



SIEMENS

The top half of the image shows a Siemens logo in a teal box. Below it, on a wooden desk, are three rectangular blocks made of a light-colored wood. The top surfaces of these blocks are polished metal plates. The leftmost block has a metal number '4' engraved on it. The middle block has a metal number '5' engraved on it. The rightmost block has a metal letter 'Y' engraved on it. In the background, a laptop is partially visible.

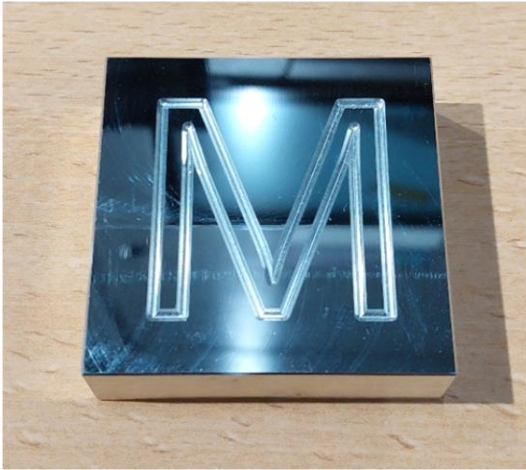


The bottom half of the image shows a close-up of a CNC machining process. A large, cylindrical metal tool bit is positioned over a workpiece. The workpiece is a dark, rectangular block with a metal number '4' engraved on its top surface. The tool bit is cutting into the workpiece, and a large amount of metal chips is being removed, creating a spray of sparks and debris. The background is dark and out of focus.

Letters and numbers

[siemens.com/cnc4you](https://www.siemens.com/cnc4you)

## Workpiece „Letters and numbers“



The CNC4you ABC workpiece comprises one or several aluminum blocks in each of which a large-format alphanumeric character is engraved. Several of these blocks together result in a lettering of your choice.



### **SINUMERIK Machining Technology Extension (SMTE)**

A special SMTE engraving cycle (SMTE: **SINUMERIK Machine Technology Extension**) is used to engrave the letters. The SMTE engraving cycle allows the font, the font style (regular, bold, italics ...) and the text size to be selected. Users can therefore determine the engraving of the workpiece themselves.

Appropriate license is required to use the SMTE engraving cycle (SMTE Gravur, 6FC5800-0BR54-OYB0).

### **License-free simulation at the PC with the Run MyVirtual Machine demo milling machine**

The SMTE engraving cycle is preinstalled in the demo milling machine "SinuMill 3 (Demo)" of Run MyVirtual Machine for training purposes and exercises at the PC.

In SinuTrain an appropriate license is required to install the SMTE engraving cycle – both for the specific software release (version 4.95 or later) and for the cycle itself.

All the information required to machine the part is subsequently listed – such as tool data, machining plans and NC programs.

[www.siemens.com/cnc4you](http://www.siemens.com/cnc4you)



Table of contents

1	Safety note	4
2	Preliminary comment	4
3	Workpiece, blanks/bill of materials	5
4	Machines and machining plans	5
5	Tools used	5
6	Fabricating the "Letters and numbers" workpiece	6
7	Information on the Internet	9

## 1 Safety note

Operating machinery involves a wide range of risks. It is therefore crucial to comply with all legal and standard safety regulations applicable to factory environments when manufacturing CNC4you workpieces like this one.

## 2 Preliminary comment

The following description addresses technicians familiar with CNC machines who have experience or expertise in SINUMERIK CNC controls. All the technology data listed here corresponds to the machines, tools, materials, machining plans and drawings used to craft this workpiece. However, when it comes to replicating the workpiece, this only serves as an example because of the wide diversity of resources available in other workshops. Having said that, in most cases it should be possible to simply replicate this workpiece.

The program for the milled part was created and tested at a CNC milling machine. The machine was equipped with a SINUMERIK 828D with the ShopMill user interface. SINUMERIK Operate V4.95 was installed on the machine.

The workpiece is fabricated in two clamping operations: One when machining on the front side and one when machining on the rear side.

Generally, the NC programs can be simply adapted to other SINUMERIK versions, for example, to higher SINUMERIK Operate software releases. A simulation and any necessary modifications – for example, the zero offsets – must always be performed.

NC programs and machining descriptions for the workpieces can be downloaded at no charge from [www.siemens.com/cnc4you](http://www.siemens.com/cnc4you). You can find the following files and formats for this workpiece here:

- NC programs for the workpiece
- This manufacturing description (also in German language)

### 3 Workpiece, blanks/bill of materials

- The following is required for the workpiece:  
For each letter, an aluminum cuboid with dimensions 603 mm x 603 mm x 203 mm.

### 4 Machines and machining plans

#### CNC milling machine:

- Type: Mazak (3 axis)
- CNC: SINUMERIK 828D with ShopMill V 4.95

#### ShopMill Machining Plans:

- BUCHSTABEN\_SEITE1.MPF (rear side)
- BUCHSTABEN\_SEITE2.MPF (front side with engraving)

For CNC training on the PC, you can download the **Run MyVirtual Machine** software from the CNC4you online portal, which also includes a license-free demonstration milling machine with the SMTE engraving cycle.

### 5 Tools used

Tool/short name	Description
ALU_D63	Face-milling cutter, Ø 63 mm
ALU_D16	End-milling cutter, Ø 16 mm
FASER_10_VHM_4SN	Chamfer tool 45 degrees, Ø 10 mm
DIAMOND_2SN	Face-milling cutter with at least two diamond cutting edges for high-gloss or mirror finishes, Ø 58 mm
BALLMILL_D2	Ball mill cutter, Ø 2 mm

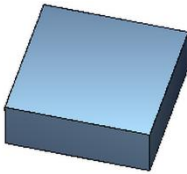
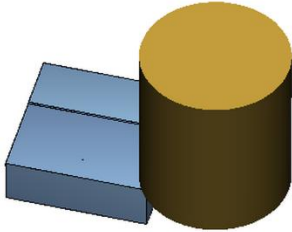
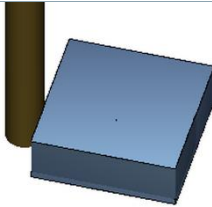
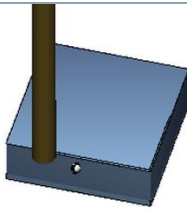
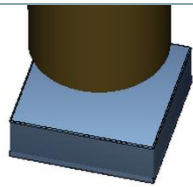
## 6 Fabricating the "Letters and numbers" workpiece

### 6.1 Rear side

#### 6.1.1 Machining steps at the milling machine

1. Approach the machine reference point.
2. Read-in the machining plan: BUCHSTABEN\_SEITE1.MPF
3. Read-in the tool list: BUCHSTABEN\_TMZ.INI
4. Measure the tools, enter in the tool list.
5. Insert the tools in the magazine.
6. Clamp the workpiece close to the lower edge.
7. Set the workpiece zero using a measuring probe or by probing using an appropriate device.
8. Check the work offsets programmed in the part program and if required, adapt to the specific machine configuration.
9. Perform a simulation, including checking whether there is a risk of collision.
10. Start machining, execute the machining plan.
11. Remove the workpiece.

#### 6.1.2 Working through the ShopMill machining plan BUCHSTABEN\_SEITE1.MPF

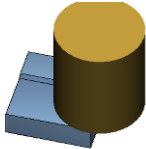
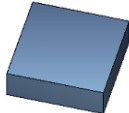
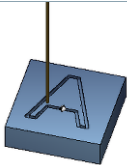
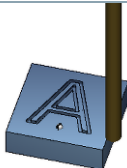
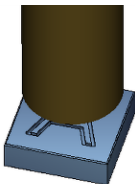
Machining step	Graphic
Clamp the blank close to the lower edge	
Face mill the surface	
Finish the outer edge	
Chamfer the edge	
High-gloss finish / finish the rear side using the diamond milling tool	

## 6.2 Front side (engraving)

### 6.2.1 Machining steps at the milling machine

1. Approach the machine reference point.
  2. Read-in the machining plan: BUCHSTABEN\_SEITE2.MPF
- If you have not already done so:
3. Read-in the tool list: BUCHSTABEN\_TMZ.INI
  4. Measure the tools, enter in the tool list.
  5. Insert the tools in the magazine.
  6. Clamp the turned workpiece.
  7. Set the workpiece zero using a measuring probe or by probing with appropriate device.
  8. Check work offsets G54 und G55 programmed in the part program and if required, adapt to the specific machine configuration.
  9. Perform the simulation run: Check that the engraving is milled at the specified position, otherwise adapt the settings of the SMTE engraving cycle respective via the G55 settings.
  10. Start machining, execute the machining plan.
  11. Remove the workpiece.

### 6.2.2 Working through the ShopMill machining plan BUCHSTABEN\_SEITE1.MPF

Machining step	Graphic
The workpiece that has been completely machined on the rear side is turned and clamped (take care to protect the surfaces). In the first machining step, the unmachined overhang is removed up to the target workpiece height (roughing and finishing).	
Message "Path generation in progress" is displayed if the engraving path for the current letter must be recalculated.	path generation in progress 
The letter or text specified in the SMTE cycle is milled.	
The upper workpiece edge is chamfered.	
Using a diamond milling cutter, the front side is finished to achieve a high-gloss surface.	

### 6.3 Changing the letters or the text in the NC program

The letter, font and marking to be engraved – as well as its position – are defined in part program BUCHSTABEN\_SEITE2.MPF and more precisely in the machining screen form of the SMTE engraving cycle.

Operation, installation and significance of the parameters of the SMTE engraving cycle are described in **Function Manual "SINUMERIK ONE / SINUMERIK Machining Technology Extensions"**. You can find this manual in the Siemens Industry Online Service. To do this, search for **SMTE** at <https://support.industry.siemens.com> – and under the results, select the latest version of the function manual.

#### Special features of the SMTE engraving cycle pre-installed in Run MyVirtual Machine demonstration milling machine "SinuMill 3 (Demo)"

##### Defining the reference point with G55

Contrary to the full version of the SMTE engraving cycle, in the Run MyVirtual Machine demonstration milling machine, it is not possible to define the reference point of the text ("bottom left", "top center" or similar). This is the reason that in NC program "BUCHSTABEN\_SEITE2.MPF", the reference point is defined using the G55 settings. In "Sinu-Mill 3 (Demo)", the G55 values X:-16.5, Y:-26, Z:-3 are suitable as starting points. After the engraving cycle, G54 again applies; see the markings in the following diagram.

USB/ABC/BUCHSTABEN_SEITE2		8
Face milling	T=ALU_D63 F=0.05/t V=600m X0=-30.15 Y0=-30.15 Z0=2.8 Z1=0.05	
G	T="BALLMILL_D2"¶	
G	M6¶	
G	G55 X12000 F500 M3 M8¶	
G	;G0 X0 Y0¶	
G	CYCLE_ENGRAVE("USB:", "engrave", "A", "Arimo-Regular.ttf", 30, 0.05, 2, 1.05, -3, 7, 0, 0, 40, 0, 200, →	
G	G54¶	
Rectang.spigot	Cham. T=FASER_10_VHM_45N F=1200/min S=12000rev X0=0 Y0=0 F5=0.5 ZFS=4inc Z0=0	
Face milling	T-DIAMANT_25N F=0.02/t V=1000m X0=-30.15 Y0=-30.15 Z0=0.05 Z1=0	

The simplified cycle operating screen form:

US1 Engraving	
PL	G17 (XY)
RP	30.000
SC	2.000
F	500.000
FZ	200.000
FONT	USB
STYLE	Arimo Regular
TEXT	Engraving
TXT	B
X0	-3.000
Y0	7.000
Z0	0.050
Z1	1.050 inc
W	40.000
a	0.000 °

ABCDEFGHIJKLMN  
OPQRSTUVWXYZ  
abcdefghijklmnopqrstuvwxyz  
opqrstuvwxyz  
0123456789

*Note: All entries in the cycle user interface must be completed using the Enter key so that they are applied in the NC program block and become effective. To edit the NC program, also at the PC, the key switch of the virtual CNC must be brought into position 3 (for Run MyVirtual Machine by clicking the mouse on the key switch icon on the user interface).*



## 7 Information on the Internet

### Published by

The Impact, Experience Center for Digital Transformation  
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### Design of the parts, creation of the drawings, development of the machining plans

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### Manuals and information of Siemens AG

Manuals and detailed information about our products are provided at the following web-sites:

- Siemens Industry Online Support: (<https://support.industry.siemens.com/cs/document/108464614>)
- Service & Support Portal (<https://support.industry.siemens.com>)
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