HEIDENHAIN

NC solutions

Description of NC program 6050

English (en)
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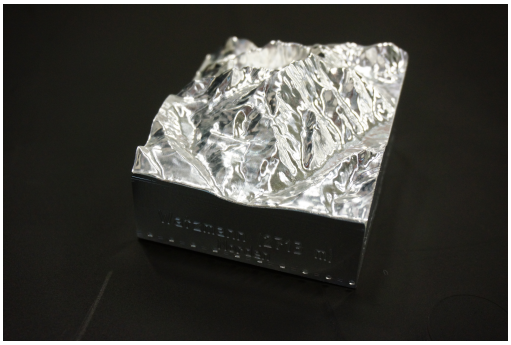
1 Description of NC programs 6050_en.h, 6050_3X_en.h, and 6050_5X_en.h

NC programs for machining a relief model of the Watzmann



The Watzmann

The Watzmann is the most famous mountain in the Berchtesgaden Alps. At 2713 meters, it is the third-highest peak in Germany and is widely known for its distinctive silhouette.

NOTICE

Danger of collision!

These NC programs are output for a machine with A/C kinematics.

- Adapt tilting movements
- Adapt safety position

Description of NC program 6050_en.h

With this NC program, the control pre-machines the raw material and engraves the geographic information and compass directions on the sides.

In the first part of the NC program, the tool is defined. The first machining step is a face milling cycle for machining the top side. Then the control machines the lateral sides. To do so, the control shifts the datum to each surface to be machined and tilts the working plane to the surface with a **PLANE SPATIAL**. The machining operation is defined with linear paths. Please note that, in the example program, the surfaces of the workpiece blank are milled with complete machining. Vise jaws or other clamping elements are not taken into account.

After a surface is machined, the tool retracts along the tool axis. The control then resets the working plane and the datum. Then the subsequent surfaces are machined.

After completed machining of the surfaces, the control changes the tool. In the example program, a ball-nose cutter is programmed for the engraving operation. For engraving, the control also shifts the datum to the surface and tilts the working plane.

In the example program, two engraving cycles are defined for each lateral side. One cycle is for engraving the geographic information, and the second is for engraving the compass direction.

The texts to be engraved are as follows:

- Steinernes Meer; South
- Schönau / Königssee; East
- Watzmann (2713 m); North
- Ramsau / Hochkalter; West

NC program 6050_3X_en.h and 6050_5X_en.h

The NC programs are based on a topographical model of the Watzmann. Based on this model, a CAM software application generated two different NC programs. In each program, machining is carried out in four machining steps.

Machining step	Tool used	Cutting data
Roughing	End mill: Ø 6 mm	Infeed: 3 mm Oversize: 0.5 mm
Roughing of residual material	End mill: Ø 3 mm	Infeed: 2 mm Oversize: 0.5 mm Step height: 0.8 mm
Pre-finishing	Ball-nose cutter: Ø 4 mm	3-D infeed: 0.5 mm Oversize: 0.2 mm
Finishing	Ball-nose cutter: Ø 3 mm	3-D infeed: 0.05 mm

The two NC programs differ only when it comes to the finishing operation.

In NC program 6050_3X_en.h, the control performs the finishing operation in three axes. The tool paths were output in HEIDENHAIN Klartext by the postprocessor.

NC program 6050_5X_en.h was generated such that the tool axis is inclined by 15 degrees. For the purpose of avoiding collisions and damage to the contour, all five axes are moved simultaneously. In this section of the program, the tool paths are output as vectors.

Output in HEIDENHAIN Klartext format

If you output the NC program in Klartext format you have the following options:

- Output with three axes
- Output with up to five axes, without **M128** or **TCPM**
- Output with up to five axes, with **M128** or **TCPM**

If the kinematics of the machine and tool data are made available to the CAM system, it is possible to output NC programs with five axes without **M128** or **TCPM**.

An NC program with **M128** or **TCPM** is more flexible because calculation of the kinematics is performed on the machine and the tool data from the tool table are used.

Example

L X+88 Y+23.5 Z-8.3 R0 F5000	3-axis
L X+88 Y+23.5 Z-8.3 A+1.5 C+45 R0 F5000	5-axis without M128
L X+88 Y+23.5 Z-8.3 A+1.5 C+45 R0 F5000 M128	5-axis with M128

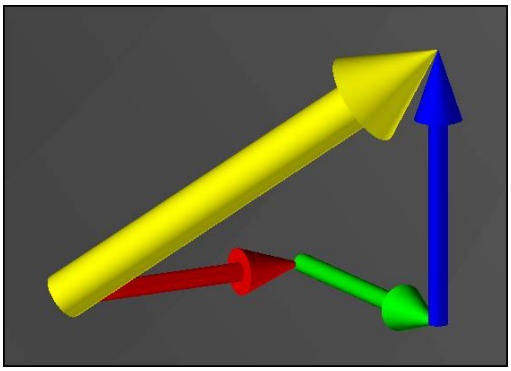
Output with vectors

From the point of view of physics and geometry a vector is a directed variable that specifies direction and length.

When outputting with vectors, the control requires at least one normalized vector that specifies the direction of the surface normals. The NC block optionally contains a second normalized vector that determines the direction of the tool orientation.

A normalized vector is a vector with the value 1. The vector value is calculated from the root sum of the squares of its components.

$$\sqrt{NX^2+NY^2+NZ^2}=1$$



Vector output is the precondition for use of 3-D radius compensation depending on the tool's contact angle (Option 92).

Example

LN X0.499 Y-3.112 Z-17.105 NX0.2196165 NY-0.1369522 NZ0.9659258 M128	Output without tool orientation
LN X0.499 Y-3.112 Z-17.105 NX0.2196165 NY-0.1369522 NZ0.9659258 TX+0.0078922 TY-0.8764339 TZ +0.2590319 M128	Output with tool orientation