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Effective multiple clamping

Principle and application with SINUMERIK Operate

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Effective multiple clamping for milling

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1 Multiple clamping

1.1 Multiple clamping fundamentals

1.2 Using multiple clamping

1.3 Multiple clamping with SINUMERIK Operate

2 Practical example on a Mazak VTC 530C with SINUMERIK 828D

3 Summary

1 Fundamentals of multiple clamping

Ineffective utilization of the machining space with one clamping in the machine.

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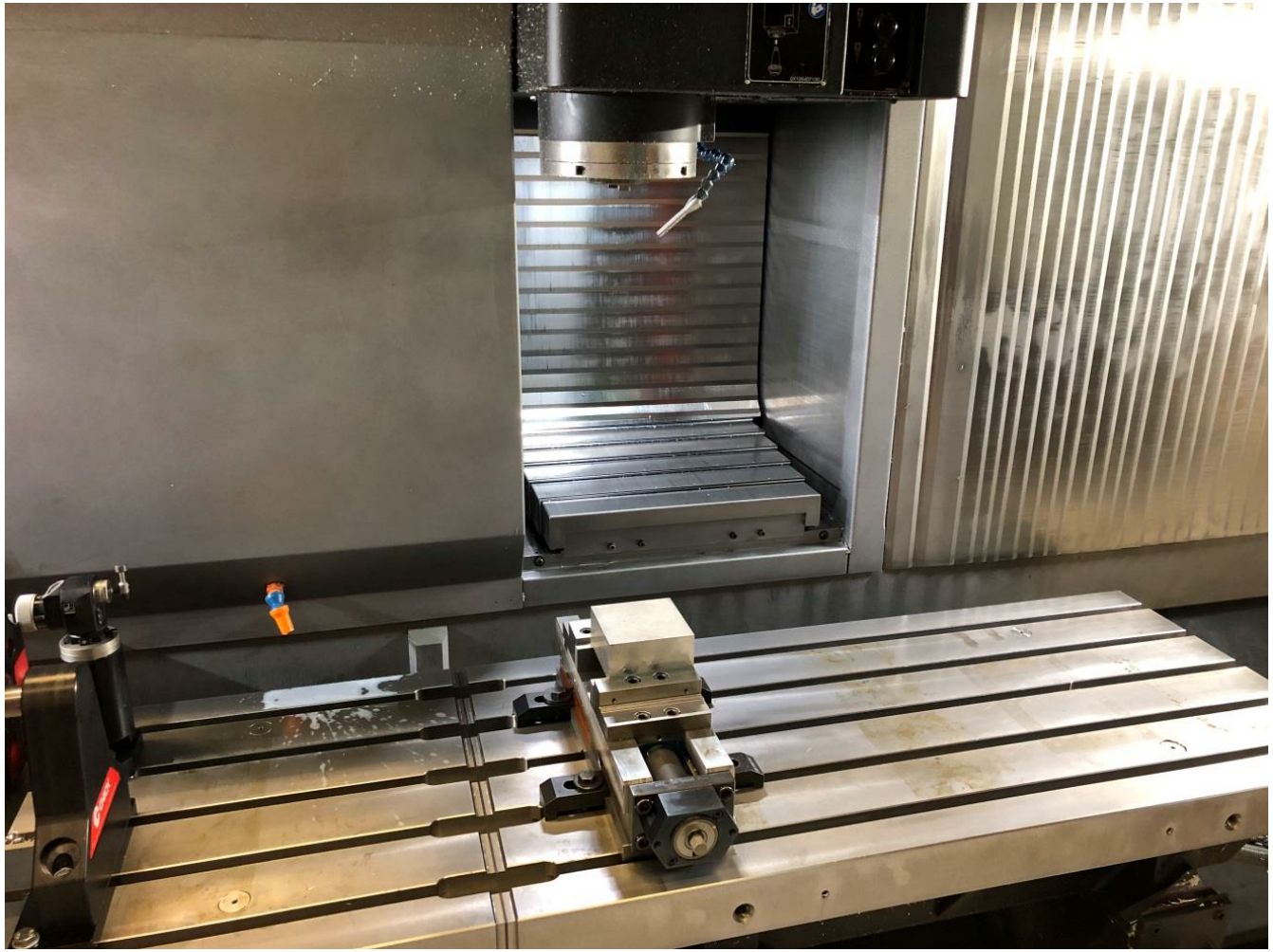

1

Fundamentals of multiple clamping

Linear arrangement of several vices in the machine space results in better utilization of that space.

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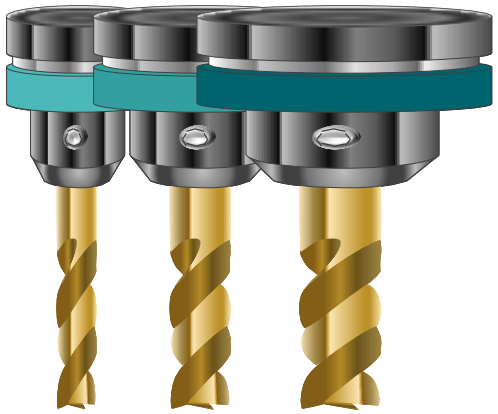
1 Fundamentals of multiple clamping

The advantage of multiple clamping devices in the machining space is lost as the number of tool changes is multiplied.



1 Using multiple clamping

Manual programming to optimize the machining sequence is complex to implement in G code.

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Conventional machining of components without optimizing the tool change

	Component #1	Component #2	Component #3
1st tool change	Drilling	4th tool change Drilling	7th tool change Drilling
2nd tool change	Chamfering	5th tool change Chamfering	8th tool change Chamfering
3rd tool change	Threading	6th tool change Threading	9th tool change Threading

3 components x 3 tools
=
9 tool changes

Optimized machining (arrangement and fewer tool changes)

	Component #1	Component #2	Component #3
1st tool change	Drilling	Drilling	Drilling
2nd tool change	Chamfering	Chamfering	Chamfering
3rd tool change	Threading	Threading	Threading

3 components x 3 tools
=
3 tool changes

1 Using multiple clamping

Outside a CAD/CAM environment, optimizing the tool change is complex.

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```
; *** Programm SINUMERIK 3x Milling
N0010 G17 G90 G64 G54
; ********************************************************
N0020 ; T01 DRILL_D8.5_VHM
N0030 T01
N0040 M6
N0050 MSG ("DRILL_D8.5_VHM")
N0060 MSG ("SM-DRILL")
; ********************************************************
N0070 MSG ("SM-DRILL ESP.AUFM.: R0. L0. ")
; ********************************************************
; *** VORSCHUB PARAMETER ***
N0080 R62=524 ;Z-VORSCHUB
F=R62
N0090 G0 X-35. Y35.
N0100 G0 Z100.
N0110 S5243 M3 M99 M8
N0120 G0 X-35. Y35.
N0130 G0 Z100.
N0140 MCALL CYCLE81(100.,0,2.,,32.554)
N0150 X-35. Y35. F=R62
N0160 X35. Y35.
N0170 X35. Y-35.
N0180 X-35. Y-35.
N0190 MCALL
N0200 G0 Z2.
; ********************************************************
N0210 MSG ("SM-DRILL ESP.AUFM.: R0. L0. ")
; ********************************************************
; *** VORSCHUB PARAMETER ***
N0220 R62=524 ;Z-VORSCHUB
F=R62
N0230 G0 X115. Y35.
N0240 G0 Z100.
N0250 S5243 M3 M99 M8
N0260 G0 X115. Y35.
N0270 G0 Z100.
N0280 MCALL CYCLE81(100.,0,2.,,32.554)
N0290 X115. Y35. F=R62
N0300 X185. Y35.
N0310 X185. Y-35.
N0320 X115. Y-35.
N0330 MCALL
N0340 G0 Z2.
; ********************************************************
N0350 MSG ("SM-DRILL ESP.AUFM.: R0. L0. ")
; ********************************************************
```

```
; *** VORSCHUB PARAMETER ***
N0360 R62=524 ;Z-VORSCHUB
F=R62
N0370 G0 X265. Y35.
N0380 G0 Z100.
N0390 S5243 M3 M99 M8
N0400 G0 X265. Y35.
N0410 G0 Z100.
N0420 MCALL CYCLE81(100.,0,2.,,32.554)
N0430 X265. Y35. F=R62
N0440 X335. Y35.
N0450 X335. Y-35.
N0460 X265. Y-35.
N0470 MCALL
N0480 G0 Z2.
N0490 ; T01 CENTERDRILL_D12_HSS
N0500 T01
N0510 M6
N0520 MSG ("CENTERDRILL_D12_HSS")
N0530 MSG ("SM-CENTERDRILL")
; ********************************************************
N0540 MSG ("SM-CENTERDRILL ESP.AUFM.: R0. L0. ")
; ********************************************************
; *** VORSCHUB PARAMETER ***
N0550 R62=159 ;Z-VORSCHUB
F=R62
N0560 G0 X-35. Y35.
N0570 G0 Z100.
N0580 S1326 M3 M99 M8
N0590 G0 X-35. Y35.
N0600 G0 Z100.
N0610 MCALL CYCLE81(100.,0,2.,,5.75)
N0620 X-35. Y35. F=R62
N0630 X35. Y35.
N0640 X35. Y-35.
N0650 X-35. Y-35.
N0660 MCALL
N0670 G0 Z2.
; ********************
N0680 MSG ("SM-CENTERDRILL ESP
; ********************
; *** VORSCHUB PARAMETER ***
N0690 R62=159 ;Z-VORSCHUB
F=R62
N0700 G0 X115. Y35.
N0710 G0 Z100.
N0720 S1326 M3 M99 M8
```

```
N0720 S1326 M3 M99 M8
N0730 G0 X115. Y35.
N0740 G0 Z100.
N0750 MCALL CYCLE81(100.,0,2.,,5.75)
N0760 X115. Y35. F=R62
N0770 X185. Y35.
N0780 X185. Y-35.
N0790 X115. Y-35.
N0800 MCALL
N0810 G0 Z2.
; ********************************************************
N0820 MSG ("SM-CENTERDRILL ESP.AUFM.: R0. L0. ")
; ********************************************************
; *** VORSCHUB PARAMETER ***
N0830 R62=159 ;Z-VORSCHUB
F=R62
N0840 G0 X265. Y35.
N0850 G0 Z100.
N0860 S1326 M3 M99 M8
N0870 G0 X265. Y35.
N0880 G0 Z100.
N0890 MCALL CYCLE81(100.,0,2.,,5.75)
N0900 X265. Y35. F=R62
N0910 X335. Y35.
N0920 X335. Y-35.
N0930 X265. Y-35.
N0940 MCALL
N0950 G0 Z2.
N0960 ; T03 M10
N0970 T03
N0980 M6
N0990 T01 ; WZ-VORWAHL
N1000 MSG ("M10")
N1010 MSG ("SM-THREAD_M10")
; ********************************************************
```

Complex, for quick change directly at the control system
inflexible, G-code output

1 Using multiple clamping

The "Multiple clamping" function is available under ShopMill.

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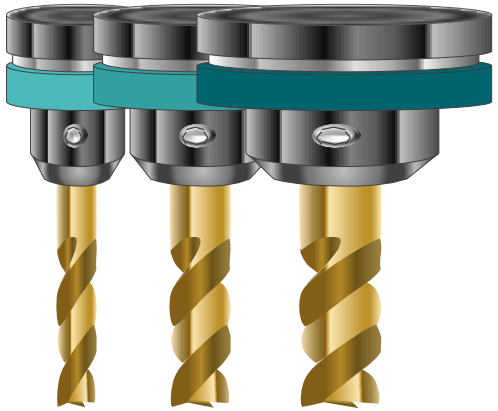

Automatic optimization and fewer tool changes facilitates effective machining and more components in the machine space.

1 Multiple clamping with SINUMERIK Operate

ShopMill facilitates user-friendly multiplication of machining programs with high process reliability.

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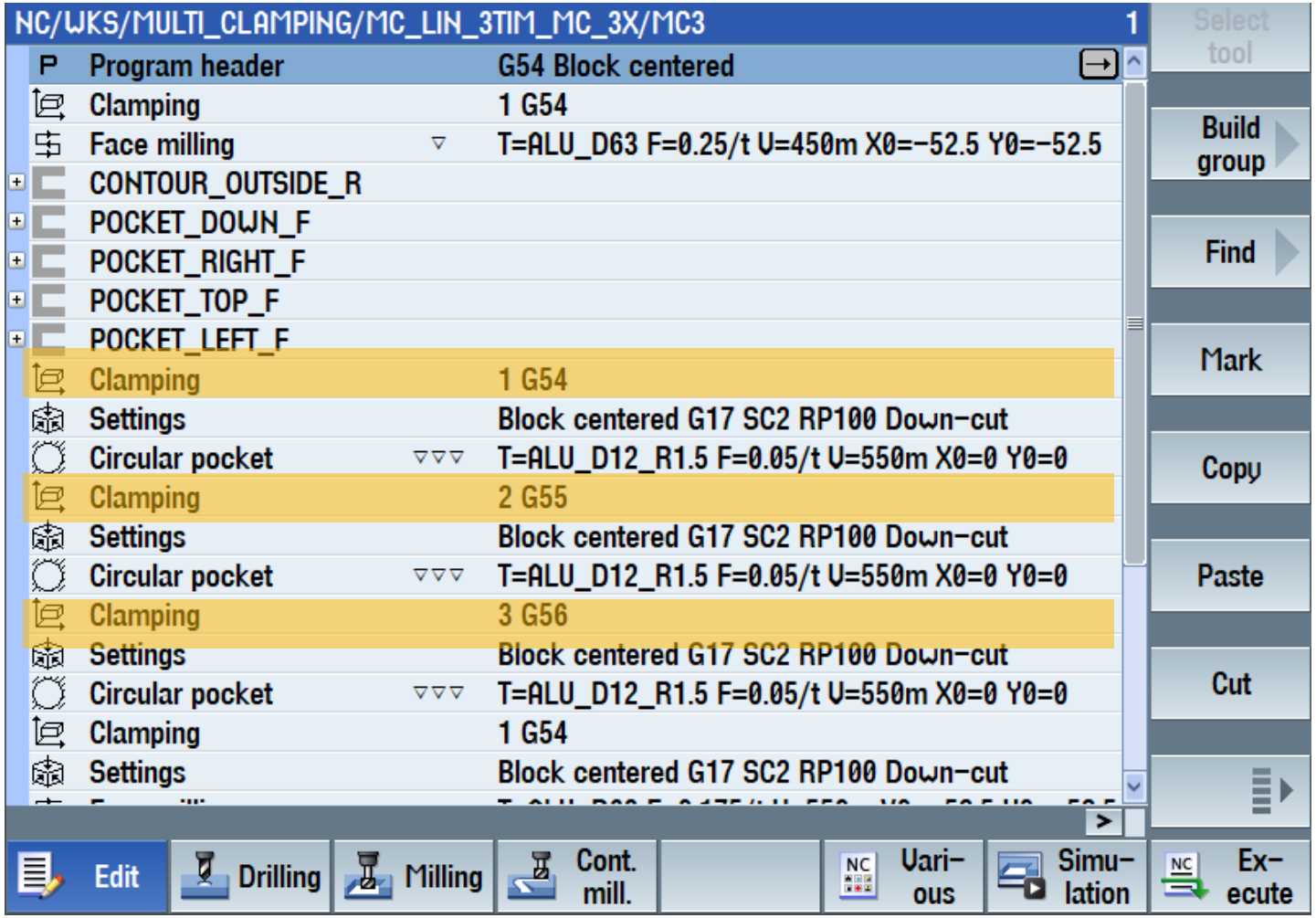
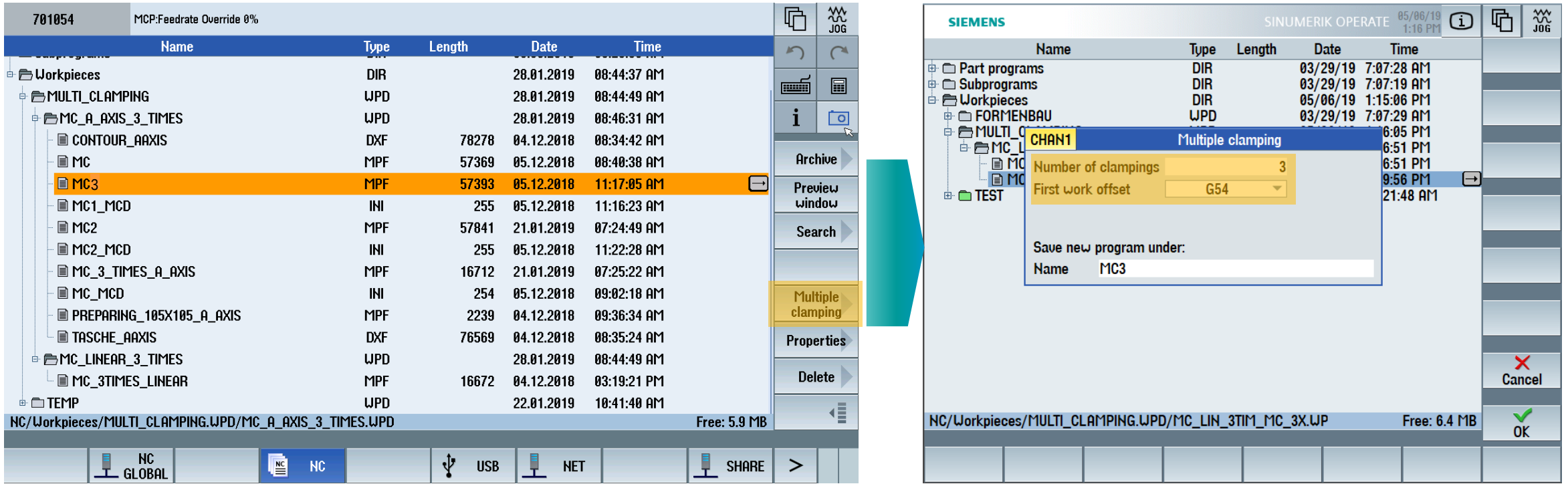


1 Multiple clamping with SINUMERIK Operate

The multiple clamping function is in the Program Manager with subsequent menu extension.



The "Multiple clamping" function is selected in the Program Manager and then in the menu extension. The number of clamping operations and the work offset are defined there.

1 Using multiple clamping

The arrangement of multiple clamping operations depends on the batch size to be machined.

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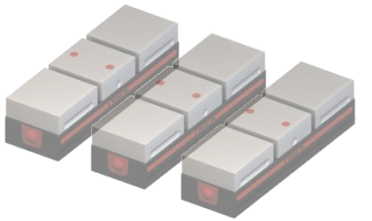
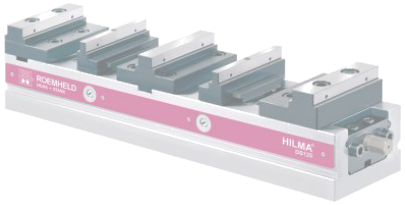
Linear arrangement of several clamping operations

Flat clamping systems, own clamping systems or several vises

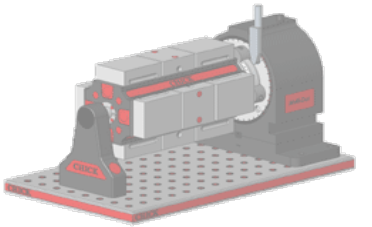


Longitudinal multiple clamping systems

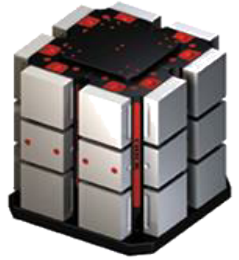


Clamping arrangements with rotating axis are suitable for large batch quantities

Reversible clamping device
(vertical milling machines, the rotary axis/axes has/have to be prepared)



Stacked plates
(horizontal milling machines, the rotary axis/axes has/have to be prepared)



1 Multiple clamping with SINUMERIK Operate

The CUST_CLAMP defines the switch condition for the rotary axis when using rotating/reversible clamping devices.

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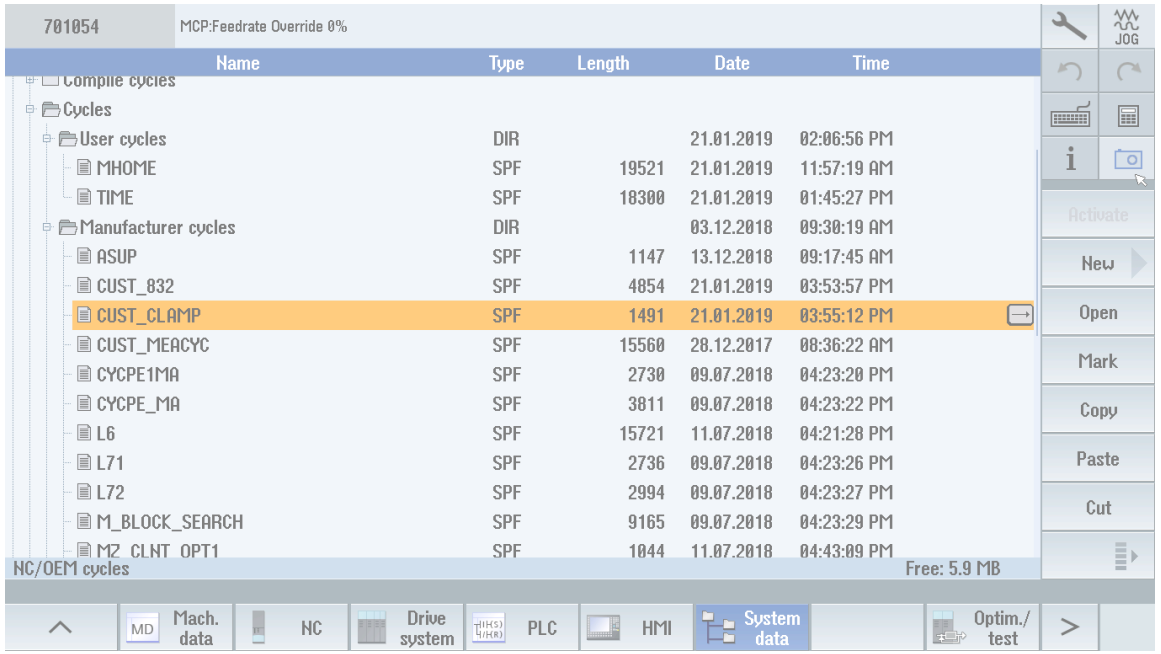
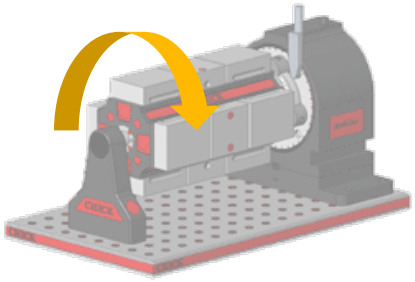
- A 4th axis (= rotary axis) is required when using reversible/rotating clamping devices.
- CUST_CLAMP defines the switch condition of the rotary axis
- Generates an executable, multiple clamping program from single workpiece programs.
- Only clocking the rotary axis to bring the workpiece into the correct machining position; no swiveling with CYCLE 800!
- Changes require intervention in the PLC.





1 Multiple clamping with SINUMERIK Operate

CUST_CLAMP.spf*

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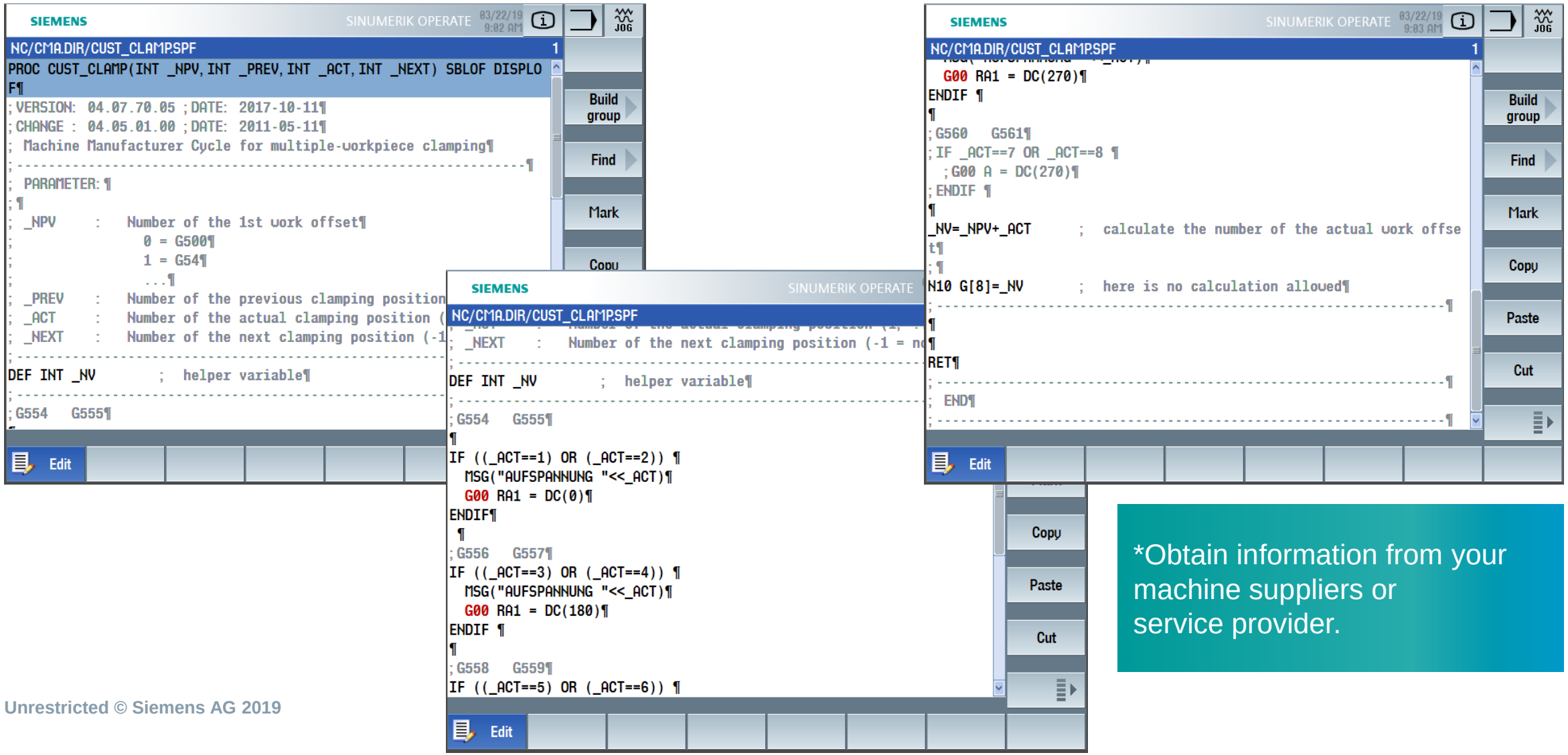

*Obtain information from your machine suppliers or service provider.

1 Multiple clamping with SINUMERIK Operate

In one clamping situation, identical or different parts can be machined.

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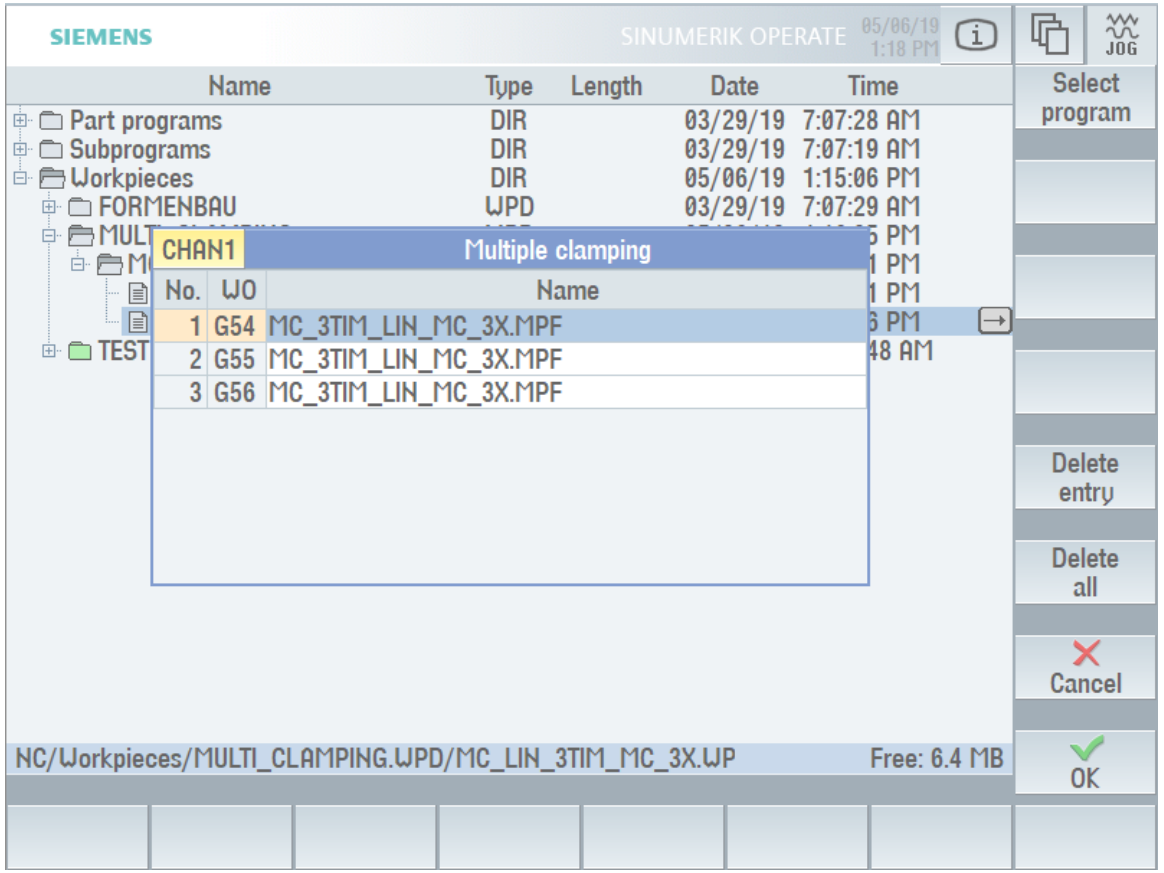
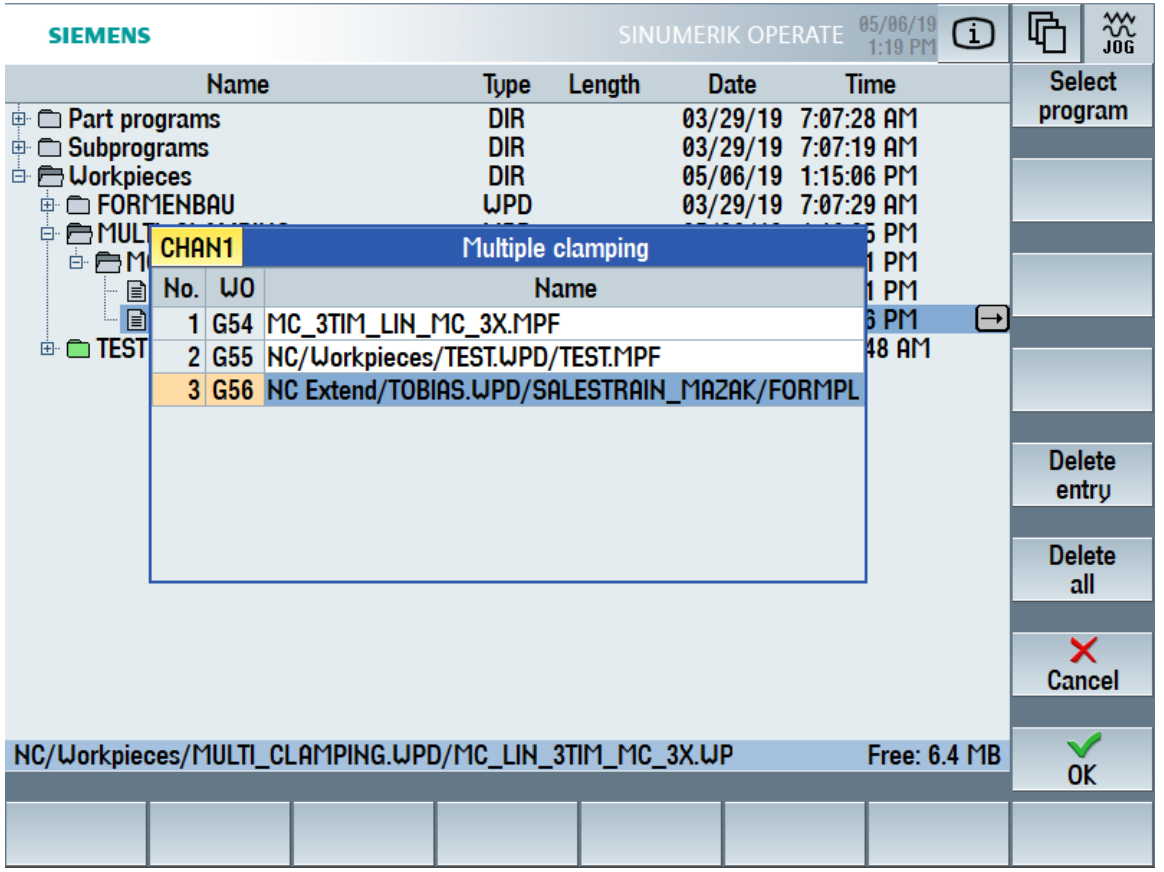
Same programs



Different programs



2 Practical example at a Mazak VTC 530C with SINUMERIK 828D

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3 Summary

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The following must be taken into consideration from the user's perspective:

- Only in ShopMill: no G-code programming
- No marks/repetitions, work offsets or coordinate transformations in the program
- The "Starting point" parameter must not be set to "manual" in the stock removal cycle (contour milling, pocket).

Advantages for the user:

- Fewer tool changes reduces idle times → Maximized machining times
- Effective use of the available clamping area on the machine table
- Reduced programming work
- User-friendly, multiplication of machining programs with high process reliability
- Multiple clamping is also possible under CAD/CAM

Maximum productivity with the greatest flexibility.

Produced by

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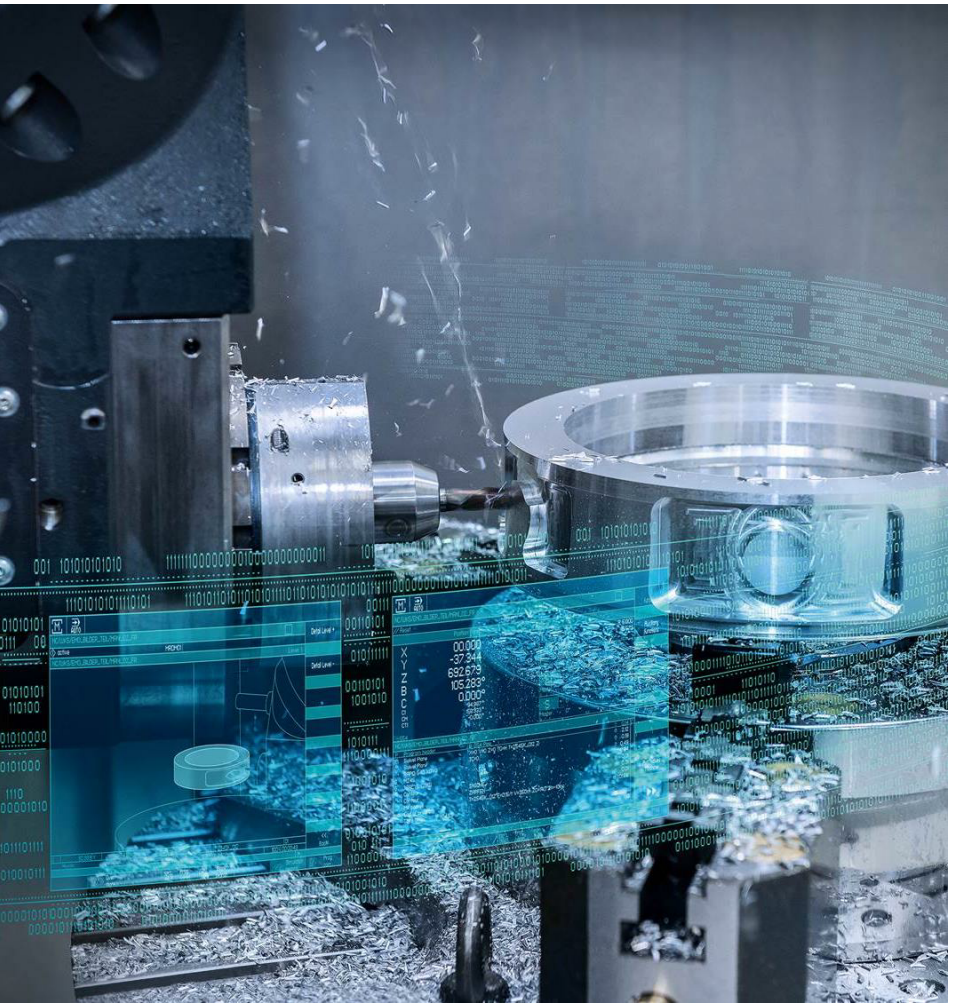

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