis index is missing
- Array index does not match the definition of the variables

- An attempt was made to access a variable at array initialization via SET or REP; this attempt did not correspond to the standard access. Single character access, partial frame access, omitted indices not possible. A non-existent element was addressed on initializing this array.

**Remedy:** Press the NC Stop key and select the function "Correction block" with the softkey PROGRAM CORRECT. The correction pointer positions on the incorrect block. Array initialization: Check the array index of the addressed element. The 1st array element is given the index [0,0], the 2nd array element [0,1] etc. The right array index (column index) is incremented first. In the 2nd row, the 4th element is also addressed with the index [1,3] (the indices start at zero). Array definition: Check the size of the array. The 1st number indicates the number of elements in the 1st dimension (number of rows), the 2nd number indicates the number of elements in the 2nd dimension (number of columns). An array with 2 rows and 3 columns must be defined by specifying [2,3].

**12430 [Channel %1: ] Block %2 specified index is invalid**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** In specifying an array index (in the array definition) an index was used that is outside the permissible range.

**Remedy:** Press the NC Stop key and select the function "Correction block" with the softkey PROGRAM CORRECT. The correction pointer positions on the incorrect block. Specify array index within the permissible range. Value range per array dimension: 1 - 32 767.

**12470 [Channel %1: ] Block %2 G function %3 is unknown**

**Parameters:** %1 = Channel number  
%2 = Block number, label  
%3 = Source string

**Definitions:** With indirectly programmed G functions, an invalid or non-allowed group number has been programmed. Allowed group number = 1. and 5 max. number of G groups. In the displayed block, a nondefined G function has been programmed. Only "real" G functions are checked, which begin with the address G, e.g. G555. "Named" G functions such as CSPLINE, BRISK etc. are interpreted as subroutine names.

**Remedy:** Press the NC Stop key and select the function "Correction block" with the softkey PROGRAM CORRECT. The correction pointer positions on the incorrect block. You should decide on the basis of the machine manufacturer's programming guide whether or not the displayed G function exists or is available, or whether a standard G function has been reconfigured (or introduced by an OEM). Remove G function from the part program or program function call in accordance with the machine manufacturer's programming guide.

**12475 [Channel %1: ] Block %2 invalid G function number %3 programmed**

**Parameters:** %1 = Channel number  
%2 = Block number, label  
%3 = G code number

**Definitions:** A non-allowed G function number (parameter 3) has been programmed for a G group with indirect G code programming. Only the G function numbers indicated in the Programming Guide "Fundamentals", Section 12.3 "List of G functions/Path conditions" are allowed. Alarm display.

**Remedy:** Modify part program.

**12550 [Channel %1: ] Block %2 name %3 not defined or option/function not activated**

**Parameters:** %1 = Channel number  
%2 = Block number, label  
%3 = Source symbol

**Explanation:** The identifier displayed has not been defined before being used.

\_N\_SMAC\_DEF



\_N\_MMAL\_DEF  
 \_N\_UMAL\_DEF  
 \_N\_SGUD\_DEF  
 \_N\_MGUD\_DEF  
 \_N\_UGUD\_DEF

Variable: DEF instruction is missing  
 Program: PROC declaration is missing  
 The T word cannot be interpreted in ISO mode 2,  
 \$MN\_EXTERN\_DIGITS\_TOOL\_NO and \$MN\_extern\_digits\_offset\_no are 0.

**Remedy:** Press the NC Stop key and select the function "Compensation block" with the softkey PROGRAM

CORRECT. The cursor positions itself on the incorrect block.

- Correct the name used (writing error)
- Check definitions of variables, subroutines and macros
- Declare subroutine with EXTERN, load subroutine to SPF-Dir
- Check interface definition of subroutine
- Check options. See also MD10711 \$MN\_NC\_LANGUAGE\_CONFIGURATION.

#### 12555 [Channel %1: ] Block %2 function not available (identification %3)

**Parameters:** %1 = Channel number  
 %2 = Block number, label  
 %3 = Fine ID

**Definitions:** The identifier has not been defined for this system.

**Remedy:** Press the NC stop key and select the "Compensation block" function by pressing the "Program correct" softkey. The correction indicator will position in the incorrect block.

- Correct the name used (write error)
- Use a better software system in case of malfunction
- Check the definition of variables, subroutines and macros
- Declare a subroutine with EXTERNAL; load the subroutine to SPF-Dir
- Check the interface definition of the subroutine

#### 12640 [Channel %1: ] Block %2 invalid nesting of control structures

**Parameters:** %1 = Channel number %2 = Block number

**Explanation:** Error in program run: Opened control structures (IF-ELSE-ENDIF, LOOP-ENDLOOP etc.) are not terminated or there is no beginning of loop for the programmed end of loop. Example: LOOP ENDIF ENDLOOP

**Remedy:** Correct part program in such a way that all opened control structures are also terminated.

#### 14009 [Channel %1: ] Block %2 illegal program path %3

**Parameters:** %1 = Channel number  
 %2 = Block number, label  
 %3 = Program path

**Definitions:** The part program command CALL-PATH was called with a parameter (program path) referring to a directory which does not exist in the file system of the NCK.

**Remedy:** - Modify the CALLPATH instruction such that the parameter contains the complete path name of the loaded directory.

- Load the programmed directory in the file system of the NCK.

#### 14011[Channel %1: ] Block %2 program %3 not existing or will be edited

**Parameters:**%1 = Channel number%2 = Block number, label%3 = Program name

**Explanation:** A subroutine call was aborted because the called subroutine could not be opened.The subroutine call can be executed via- subroutine designator - CALL / PCALL / MCALL command- SETINT command- M/T function replacement- event-driven program calls (PROG\_EVENT)- selection of a PLC ASUB via PI "\_N\_ASUP\_" and/or FB-4- calling a PLC ASUB via interrupt interface (FC-9)There are various reasons for the alarm:- the subroutine is not in the parts program memory the subroutine- the subroutine is not in the search path (selected directory, \_N\_SPF\_DIR or cycle directories \_N\_CUS\_DIR, \_N\_CMA\_DIR, \_N\_CST\_DIR- the subroutine has not been released or is being edited- faulty absolute path name in subroutine call: Examples of complete path names: /\_N\_directoryName\_DIR/\_N\_programmName\_SPF or /\_N\_WKS\_DIR/\_N\_wpdName\_WPD/\_N\_programmName\_SPF. directoryName: MPF, SPF, CUS, CMA, CST (predefined directories). wpdName: application-specific designator for workpiece directories (max. of 24 signs). programmName: Name of subroutine (max. of 24 signs)- A reload buffer for executing from external was called as subroutine. Note: Unknown designators (string) found in the parts program line by themselves, are interpreted as subroutine calls.

**Remedy:** Ensure that the subroutine (alarm parameter %3)- is available in the parts program memory- has been released and is not being edited- is available in the search path if not being called via an absolute path name.

**14012 [Channel %1: ] Block %2 maximum sub-routine level exceeded**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Definitions:** The maximum nesting depth of 8 program levels has been exceeded.

Subroutines can be called from the main program, and these in turn may have a nesting depth of 7. In interrupt routines the maximum number of levels is 4!

**Remedy:** Modify the machining program so that the nesting depth is reduced, e.g. using the editor copy a subroutine of the next nesting level into the calling program and remove the call for this subroutine. This reduces the nesting depth by one program level.

**14013 [Channel %1: ] Block %2 number of subroutine passes invalid**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** In a subroutine call the programmed number of passes P is zero or negative.

**Remedy:** Program number of passes between 1 and 9 999.

**14020 [Channel %1: ] Block %2 wrong value or wrong number of parameters on function or procedure call**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** - An illegal parameter value was specified in a function or procedure call.

- An illegal number of actual parameters was programmed in a function or procedure call.

**Remedy:** Modify part program.

**14021 [Channel %1: ] Block %2 wrong value or wrong number of parameters on function or procedure call**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** - An illegal parameter value was specified in a function or procedure call.

- An illegal number of actual parameters was programmed in a function or procedure call.

**Remedy:** Modify part program.

**14080 [Channel %1: ] Block %2 jump destination %3 not found**

**Parameters:** %1 = Channel number %2 = Block number, label %3 = Jump destination

**Explanation:** In conditional and unconditional jumps, the jump destination within the program must be a block with a label (symbolic name instead of block number). If no jump destination has

been found with the given label when searching in the programmed direction, an alarm is output. For parameterizable returns with RET to block number or label, the jump destination within the program must be a block with the block number or label (symbolic name instead of block number). For returns over several levels (parameter 2), the jump destination must be a block within the program level you jumped to. For returns with a string as return destination, the search string must be a name known in the control and the search string must be preceded in the block by a block number and/or a label only.

**Remedy:** Check NC part program for the following possible errors:

1. Check whether the target designation is identical with the label.
2. Is the jump direction correct?
3. Has the label been terminated with a colon?

**14082 [Channel %1: ] Block %2 label %3 program section not found**

**Parameters:** %1 = Channel number %2 = Block number, label %3 = Start or end label

**Explanation:** The start point for repetition of the program part with CALL <program name> BLOCK <start label> TO <end label> has not been found or the same program part repetition has been called recursively.

**Remedy:** Check the start and end labels for programming repetition in the user program.

**14092 [Channel %1: ] Block %2 axis %3 is wrong axis type**

**Parameters:** %1 = Channel number  
%2 = Block number, label  
%3 = Axis name, spindle number

**Definitions:** One of the following programming errors has occurred:

1. The keyword WAITP(x) "Wait with block change until the specified positioning axis has reached its end point" has been used for an axis that is not a positioning axis.
2. G74 "Reference point approach from the program" has been programmed for a spindle. (Only axis addresses are permitted).
3. The keyword POS/POSA has been used for a spindle. (The keywords SPOS and SPOSA must be programmed for spindle positioning).
4. If the alarm occurs with the "Rigid tapping" function (G331), the following causes are conceivable:
  - The master spindle is not in position-controlled mode.
  - Incorrect master spindle
  - Master spindle without encoder

5. An axis name was programmed which no longer exists (e.g. when using axial variables as an index). Or NO\_AXIS has been programmed as an index.

6. If 14092 is output as a note with alarm 20140 Motion-synchronous action: traversing of command axis, the following causes are possible:

- The axis is currently being traversed by the NC program already.

- An overlaid movement is active for the axis.

- The axis is active as following axis of a coupling.

- An interpolation compensation such as a temperature compensation is active for the axis.

**Remedy:** - Correct the part program according to which of the above errors is involved.

- Program SPOS.

- Set the correct master spindle with SETMS.

#### 14095 [Channel %1: ] Block %2 radius for circle programming too small

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The radius entered for radius programming is too small, i.e. the programmed radius is smaller than half of the distance between start and end point.

**Remedy:** Modify part program.

Clear alarm with NC START or RESET key and continue the program.

#### 14096 [Channel %1: ] Block %2 illegal type conversion

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** During the program run, a variable value assignment or an arithmetic operation has caused data to be processed in such a way that they have to be converted to another type. This would lead to the value range being exceeded. Value ranges of the various variable types:-  
 REAL: Property: Fractional number with dec. pt., value range: +/-(-2-1022-2+1023)-  
 INT: Property: Integers with signs, value range: +/-(-231-1)-  
 BOOL: Property: Truth value TRUE, FALSE, value range: 0,1-  
 CHAR: Property: 1 ASCII character, value range: 0-255-  
 STRING: Property: Character string (max. 100 values), value range: 0-255-  
 AXIS: Property: Axis addresses, value range: Axis names only-  
 FRAME: Property: Geometric information, value range: As for axis paths  
 Overview of type conversions:- from REAL to: REAL: yes, INT: yes\*, BOOL: yes1), CHAR: yes\*, STRING: -, AXIS: -, FRAME: -- from INT to: REAL: yes, INT: yes, BOOL: yes1), CHAR: if value 0 ...255, STRING: -, AXIS: -, FRAME: -- from BOOL to: REAL: yes, INT: yes, BOOL: yes, CHAR: yes,

STRING: -, AXIS: -, FRAME: -- from CHAR to: REAL: yes, INT: yes, BOOL: yes1), CHAR: yes, STRING: yes, AXIS: -, FRAME: -- from STRING to: REAL: -, INT: -, BOOL: yes2), CHAR: only if 1 character, STRING: yes, AXIS: -, FRAME: -- from AXIS to: REAL: -, INT: -, BOOL: -, CHAR: -, STRING: -, AXIS: yes, FRAME: -- from FRAME to: REAL: -, INT: -, BOOL: -, CHAR: -, STRING: -, AXIS: -, FRAME: yes1) Value <> 0 corresponds to TRUE, value ==0 corresponds to FALSE.2) String length 0 => FALSE, otherwise TRUE.3) If only 1 character. It is not possible to convert from type AXIS and FRAME nor into type AXIS and FRAME.

**Remedy:** Modify the program section such that the value range is not exceeded, e.g. by a modified variable def-inition.

#### 14270 [Channel %1: ] Block %2 pole programmed incorrectly

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** When defining the pole, an axis was programmed that does not belong to the selected processing level. Programming in polar coordinates always refers to the plane activated with G17 to G19. This also applies to the definition of a new pole with G110, G111 or G112.

**Remedy:** Correct the NC part program. Only the two geometry axes may be programmed that establish the current machining plane.

#### 14280 [Channel %1: ] Block %2 polar coordinates programmed incorrectly

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The end point of the displayed block has been programmed both in the polar coordinate system (with AP=..., RP=...) and in the Cartesian coordinate system (axis addresses X, Y,...).

**Remedy:** Correct the NC part program - the axis motion may be specified in one coordinate system only.

#### 14404 [Channel %1: ] Block %2 illegal parameterization of transformation

**Parameters:** %1 = Channel number %2 = Block number, label

**Definitions:** Error has occurred when selecting transformation.

Possible causes of error:

- An axis traversed by the transformation has not been enabled:

- is being used by another channel (-> enable)

- is in spindle mode (-> enable with SPOS)

- is in POSA mode (-> enable with WAITP)

- is concurrent Pos axis (-> enable with WAITP)

- Parameterization via machine data has an error  
 - Axis or geometry axis assignment to the transformation has an error,  
 - Machine data has an error (-> modify machine data, restart) Please note: Any axes not enabled might be signaled via alarm 14092 or alarm 1011 instead of alarm 14404. Transformation-dependent error causes can be in: TRAORI: -  
 TRANSMIT:

- The current machine axis position is unsuitable for selection (e.g. selection in the pole) (-> change position slightly).

- Parameterization via machine data has an error.  
 - Special requirement with respect to the machine axis has not been fulfilled (e.g. rotary axis is not a modulo axis) (-> modify machine data, restart).

TRACYL:

The programmed parameter is not allowed when transformation is selected.

TRAANG:

- The programmed parameter is not allowed when transformation is selected.

- Parameterization via machine data has an error.  
 - Parameter is faulty (e.g. TRAANG: unfavorable angle value (-> modify machine data, restart)

Persistent transformation:

- Machine data for persistent transformation are wrong (-> consider dependencies, change machine data, restart) Only with active "OEM transformation" compile cycle: The axes included in the transformation must be referenced.

**Remedy:** Please inform the authorized personnel/service department. Modify part program or machine data. Only with active "OEM transformation" compile cycle: Reference the axes included in the transformation before selecting transformation.

#### **14861 [Channel %1 ] Block %2 SVC programmed, but no tool offset active**

**Parameters:** %1 = Channel number  
 %2 = Block number, label

**Explanation:** Cutting velocity SVC programmed in the block, but no tool offset active.

**Remedy:** Select an appropriate tool prior to the SVC instruction.

#### **14862 [Channel %1 ] Block %2 SVC has been programmed, but the radius of the active tool correction is zero**

**Parameters:** %1 = Channel number  
 %2 = Block number, label

**Explanation:** A cutting velocity SVC has been programmed in the block, but the radius of the active tool offset is zero.

The radius of the active tool offset consists of the offset parameters \$TC\_DP6, \$TC\_DP12,

\$TC\_SCPx6 and \$TC\_ECPx6.

**Remedy:** Select an appropriate tool offset with a positive tool radius prior to the SVC instruction.

#### **14863 [Channel %1 ] Block %2 The programmed SVC value is zero or negative**

**Parameters:** %1 = Channel number  
 %2 = Block number, label

**Explanation:** The programmed value for the cutting velocity SVC is zero or negative.

**Remedy:** Program an SVC value larger than zero.

#### **14910 [Channel %1: ] Block %2 invalid angle of aperture for programmed circle**

**Parameters:** %1 = Channel number  
 %2 = Block number, label

**Definitions:** When programming a circle by means of the opening angle, a negative opening angle or an opening angle greater than or equal to 360 degrees has been programmed.

**Remedy:** Program opening angle within the allowed range of values between 0.0001 and 359.9999 [degrees].

#### **16100 [Channel %1: ] Block %2 Spindle %3 not available in channel**

**Parameter:** %1 = Channel number  
 %2 = Block number, label  
 %3 = String

**Explanation:** Programming incorrect: the spindle number is not recognized in this channel. The alarm can occur in conjunction with dwell time or a spindle function.

**Remedy:** Please notify the authorized personnel/service. Check parts program to establish whether the programmed spindle number is correct and that the program is running in the right channel. Check MD35000 \$MA\_SPIND\_ASSIGN\_TO\_MACHAX for all machine axes to establish whether the programmed spindle number is present in one of them. This machine axis number must be entered in a channel axis of the MD20070 \$MC\_AXCONF\_MACHAX\_USED.

#### **17020 [Channel %1: ] Block %2 illegal array index 1**

**Parameters:** %1 = Channel number  
 %2 = Block number, label

**Explanation:** General: Read or write access has been programmed to an array variable with an illegal 1st array index. The valid array indices must lie within the defined array size and the absolute limits (0 - 32,766).

PROFIBUS I/O:

An illegal slot / I/O area index was used while

reading/writing data.

Cause:

1.: Slot / I/O area index >= max. number of available slot / I/O areas.

2.: Slot / I/O area index references a slot / I/O area that has not been configured.

3.: Slot / I/O area index references a slot / I/O area that has not been released for system variables.

The following applies specifically: If the alarm occurs while writing one of the parameters \$TC\_MDP1/\$TC\_MDP2/\$TC\_MLSR, check whether MD18077 \$MN\_MM\_NUM\_DIST\_REL\_PER\_MAGLOC has been set correctly.

MD18077 \$MN\_MM\_NUM\_DIST\_REL\_PER\_MAGLOC defines the number of different Index1 statements that may be made for an Index2 value.

If an MT number is programmed, the value may collide with a previously defined T number or a previously defined magazine number.

**Remedy:** Correct the specification of array elements in the access instruction to match the defined size. If an SPL is used in Safety Integrated, the field index via optional data may be subject to additional restrictions.

#### 17181 [Channel %1: ] Block %2 T no.= %3, D no.= %4 not existing

**Parameters:** %1 = Channel number %2 = Block number, label %3 = T number %4 = D number

**Explanation:** A programmed D number was not recognized by the NC. By default, the D number refers to the specified T number. If the flat D number function is active, T= 1 is output.

**Remedy:** If the program is incorrect, remedy the error with a correction block and continue the program. If the data block is missing, download a data block for the specified T/D values onto the NCK (via HMI with overstore) and continue the program.

#### 17190 [Channel %1: ] Block %2 illegal T number %3

**Parameters:** %1 = Channel number %2 = Block number, label %3 = T number

**Explanation:** In the displayed block, access is made to a tool that is not defined and therefore not available. The tool has been named by its T number, its name or its name and duplo number.

**Remedy:** Check tool call in the NC part program:  
 - Correct tool number T.. programmed?  
 - Tool parameters P1 - P25 defined? The dimensions of the tool edge must have been entered previously either through the operator panel or through the V.24 interface. Description of the system variables \$P\_DP x [n, m] n ... Associated tool number T m ... Tool edge number D x ... Parameter number P

#### 17210 [Channel %1: ] Block %2 access to variable not possible

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The variable cannot be written/read directly from the part program. It is allowed only in motion synchronous actions. Example for variable: \$P\_ACTID (which planes are active) \$AA\_DTEPB (axial distance-to-go for reciprocating infeed) \$A\_IN (test input) Safety Integrated: Safety PLC system variables can only be read during the safety SPL setup phase.

**Remedy:** Modify part program.

#### 18310 [Channel %1: ] Block %2 frame: illegal rotation

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Rotations are not possible with NCU global frames.

**Remedy:** Modify part program.

#### 22069 [Channel %1: ] Block %2 tool management: No tool available in tool group %3, program %4

**Parameters:** %1 = Channel number %2 = Block number, label %3 = String (identifier) %4 = Program name

**Explanation:** The specified tool group does not contain a tool which is ready for use and could be used for tool change. It is possible that all of the tools in question have been set to the 'Disabled' state by the tool monitoring function. Parameter %4 = program name facilitates the identification of the program containing the programming command (tool selection) that caused the error. This can be a subprogram or cycle, etc., which can no longer be identified from the display. If the parameter is not specified, it is the currently displayed program.

**Remedy:** - Ensure that the specified tool group contains a tool that is ready for use when tool change is requested.

- This can be achieved, for example, by replacing disabled tools, or

- by releasing a disabled tool manually.

- Check whether the tool data are correctly defined. Have all intended tools in the group been defined with the specified identifier and loaded?

#### 61000 %[[Channel %1: ] Block %2: %]No tool offset active

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Alarm triggered by following cycles: LONGHOLE, SLOT1, SLOT2, POCKET1 bis POCKET4, CYCLE63, CYCLE64, CYCLE71, CYCLE72, CYCLE90, CYCLE93 through CYCLE96, CYCLE952.

**Remedy:** D-correction must be programmed before the cycle call.

#### 61001 [Channel %1: ] Block %2: Thread pitch incorrectly defined

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE84, CYCLE840, CYCLE96, CYCLE97.

**Remedy:** Check parameter for the thread size or setting for the pitch (contradict each other)

#### 61002 %[[Channel %1: ] Block %2: %]Type of machining incorrectly defined

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The value of the VARI parameter for the machining has been incorrectly specified. Alarm triggered by following cycles: SLOT1, SLOT2, POCKET1 to POCKET4, CYCLE63, CYCLE64, CYCLE71, CYCLE72, CYCLE76, CYCLE77, CYCLE93, CYCLE95, CYCLE97, CYCLE98.

**Remedy:** Modify VARI parameter.

#### 61003 %[[Channel %1: ] Block %2: %]No feed programmed in cycle

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The parameter for the feed has been incorrectly specified. Alarm triggered by following cycles: CYCLE71, CYCLE72.

**Remedy:** Modify feed parameter.

#### 61005 [Channel %1: ] Block %2: 3rd geometry axis not available

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** With an application on the lathe with no Y-axis in the G18 plane. Alarm triggered by following cycle: CYCLE86.

**Remedy:** Check parameter on cycle call.

#### 61006 %[[Channel %1: ] Block %2: %]Tool radius too large

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The tool radius is too large for machining. Alarm triggered by following cycles: CYCLE63, CYCLE64, CYCLE930, CYCLE951,

E\_CP\_CE, E\_CP\_CO, E\_CP\_DR, E\_PO\_CIR, E\_PO\_REC, F\_CP\_CE, F\_CP\_CO, F\_CP\_DR, F\_PO\_CIR, F\_PO\_REC.

**Remedy:** Select a smaller tool.

#### 61007 [Channel %1: ] Block %2: Tool radius too small

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The tool radius is too small for machining. Alarm triggered by following cycles: CYCLE92, E\_CP\_CO, E\_SL\_CIR, F\_CP\_CO, F\_PARTOF, F\_SL\_CIR.

**Remedy:** Select a larger tool.

#### 61008 [Channel %1: ] Block %2: No tool active

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles:

**Remedy:** Select a tool.

#### 61009 [Channel %1: ] Block %2: Active tool number = 0

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** No tool (T) has been programmed before the cycle call. Alarm triggered by following cycles: CYCLE71, CYCLE72.

**Remedy:** Program tool (T).

#### 61010 [Channel %1: ] Block %2: Finishing allowance too large

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The finishing allowance for the base is greater than the total depth. Alarm triggered by following cycle: CYCLE72.

**Remedy:** Reduce finishing allowance.

#### 61011 [Channel %1: ] Block %2: Scaling not permissible

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** A scale factor is active which is illegal for this cycle. Alarm triggered by following cycles: CYCLE71, CYCLE72.

**Remedy:** Modify scale factor.

#### 61012 %[[Channel %1: ] Block %2: %]Different scaling in planes

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64, CYCLE76, CYCLE77.

**Remedy:** -Clear alarm with the RESET key.

**61014 [Channel %1: ] Block %2: Return plane exceeded**

**Parameters:** %1 = Channel number  
%2 = Block number, label channel number  
**Explanation:** Alarm triggered by following cycles: CYCLE72.

**Remedy:** Check parameter RTP.

**61016 [Channel %1: ] Block %2: System frame for cycles missing**

**Parameters:** %1 = Channel number  
%2 = Block number, label channel number  
**Explanation:** All measuring cycles can trigger this alarm.

**Remedy:** Set MD 28082: MM\_SYSTEM\_FRAME\_MASK, Bit 5=1.

**61017 %[[Channel %1: ] Block %2: %]function %4 not present in NCK**

**Parameters:** %1 = Channel number  
%2 = Block number, label channel number  
**Explanation:** Alarm triggered by following cycles:  
**Remedy:** Clear alarm with the RESET key.

**61018 [Channel %1: ] Block %2: function %4 not executable with NCK**

**Parameters:** %1 = Channel number  
%2 = Block number, label channel number  
**Explanation:** Alarm triggered by following cycles:  
**Remedy:** Clear alarm with the RESET key.

**61019 %[[Channel %1: ] Block %2: %]Parameter %4 incorrectly defined**

**Parameters:** %1 = Channel number  
%2 = Block number, label channel number  
**Explanation:** Alarm triggered by following cycles: CYCLE60, CYCLE63, CYCLE64, CYCLE83, CYCLE952.

**Remedy:** Check the value of the parameter. Clear alarm with the RESET key.

**61020 [Channel %1: ] Block %2: Machining not possible with active TRANSMIT/TRACYL**

**Parameters:** %1 = Channel number  
%2 = Block number, label channel number  
**Explanation:** Alarm triggered by following cycles:  
**Remedy:** Clear alarm with the RESET key.

**61021 [Channel %1: ] Block %2: Parameter %4 value too high**

**Parameters:** %1 = Channel number  
%2 = Block number, label channel number  
**Explanation:** Alarm triggered by following cycles:  
**Remedy:** Clear alarm with the RESET key.

**61022 [Channel %1: ] Block %2: Parameter %4 value too low**

**Parameters:** %1 = Channel number  
%2 = Block number, label channel number  
**Explanation:** Alarm triggered by following cycles:  
**Remedy:** Clear alarm with the RESET key.

**61023 [Channel %1: ] Block %2: Parameter %4 value must be unequal to zero**

**Parameters:** %1 = Channel number %2 = Block number, label channel number  
**Explanation:** Alarm triggered by following cycles:  
**Remedy:** Clear alarm with the RESET key.

**61024 [Channel %1: ] Block %2: Parameter %4 check value**

**Parameters:** %1 = Channel number  
%2 = Block number, label channel number  
**Explanation:** Alarm triggered by following cycles:  
**Remedy:** Clear alarm with the RESET key.

**61025 [Channel %1: ] Block %2: Check tool carrier position**

**Parameters:** %1 = Channel number  
%2 = Block number, label channel number  
**Explanation:** Alarm triggered by following cycles:  
**Remedy:** Clear alarm with the RESET key.

**61027 %[[Channel %1: ] Block %2: %]Sub-routine %4 does not exist**

**Parameters:** %1 = Channel number  
%2 = Block number, label  
**Explanation:** Alarm triggered by following cycle: CYCLE62  
**Remedy:** - Check CYCLE62 call  
- Check whether the subroutines specified on CYCLE62 call exist in the program storage

**61099 [Channel %1: ] Block %2: Internal cycle error (%4)**

**Parameters:** %1 = Channel number  
%2 = Block number, label channel number  
**Explanation:** Alarm triggered by following cycles:  
**Remedy:** Clear alarm with the RESET key.

**61101 %[[Channel %1: ] Block %2: %]Reference point defined incorrectly**

**Parameters:** %1 = Channel number %2 = Block number, label  
**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64, CYCLE71, CYCLE72, CYCLE81 to CYCLE90, CYCLE840, SLOT1, SLOT2, POCKET1 to POCKET4, LONGHOLE.  
**Remedy:** With an incremental specification of the depth, either different values have to be selected

for the reference point (reference plane) and the retraction plane, or an absolute value must be specified for the depth.

**61102 [%1: ] Block %2: %1]No spindle direction programmed**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64, CYCLE86, CYCLE87, CYCLE88, CYCLE840, POCKET3, POCKET4.

**Remedy:** Parameter SDIR (or SDR in CYCLE840) must be programmed.

**61103 [Channel %1: ] Block %2: Number of holes is zero**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** No value for the number of holes has been programmed. Alarm triggered by following cycles:

HOLES1, HOLES2.

**Remedy:** Check parameter NUM.

**61104 [Channel %1: ] Block %2: Contour violation of slots**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Incorrect parameterization of the milling pattern in the parameters which define the position of the slots/elongated holes on the circle and their form. Alarm triggered by following cycles: SLOT1, SLOT2, LONGHOLE.

**Remedy:** - Clear alarm with the RESET key.

**61105 [Channel %1: ] Block %2: Milling cutter radius too large**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The diameter of the cutter used is too large for the form to be machined. Alarm triggered by following cycles: SLOT1, SLOT2, POCKET1 to POCKET4, LONGHOLE, CYCLE90.

**Remedy:** Either a tool with a smaller radius has to be used or the contour must be modified.

**61106 [Channel %1: ] Block %2: Number of or distance between circular elements**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Incorrect parameterization of NUM or INDA. The layout of the circle elements within a full circle is not possible. Alarm triggered by following cycles: HOLES2, LONGHOLE, SLOT1, SLOT2.

**Remedy:** Correct parameterization.

**61107 [Channel %1: ] Block %2: First drilling depth incorrectly defined**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** First drilling depth is in the opposite direction to the total drilling depth. Alarm triggered by following cycle: CYCLE83.

**Remedy:** Modify drilling depth.

**61108 [Channel %1: ] Block %2: Illegal values for radius and insertion depth parameters**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The radius (\_RAD1) and insertion depth (\_DP1) parameters for defining the helix path for the depth infeed have been incorrectly specified. Alarm triggered by following cycles: POCKET3, POCKET4.

**Remedy:** Modify parameter. Clear alarm with the RESET key.

**61109 [%1: ] Block %2: %1]Milling direction parameter incorrectly defined**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The value of the parameter for the cutting direction \_CDIR has been incorrectly defined. Alarm triggered by following cycles: CYCLE63, CYCLE64, POCKET3, POCKET4.

**Remedy:** - Change milling direction.

- During pocket machining (CYCLE63), the selected milling direction must match the milling direction of centering/rough drilling.

**61110 [Channel %1: ] Block %2: Finishing allowance at bottom > depth infeed**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The finishing allowance at the base has been specified greater than the maximum depth infeed. Alarm triggered by following cycles: POCKET3, POCKET4.

**Remedy:** Either reduce finishing allowance or increase depth infeed.

**61111 [Channel %1: ] Block %2: Infeed width > Tool diameter**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The programmed infeed width is greater than the diameter of the active tool. Alarm triggered by following cycles: CYCLE71,



POCKET3, POCKET4.

**Remedy:** Infeed width must be reduced.

**61112 [Channel %1: ] Block %2: Tool radius negative**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The radius of the active tool is negative. This is illegal. Alarm triggered by following cycles: CYCLE72, CYCLE76, CYCLE77, CYCLE90.

**Remedy:** Change the tool radius.

**61113 [Channel %1: ] Block %2: Parameter for corner radius too large**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The parameter for the corner radius \_CRAD has been specified too large. Alarm triggered by following cycle: POCKET3.

**Remedy:** Reduce corner radius

**61114 [Channel %1: ] Block %2: Machining direction G41/G42 incorrectly defined**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The machining direction of the cutter radius compensation G41/G42 has been incorrectly selected. Alarm triggered by following cycle: CYCLE72.

**Remedy:** Change machining direction.

**61115 [Channel %1: ] Block %2: Approach or retract mode(straight / circle / plane / space) incorrectly defined**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The approach or retract mode to/from the contour has been incorrectly defined. Alarm triggered by following cycle: CYCLE72.

**Remedy:** Check parameter \_AS1 or \_AS2.

**61116 [Channel %1: ] Block %2: Approach or retract path = 0**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The approach or retract path has been specified with zero. Alarm triggered by following cycle: CYCLE72.

**Remedy:** Check parameter \_LP1 or \_LP2.

**61117 %[[Channel %1: ] Block %2: %]Active tool radius <= 0**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The radius of the active tool is negative or zero. Alarm is triggered by the following cycles: CYCLE63, CYCLE71, POCKET3, POCKET4.

**Remedy:** Modify radius.

**61118 [Channel %1: ] Block %2: Length or width = 0**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The length or width of the milling area is illegal. Alarm triggered by following cycle: CYCLE71.

**Remedy:** Check parameters \_LENG and \_WID.

**61119 [Channel %1: ] Block %2: Nominal or core diameter programmed incorrectly**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The nominal or core diameter was incorrectly programmed. Alarm triggered by following cycles: CYCLE70, E\_MI\_TR, F\_MI\_TR.

**Remedy:** Check thread geometry.

**61120 [Channel %1: ] Block %2: Thread type inside / outside not defined**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The thread type (internal/external) was not defined. Alarm triggered by following cycles: CYCLE70.

**Remedy:** The internal/external thread type must be entered.

**61121 [Channel %1: ] Block %2: Number of teeth per cutting edge is missing**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** No value was entered for the number of teeth per cutting edge. Alarm triggered by following cycles: CYCLE70.

**Remedy:** Enter the number of teeth/cutting edges for the active tool into the tool list.

**61124 [Channel %1: ] Block %2: Infeed width is not programmed**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE71.

**Remedy:** With active simulation without tool, a value for the infeed width \_MIDA must always be programmed.

**61125 [Channel %1: ] Block %2: Technology selection parameter incorrectly defined**  
**Parameters:** %1 = Channel number  
 %2 = Block number, label  
**Explanation:** Alarm triggered by following cycles: CYCLE84, CYCLE840.  
**Remedy:** Check technology selection parameter (\_TECHNO).

**61126 [Channel %1: ] Block %2: Thread length too short**  
**Parameters:** %1 = Channel number  
 %2 = Block number, label  
**Explanation:** Alarm triggered by following cycle: CYCLE840.  
**Remedy:** Program lower spindle speed or raise reference point (reference plane).

**61127 [Channel %1: ] Block %2: Wrong definition of tapping axis transformation ratio (machine data)**  
**Parameters:** %1 = Channel number  
 %2 = Block number, label  
**Explanation:** Alarm triggered by following cycles: CYCLE84, CYCLE840.  
**Remedy:** Check machine data 31050 and 31060 in the appropriate gear stage of the drilling axis.

**61128 [Channel %1: ] Block %2: Insertion angle = 0 for insertion with oscillation or helix**  
**Parameters:** %1 = Channel number  
 %2 = Block number, label  
**Explanation:** Alarm triggered by following cycle: SLOT1.  
**Remedy:** Check parameter \_STA2.

**61129 [Channel %1: ] Block %2: perpendic. approach and retraction during contour milling only allowed with G40**  
**Parameters:** %1 = Channel number  
 %2 = Block number, label  
**Explanation:** Alarm triggered by following cycle: CYCLE72.  
**Remedy:** Clear alarm with the RESET key.

**61150 [Channel %1: ] Block %2: Tool cannot be aligned --> error code: %4**  
**Parameters:** %1 = Channel number  
 %2 = Block number, label  
**Explanation:** Alarm triggered by following cycle: CYCLE800.  
**Remedy:** Causes of error:  
 1st error code = A -> only new swivel plane permitted, see parameter \_ST

**61151 [Channel %1: ] Block %2: Orientation of tool not possible --> error code: %4**  
**Parameters:** %1 = Channel number  
 %2 = Block number, label  
**Explanation:** Alarm triggered by following cycle: CYCLE800.  
**Remedy:** Causes of error:  
 1st error code = A -> only additive swivel plane permitted, see parameter \_ST

**61152 [Channel %1: ] Block %2: B axis kinematics (turning technology) either not or incorrectly set up in Start-up of swivel cycle --> error code: %4**  
**Parameters:** %1 = Channel number  
 %2 = Block number, label  
**Explanation:** Alarm triggered by following cycle: CYCLE800.  
**Remedy:** Causes of error:  
 1st error code = A123 -> B axis not an automatic rotary axis under ShopTurn (123 corresponds to parameter \_TCBA)  
 2nd error code = B123 -> B axis not activated in swiveling start-up (kinematics) (123 corresponds to \$TC\_CARR37[n], n ... number of the swivel data record)

**61153 [Channel %1: ] Block %2: No 'Rotary axes direct' swivel mode possible -> error code: %4**  
**Parameters:** %1 = Channel number  
 %2 = Block number, label  
**Explanation:** Alarm triggered by following cycle: CYCLE800.  
**Remedy:** Causes of error:  
 1st error code = A -> No tool or cutting edge (D1..) active

**61154 %[[Channel %1: ] Block %2: %]Final depth wrongly programmed**  
**Parameters:** %1 = Channel number  
 %2 = Block number, label channel number  
**Explanation:** The alarm is triggered by the following cycle: CYCLE63, CYCLE64, CYCLE899  
**Remedy:** Input of end depth possible only absolutely or incrementally

**61155 [Channel %1: ] Block %2: Unit for plane infeed wrongly programmed**  
**Parameters:** %1 = Channel number  
 %2 = Block number, label channel number  
**Explanation:** The alarm is triggered by the following cycle: CYCLE899  
**Remedy:** Unit for plane infeed possible only in mm or % of tool diameter

**61156 [Channel %1: ] Block %2: Depth calculation wrongly programmed**

**Parameters:** %1 = Channel number  
 %2 = Block number, label channel number  
**Explanation:** The alarm is triggered by the following cycle: CYCLE899  
**Remedy:** Depth calculation possible only with or without SDIS

**61157 %[[Channel %1: ] Block %2: %]Reference point wrongly programmed**

**Parameters:** %1 = Channel number  
 %2 = Block number, label channel number  
**Explanation:** The alarm is triggered by the following cycle: CYCLE63, CYCLE64, CYCLE899  
**Remedy:** Check reference point in screen form, input only -X, centred or +X

**61158 %[[Channel %1: ] Block %2: %]Machining plane wrongly programmed**

**Parameters:** %1 = Channel number  
 %2 = Block number, label channel number  
**Explanation:** The alarm is triggered by the following cycle: CYCLE63, CYCLE64, CYCLE899, CYCLE952  
**Remedy:** Check machining plane (G17, G18 or G19)

**61159 [Channel %1: ] Block %2: Machining plane on cycle call differs from the one in the position pattern**

**Parameters:** %1 = Channel number  
 %2 = Block number, label channel number  
**Explanation:** The alarm is triggered by the following cycle: CYCLE899  
**Remedy:** Adjust the machining plane on cycle call to the machining plane in the position pattern.

**61160 [Channel %1: ] Block %2: Residual material remains stationary, reduce plane infeed**

**Parameters:** %1 = Channel number  
 %2 = Block number, label channel number  
**Explanation:** The alarm is triggered by the following cycle: CYCLE899  
**Remedy:** Reduce plane infeed or slot width, or use milling cutter with larger diameter

**61161 [Channel %1: ] Block %2: Centering diameter or tool parameter (diameter, tip angle) are incorrect**

**Parameters:** %1 = Channel number  
 %2 = Block number, label channel number  
**Explanation:** The alarm is triggered by the following cycle: CYCLE81  
**Remedy:** - Diameter of centering with tip angle of

active tool not possible  
 - Entered workpiece diameter, tool diameter or tip angle of tool incorrect  
 - Diameter of tool only has to be entered if centering is to be on workpiece diameter.

**61162 [Channel %1: ] Block %2: Tool parameter diameter or tip angle incorrect**

**Parameters:** %1 = Channel number  
 %2 = Block number, label channel number  
**Explanation:** The alarm is triggered by the following cycle: CYCLE81  
**Remedy:** - The tool parameter diameter or tip angle must be greater than zero  
 - Tip angle must be less than 180°

**61175 [Channel %1: ] Block %2: angle of aperture programmed too small**

**Parameters:** %1 = Channel number %2 = Block number, label  
**Explanation:** The angle of aperture of the text (\_DF) in the engraving cycle is too small. This means that the text for engraving does not fit in the specified angle.  
**Remedy:** Enter a larger angle of aperture.

**61176 [Channel %1: ] Block %2: text length programmed too small**

**Parameters:** %1 = Channel number %2 = Block number, label  
**Explanation:** The text length (\_DF) in the engraving cycle is too short. This means that the text for engraving is longer than the specified text length.  
**Remedy:** Enter longer text length

**61177 [Channel %1: ] Block %2: polar text length > 360 degrees**

**Parameters:** %1 = Channel number  
 %2 = Block number, label  
**Explanation:** In the engraving cycle, the polar text length must not exceed 360 degrees.  
**Remedy:** Enter shorter text length.

**61178 [Channel %1: ] Block %2: code page not present**

**Parameters:** %1 = Channel number  
 %2 = Block number, label  
**Explanation:** The specified code page is not supported by the cycle.  
**Remedy:** Use code page 1252.

**61179 [Channel %1: ] Block %2: character does not exist, no.: %4**

**Parameters:** %1 = Channel number %2 = Block number, label %4 = Character number  
**Explanation:** The character entered in the text

for engraving cannot be milled.

**Remedy:** Enter another character.

**61180 [Channel %1: ] Block %2: No name assigned to swivel data record**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Although there are several swivel data blocks, no unique names have been assigned. Alarm triggered by following cycles: CYCLE800.

**Remedy:** Assign unique name to swivel data block (\$TC\_CARR34[n]), if machine data 18088 \$MN\_MM\_NUM\_TOOL\_CARRIER is >1.

**61181 [Channel %1: ] Block %2: NCK software version is insufficient for the Swivel function**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Swivelling is not possible with the current NCK software version. Alarm triggered by following cycles: CYCLE800.

**Remedy:** Upgrade NCK software to NCK 75.00 or higher.

**61182 [Channel %1: ] Block %2: Name of swivel data record unknown: %4**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** the specified name of the swivel data block is unknown. Alarm triggered by following cycles: CYCLE800.

**Remedy:** Check name of swivel data record \$TC\_CARR34[n].

**61183 [Channel %1: ] Block %2: Swivel CYCLE800: Retraction mode parameter lies outside value range: %4**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The value of the retraction mode parameter (\_FR) lies outside the valid range. Alarm triggered by following cycles: CYCLE800.

**Remedy:** Swivel CYCLE800: Check transfer parameter \_FR. Value range 0 to 8

**61184 [Channel %1: ] Block %2: No solution possible with current input angle values**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The surface defined via the input angle cannot be processed with the machine. Alarm triggered by following cycles: CYCLE800.

**Remedy:** -Check the angles entered for swiveling

the machining plane: %4 -Parameter \_MODE coding incorrect, e.g. rotation axis-wise YXY

**61185 [Channel %1: ] Block %2: Invalid angular ranges of rotary axes in swivel data record: %4**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The angular range of the rotary axes is invalid. Alarm triggered by following cycles: CYCLE800. Check setup of the swivel CYCLE800. Parameter \$TC\_CARR30[n] to \$TC\_CARR33[n] n number of swivel data record Example: Rotary axis 1 modulo 360 degrees: -> \$TC\_CARR30[n]=0 \$TC\_CARR32[n]=360

**Remedy:** Check setup of swivel cycle CYCLE800.

**61186 [Channel %1: ] Block %2: Invalid rotary axis vectors --> Check setup of the swivel cycle CYCLE800.**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** No or incorrect entry for rotary axis vector V1 or V2. Alarm triggered by following cycles: CYCLE800.

**Remedy:** Check setup of swivel CYCLE800 Check rotary axis vector V1: \$TC\_CARR7[n], \$TC\_CARR8[n], \$TC\_CARR9[n] Check rotary axis vector V2: \$TC\_CARR10[n], \$TC\_CARR11[n], \$TC\_CARR12[n] n number of swivel data record

**61187 [Channel %1: ] Block %2: Check setup of the swivel cycle CYCLE800. --> Error code: %4**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The alarm is triggered by the following cycles: CYCLE800.

**Remedy:** Error code: See current cycles software version notes in siemens.txt

**61188 [Channel %1: ] Block %2: No axis name agreed for rotary axis 1 -> Check setup of the swivel cycle CYCLE800.**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** No axis name was specified for the rotary axis 1. Alarm triggered by following cycles: CYCLE800.

**Remedy:** Check setup of swivel CYCLE800. Axis name of rotary axis 1 see parameter \$TC\_CARR35[n] n number of swivel data record

**61189 [Channel %1: ] Block %2: Swivel direct: Invalid rotary axis positions: %4**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Swivel direct: Check input values of rotary axes. Alarm triggered by following cycles: CYCLE800.

**Remedy:** Swivel mode direct: Check input values of rotary axes or setup of swivel CYCLE800. Check angular range of rotary axes in swivel data record n: Rotary axis 1: \$TC\_CARR30[n], \$TC\_CARR32[n] Rotary axis 2: \$TC\_CARR31[n], \$TC\_CARR33[n]

**61190 [Channel %1: ] Block %2: Unable to retract prior to swiveling -> Error code: %4**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** See error code for error causes. The alarm is triggered by the following cycles: CYCLE800.

**Remedy:** Check setup of swiveling CYCLE800. Parameter \$TC\_CARR37[n] 7th and 8th decimal place n number of swivel data record  
Error code:

- A: Retraction Z not set up
- B: Retraction Z XY not set up
- C: Retraction in tool direction max. not set up
- D: Retraction in tool direction incremental not set up
- E: Retraction in tool direction: NC function CAL-CPOSI reports error
- F: Retraction in tool direction: no tool axis existing
- G: Retraction in tool direction max.: negative retraction path
- H: Retraction in tool direction incremental: negative retraction path
- I: Retraction not possible

**61191 [Channel %1: ] Block %2: Multi-axis transformation not set up. Error code: %4**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** See error code for error cause. The alarm is triggered by the following cycles: CYCLE800, 832.

**Remedy:** Error code:  
Number or parameter name of multi-axis transformation

**61192 [Channel %1: ] Block %2: Additional multi-axis transformations not set up. Error code: %4**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** See error code for error cause. The alarm is triggered by the following cycles: CYCLE800, 832.

**Remedy:** Error code:  
Number or parameter name of multi-axis transformation

**61193 [Channel %1: ] Block %2: compressor option not set up**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** The alarm is triggered by the following cycles: CYCLE832.

**Remedy:** -Clear alarm with the RESET key.

**61194 [Channel %1: ] Block %2: spline interpolation option not set up**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** The alarm is triggered by the following cycles: CYCLE832.

**Remedy:** Clear alarm with the RESET key.

**61196 [Channel %1: ] Block %2: No swiveling in JOG --> Multi-axis transformations and TCARR activated at the same time**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Multi-axis transformations (TRAORI) and Toolcarrier (TCARR) activated at the same time. Alarm triggered by following cycles: CYCLE800.

**Remedy:** Deselection of multi-axis transformation with TRAFOOF or deselection of Toolcarrier (TCARR) with CYCLE800()

**61199 [Channel %1: ] Block %2: Swiveling - tool not allowed -> Error code: %4**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** See error code for error cause. Alarm triggered by following cycles: CYCLE800.

**Remedy:** Error code:  
A: Orientation of tool and change of swivel data record not allowed

**61200 [Channel %1: ] Block %2: Too many elements in machining block**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The machining block contains too many elements. Alarm triggered by following cycles: CYCLE76, CYCLE77, E\_CALL, E\_DR, E\_DR\_BGF, E\_DR\_BOR, E\_DR\_O1, E\_DR\_PEC, E\_DR\_REA, E\_DR\_SIN, E\_DR\_TAP, E\_MI\_TR, E\_PI\_CIR, E\_PI\_REC, E\_PO\_CIR, E\_PO\_REC, E\_PS\_CIR, E\_PS\_FRA, E\_PS\_HIN, E\_PS\_

MRX, E\_PS\_POL, E\_PS\_ROW, E\_PS\_SEQ, E\_PS\_XYA, E\_SL\_LON, F\_DR, F\_DR\_PEC, F\_DR\_REA, F\_DR\_SIN, F\_DR\_TAP, F\_MI\_TR, F\_PI\_CIR, F\_PI\_REC, F\_PO\_CIR, F\_PO\_REC, F\_PS\_CIR, F\_PS\_MRX, F\_PS\_ROW, F\_PS\_SEQ, F\_SL\_LON

**Remedy:** Check the machining block, delete some elements if required.

**61201 [Channel %1: ] Block %2: Wrong sequence in machining block**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The sequence of elements in the machining block is invalid. Alarm triggered by following cycles: E\_CP\_CE, E\_CP\_DR, E\_MANAGE, F\_CP\_CE, F\_CP\_DR, F\_MANAGE.

**Remedy:** Sort the sequence in the machining block.

**61202 [Channel %1: ] Block %2: No technology cycle**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** No technology cycle was programmed in the machining block. Alarm triggered by following cycles: E\_MANAGE, F\_MANAGE.

**Remedy:** Program a technology block.

**61203 [Channel %1: ] Block %2: No position cycle**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** No positioning cycle was programmed in the machining block. Alarm triggered by following cycles: E\_MANAGE, F\_MANAGE.

**Remedy:** Program positioning block.

**61204 [Channel %1: ] Block %2: Technology cycle unknown**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The specified technology cycle in the machining block is unknown. Alarm triggered by following cycles: E\_MANAGE, F\_MANAGE.

**Remedy:** Delete and reprogram the technology block.

**61205 [Channel %1: ] Block %2: Position cycle unknown**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The specified positioning cycle in the machining block is unknown. Alarm triggered by following cycles: E\_MANAGE, F\_MANAGE.

**Remedy:** Delete and reprogram the positioning block.

**61210 [Channel %1: ] Block %2: Block search element not found**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The element specified for the block search does not exist. Alarm triggered by following cycles: E\_MANAGE, E\_PS\_CIR, E\_PS\_MRX, E\_PS\_POL, E\_PS\_SEQ, E\_PS\_XYA, F\_MANAGE, F\_PS\_CIR, F\_PS\_MRX, F\_PS\_SEQ

**Remedy:** Repeat block search.

**61211 [Channel %1: ] Block %2: Absolute reference missing**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** An incremental indication was made, but the absolute reference is unknown. Alarm triggered by following cycles: E\_MI\_CON, E\_MI\_PL, E\_PI\_CIR, E\_PI\_REC, E\_PO\_CIR, E\_PO\_REC, E\_PS\_CIR, E\_PS\_HIN, E\_PS\_MRX, E\_PS\_POL, E\_PS\_SEQ, E\_PS\_XYA, E\_SL\_CIR, E\_SL\_LON, F\_PS\_CIR, F\_PS\_MRX, F\_PS\_SEQ

**Remedy:** Program an absolute position prior to using incremental indications.

**61212 %[[Channel %1: ] Block %2: %]Wrong tool type**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The tool type is not suitable for machining. Alarm triggered by following cycles: CYCLE63, CYCLE64, CYCLE92, CYCLE951, CYCLE952, E\_DR, E\_DR\_O1, E\_DR\_PEC, E\_DR\_SIN, E\_MI\_TXT, F\_DR, F\_DR\_PEC, F\_DR\_SIN, F\_DRILL, F\_DRILLC, F\_DRILLD, F\_DRM\_DR, F\_DRM\_PE, F\_DRM\_SI, F\_GROOV, F\_MI\_TXT, F\_MT\_LEN, F\_PARTOF, F\_ROU\_Z, F\_ROUGH, F\_SP\_EF, F\_TAP, F\_TR\_CON, F\_UCUT\_T

**Remedy:** Select a new tool type.

**61213 [Channel %1: ] Block %2: Circle radius too small**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The programmed circle radius is too small. Alarm triggered by following cycles: CYCLE77, E\_CR\_HEL, E\_PI\_CIR, E\_PO\_CIR, E\_PO\_REC, F\_PI\_CIR, F\_PO\_CIR, F\_PO\_REC

**Remedy:** Correct the circle radius, center point or end point.

**61214 [Channel %1: ] Block %2: No pitch programmed**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** No thread/helical pitch has been entered. Alarm triggered by following cycles: E\_CR\_HEL, E\_PO\_CIR, E\_PO\_REC, F\_PO\_CIR, F\_PO\_REC.

**Remedy:** Program a pitch.

**61215 [Channel %1: ] Block %2: Unfinished dimension incorrectly programmed**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Check the blank spigot dimensions. The blank spigot must be larger than the production part spigot. Alarm triggered by following cycles: CYCLE76, CYCLE77, E\_PI\_CIR, E\_PI\_REC, E\_PO\_CIR, E\_PO\_REC, F\_PI\_CIR, F\_PI\_REC, F\_PO\_CIR, F\_PO\_REC

**Remedy:** Check parameters \_AP1 and \_AP2.

**61216 %[[Channel %1: ] Block %2: %]Feed/tooth only possible with cutting tools**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Feed per tooth is only possible with milling tools. Alarm triggered by following cycles: E\_TFS, F\_TFS.

**Remedy:** As alternative, set a different feed type.

**61217 [Channel %1: ] Block %2: Cutting speed programmed for tool radius 0**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** To be able to work with cutting speed, the tool radius has to be specified. Alarm triggered by following cycles: E\_DR\_SIN, E\_DR\_TAP, E\_TFS, F\_DR\_SIN, F\_DR\_TAP, F\_DRILLC, F\_DRM\_TA, F\_TAP, F\_TFS

**Remedy:** Enter a value for cutting speed.

**61218 [Channel %1: ] Block %2: Feed/tooth programmed, but number of tools equals zero**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** For feed per tooth, the number of teeth has to be specified. Alarm triggered by following cycles: E\_TFS, E\_DR\_BGF, F\_TFS.

**Remedy:** Enter the number of teeth on the milling tool in the "Tool list" menu.

**61220 [Channel %1: ] Block %2: Tool radius too small**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The tool radius is too small for machining. Alarm triggered by following cycles: CYCLE78.

**Remedy:** Select a suitable tool.

**61221 [Channel %1: ] Block %2: No tool active**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** No tool active.

**Remedy:** Select a suitable tool.

**61222 [Channel %1: ] Block %2: Plane infeed greater than tool diameter**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The plane infeed must not be greater than the tool diameter. Alarm triggered by following cycles: CYCLE79, , E\_MI\_PL, E\_PO\_CIR, E\_PO\_REC, F\_PO\_CIR, F\_PO\_REC.

**Remedy:** Reduce plane infeed.

**61223 [Channel %1: ] Block %2: Approach path too small**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The approach path must not be less than zero. Alarm triggered by following cycles: E\_MI\_CON, F\_MI\_CON.

**Remedy:** Enter a greater value for the approach path.

**61224 [Channel %1: ] Block %2: Retract path too small**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The retract path must not be less than zero. Alarm triggered by following cycles: E\_MI\_CON, F\_MI\_CON.

**Remedy:** Enter a greater value for the retract path.

**61225 [Channel %1: ] Block %2: Swivel data record unknown**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** An attempt was made to access a swivel data block which has not been defined. Alarm triggered by following cycles: E\_TCARR, F\_TCARR.

**Remedy:** Select another swivel data block or define a new swivel data block.

**61226 [Channel %1: ] Block %2: Inclinable head cannot be exchanged**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The parameter "Swivel data block" is set to "No". In spite of this, an attempt has been made to change the swivel head. Alarm triggered by following functions: E\_TCARR, F\_TCARR.

**Remedy:** Set the parameter "Swivel data block" in the setup screen "Rotary axes" to "Automatic" or "Manual".

**61231 [Channel %1: ] Block %2: ShopMill program %4 not executable, as not tested by ShopMill**

**Parameters:** %1 = Channel number %2 = Block number, label %4 = Program name

**Explanation:** Before a ShopMill program can be executed, it has to be tested by ShopMill. Alarm triggered by following cycle: E\_HEAD.

**Remedy:** The program first has to be simulated in ShopMill or loaded into the operating mode "Machine auto" by ShopMill.

**61232 [Channel %1: ] Block %2: Impossible to load magazine tool**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Only manual tools may be loaded into a swivel head in which only manual tools can be loaded. The alarm is triggered by the following cycles: E\_TD, E\_TFS, F\_TFS

**Remedy:** Load a manual tool into the swivel head or set the parameter "Tool change" on the setup screen form "Rotary axes" to "Automatic".

**61233 [Channel %1: ] Block %2: Thread angle wrongly defined**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The thread angles were specified too large or too small. Alarm triggered by following cycles: E\_TR\_CON, F\_TR\_CON

**Remedy:** Check thread geometry.

**61234 [Channel %1: ] Block %2: ShopMill subroutine %4 cannot be executed, as not tested by ShopMill**

**Parameters:** %1 = Channel number %2 = Block number, label %4 = Subroutine name

**Explanation:** Before a ShopMill subroutine can be used, it has to be tested by ShopMill. Alarm triggered by following cycle: E\_HEAD.

**Remedy:** The subroutine first has to be simulated in ShopMill or loaded into the ShopMill operating mode "Machine auto".

**61235 [Channel %1: ] Block %2: ShopTurn program %4 cannot be executed as not tested by ShopTurn.**

**Parameters:** %1 = Channel number %2 = Block number, label %4 = Program name

**Explanation:** Before a ShopTurn program can be executed, it has to be tested by ShopTurn. Alarm triggered by following cycle: F\_HEAD

**Remedy:** Simulate the subroutine first in ShopTurn or load it into the ShopTurn operating mode "Machine auto".

**61236 [Channel %1: ] Block %2: ShopTurn subroutine %4 cannot be executed as not tested by ShopTurn.**

**Parameters:** %1 = Channel number %2 = Block number, label %4 = Subroutine name

**Explanation:** Before a ShopTurn subroutine can be used, it has to be tested by ShopTurn. Alarm triggered by following cycle: F\_HEAD.

**Remedy:** Simulate the subroutine first in ShopTurn or load it into the ShopTurn operating mode "Machine auto".

**61237 [Channel %1: ] Block %2: Retraction direction unknown. Withdraw tool manually!**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The tool is in the retraction area and it is unknown in which direction it can be travelled out of it. Alarm triggered by following cycle: F\_SP\_RP

**Remedy:** Manually retract the tool from the retraction area defined in the program header and restart the program.

**61238 [Channel %1: ] Block %2: Machining direction unknown!**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The direction of the next machining is unknown. Alarm triggered by following cycle: F\_SP\_RP.

**Remedy:** Please contact the responsible Siemens regional office.

**61239 [Channel %1: ] Block %2: Tool change point lies within retraction area!**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The tool change point has to be far enough outside the retraction area so that when the revolver is swiveled, no tool extends into the retraction area. The alarm is triggered by the following cycle: F\_SP\_RP

**Remedy:** Specify another tool change point.



**61240 [%1: ] Block %2: %3] Wrong feed type**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The feed type is not possible for this machining. Alarm triggered by following cycles: F\_DRM\_DR, F\_DRM\_PE, F\_DRM\_RE, F\_DRM\_SI, F\_GROOV, F\_MIM\_TR, F\_ROUGH, F\_SP\_EF, F\_UCUT\_T, CYCLE952

**Remedy:** Check feed type

**61241 [%1: ] Block %2: Retraction plane not defined for this machining direction**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** No retraction plane has been defined for the selected machining direction. Alarm triggered by following cycles: F\_SP\_RP, F\_SP\_RPT.

**Remedy:** Define the missing retraction plane.

**61242 [%1: ] Block %2: Wrong machine direction**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The machining direction has been specified incorrectly. Alarm triggered by following cycles: F\_DR, F\_DR\_PEC, F\_DR\_REA, F\_DR\_SIN, F\_DR\_TAP, F\_DRILL, F\_DRILLC, F\_DRILLD, F\_DRM\_DR, F\_DRM\_PE, F\_DRM\_RE, F\_DRM\_SI, F\_DRM\_TA, F\_MI\_CON, F\_MI\_EDG, F\_MI\_TR, F\_MI\_TXT, F\_MIM\_TR, F\_PI\_CIR, F\_PI\_REC, F\_PO\_CIR, F\_PO\_REC, F\_SL\_CIR, F\_SL\_LON, F\_TAP.

**Remedy:** Check the programmed machining direction.

**61243 [%1: ] Block %2: Correct tool change point, tool tip in**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The tool change point must be situated so far outside the retraction area that no tool protrudes into the retraction area on turret swiveling. Alarm triggered by following cycle: F\_SP\_RP

**Remedy:** Specify another tool change point.

**61244 [%1: ] Block %2: Pitch change causing**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The specified pitch change causes a reversal of the thread direction. Alarm triggered by following cycle: CYCLE99

**Remedy:** Check thread pitch change and thread geometry.

**61246 [%1: ] Block %2: Safety distance too small**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The safety clearance is too small for machining. Alarm triggered by following cycle: CYCLE79.

**Remedy:** Increase safety clearance.

**61247 [%1: ] Block %2: Blank radius too small**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The blank radius is too small for machining. Alarm triggered by following cycle: CYCLE79.

**Remedy:** Increase blank radius.

**61248 [%1: ] Block %2: Infeed too small**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The infeed is too small for machining. Alarm triggered by following cycle: CYCLE79.

**Remedy:** Increase infeed.

**61249 [%1: ] Block %2: Number of edges too small**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The number of edges is too small. Alarm triggered by following cycle: CYCLE79.

**Remedy:** Increase number of edges.

**61250 [%1: ] Block %2: Width across flats/edge length too small**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The width across flats/edge length is too small. Alarm triggered by following cycle: CYCLE79.

**Remedy:** Increase key width/edge length.

**61251 [%1: ] Block %2: Width across flats/edge length too large**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The width across flats/edge length is too large. Alarm triggered by following cycle: CYCLE79.

**Remedy:** Decrease key width/edge length.

**61252 [%1: ] Block %2: Chamfer/radius too large**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Chamfer/radius is too large. Alarm triggered by following cycle: CYCLE79.

**Remedy:** Decrease chamfer/radius.

**61253 [Channel %1: ] Block %2: No finishing allowance programmed**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** No finishing allowance has been entered. Alarm triggered by following cycles: E\_PO\_CIR, E\_PO\_REC, E\_SL\_CIR, E\_SL\_LON, F\_PO\_CIR, F\_PO\_REC, F\_SL\_CIR, F\_SL\_LON.

**Remedy:** Programm a finishing allowance.

**61254 [Channel %1: ] Block %2: Error while traveling to fixed stop**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Error on travelling to fixed stop. Alarm triggered by following cycle: F\_SUB\_SP.

**Remedy:** specify another Z1 position for gripping the counterspindle.

**61255 [Channel %1: ] Block %2: Error during cut-off: Tool broken?**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Cut-off could not be completed. A tool breakage might have occurred. Alarm triggered by following cycles: F\_PARTOF, F\_SUB\_SP.

**Remedy:** Check the tool.

**61256 [Channel %1: ] Block %2: Mirroring not allowed at program start. Deselect work offset!**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Mirroring impermissible at program start. Alarm triggered by following cycle: F\_HEAD.

**Remedy:** Deselect work offset.

**61257 [Channel %1: ] Block %2: incomplete setup of counterspindle**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Setup of the counterspindle is incomplete. Alarm triggered by following cycle: F\_SUB\_SP.

**Remedy:** The following machine and setting data must be set for the counterspindle:

- MD52206 \$MCS\_AXIS\_USAGE
- SD55232 \$SCS\_SUB\_SPINDLE\_REL\_POS
- SD55550 \$SCS\_TURN\_FIXED\_STOP\_DIST
- SD55551 \$SCS\_TURN\_FIXED\_STOP\_FEED
- SD55552 \$SCS\_TURN\_FIXED\_STOP\_FORCE

**61258 [Channel %1: ] Block %2: Assign parameters for counterspindle chuck in the spindle chuck data**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The parameters for the counterspindle chuck in the spindle chuck data have not been assigned. The alarm is triggered by the following cycles: F\_SUB\_SP.

**Remedy:** Indicate parameters ZCn, ZSn and ZEn in the mask "Parameters" > "Setting data" > "Spindle chuck data".

**61261 [Channel %1: ] Block %2: center offset too large**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The center offset on center drilling is larger than permissible. Alarm triggered by following cycles: F\_DRILL, F\_DRILLD.

**Remedy:** Enter smaller center offset (see display machine data 9862).

**61263 [Channel %1: ] Block %2: Chained ShopMill program blocks not permissible in subprogram on pos. pattern**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** If a subroutine is called from a position pattern, the subroutine itself must not include a position pattern. The alarm is triggered by the following cycle: E\_MANAGE

**Remedy:** Reprogram machining.

**61265 [Channel %1: ] Block %2: Too many restrictions, use rectangular pocket**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** In face milling a maximum of only 3 sides can be delimited. Alarm triggered by following cycle: CYCLE61

**Remedy:** Use pocket cycle.

**61266 [Channel %1: ] Block %2: Illegal machining direction**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** In face milling, the delimitations and the direction of machining do not match. Alarm triggered by following cycle: CYCLE61

**Remedy:** Select another direction of machining.

**61267 [Channel %1: ] Block %2: Plane infeed too large, residual corners remain**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** In face milling, the plane infeed must not exceed 85%. Alarm triggered by following cycle: CYCLE61

**Remedy:** Select a smaller plane infeed, as otherwise residual corners will be left over.

**61268 [Channel %1: ] Block %2: Illegal machining direction, residual corners are left over.**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** In face milling, the machining direction does not match the selected delimitations. Alarm triggered by following cycle: CYCLE61.

**Remedy:** The machining direction must be selected to match the delimitations.

**61269 [Channel %1: ] Block %2: External tool diameter too small**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Incorrect tool definition. Alarm triggered by following cycle: CYCLE61.

**Remedy:** Check angle and diameter of the tool used.

**61270 %[[Channel %1: ] Block %2: %]Chamfer width too small**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Chamfer width selected too small. Alarm triggered by the following cycles: E\_SP\_CHA, F\_SP\_CHA.

**Remedy:** Increase the chamfer width.

**61271 %[[Channel %1: ] Block %2: %]Chamfer width > tool radius**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Chamfer width larger than tool radius. Alarm triggered by following cycles: E\_SP\_CHA, F\_SP\_CHA.

**Remedy:** Use a larger tool.

**61272 %[[Channel %1: ] Block %2: %]Insertion depth too small**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Insertion depth on chamfering too small. Alarm triggered by following cycles: E\_SP\_CHA, F\_SP\_CHA.

**Remedy:** Increase the insertion depth.

**61273 %[[Channel %1: ] Block %2: %]Insertion depth too large**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Insertion depth on chamfering too large. Alarm triggered by following cycles: E\_SP\_CHA, F\_SP\_CHA.

**Remedy:** Decrease the insertion depth.

**61274 %[[Channel %1: ] Block %2: %]Invalid tool angle**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Invalid tool angle. Alarm triggered by following cycles: E\_SP\_CHA, F\_SP\_CHA.

**Remedy:** Check tool angle

**61275 [Channel %1: ] Block %2: Target point violates software limit switch!**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Due to a swivel action, the end point is outside the software limit switches. Alarm triggered by following cycle: E\_SP\_RP.

**Remedy:** Select another retraction plane or approach a suitable interpolation point.

**61276 [Channel %1: ] Block %2: External tool diameter required for restrictions**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Outer tool diameter required in case of delimitations. Alarm triggered by following cycle: CYCLE61.

**Remedy:** Specify the outer tool diameter.

**61277 [Channel %1: ] Block %2: Tool diameter larger than restriction**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Tool diameter larger than delimitation. Alarm triggered by following cycle: CYCLE61.

**Remedy:** Use a smaller tool.

**61278 [Channel %1: ] Block %2: If tool angle is larger than 90°, both tool diameters must be equal**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** For tool angles larger than 90°, the two tool diameters must be identical. Alarm triggered by following cycle: CYCLE61.

**Remedy:** Correct the tool angle or the tool diameters.

**61279 [Channel %1: ] Block %2: If tool angle equals 90°, both tool diameters must be equal**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** For tool angles equal to 90°, the two tool diameters must be identical. Alarm triggered by following cycle: CYCLE61.

**Remedy:** Correct the tool angle or the tool diameters.

**61280 [Channel %1: ] Block %2: %4- Mirroring missing in work offset for counterspindle**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The work offset for counterspindle machining does not have Z mirroring. The alarm is triggered by the following cycle: F\_SUB\_SP, CYCLE209

**Remedy:** Select Z mirroring for the work offset used.

**61281 [Channel %1: ] Block %2: starting point of machining outside retraction planes**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The starting point of machining is outside the retraction planes. Alarm triggered by following cycle: F\_SP\_RP.

**Remedy:** Adjust the retraction planes.

**61282 [Channel %1: ] Block %2: end point of machining outside retraction planes**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The end point of machining is outside the retraction planes. Alarm triggered by following cycle: F\_SP\_RP.

**Remedy:** Adjust the retraction planes.

**61283 [Channel %1: ] Block %2: direct approach not possible, as tool change required**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** After block search a position is to be reached by direct approach, but a tool change is required before. Alarm triggered by following cycle: F\_TFS.

**Remedy:** First execute a manual tool change, then restart the block search.

**61284 [Channel %1: ] Block %2: starting point cannot be approached without collision. Pre-position tool manually**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The starting point cannot be approached without collisions. Alarm triggered by following cycles: F\_DRILL, F\_DRILLC, F\_DRILLD, F\_DRM\_DR, F\_DRM\_PE, F\_DRM\_RE, F\_DRM\_SI, F\_DRM\_TA, F\_GROOV, F\_MIM\_TR, F\_PARTOF, F\_SP\_EF, F\_TAP, F\_TR\_CON, F\_UCUT\_T.

**Remedy:** Preposition the tool manually.

**61285 [Channel %1: ] Block %2: parking position is below return plane XRA.**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The parking position is below retraction plane XRA. Alarm triggered by following cycle: F\_SP\_RP.

**Remedy:** Move the parking position above retraction plane XRA.

**61286 [Channel %1: ] Block %2: machining not possible, check tool angle.**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Machining not possible with the specified tool. Alarm triggered by following cycles: F\_UCUT\_T.

**Remedy:** Use a suitable tool.

**61287 %[[Channel %1: ] Block %2: %]no master spindle active.**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** No master spindle active. Alarm triggered by following cycle: CYCLE63, CYCLE64, F\_TFS.

**Remedy:** Activate the master spindle (machine data 20090).

**61288 [Channel %1: ] Block %2: Main spindle not set up**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE210

**Remedy:** Enter channel axis number of main spindle in MD52206 \$MCS\_AXIS\_USAGE.

**61289 [Channel %1: ] Block %2: Counterspindle not set up**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE210

**Remedy:** Enter channel axis number of counterspindle in MD52206 \$MCS\_AXIS\_USAGE.

**61290 [Channel %1: ] Block %2: Tool spindle not set up****Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE210**Remedy:** Enter channel axis number of tool spindle in MD52206 \$MCS\_AXIS\_USAGE.**61291 [Channel %1: ] Block %2: Linear axis of counterspindle not set up****Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE210**Remedy:** Enter channel axis number of linear axis of counterspindle in MD52206 \$MCS\_AXIS\_USAGE.**61292 [Channel %1: ] Block %2: B axis not set up****Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE210**Remedy:** Enter channel axis number of B axis in MD52206 \$MCS\_AXIS\_USAGE.**61293 [Channel %1: ] Block %2: Tool %4 has no spindle rotation direction****Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm will be triggered by the following cycles: E\_TFS, F\_TFS**Remedy:** Select spindle rotation direction in tool list.**61320 [Channel %1: ] Block %2: Check tool number****Parameters:** %1 = Channel number %2 = Block number, label**Explanation:** Alarm can be triggered by following measuring cycles: all measuring cycles.**Remedy:** Bei 840D sl:

-Check parameter T. With active tool management, parameter T=0 (\_TNUM=0), and parameter \_TNAME is empty or the specified tool name is unknown to the tool management.

**61328 [Channel %1: ] Block %2: Check D number****Parameters:** %1 = Channel number %2 = Block number, label**Explanation:** D number in parameter \_KNUM is 0. The alarm can be triggered by all measuring cycles.**Remedy:** Check parameter for tool offset target (\_KNUM)**61329 [Channel %1: ] Block %2: Check rotary axis****Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered: CYCLE998**Remedy:** No name assigned to the axis number specified in the parameter of the rotary axis (\_RA), or this axis is not configured as a rotary axis. Check MD 20080 and MD 30300.**61343 %[[Channel %1: ] Block %2: %]No tool available with this name %4****Parameters:** %1 = Channel number %2 = Block number, label channel number**Explanation:** The alarm can be triggered by the following measuring cycles: all measuring cycles, CYCLE63, CYCLE64**Remedy:** Check tool name.**61357 %[[Channel %1: ] Block %2: %]No resources free****Parameters:** %1 = Channel number %2 = Block number, label channel number**Explanation:** Alarm is triggered by the following cycles: CYCLE63, CYCLE64, CYCLE106 Not enough NC memory space available or too many files / directories in the NC file system.**Remedy:** Delete or unload files MD18270: \$MN\_MM\_NUM\_SUBDIR\_PER\_DIR, MD18280: \$MN\_MM\_NUM\_FILES\_PER\_DIR or MD18320: Check \$MN\_MM\_NUM\_FILES\_IN\_FILESYSTEM and increase if necessary.**61403 [Channel %1: ] Block %2: Work offset correction not executed****Parameters:** %1 = Channel number

%2 = Block number, label channel number

**Explanation:** Alarm can be triggered by following measuring cycles: all measuring cycles.**Remedy:** Call the SIEMENS hotline**61519 %[[Channel %1: ] Block %2: %]Incorrect type of machining****Parameters:** %1 = Channel number %2 = Block number, label channel number**Explanation:** The alarm can be triggered by the following grinding cycles: CYCLE63, CYCLE64, CYCLE410, CYCLE411, CYCLE412, CYCLE413, CYCLE415, CYCLE952

**Remedy:** Assign a value between 1 and 3 to parameter B\_ART

**61532 [Channel %1: ] Block %2: Value for \_LAGE is incorrect**

**Parameters:** %1 = Channel number  
%2 = Block number, label channel number

**Explanation:** The alarm can be triggered by the following grinding cycle: CYCLE414

**Remedy:** Correct parameter content for \_LAGE

**61564 %[[Channel %1: ] Block %2: %]Feed insertion <=0**

**Parameters:** %1 = Channel number  
%2 = Block number, label channel number

**Explanation:** The alarm can be triggered by the following grinding cycles: CYCLE434, CYCLE444

**Remedy:** Check values in grinding wheel data

**61601 [Channel %1: ] Block %2: Finished part diameter too small**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The programmed radius of the machined part is too small. Alarm triggered by following cycles:

CYCLE94, CYCLE96.

**Remedy:** Check parameter SPD or DIATH.

**61602 [Channel %1: ] Block %2: Tool width incorrectly defined**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Plunge cutter is larger than the programmed groove width. Alarm triggered by following cycle:

CYCLE93.

**Remedy:** Check tool or change program.

**61603 [Channel %1: ] Block %2: Recess type incorrectly defined**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Radii/chamfers at the groove base do not match the groove width. Face groove on a contour element

running parallel to the longitudinal axis is not possible. Alarm triggered by following cycle: CYCLE93.

**Remedy:** Check parameter VARI.

Clear alarm with the RESET key. Restart part program

**61604 [Channel %1: ] Block %2: Active tool violates programmed contour**

**Parameters:** %1 = Channel number %2 = Block

number, label

**Explanation:** Contour violation in the relief cut elements due to the tool clearance angle of the tool used. Alarm triggered by following cycle: CYCLE95.

**Remedy:** Use a different tool or check the contour subroutine.

**61605 [Channel %1: ] Block %2: Contour incorrectly programmed**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Illegal relief cut element detected. Alarm triggered by following cycles: CYCLE76, CYCLE77, CYCLE95.

**Remedy:** Check contour program.

**61606 [Channel %1: ] Block %2: Error during contour preparation**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** An error has been found on conditioning the contour. This alarm is always related to one of NCK alarms 10930...10934, 15800 or 15810. Alarm triggered by following cycle: CYCLE95.

**Remedy:** Check contour subroutine.

**61607 [Channel %1: ] Block %2: Starting point incorrectly programmed**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The starting point reached before the cycle call does not lie outside the rectangle described by the contour subroutine. Alarm triggered by following cycle: CYCLE95.

**Remedy:** Check starting point prior to cycle call.

**61608 [Channel %1: ] Block %2: Incorrect tool point direction programmed**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE94, CYCLE96.

**Remedy:** A cutting edge position 1...4, matching the undercut form, must be programmed.

**61609 [Channel %1: ] Block %2: Shape incorrectly defined**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE94, CYCLE96, LONGHOLE, POCKET3, SLOT1.

**Remedy:** Check parameter for the undercut form or groove form or pocket.

**61610 [Channel %1: ] Block %2: No infeed depth programmed**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE76, CYCLE77, CYCLE96.

**Remedy:** Check parameter MID.

**61611 [Channel %1: ] Block %2: No point of intersection found**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** No intersection could be calculated with the contour. Alarm triggered by following cycle: CYCLE95.

**Remedy:** Check contour programming or modify infeed depth.

**61612 [Channel %1: ] Block %2: Thread finishing not possible**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE97, CYCLE98.

**Remedy:** Check the conditions for thread finishing.

**61613 [Channel %1: ] Block %2: Undercut position incorrectly defined**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE94, CYCLE96.

**Remedy:** Check value in parameter \_VARI.

**61700 %[[Channel %1: ] Block %2: %]Name of program to be generated is missing**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check parameter PRG

**61701 %[[Channel %1: ] Block %2: %]Contour %4 does not exist**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check parameter CON  
- Check contour call  
- Check whether the contours exist in the program storage (workpieces, subroutines or part programs)

**61702 %[[Channel %1: ] Block %2: %]Label %4 not existing in machined part contour**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check whether the labels exist in the machined part contour

**61703 %[[Channel %1: ] Block %2: %]Label %4 not existing in the blank contour**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check whether the labels exist in the blank contour

**61704 %[[Channel %1: ] Block %2: %]Machined part contour missing**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check contour call

**61705 %[[Channel %1: ] Block %2: %]Blank contour missing**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check contour call

**61706 %[[Channel %1: ] Block %2: %]Error in machined part contour %4**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check programming of machined part contour

**61707 %[[Channel %1: ] Block %2: %]Error in the blank contour %4**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check programming of the blank contour

**61708 %[[Channel %1: ] Block %2: %]Too many contours specified**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check number of contours  
- Max. two contours (machined part and blank contours)  
- Min. one contour (machined part contour)

**61709 %[[Channel %1: ] Block %2: %]Cutting edge radius too small**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952.

**Remedy:** - Check cutting edge radius of the tool in tool management

**61710 %[[Channel %1: ] Block %2: %]Calculation has been cancelled**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952.

**Remedy:** - Calculation has been cancelled by PI service; please try again

**61711 %[[Channel %1: ] Block %2: %]Infeed D is larger than the tip width of the tool**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952.

**Remedy:** - Check infeed D in connection with the tip width of the tool in tool management.

**61712 %[[Channel %1: ] Block %2: %]Infeed DX or DZ is larger than tip length of tool**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952.

**Remedy:** - Check infeed DX or DZ in connection with tip length of the tool in tool management.

**61713 %[[Channel %1: ] Block %2: %]Tool radius larger than half the tip width**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952.

**Remedy:** - Check tool radius and tip width of tool (plunge cutter, cutting tool)

**61714 %[[Channel %1: ] Block %2: %]System error contour turning %4**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952.

**Remedy:** With error number 103 the cycle is parameterized incorrectly. Change the program name in the cycle. PRG parameters: the name of the part program must not already exist in the calling directory or used a second time.

**61730 %[[Channel %1: ] Block %2: %]Machining range outside delimitation**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check machining range and delimitation

**61731 %[[Channel %1: ] Block %2: %]Unable to determine contour direction**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check contours  
- Check whether the contour starting point exists

**61732 %[[Channel %1: ] Block %2: %]No material available for machining**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check programming of the blank and machined part contour, particularly their position towards each other

**61733 %[[Channel %1: ] Block %2: %]Cutting edge not compatible with cutting direction**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check cutting edge position and cutting direction in tool management

**61734 %[[Channel %1: ] Block %2: %]Machined part contour is outside the blank contour**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952



**Remedy:** - Check programming of the machined part and blank contour, particularly their position towards each other.

**61735 %[[Channel %1: ] Block %2: %]Infeed D larger than the tip length of the tool**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check infeed D in relation to the tip length of the tool in tool management

**61736 %[[Channel %1: ] Block %2: %]Cutting depth greater than maximum depth of cut of the tool**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Clear alarm with the RESET key. Restart part program.

**61737 %[[Channel %1: ] Block %2: %]Cutting depth smaller than minimum depth of cut of the tool**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Clear alarm with the RESET key. Restart part program.

**61738 %[[Channel %1: ] Block %2: %]Incorrect cutting edge position**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check cutting edge position in tool management

**61739 %[[Channel %1: ] Block %2: %]Blank must be closed contour**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check whether the blank contour is closed

**61740 %[[Channel %1: ] Block %2: %]Collision through approach**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Select the starting position to enable collision-free approach of the contour

**61741 %[[Channel %1: ] Block %2: %]Axis in negative range**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - Check the position of the axis in the ordinate

**61742 %[[Channel %1: ] Block %2: %]Retraction plane %4 is within the machining range**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE952

**Remedy:** - On internal machining check machining range in relation to the entered retraction distance (\$SCS\_TURN\_ROUGH\_I\_RELEASE\_DIST)

**61800 [Channel %1: ] Block %2: Ext. CNC system missing**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Machine data for external language MD18800: \$MN\_MM\_EXTERN\_LANGUAGE or option bit 19800 \$ON\_EXTERN\_LANGUAGE is not set.

**Remedy:** Clear alarm with the RESET key. Restart part program.

**61801 [Channel %1: ] Block %2: Wrong G code selected**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** In the program call CYCLE300<value> an impermissible numerical value was programmed for the entered CNC System, or in the Cycles Setting Datum an incorrect value for the G Code System was set.

**Remedy:** - Clear alarm with the RESET key. Restart part program

**61803 [Channel %1: ] Block %2: Programmed axis not available**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** The programmed axis is not in

the system. Alarm triggered by following cycles: CYCLE83, CYCLE84, CYCLE840.

**Remedy:** Check parameter \_AXN. Check MD20050-20080.

**61807 [Channel %1: ] Block %2: Wrong spindle direction programmed (active)**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE840. The programmed spindle direction contradicts the spindle direction planned for the cycle.

**Remedy:** Check parameters SDR and SDAC.

**61809 [Channel %1: ] Block %2: Drill position not permissible**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**61816 [Channel %1: ] Block %2: Axes not on reference point**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**61900 %[[Channel %1: ] Block %2: %]Name of program to be generated is missing**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64

**Remedy:** - Check parameter PRG

**61901 %[[Channel %1: ] Block %2: %]Contour %4 does not exist**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64

**Remedy:** - Check contour call  
- Check whether the contours exist in the program storage (workpieces, subroutines or part programs)

**61902 %[[Channel %1: ] Block %2: %]Label %4 not existing in the pocket contour**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63

**Remedy:** - Check whether the labels exist in the pocket contour

**61903 %[[Channel %1: ] Block %2: %]Label %4 not existing in the blank contour**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63

**Remedy:** - Check whether the labels exist in the blank contour

**61904 %[[Channel %1: ] Block %2: %]Label %4 not existing in the island contour**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63

**Remedy:** - Check whether the labels exist in the island contour

**61905 %[[Channel %1: ] Block %2: %]Label %4 not existing in the spigot contour**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63

**Remedy:** - Check whether the labels exist in the spigot contour

**61906 %[[Channel %1: ] Block %2: %]Label %4 not existing in the contour**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE64

**Remedy:** - Check whether the labels exist in the contour

**61907 %[[Channel %1: ] Block %2: %]Pocket contour missing**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64

**Remedy:** - Check contour call

**61908 %[[Channel %1: ] Block %2: %]Blank contour missing**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64

**Remedy:** - Check contour call

**61909 %[[Channel %1: ] Block %2: %]Error in pocket contour %4**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63

**Remedy:** - Check programming of the pocket contour

**61910 %[[Channel %1: ] Block %2: %]Error in the blank contour %4**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63

**Remedy:** - Check programming of the blank contour

**61911 %[[Channel %1: ] Block %2: %]Error in island contour %4**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63

**Remedy:** - Check programming of the island contour

**61912 %[[Channel %1: ] Block %2: %]Error in spigot contour %4**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63

**Remedy:** - Check programming of the spigot contour

**61913 %[[Channel %1: ] Block %2: %]Error in contour %4**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE64

**Remedy:** - Check programming of the contour

**61914 %[[Channel %1: ] Block %2: %]Too many contours specified**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64

**Remedy:** - Check the number of contours

**61915 %[[Channel %1: ] Block %2: %]Cutter radius too small**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64

**Remedy:** - Check the radius of the milling cutter in tool management

**61916 %[[Channel %1: ] Block %2: %]Calculation has been cancelled**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64

**Remedy:** - Calculation has been cancelled by PI service; please try again

**61917 %[[Channel %1: ] Block %2: %]Combination of centering/predrilling and spigot not allowed**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63

**Remedy:** - Machining of spigot in conjunction with predrilling/centering not allowed!

**61918 %[[Channel %1: ] Block %2: %]Cut. radius for residual mach. must be smaller than cut. radius for ref. tool**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63

**Remedy:** - Check cutter radius for residual machining which must be smaller than cutter radius for reference tool !

**61919 %[[Channel %1: ] block %2: %]Radius of the reference tool is too small**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64

**Remedy:** - Check the radius of the reference tool.

**61920 %[[Channel %1: ] block %2: %]System error contour milling %4**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64

**Remedy:** With error number 103 the cycle is parameterized incorrectly. Change the program name in the cycle. PRG parameters: the name of the part program must not already exist in the calling directory or used a second time.

**61930 %[[Channel %1: ] Block %2: %]No contour available**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles:  
CYCLE63, CYCLE64

**Remedy:** - Check contour call  
- Check whether the contours exist in the program storage (workpieces, subroutines or part programs)

**61931 %[[Channel %1: ] Block %2: %]Contour not closed**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles:  
CYCLE63, CYCLE64

**Remedy:** - Check whether the contours are closed

**61932 %[[Channel %1: ] Block %2: %]Selfcutting contour**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Alarm triggered by following cycles:  
CYCLE63, CYCLE64

**Remedy:** - Modify contour programming

**61933 %[[Channel %1: ] Block %2: %]Too many contour elements**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles:  
CYCLE63, CYCLE64

**Remedy:** - Modify contour programming and thereby try to reduce the number of contour elements

**61934 %[[Channel %1: ] Block %2: %]Programming of the machining plane not allowed here**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles:  
CYCLE63, CYCLE64

**Remedy:** - Modify contour programming

**61935 %[[Channel %1: ] Block %2: %]Programming of inch/metric measuring system not allowed here**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles:  
CYCLE63, CYCLE64

**Remedy:** - Modify contour programming

**61936 %[[Channel %1: ] Block %2: %]G0 is not allowed in contour programming**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles:  
CYCLE63, CYCLE64

**Remedy:** - Modify contour programming, replace G0 by G1

**61937 %[[Channel %1: ] Block %2: %]Pocket depth programmed incorrectly**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles:  
CYCLE63

**Remedy:** - Check parameter Z1

**61938 %[[Channel %1: ] Block %2: %]No starting point specified**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles:  
CYCLE63

**Remedy:** - Check parameter for specified starting point,  
- for G17: XS, YS  
- for G18: ZS, XS  
- for G19: YS, ZS

**61939 %[[Channel %1: ] Block %2: %]No center point specified for circle**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles:  
CYCLE63, CYCLE64

**Remedy:** - Check contour programming, particularly circular-path programming

**61940 %[[Channel %1: ] Block %2: %]Specified starting point programmed incorrectly**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles:  
CYCLE63

**Remedy:** - Correct specified starting point

**61941 %[[Channel %1: ] Block %2: %]Helix radius too small**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Alarm triggered by following cycles:  
CYCLE63

**Remedy:** - Increase helix radius

**61942 %[[Channel %1: ] Block %2: %]Helix violates contour**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycles:  
CYCLE63

**Remedy:** - Check helix radius and reduce in size, if possible

**61943 %[[Channel %1: ] Block %2: %]Approach/retract motion violates contour**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64

**Remedy:** - Reduce safety clearance SC, if possible

**61944 %[[Channel %1: ] Block %2: %]Ramp path too short**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63

**Remedy:** - Check insertion angle, possibly use different insertion mode

- Use tool with smaller radius

**61945 %[[Channel %1: ] Block %2: %]Plane infeed too large, residual corners remaining**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63

**Remedy:** - Check parameter for plane infeed

- for G17: DXY

- for G18: DZX

- for G19: DYZ

**61946 %[[Channel %1: ] Block %2: %]Island contour existing twice**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64

**Remedy:** - Delete double island contour

**61947 %[[Channel %1: ] Block %2: %]Spigot contour existing twice**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64

**Remedy:** - Delete double spigot contour

**61948 %[[Channel %1: ] Block %2: %]No material available for machining**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64

**Remedy:** - Check programming of the contours

**61949 %[[Channel %1: ] Block %2: %]Island is outside the pocket**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63, CYCLE64

**Remedy:** - Check programming of the island/pocket contour

**61950 %[[Channel %1: ] Block %2: %]No residual material available**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63

**61951 %[[Channel %1: ] Block %2: %]Cutter radius for residual material too large**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63

**Remedy:** - Use cutter with smaller radius

**61952 %[[Channel %1: ] Block %2: %]Radius of res. material cutter too small in relation to ref. cutter**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Alarm triggered by following cycles: CYCLE63

**Remedy:** - Use a cutter with a larger radius for residual machining

**62100 [Channel %1: ] Block %2: No drilling cycle active**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** No modal drilling cycle has been called before the drilling pattern cycle call. Alarm triggered by following cycles: HOLES1, HOLES2.

**Remedy:** Check whether a drilling cycle was called prior to calling the drilling pattern cycle.

**62101 [Channel %1: ] Block %2: Milling direction incorrect - G3 is generated**

**Parameters:** %1 = Channel number

%2 = Block number, label

**Explanation:** Synchronous or reverse rotation programmed. But the spindle does not rotate at a cycle call.

**Remedy:** Check value in parameter CDIR.

**62103 [Channel %1: ] Block %2: No finishing allowance programmed**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** No finishing allowance is programmed, although it is necessary for this machining.

**Remedy:** Program a finishing allowance.

**62106 [Channel %1: ] Block %2: incorrect value for monitoring status in tool monitoring**

**Parameters:** %1 = Channel number %2 = Block number, label

**62180 [Channel %1: ] Block %2: Set rotary axes %4 [deg]**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE800. Note on 62180 and 62181: Sample display of the swivel angle to be set for a manual rotary axis in CYCLE800: 62181 "Set rotary axis B: 32.5 [grd]"

**Remedy:** Settable angles for manual rotary axes.

**62181 [Channel %1: ] Block %2: Set rotary axis %4 [deg]**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE800. Note on 62180 and 62181: Sample display of the swivel angle to be set for a manual rotary axis in CYCLE800: 62181 "Set rotary axis B: 32.5 [grd]"

**Remedy:** Settable angle for manual rotary axis.

**62182 [Channel %1: ] Block %2 : load inclinable head: %4**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** No swivel head is active. Alarm triggered by following cycles: E\_TCARR, F\_TCARR.

**Remedy:** Request to load a swivel head.

**62183 [Channel %1: ] Block %2 : unload inclinable head: %4**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE800.

**62184 [Channel %1: ] Block %2 : replace inclinable head: %4**

**Parameters:** %1 = Channel number  
%2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE800.

**62185 [Channel %1: ] Block %2 : angle adapted to angle grid: %4**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** %4 difference angle with Hirth tooth system Alarm triggered by following cycle: CYCLE800.

**Remedy:** Check setup of swivel CYCLE800.

**62186 [Channel %1: ] Block %2: No swiveling in JOG -> WO G%4 active and total basic WO (G500) contain rotations**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE800. On swiveling in JOG no rotation can be written to the work offset WO, if rotations are already contained in the total basic WO or in the basic reference Error 62186 message can be masked -> see setting data 55410 \$SCS\_MILL\_SWIVEL\_ALARM\_MASK

**Remedy:** ...%4 number of the active work offset WO.

**62187 [Channel %1: ] Block %2: Swiveling in JOG --> G500 active and total basic WO or basic reference contain rotations**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** Alarm triggered by following cycle: CYCLE800. During swiveling in JOG, it is not possible to write a rotation into the work offset WO, if, with active G500, rotations are already contained in the total basic WO or in the basic reference Error message 62187 can be masked -> see setting data 55410 \$SCS\_MILL\_SWIVEL\_ALARM\_MASK

**Remedy:** See notes for 62186 and 62187.

**62201 [Channel %1: ] Block %2: Z offset does not influence the retraction planes.**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** The retraction planes refer to the workpiece. Therefore, programmable offsets do not influence the retraction planes. Alarm triggered by following cycle: F\_SP\_RP.

**Remedy:** Ensure that the offset will not cause a collision. Then start the NC. The alarm can be suppressed via display machine data 9898.

**62202 [Channel %1: ] Block %2: NOTICE:  
tool travels directly to machining!**

**Parameters:** %1 = Channel number %2 = Block number, label

**Explanation:** After block search a position is to be reached by direct approach. Alarm triggered by following cycle: F\_TFS.

**Remedy:** Check whether the desired position can be reached without collision. Then execute an NC start.





# W: Accessory Functions

## Activating accessory functions

According to the machine (turn/mill) the following accessories can be taken into operation:

- automatic tailstock
- automatic vice/clamping device
- Air purge system
- Dividing attachment
- Robot interface
- Automatic doors
- Win3D view simulation software
- DNC interface

The accessories are activated with EMConfig.

## Robotic Interface

The robotic interface is used to connect the concept machines to an FMS/CIM system.

The most important functions of a concept machine can be automated via the inputs and outputs of an optional hardware module.

The following functions can be controlled via the robotic interface:

- Program START / STOP
- Door open / closed
- Quill clamp / back
- Clamping device open / closed
- Feed STOP

### Note:

The functionality of the Win3D-View is depending on the control software that is used.



## Automatic doors

Preconditions for activation:

- The auxiliary drives must be switched on.
- The main spindle must be still (M05 or M00) - this also means that the run-out phase of the main spindle must be ended (program dwell time if required).
- The feed axes must be still.
- The tool changer must be still.

Behavior when automatic doors active:

Opening door

The door can be opened manually, via the robot interface or DNC interface.

In addition, the door opens when the following commands are executed in the CNC program:

- M00
- M01
- M02
- M30

Closing door:

The door can be closed by manually pressing the button via the robot interface. It is not possible to close the door via the DNC interface.

## Win3D View

Win3D View is a 3D simulation for turning and milling, which is offered as an additional option for the WinNC product. Graphical simulations of CNC controls are primarily designed for industrial practice. The Win3D View screen representation goes beyond the industrial standard. Tools, raw parts, clamping devices and the processing steps are represented extremely realistically. The programmed movement paths of the tool are checked by the system for a collision with clamping device and raw part. A warning message is issued when there is danger. This makes possible to have understanding and control of the manufacturing process already on the screen.

Win3D View is used to visualize and prevent costly collisions.

Win3D View offers the following advantages:

- Extremely realistic representation of workpiece
- Tool and clamping device collision control
- Cut representation
- Zoom functions and turning of views
- Representation as solid or wireframe model

## DNC interface

The DNC interface (Distributed Numerical Control) enables the control system (WinNC) to be controlled remotely via a software protocol.

The DNC interface is activated with EMConfig, by indicating TCP/IP or a serial interface for the DNC.

During the installation of the control software, the DNC interface is enabled and configured, and can be reconfigured with EMConfig later on.

The DNC interface creates a connection between a higher-level computer (production control computer, FMS computer, DNS host computer, etc.) and the control computer of an NC machine. After activation of the DNC drive the DNC computer (Master) takes over control of the NC machine (Client). The DNC computer takes over complete control of the manufacturing. The automation fittings such as door, chuck (collet), quill, coolant, etc. can be controlled from the DNC computer. The current status of the NC machine is visible on the DNC computer.

The following data can be transferred or loaded via the DNC interface:

- NC Start
- NC Stop
- NC programs \*)
- Zero point shifts \*)
- Tool data \*)
- RESET
- Approach reference point
- Periphery control
- Override data

The DNC interface can be operated with the following CNC control types:

- SINUMERIK Operate T and M
- FANUC 31i T and M

Further details of the functions and the DNC protocol can be found in the accompanying product documentation.

If the DNC interface is operated with TCP/IP, it will wait for incoming connections on port 5557.

\*) not for SINUMERIK Operate and FANUC 31i

# X: EMConfig

**Note:**

The settings which are available in EMConfig are depending on the machine and the control that is used.



## General

EMConfig is a configuration software for WinNC. EMConfig helps you to alter the settings of WinNC.

The most important settings are:

- Control language
- System of measurement mm - inch
- Activate accessories
- Selection of interface for control keyboard

Using EMConfig you can also activate diagnostic functions in case of troubles - that way you get help immediately.



Safety-related parameters are protected by a password. They can only be activated by set-up technicians or by technical support representatives.



Icon for EMConfig

## How to start EMConfig

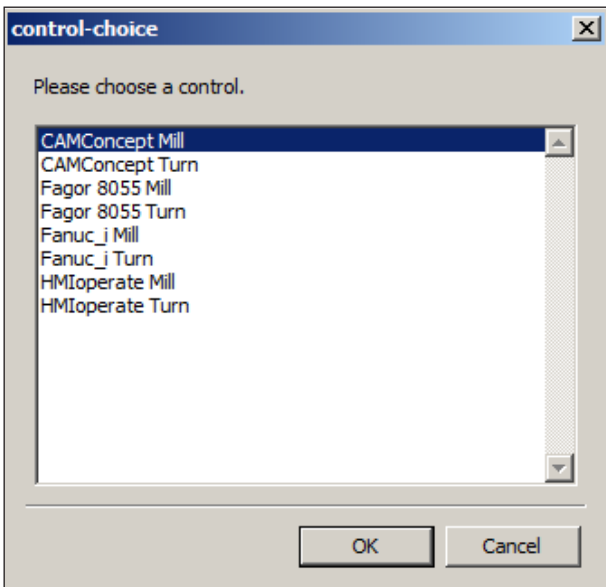
Open EMConfig.

In case several control types are installed, a selection box will appear on the screen.

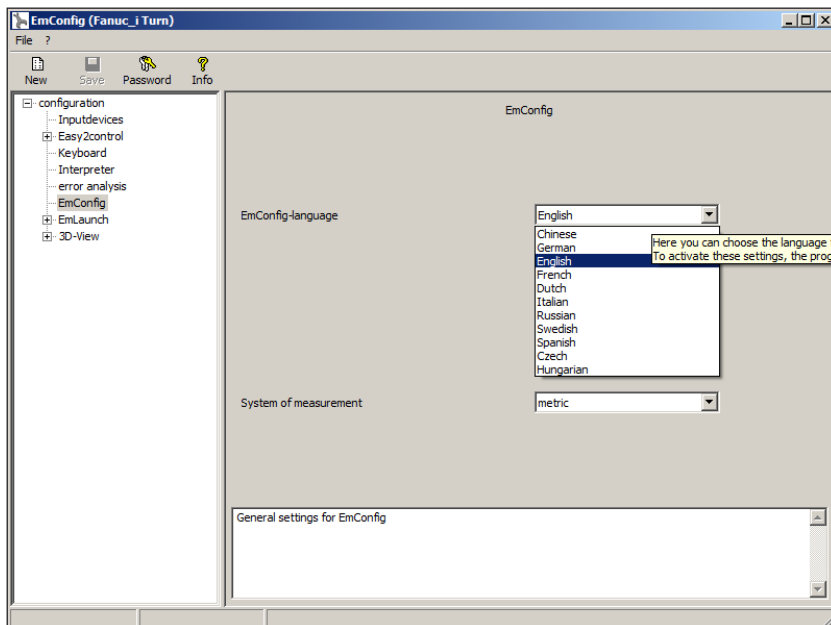
Select the required control type and click OK.

The following settings are only valid for the selected control type.

The window for EMConfig appears on the screen.



Selection box for control type



Change the language of EMConfig

Here you can change the language of EMConfig. In order to activate the settings, restart the program.

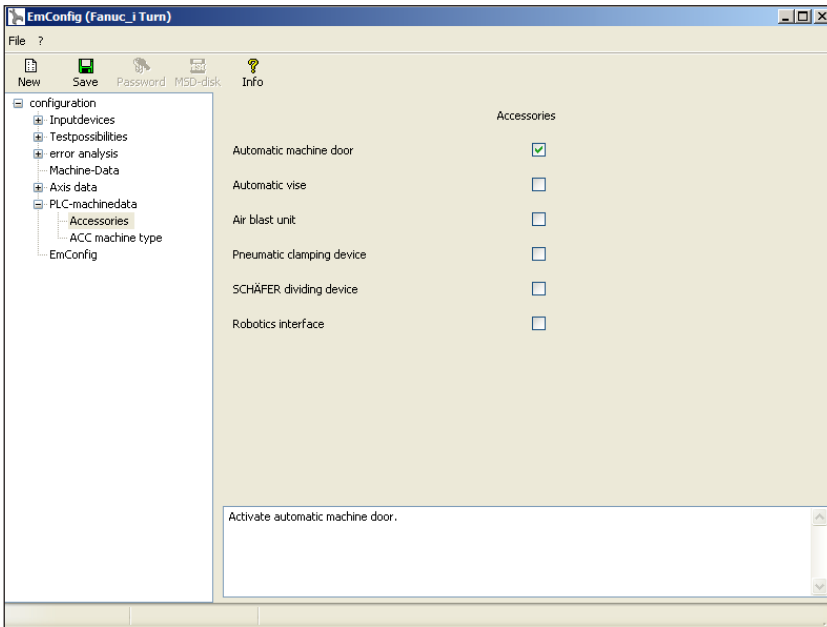
### Note:

Select the desired menu item. The appropriate function is explained in the text box.



## How to activate accessories

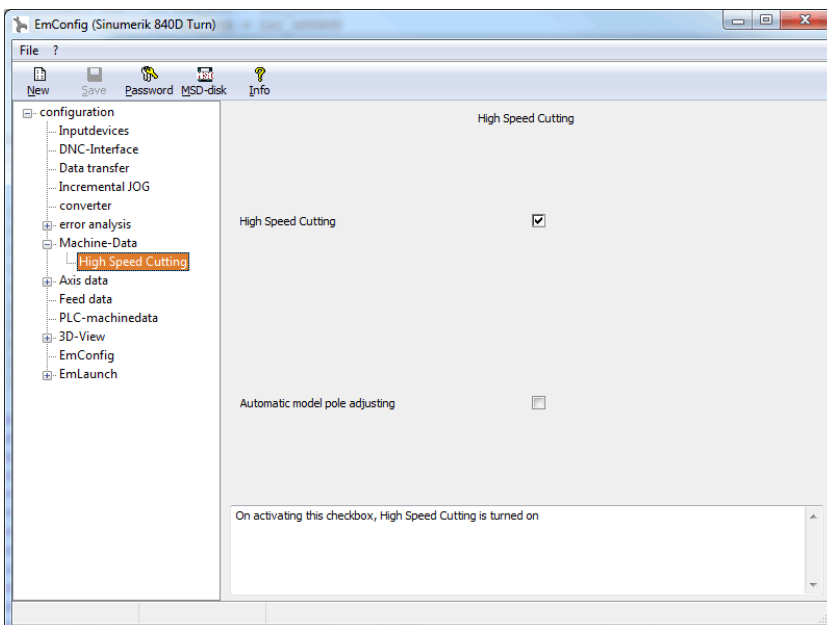
When you install accessories on your machine, you need to activate them here.



Activate accessories

## High Speed Cutting

On activating this checkbox, High Speed Cutting is turned on.



Activate High Speed Cutting

By using high speed cutting, the setting of the axis controller is adjusted. This gain is only effective until the programmed feed rate of 2500 mm/min and allows contour faithful retraction of the tool path and generating of sharp edges. If the feed is set up to higher than 2500 mm/min, it is automatically reset to the normal operating mode and sanded and rounded edges are created.

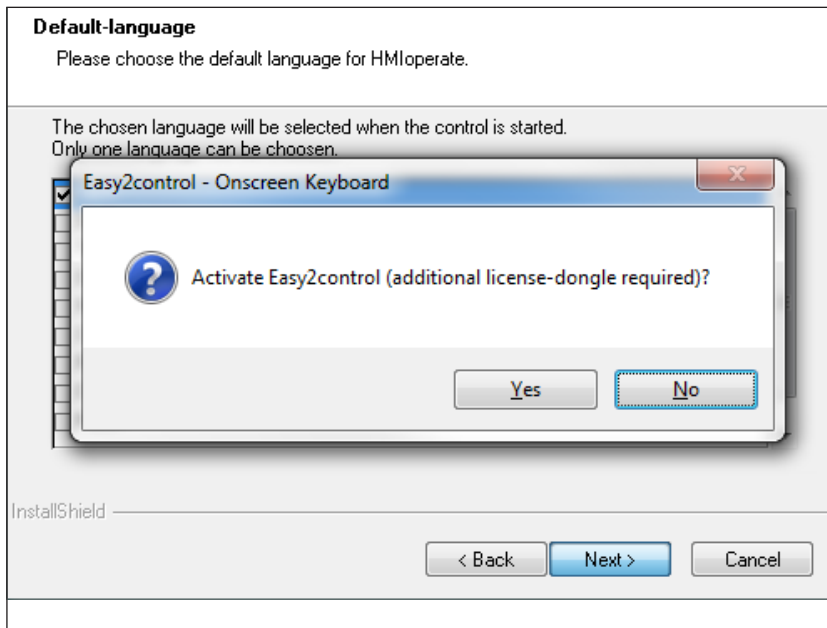
**Note:**

If Easy2control is used without the hardware-dongle, the controls are deactivated and an appropriate alarm is output by the controller. However, the virtual keyboard is displayed completely.



## Easy2control on screen operation

Installation and activation using the example of WinNC for Sinumerik Operate.

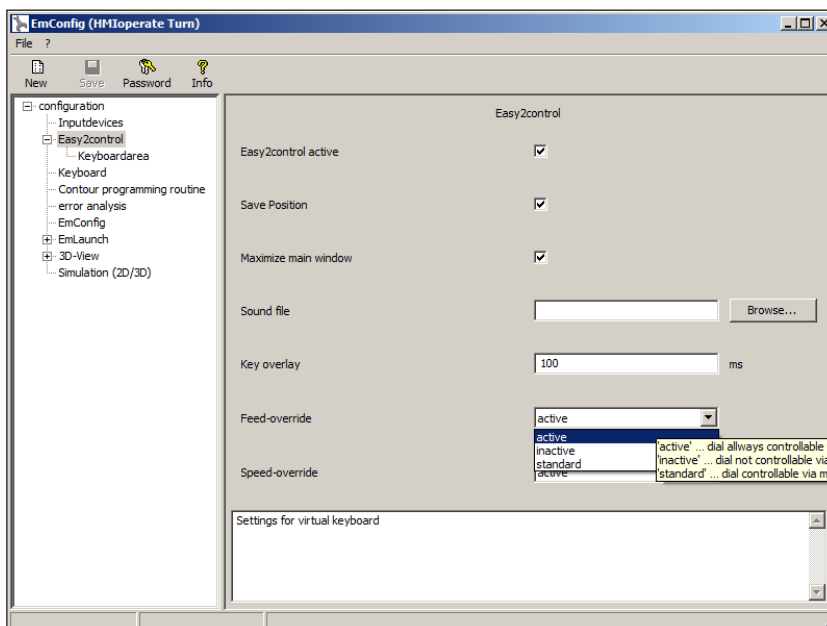


When installing the software WinNC for Sinumerik Operate you will be prompted to activate Easy2control. In order to use the Software without restriction, the supplied dongle must be connected to a free USB port.

Activating Easy2control

## Settings

This mask allows you to enable or disable Easy2control and make settings.



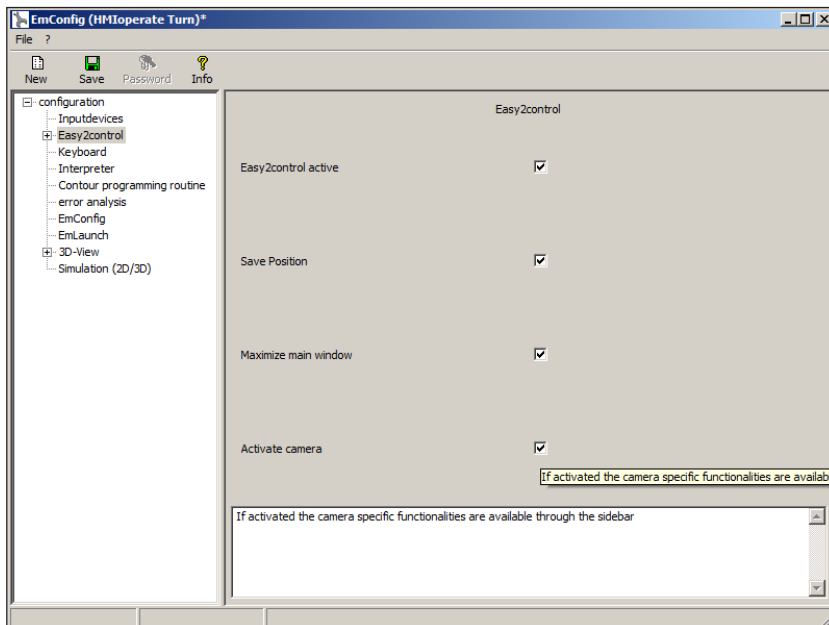
### Dial feed-override and dial speed-override:

- **Active:** dial always controllable via mouse/touchscreen (even with available hardware- version).
- **Inactive:** dial not controllable via mouse/touchscreen.
- **Standard:** dial controllable via mouse/touchscreen when no hardware-version is available.

Easy2control settings

## Machine room camera

The accessory machine room camera is available for all controls which support Easy2control.



*Activate camera*

Please refer to chapter Y “external input devices” for more information about the installation guide for the camera.

**Attention:**

The camera may not be operated without the supplied waterproof case.

If the camera is operated without the waterproof case it may be damaged by coolant and chips.

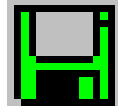
**Danger:**

Make sure the machine room camera is placed properly in the work area that collisions with the tool turret and the axes are avoided.

## How to save changes

After the settings, the changes must be saved.

Select "Save" or click on the icon.



### Note:

Input fields highlighted in red indicate inadmissible values. Inadmissible values are not saved in EMConfig.



After saving the changes, create a machine data floppy disk (MSD) or a machine data USB flash drive.

## How to create machine data floppy disk or machine data USB flash drive

After having changed the machine data, the machine data floppy disk or the machine data USB flash drive must be in the appropriate drive. Otherwise your changes cannot be saved and get lost.





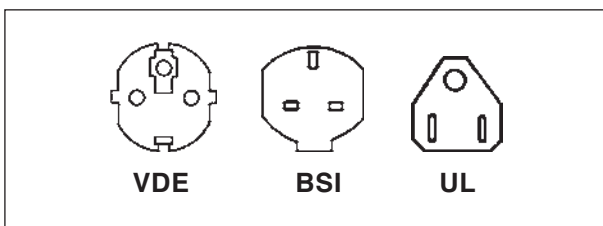
# Y: External Input Devices

## EMCO Control Keyboard USB

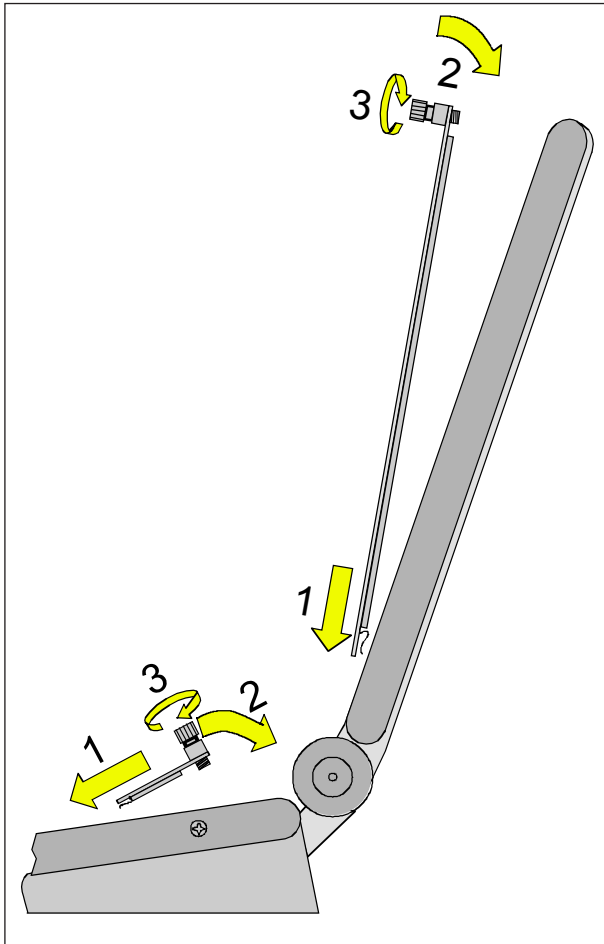
### Scope of supply

The scope of supply for a complete control keyboard consists of two parts:

- Basic case
- Key module



Ref. No.	Description		
X9B 000	Basic unit with USB cable		
X9Z 600	TFT Display with screen cable and power supply unit		
A4Z 010	Mains cable VDE		
A4Z 030	Mains cable BSI		
A4Z 050	Mains cable UL		
X9Z 050N	Key module FAGOR 8055 TC 2 key sheets with keys	X9Z 426N	Key module HEIDENHAIN 426/430 2 key sheets with keys 1 package exchange keys
X9Z 055N	Key module FAGOR 8055 MC 2 key sheets with keys	X9Z 060	Key module WinNC for SINUMERIK OPERATE 2 key sheets with keys
		X9Z 030	Key module WinNC for FANUC 31i 2 key sheets with keys 1 package exchange keys
		X9Z 640	Key module Emco WinNC for HEIDENHAIN TNC 640



### Assembling

- Place the corresponding key sheet with the clips in the basic case (1).
- Pull the key sheet into the basic case, it must be inserted plainly (2).
- Fix the key sheet with the two knurled screws (3).

**Note:**

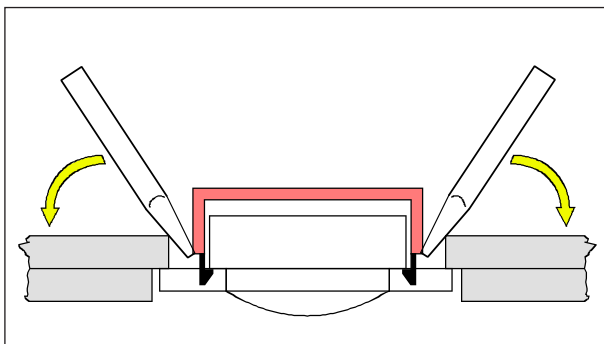
The key sheets must not be bended, otherwise the switching function can not be warranted.

### Exchange of single key caps

Off works the keyboards are equipped with the keys for turning.

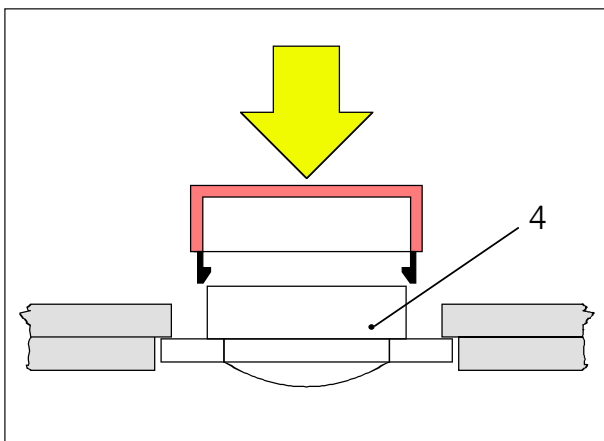
The scope of supply includes a package of exchange key caps to equip the keyboard for milling.

If you want to use the control keyboard for milling, you have to exchange a part of the key caps. Exchange them as shown on the following pages.



**Note:**

For the control type Emco WinNC for HEIDENHAIN TNC 640 only a milling version is available.



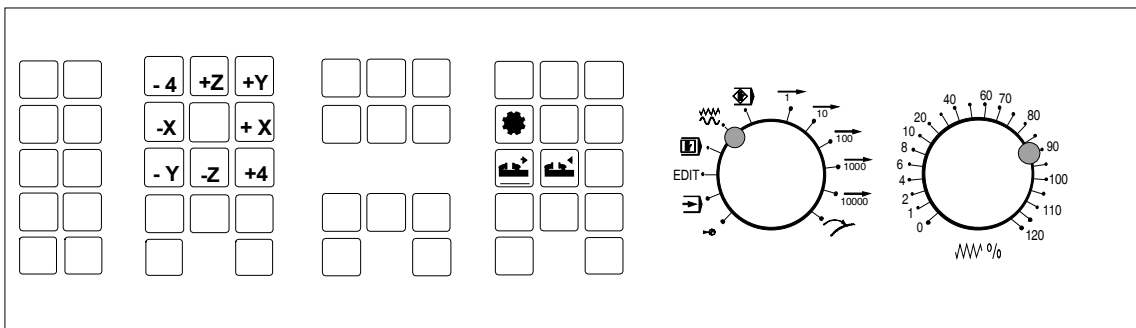
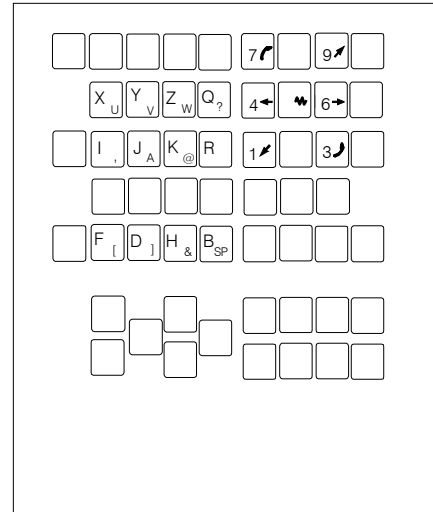
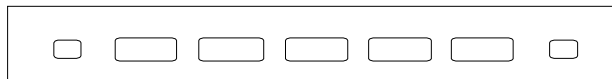
**Take off**

Pull out carefully the key caps to be exchanged with a fine screw driver or a knife.

**Clip on**

Move the key body in the middle of the recess. Push the key cap vertically down onto the key body, until the key cap snaps in tactily.

**FANUC 31iM**  
Exchange key caps  
for milling



### Connection to the PC

The control keyboard is connected via USB interface to the PC.  
The connection cable USB taking over at the same time the energy supply of the control keyboard is situated at the rear side of the control keyboard.

### Settings at the PC software

#### Setting during new installation of the PC software

During the installation indicate the control keyboard and the respective USB interface.

#### Setting in case of PC software already installed

Select in EMConfig at the INI data settings the USB control keyboard as means of entry and the respective interface USB.  
Furthermore, set the keyboard type to "New".  
Don't forget to memorize the settings.

## Easy2control On Screen operation

Easy2control adds a range of attractive applications to the successful interchangeable control system used in EMCO training machines. Suitable for use in machines and simulation workplaces alike, it displays additional control elements directly on the screen and, when used together with a touchscreen monitor, provides the ideal input interface.

### Scope of supply

The software for Easy2control is part of the control software.

The dongle for a workstation license is delivered:

**Ref. No.** X9C 111

Technical data for the screen:

16:9 Full-HD Monitor (1920x1080) at the minimum

Currently available controls (T and M):

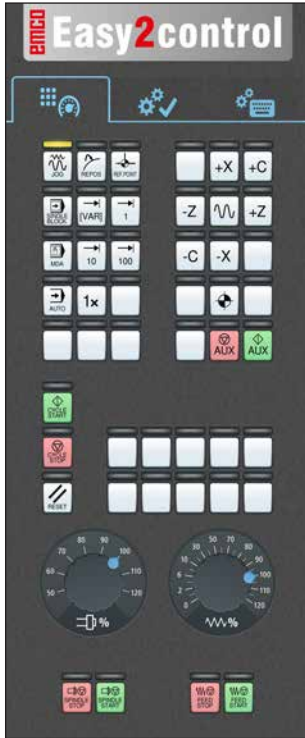
- Sinumerik Operate
- Fanuc 31i
- Emco WinNC for Heidenhain TNC 640 (M only)
- Emco WinNC for Heidenhain TNC 426 (M only)
- Fagor 8055

**Note:**

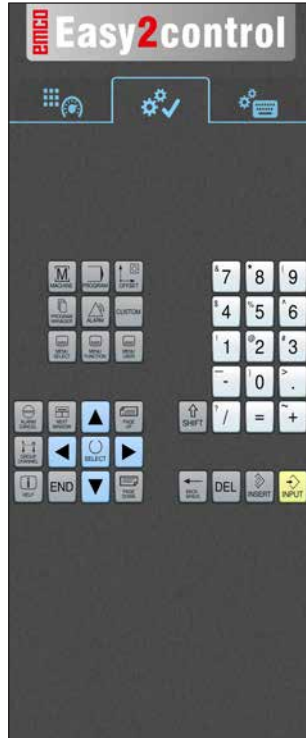
If a Full HD monitor is used without touchscreen function, the control is operated just with mouse and keyboard.

# Operating areas

## Sinumerik Operate



Machine control panel

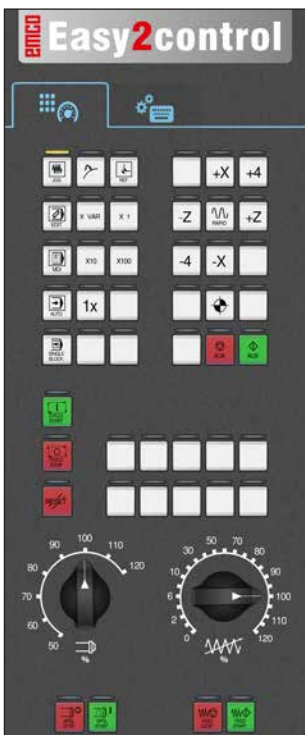


Controller-specific operation



Control operation complete

## Fanuc 31i



Machine control panel



Control operation complete

### Emco WinNC for Heidenhain TNC 640



Machine control panel

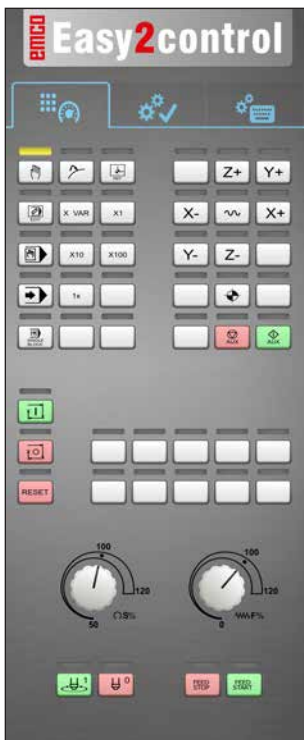


Controller-specific operation



Control operation complete

### Heidenhain TNC 426



Machine control panel

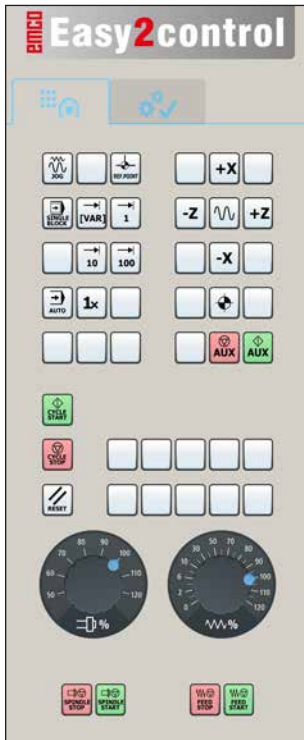


Controller-specific operation



Control operation complete

## Fagor 8055



Machine control panel



Control operation complete

Refer to the chapter “Key Description” of the respective control description for operation and key function.

**Note:**

The screen display, based on customer-specific configurations, may look different.



## Machine room camera

This accessory can be ordered using the following order number:

Ref. No.: S4Z750

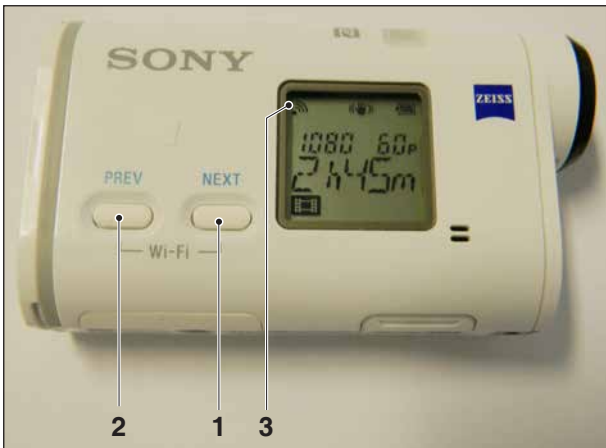
### Installing the camera

#### Requirement

USB WLAN adapter for the machine.

#### Setup WLAN

- press NEXT (1) or PREV (2) until an operating mode appears which supports WLAN, e.g. MOVIE. The symbol for WLAN (3) appears in the corner on top left.
- Open EMConfig and activate the camera.
- Connect the WLAN adapter to the USB port to the machine.
- Open windows network and sharing centre (4).
- Select the wireless network, enter the password and finish the connect setup.  
The name of the network (5) and the password are supplied together with the camera.
- Open the control software with activated Easy-2control.



Activating WLAN



Connect WLAN

5 4

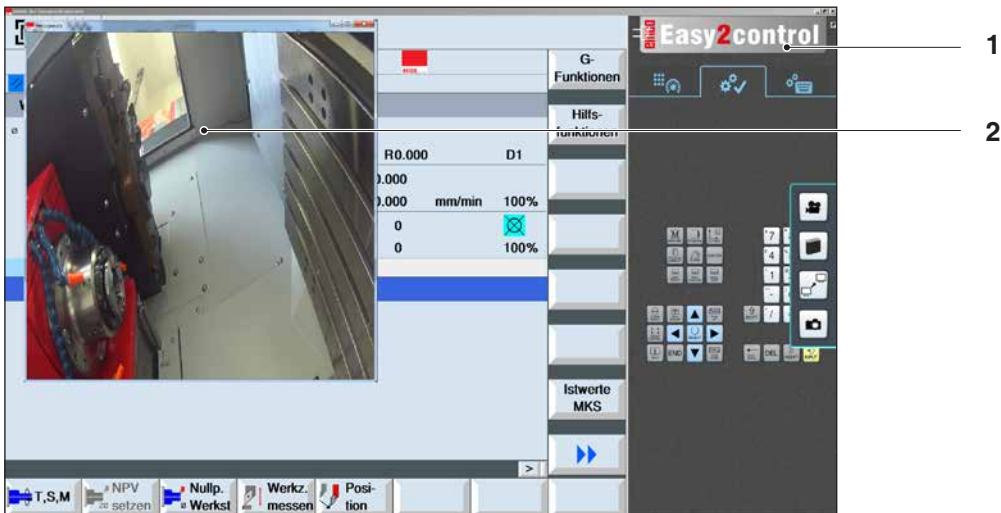


### Operating the camera

- Click the Easy2control logo to open the sidebar.

#### Functions of the sidebar

- Click the camera symbol to open the preview window (2).
- Open the operating manual of the control.
- Option for the second screen:
  - duplicate screen
  - screen extension to two monitors
- Creates a screenshot of the control in \*.png format.



Operating the machine room camera

**Note:**

The option for the second screen is only available for machines CT/CM 260 and 460.



**Attention:**

The camera may not be operated without the supplied waterproof case.

If the camera is operated without the waterproof case it may be damaged by coolant and chips.





# Z: Software Installation Windows

## System prerequisites

### Machine with integrated control PC

- All Concept machines
- Machines that were converted to ACC
- MOC with Windows 7 or higher (32 / 64 Bit)

### Machines with included control PC and programming stations

- Windows 7 or higher (32 / 64 Bit)
- free hard drive space 400 MB
- Programming station: 1\*USB, machine version: 2\*USB
- TCP/IP-capable network card for machine version)

### Recommended system prerequisites

- PC Dual Core
- Working memory 4 GB RAM
- free hard drive space 2 GB

## Software installation

- Start Windows
- Start the installation application on the USB stick or your download file.
- Follow the instructions from the installation guide.

For more informations regarding software installation and / or software update please refer to the documentation "short description for WinNC update installation".

### Note:

PC TURN and PC MILL have to be equipped with the conversion kit for ACC in order to operate EMCO WinNC.



## Variants of WinNC

You can install EMCO WinNC for the following CNC control types:

- WinNC for SINUMERIK Operate T and M
- WinNC for FANUC 31i T and M
- HEIDENHAIN TNC 426
- Emco WinNC for HEIDENHAIN TNC 640
- FAGOR 8055 TC and MC
- CAMConcept T and M

In case there are several control types installed, a menu appears when starting EM Launch from which you can select the desired type.

The following versions can be installed from the WinNC variants:

- Demo licence:
 

The demo licence is valid for 30 days after the first use. 5 days before the demo licence expires, you can enter another valid licence key (see licence manager)
- Programming station:
 

Programming and operation of the appropriate CNC control type is simulated by WinNC on your PC.
- Single user licence:
 

Authorizes to external programming of CNC-controlled machine tools on one PC workstation.
- Multi-user licence:
 

Authorizes to external programming of CNC-controlled machine tools. The multi-user licence can be installed on an unlimited number of PC workstations or in a network within the institute registered by the licensor.
- Educational licence version:
 

Is a time-limited multi-licence especially for schools and educational institutes.
- Machine licence:
 

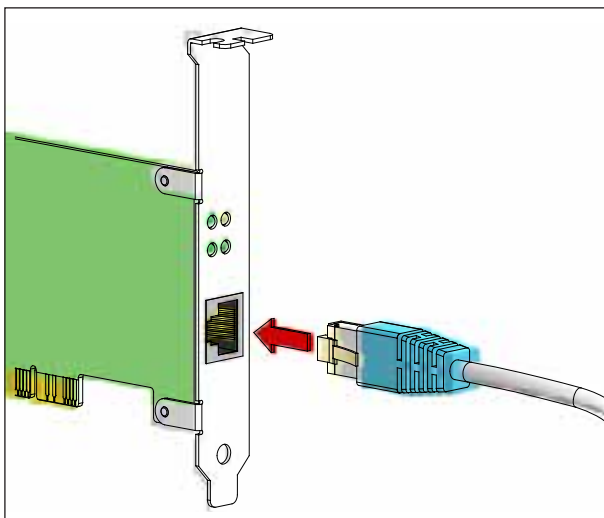
This licence allows to directly operate a PC-controlled machine (PC TURN, Concept TURN, PC MILL, Concept MILL) of WinNC as if it was operated by an ordinary CNC control.

**Danger:**

Removal and installation of the network card must only be carried by skilled personnel. The computer must be disconnected from the power supply (pull the power plug).

**Note:**

During a machine installation one network-card is reserved exclusively for the control of the machine.



Connection of the machine to the PC

**Network card (ACC)**

for:

Concept Turn 55  
 Concept Mill 55  
 Concept Turn 105  
 Concept Mill 105  
 Concept Turn 60

Only for machines with ACC kit:

PC Turn 50  
 PC Mill 50  
 PC Turn 100  
 PC Mill 120

Network card type: TCP/IP compatible network card

Setting the network card for the local connection to the machine:

**IP address: 192.168.10.10**  
**Subnetmask 255.255.255.0**



In case of problems observe the instructions of your operating system (Windows help).

**Instructions:**

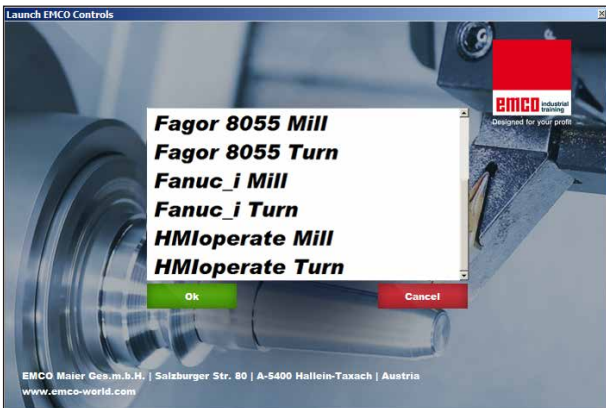
If the network connection to the machine could not be established at the start, the above adjustments are to be made.

## Starting WinNC

If you choose AUTO START YES during the installation of your machine version, WinNC starts automatically after switching on the PC.

Otherwise proceed as follows:

- 1 Switch the machine on.
- 2 Wait for 20 seconds to ensure that the machine operating system is running before the network connection to the PC is established. Otherwise it is possible that no connection can be established.
- 3 Switch the PC on and start Windows.
- 4 Click on the start symbol at the bottom.
- 5 Select program, EMCO and click on WinNC.
- 6 The start image will be shown on the screen. The licence holder is registered in the start screen.
- 7 If you have only installed one CNC control type, it starts immediately.
- 8 If you have installed several CNC control types, the selection menu appears.
- 9 Select the desired CNC control type (use cursor buttons or mouse) and press ENTER to start it.
- 10 If you use the control keyboard, you can select the desired CNC control type with the cursor buttons or mouse and start with the "NC-Start" button.



Selection menu EMLaunch

### Note:

EMLaunch displays all WinNC und CAMConcept controls that are installed in the same directory.



## Terminating WinNC

- 1 Switch off auxiliary drive with AUX OFF.  
Only for machine places, not for programming stations.
- 2 By simultaneously pressing these buttons WinNC for Sinumerik Operate will be terminated specifically.  
This corresponds to Alt+F4 on the PC keyboard.

## Checks by EmLaunch

In the ACC / ACpn-machine version EmLaunch is checking if a machine is available:

During the network configuration, the IP address is not configured correctly and DHCP for automatic configuration of the IP address is disabled. Connection to the machine is not possible.



*DHCP disabled*



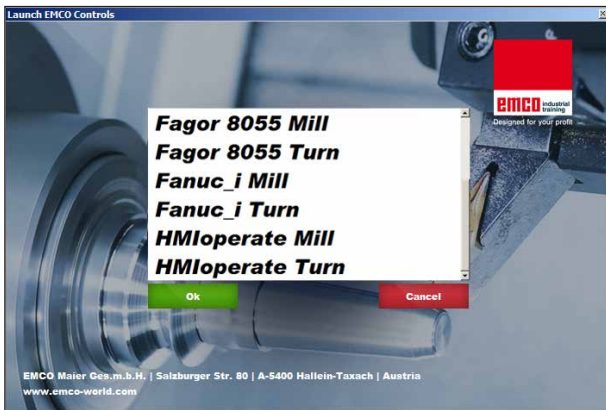
*IP-address configuration*



*Setup the connection to the machine*

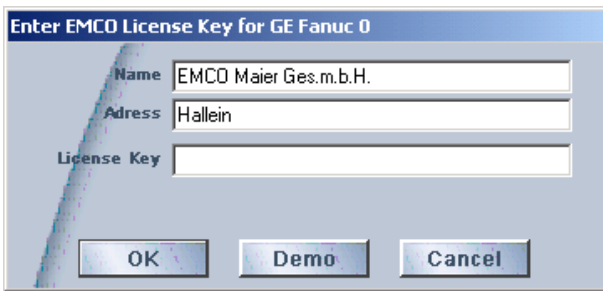
It is attempt to configure the IP address automatically via DHCP.

The IP configuration is correct and the connection to the machine is checked. Once the machine is available, the selection of the available controls is displayed.

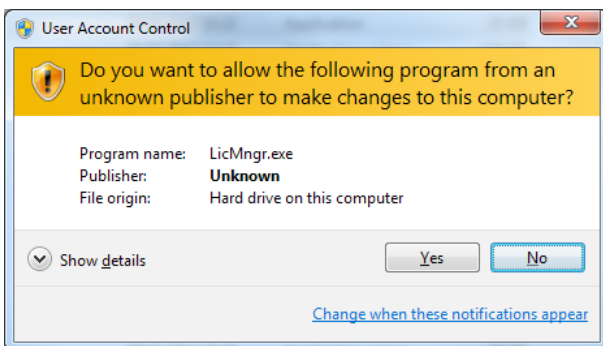


*Connection to the machine is OK*

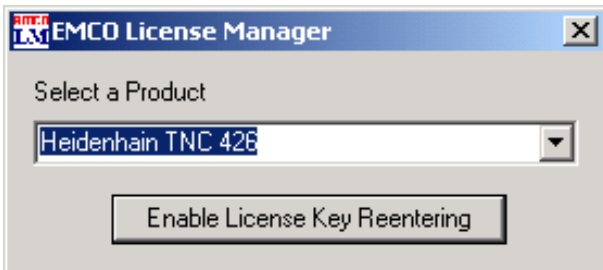
The connection to the machine is completed and the corresponding control can be started.



*Input window licence key enquiry*



*Run EMCO licence manager as an administrator*



*EMCO Licence Manager*

## Licence input

After the installation of an EMCO software product, an input window appears during initial operation and asks for name, address and licence key. This input window appears for every software product that is installed. In case a demo licence is desired (see page Z1), please select "DEMO". Then the input window reappears only 5 days before the expiry date of the demo licence. A subsequent input of a licence key is also possible via the licence manager (see licence manager below).

## Licence manager

The query in the UAC dialog box must be confirmed with Yes in order to start the Licence Manager.

For the release of additional function groups of existing EMCO software products it is necessary to enter a new licence key (exception: demo licence).

The **EMCO Licence Manager** (see picture on the bottom on the left) enables the input of further new licence keys. For this purpose select the new product in the selection window and confirm the input.

The next time you start your control software an input window appears and asks you to enter name, address and licence key (see picture on the top left).

Please note that the licence key is asked for each software product individually. The picture on the left shows e.g. the input prompt for the licence key for the software product "Heidenhain TNC 426".

Input licence key:

Start the WinNC with the option "Run as Administrator" right after installing the programm or launching the licence manager.