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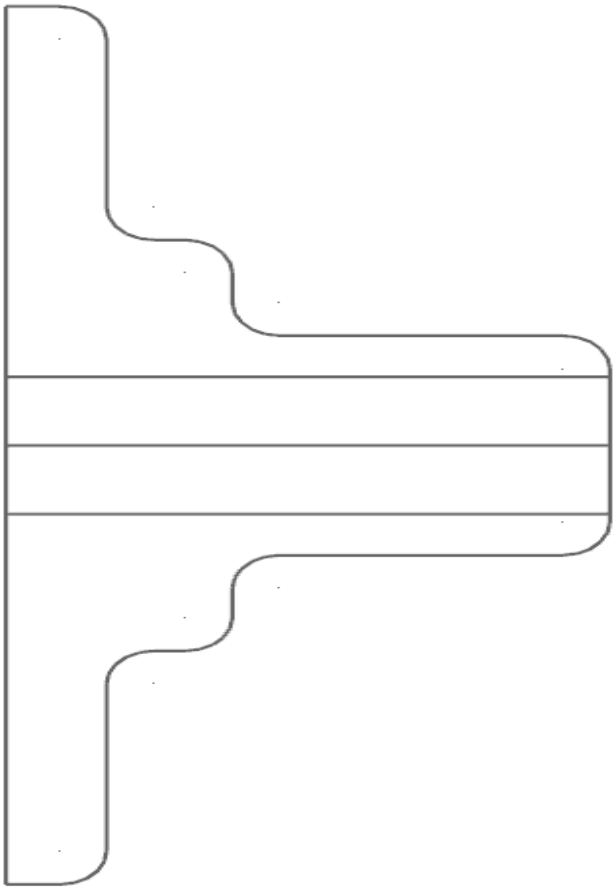
Geometry Tools - Part 1



INTRODUCTION

This lesson will introduce the Mastercam user interface in detail and will also teach you the first geometry creation tools that you will need for creating your own geometry to define toolpaths or for creating supplemental geometry to graphically control the toolpath motions in Mastercam. The main goal of the geometry lessons is to give you the basic understanding of how to create geometry in Mastercam so that you can practice to become as proficient as your job requires.

OVERVIEW OF EXERCISE:

In this lesson we will become familiar with the Mastercam screen components and learn tools and shortcuts to begin creating basic line geometry shapes.

NEW CONCEPTS COVERED IN THIS LESSON:

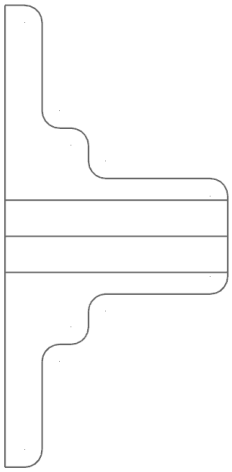
- The important components of the Mastercam Interface.
- Important Function Key shortcuts.
- How to create a Point knowing its Position.
- Line Creation - Several line creation methods with emphasis on Endpoints and Parallel.
- How to Delete Geometry.
- Fillet Creation.
- How to Trim and Extend Lines.
- How to Create Rectangles and Rectangular Shapes.

INSTRUCTOR DEMONSTRATION PREVIEW

Note: This entire lesson is a joint Instructor / Student exercise.

Topics:

- **Mastercam Interface**
- **Point Position Command**
- **Line Endpoints Command**
- **Line Parallel Command**
- **Rectangle Commands**
- **Fillet Commands**
- **Trim Commands**



NOTES:

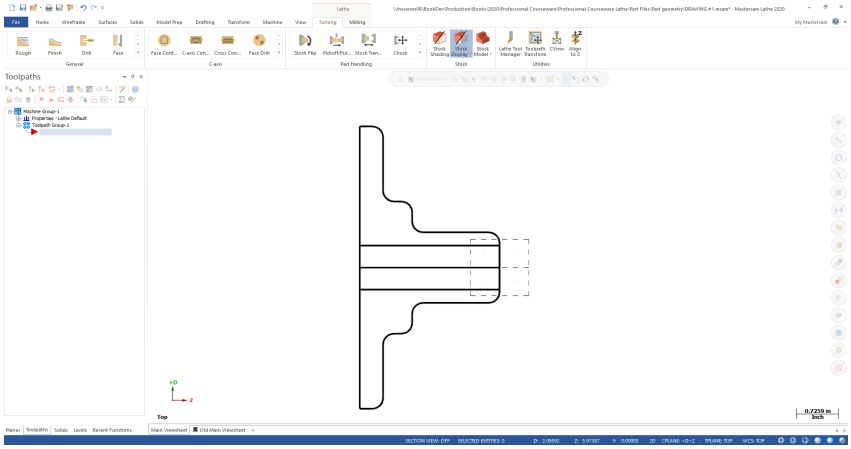
GEOMETRY TOOLS PART 1: BASIC STEPS REFERENCE

In this first lesson the students and instructor will work through the topics as a group.

EXPLORE MASTERCAM INTERFACE

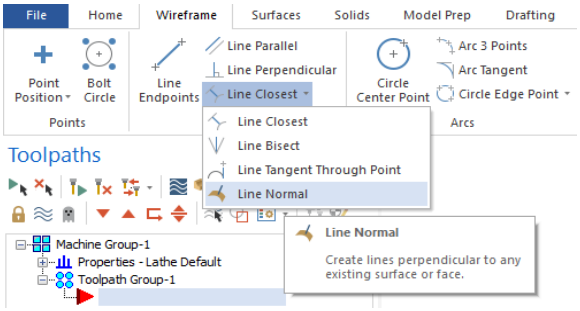
1. Load the part: "DRAWING #1 .MCAM"

We will do a "Preview" of some of the different components of the Mastercam screen. Goal is just to see where things are, not to master their usage yet.



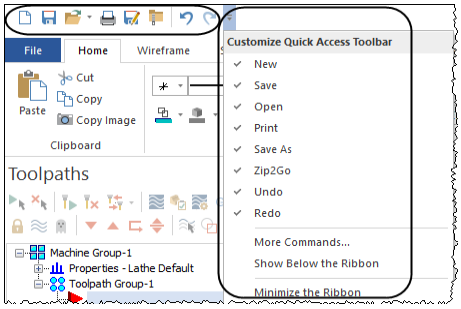
2. Tabs - Buttons - Submenus - Tooltips

Like many Windows programs, many have submenus or options. We will not go through any specific at this point, just review how they work.



3. Quick Access Toolbar

User can customize to add often used functions.

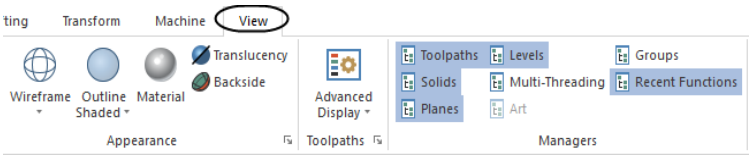


4. The ESC (Escape) Key

(Master key for ending most functions)

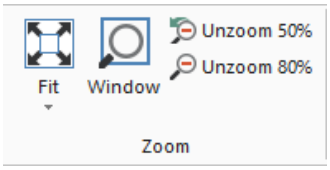
5. The View Tab

Provides access to many of the options to control the Mastercam layout.



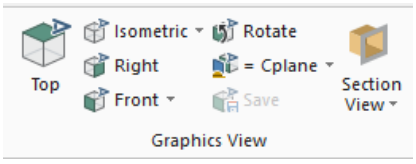
6. Zoom Commands

(Since these commands are used extensively, it may be useful to memorize the keyboard shortcut keys)

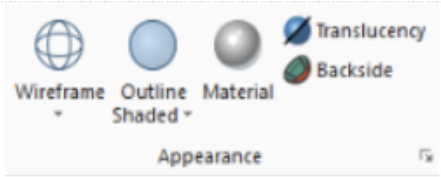


- **Fit (Alt+F1)**
- **Zoom Window(F1)**
- **Un-Zoom 80% (Alt+F2)**
- **Un-Zoom Previous / 50% (F2)**
- **Repaint (F3)**

7. Graphic Views

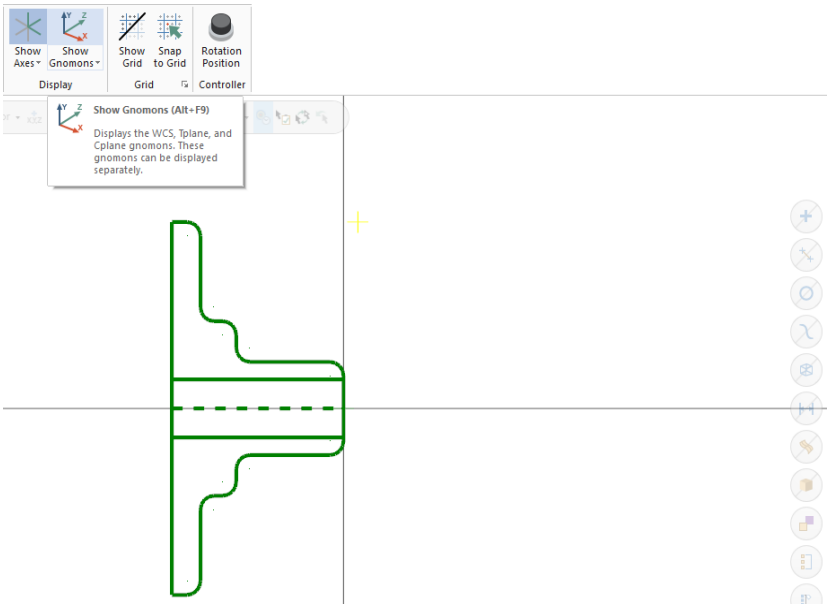


- Standard View Choices RMB (Right Mouse Button options)
- Free Spin rotation with middle mouse button
- Zoom in and out with middle mouse wheel



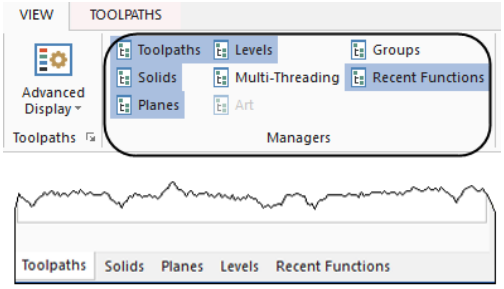
8. Appearance

- Wireframe Choices
- Shaded Choices
- Appearance
- Stock Display options
- Shaded and Wireframe Display of Solid **Alt+S**



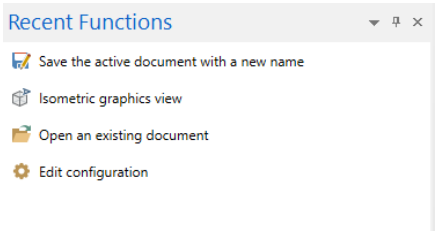
9. Axis and Gnomon Display

- **F9**
- **Alt+F9**

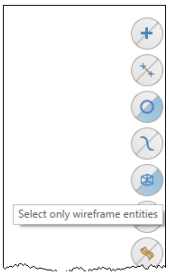


10. The Manager Panel

(Preview of the location and purpose only. Functions to be covered when needed.)



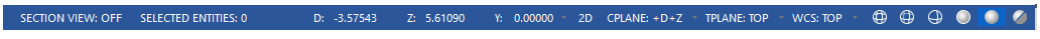
11. MRU (Most Recently Used) Panel Preview



12. Quick Mask Preview

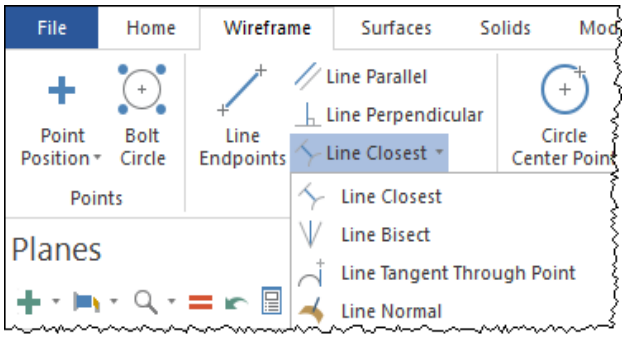
(Select all versus Select only)

13. Status Bar



14. Wireframe Tab preview

(We will focus on Lines icons)

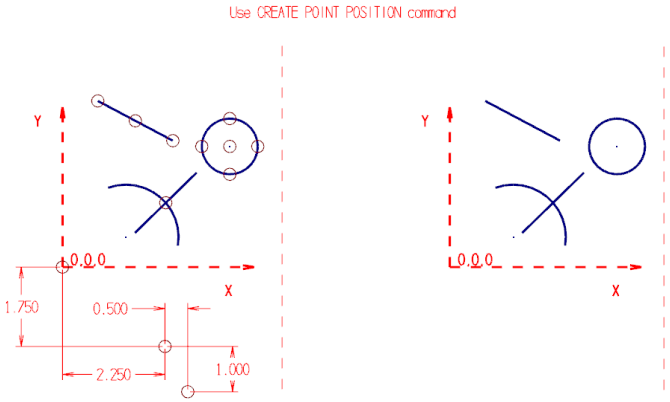


POINT POSITION COMMAND

Note: The following instructor led training exercises cover different basic geometry creation commands. The student has to complete the right side geometry based on the left side geometry and dimensions.

Resources - Download the file from www.EMASTERCAM.COM/TRAININGFILES/

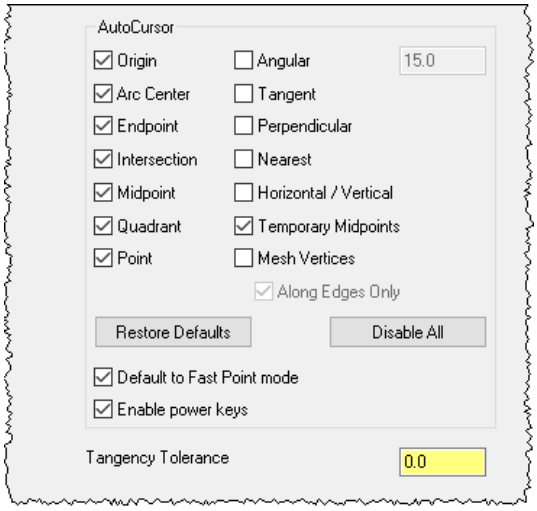
- From the **QAT**, select the **Open** icon.
- Select CREATE_POINT_POS.MCAM.



15. Set Auto Cursor in the Selection Bar

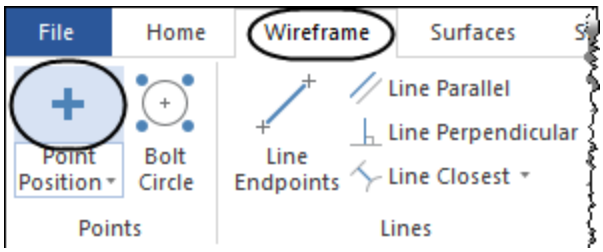
Instructor recommended settings:

- From the **General Selection Toolbar** select the **AutoCursor Configuration** icon.
- Set the settings as shown.



16. Point Position

*Note: Make sure that you are in the **Lathe +D+Z** plane. Create the points on the right side of the drawing to match the left side.*



Wireframe

- Select **Point Position**.

- Use the **AutoCursor** options to insert the points at the **Endpoint**, **Midpoint**, **Intersection**, **Quadrant**, **Origin** and **Center** locations. As Mastercam detects and snaps to the points, it displays a temporary square over the point and the corresponding cursor icon.

- Enter the coordinate values for the first point as shown.
- Press **Enter** from the keyboard to see the point created.

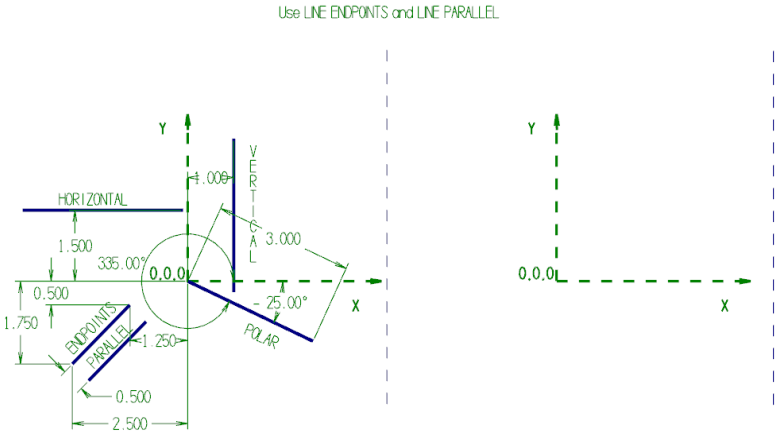
- Enter the coordinate values for the second point as shown.
- Press **Enter** from the keyboard to see the point created.

Note: Mastercam can perform simple math operations such as addition, abstracting, multiplications and divisions.
The instructor can also demonstrate how to change to Relative when entering the coordinates.

LINE ENDPOINTS & PARALLEL COMMANDS

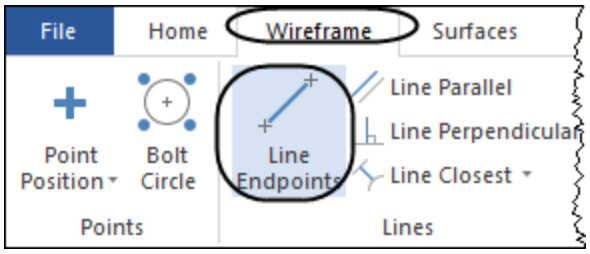
Resources - Download the file from www.EMASTERCAM.COM/TRAININGFILES/

- From the **QAT**, select the **Open** icon.
- Select CREATE LINES.MCAM.



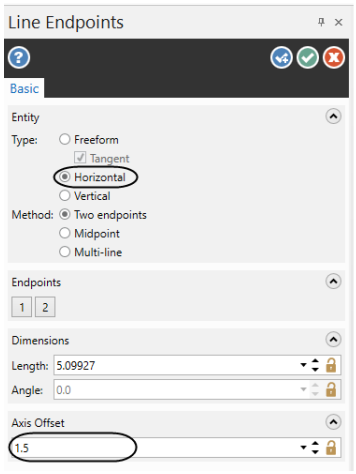
1. Line Endpoints

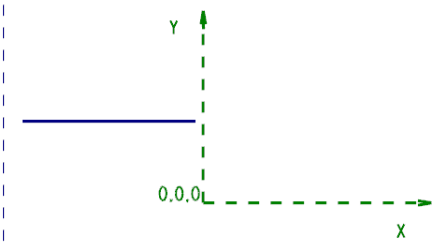
Wireframe



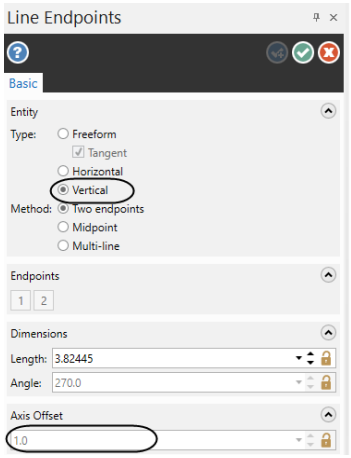
- Select **Line Endpoints**.

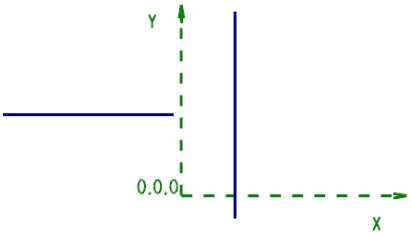
- Enable the **Horizontal** option in the **Line Endpoints** panel.
- Sketch the endpoints of the horizontal line approximately at the same location from the X and Y axes as per the left side drawing.
- In the **Axis Offset** box enter **1.5** as the **Y coordinate.**
- Press the **Enter** key to position the line.
- Press **Enter** again to finish the line or select the **OK and Create New Operation** button to continue in the same command.



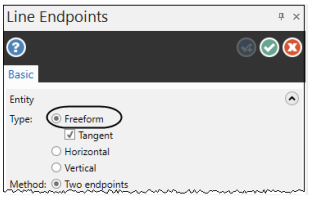


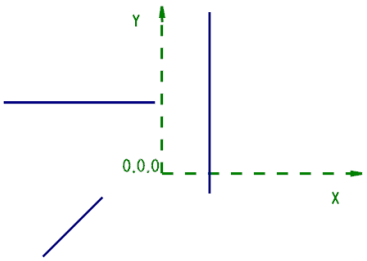
- Enable the **Vertical** option in the **Line Endpoints** panel.
- Sketch the endpoints of the vertical line approximately at the same location from the X and Y axes as per the left side drawing.
- In the **Axis Offset** box enter **1.0** as the **X coordinate.**
- Press the **Enter** key to position the line.
- Press **Enter** again to finish the line or select the **OK and Create New Operation** button to continue in the same command.



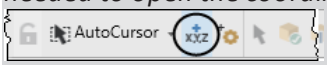


- Select the **Freeform** button in the **Line Endpoints** panel.
- Type the coordinate values for the first point (**-1.25,-0.5**) and press **Enter**.



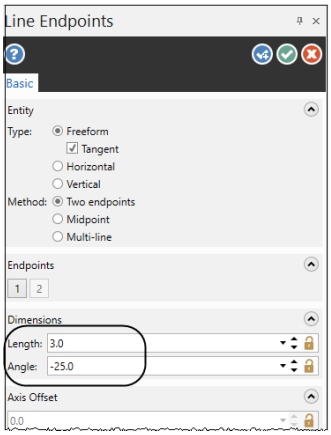


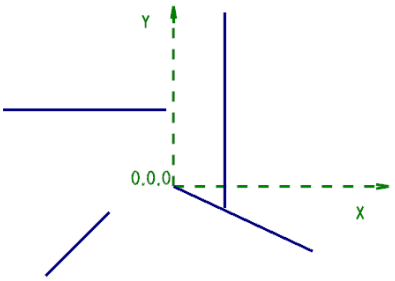
*Note: Select **the AutoCursor Fast Point** icon if needed to open the coordinates' field.*



- Type the coordinate values for the second point (**-2.5,-1.75**) and press **Enter**.
- Select the **OK and Create New Operation** button to continue in the same command.

- In the **Line Endpoints** panel, input a **Length** of **3.0** and an **Angle** of **-25.0**.
- Pick the **Origin** (center of the **Grid**) as the first endpoint.
- Select the **OK** button to exit the command.

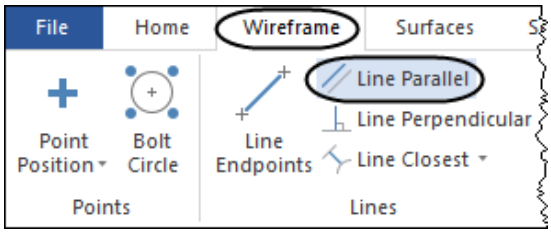




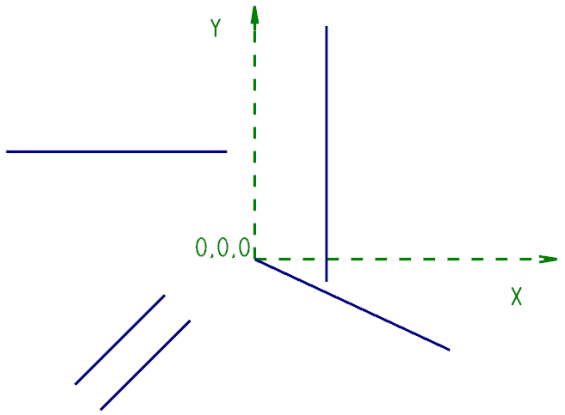
2. Line Parallel

Wireframe

- Select **Line Endpoints**.



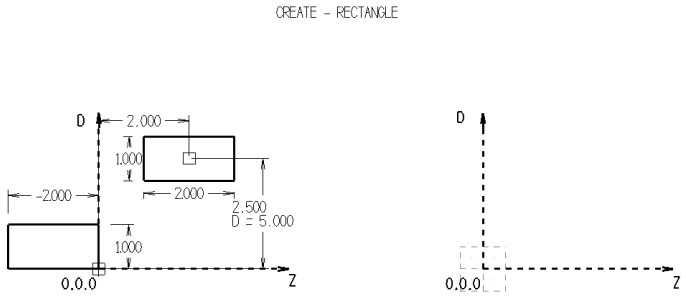
- Select the existing line and indicate the offset direction by clicking below the existing line
- In the **Line Parallel** panel, enter an **Offset Distance** of **0.5**. Press **Enter**.
- Select the **OK** button to exit the command.



RECTANGLE COMMANDS

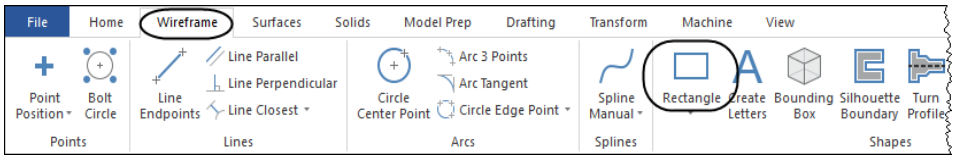
Resources - Download the file from www.EMASTERCAM.COM/TRAININGFILES/

- From the **QAT**, select the **Open** icon.
- Select CREATE_RECTANGLE.MCAM.
- Ensure that you are in the +D+Z plane.



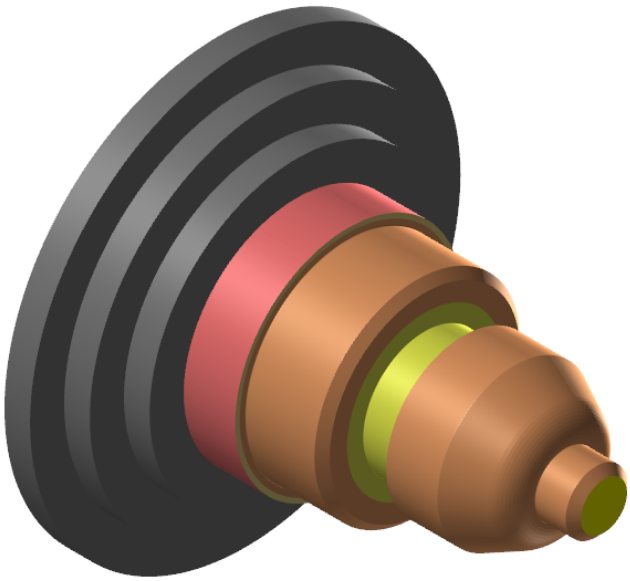
3. Rectangles

- From the **Shapes** group, select **Rectangle** icon as shown.



- Type the **Width** and the **Height** values, and make sure that you select the point placement that you know the coordinate values as per the drawing (0,0).
- Reselect the command to change the anchor to **Center** and press **Space** to enter the coordinates: (5,2.5).

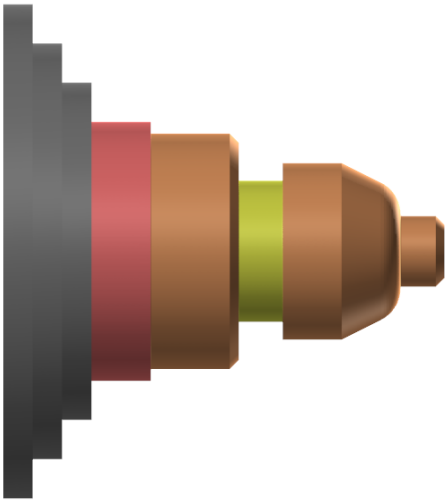
Groove Toolpath



NEW TOOLPATH INFORMATION

The following is brief description of the toolpath used in this exercise.

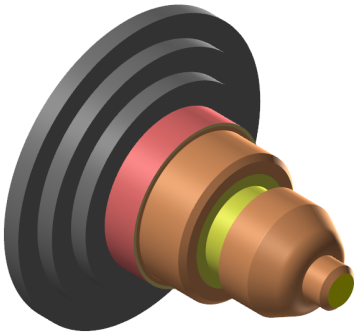
Grooving for machining indented or recessed areas that are not otherwise machinable by roughing toolpaths or tools. You can machine several grooves in a single operation, even if their geometry never connects. Mastercam integrates roughing and finishing passes, each with separate parameters, in a single operation.



INSTRUCTOR DEMONSTRATION

Topics:

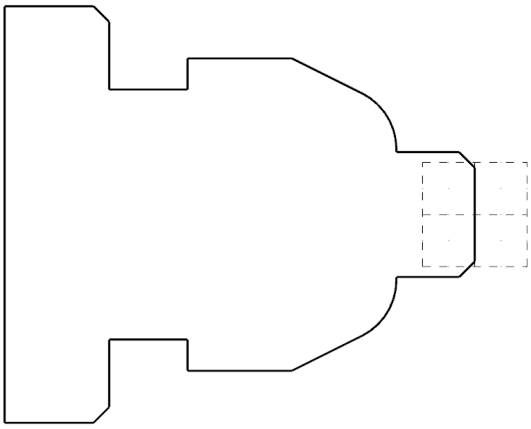
- Locate Geometry and Job Setup
- Facing Operation
- Roughing Operation
- Finishing Operation
- Grooving Operation



NOTES:

EXERCISE: DRAWING #3

STEP 1: OPEN PART GEOMETRY



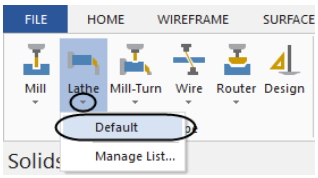
1.1 Open the file

- From the **QAT**, select the **Open** icon.
- Select **DRAWING 3.MCAM**.

STEP 2: CREATE THE JOB SETUP

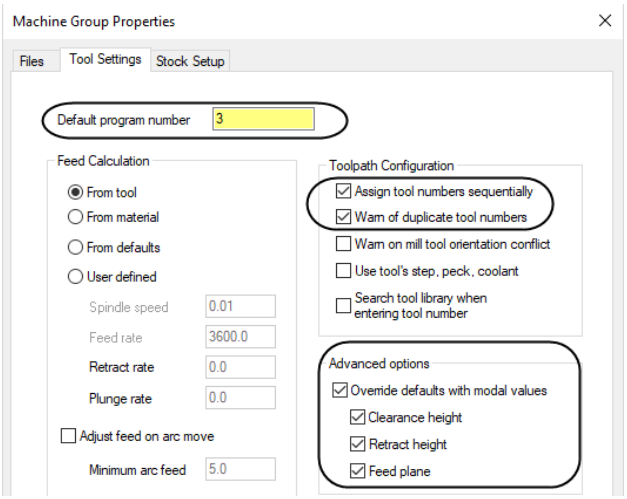
In this step you will supply Mastercam with information about tool settings, stock size and chuck jaw before starting to create the toolpaths.

2.1 Load the Lathe Default if needed



- From the **Machine** tab, select **Lathe** and **Default**.

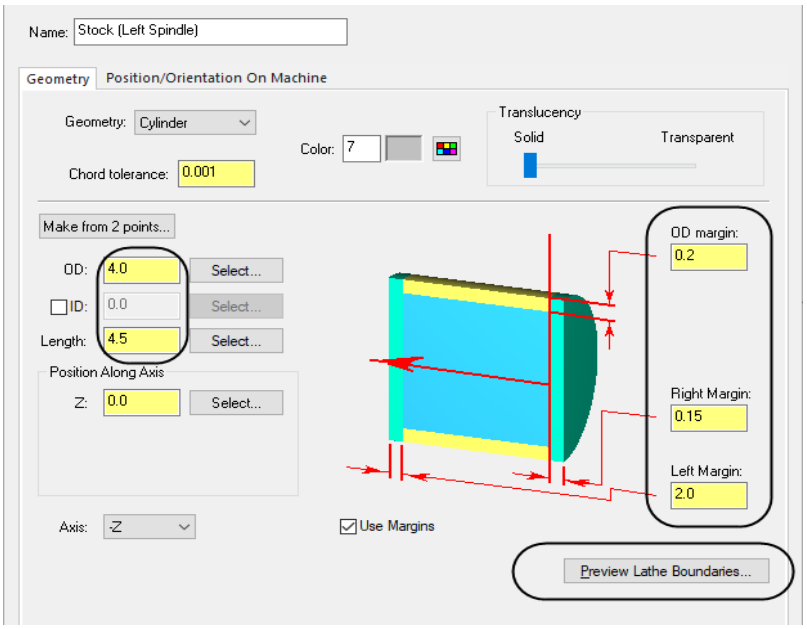
2.2 Set the Tool settings



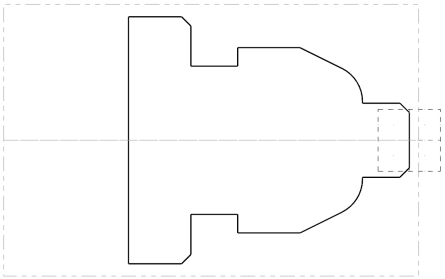
- Select the **Tool settings** icon.
- Set the **Program #** to **3**.
- Enable **Assign tool numbers sequentially**.
- Enable **Warn of duplicate tool numbers**.
- Enable **Feed Calculation From tool**.

2.3 Set the Stock settings

- Set the **OD** to **4.0"**.
- Set the **ID** to **4.5"**.
- Establish the stock as a bar giving extra margins: **OD margin = 0.2"**; **Right margin = 0.15"**.
- **Left margin = 2.0"**.
- Select the **Preview Lathe Boundaries** button to check the stock.
- Press **Enter** to continue.

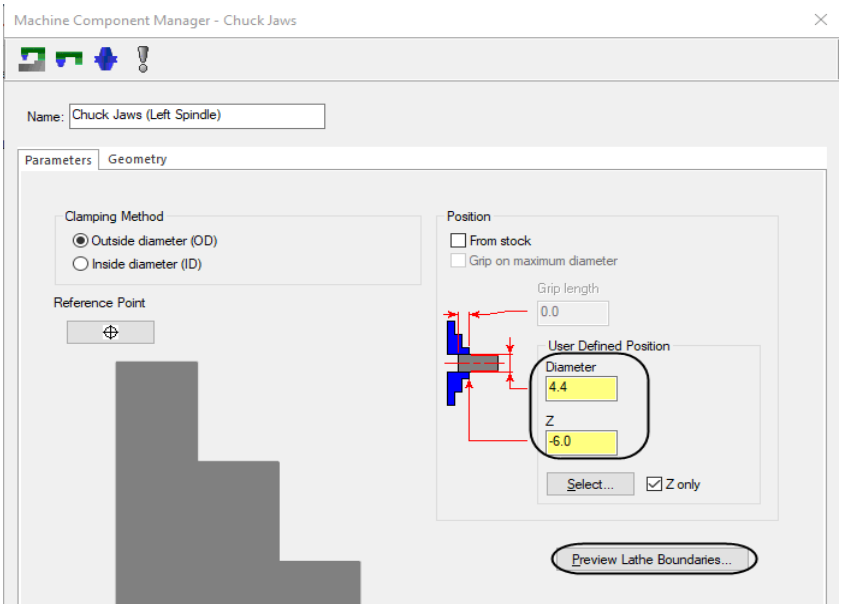


- Press **Enter** to continue.

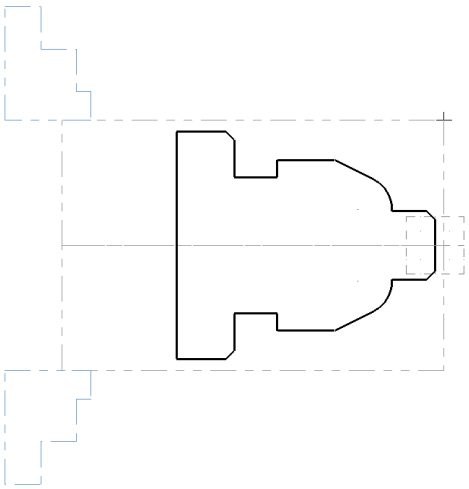


2.4 Set the Chuck Jaws settings

- **Clamping Method** set to **Outside diameter (OD)**.
- Set the chuck **Position** to **Diameter = 4.4"**; **Z = -6.0"**.
- Select the **Preview Lathe Boundaries** button to check the chuck.



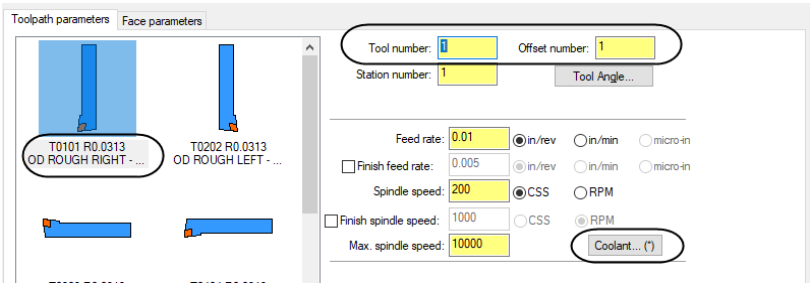
- Press **Enter** to continue.



STEP 3: LATHE FACE TOOLPATH

Turning

- From the **General** group, select the **Face** icon.

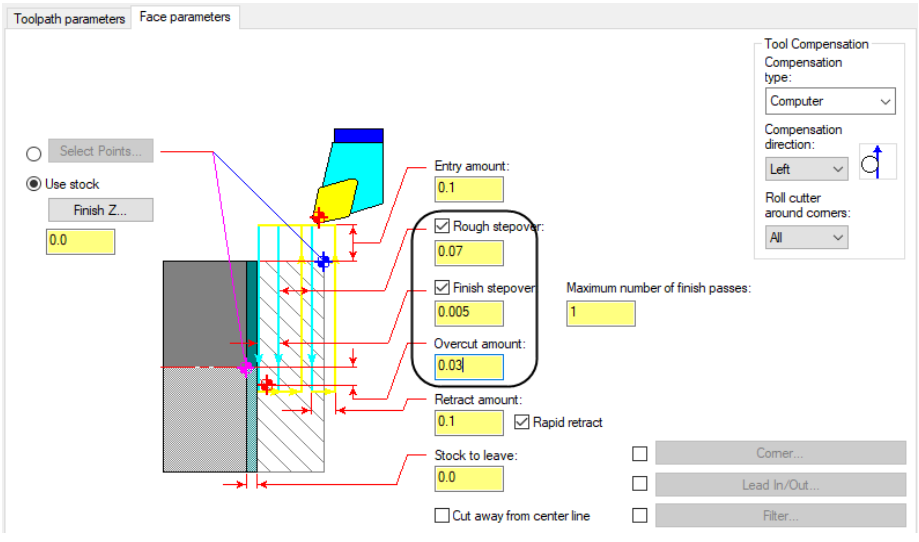


3.1 Set the Toolpath Parameters

- Select a **OD Rough Right 80 deg** tool.
- Set the **Tool/Offset Number** to **1**.
- Set the **Coolant On**.

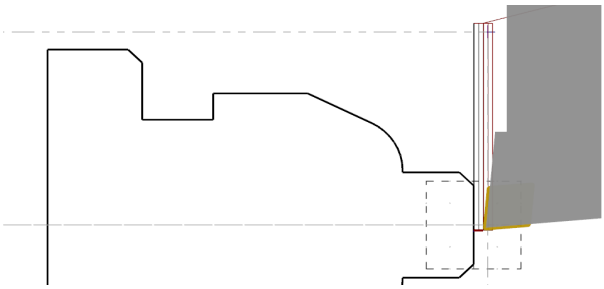
3.2 Set the Face Parameters

- Make sure that **Use stock** is enabled.
- **Finish Z = 0.0".**
- **Entry amount = 0.1".**
- **Rough stepover = 0.07".**
- **Finish stepover = 0.005".**
- **Overcut amount = 0.03".**
- **Retract amount = 0.1".**
- **Stock to leave = 0.0".**
- Set the **Cutter compensation** to **Computer** and to the **Left**.



3.3 Backplot the Face operation

- Press Alt +T to remove the toolpath display.



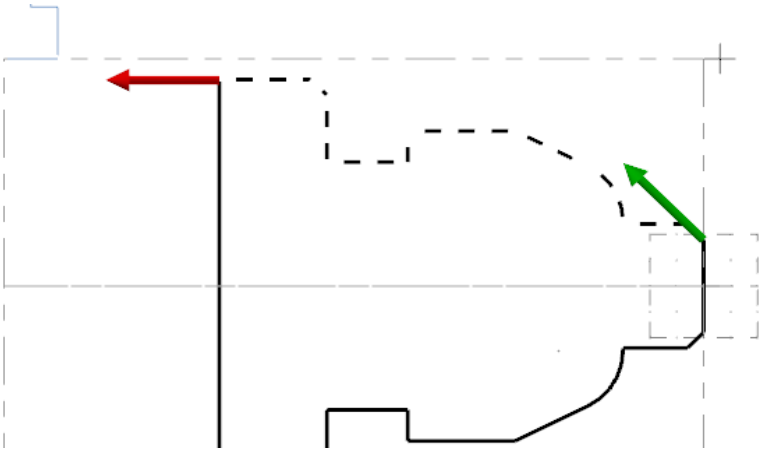
STEP 4: LATHE ROUGH TOOLPATH

Turning

- From the **General** group, select the **Rough** icon.

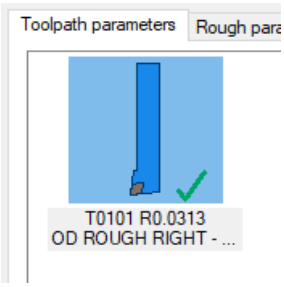
4.1 Select the geometry

- In the Selection Method, enable Partial button  and select the first entity of the chain and the last one to complete the chaining.



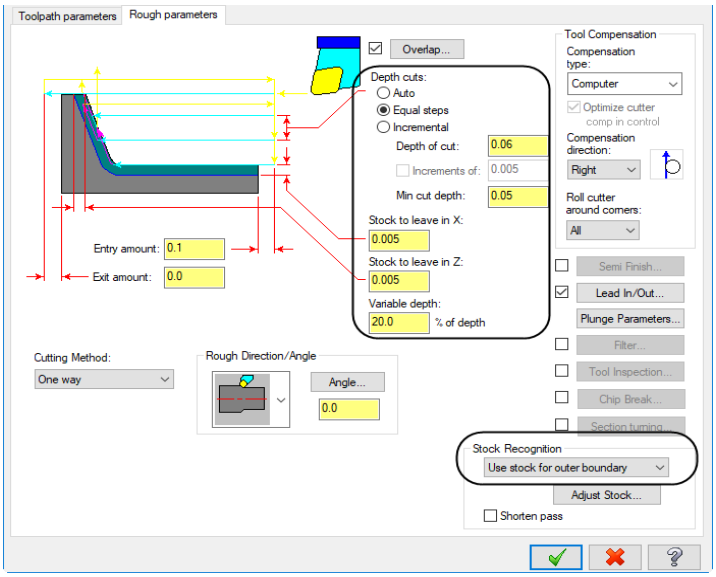
4.2 Set the Toolpath Parameters

- Select a existing **OD Rough Right 80 deg** tool.
- Set the **Tool/Offset Number** to **1**.
- Set the **Coolant On**.



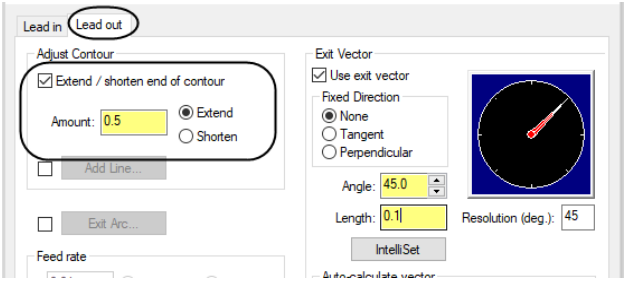
4.3 Set the Rough Parameters

- Make sure that **Overlap** is enabled.
- **Entry amount** = **0.1"**.
- Enable **Equal steps**.
- **Depth of cut = 0.06".**
- **Minimum cut depth** = **0.05"**.
- **Stock to leave in X** = **0.005"**.
- **Stock to leave in Z** = **0.005"**.
- **Variable depth** = **20%** of depth.
- Enable **Use stock for outer boundary**.



Note: Variable depth *allows you to vary the point that the surface contacts the tool insert to prevent notching and improve tool life. The variable depth can vary up to 25% of the depth of cut. The actual depth of cut can vary from 75% to 125% of the nominal depth of cut. The valid range is -25% to 25%. A positive value will result in an upward cut and a negative value will result in a downward cut. Zero will result in a straight cut.*

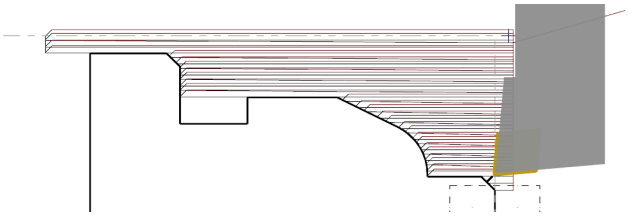
- **Cutting method** set to **One-way** and the **Rough Direction/Angle = 0**.
- Set the **Cutter compensation** to **Computer** and to the **Right**.



- Set proper **Lead In/out** parameters.
- **Extend** the end contour **0.5"**.

4.4 Backplot the Rough operation

Note: *The tool does not attempt to cut inside of the groove. This is a result of the* ***Plunge*** *parameters being set to none in the* ***Rough*** *parameters page.*

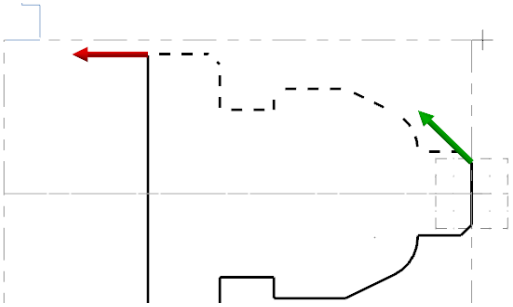


- Pres **Alt + T** to remove the toolpath display.

STEP 5: LATHE FINISH TOOLPATH

Turning

- From the **General** group, select the **Finish** icon.

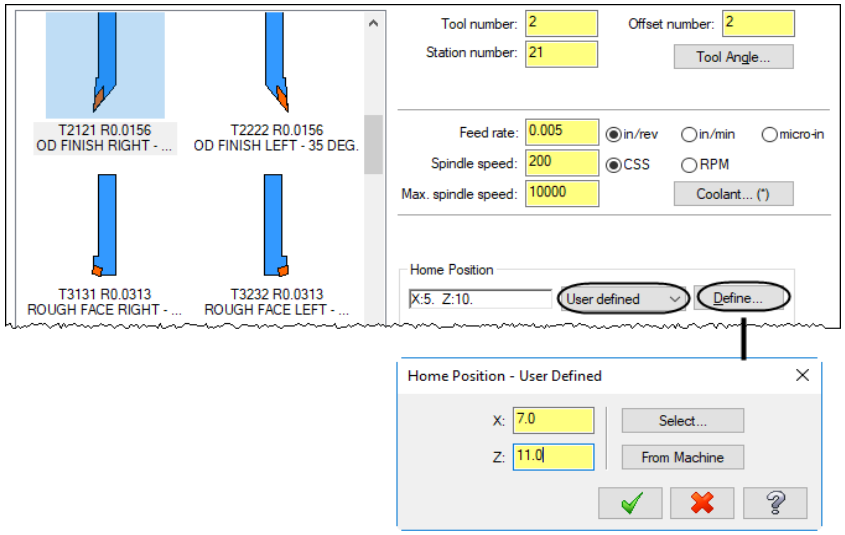


5.1 Select the geometry

- In the Wireframe Chaining dialog box, click on the **Last** button  . Mastercam selects the same chain as the one selected in the previous operation.

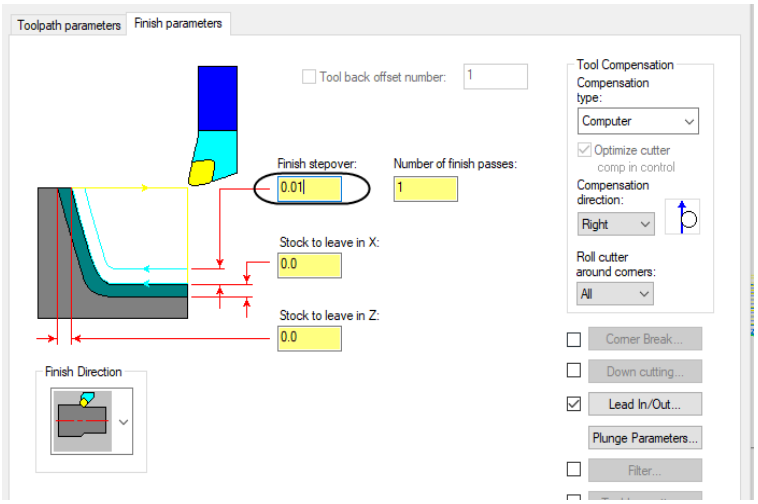
5.2 Set the Toolpath Parameters

- Select a **OD Finish Right 35 deg** tool.
- Set the **Tool/Offset Number** to **2**.
- Set the **Coolant On**.
- Set the **Home Position** as **User define; X 7.0, Z 11.0**.

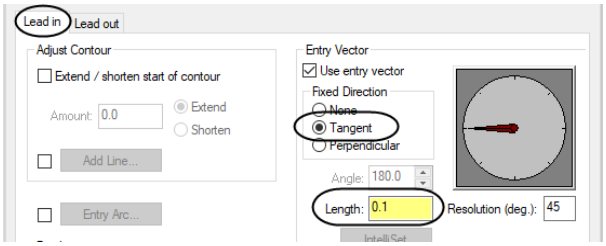


5.3 Set the Finish Parameters

- **Finish stepover** = **0.01"**.
- **Number of finish passes** = **1**.
- **Stock to leave in X** = **0.0"**.
- **Stock to leave in Z** = **0.0"**.
- **Finish direction** set to **OD**.
- Set the **Cutter compensation** to **Computer** and to the **Right**.

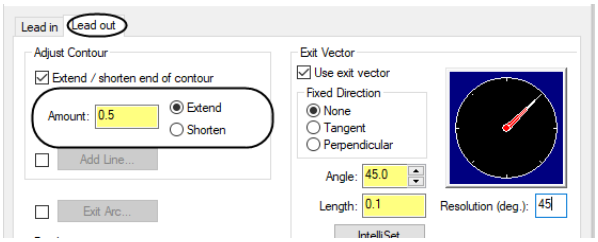


- Set proper **Lead In/Out** parameters.
- Use for **Lead In** only **Tangent entry; Length = 0.1"**.



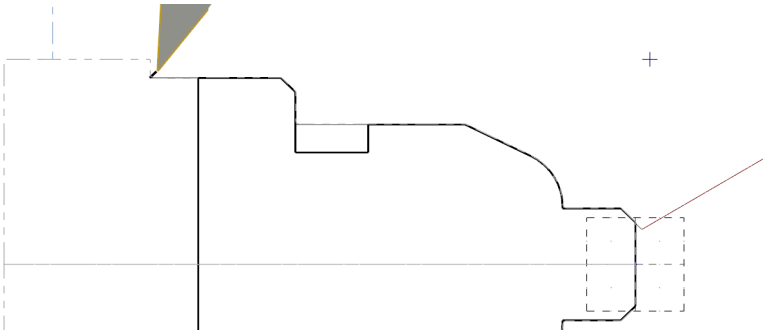
***Note:** This ensures that the entry will be extended with the length to better machine the chamfer.*

- **Extend** the end contour **0.5"**.
- Set proper **Lead In/Out** parameters; Use for **Lead In** only **Tangent entry; Length = 0.1"**.



- **Extend** the end contour **0.5"**.

5.4 Backplot the Finish operation



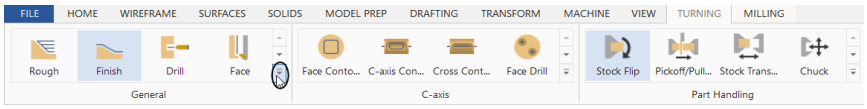
STEP 6: LATHE GROOVE TOOLPATH

Lathe Groove toolpaths are useful for machining indented or recessed areas that are not otherwise machinable by roughing toolpaths or tools.
Mastercam can machine many types of grooves based on the location of just a corner point or points; this lets you create groove toolpaths without having to create or chain geometry.
You can also use chained geometry if you prefer, or to specify complicated or intricate groove contours.

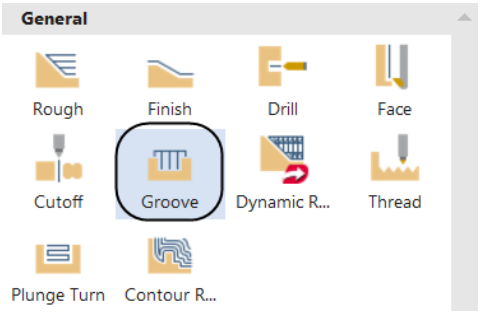
6.1 Select the toolpath

Turning

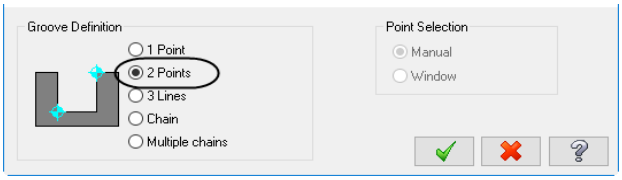
- From the **General** group, select the **Expand gallery** arrow as shown.



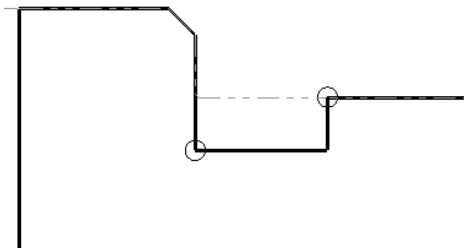
- From the **Toolpath gallery**, click on the **Groove** icon as shown.



- Select **2 Points** in the **Groove Definition**.



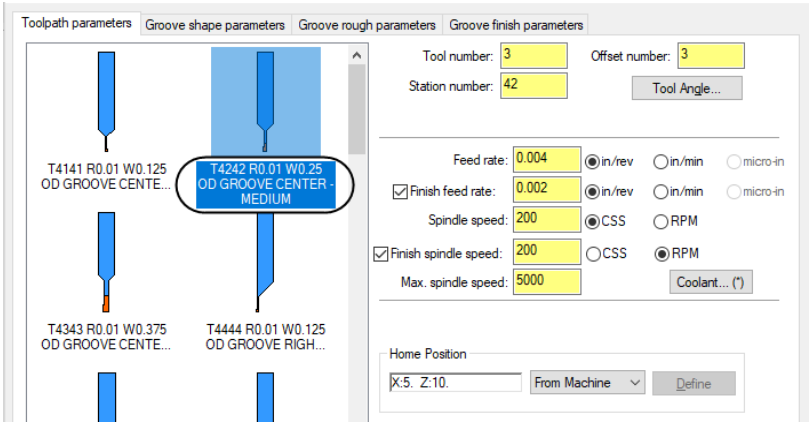
Note: *The first point should be the upper right corner of the groove and the second point should be the lower left corner.*



- Select the points as shown.
- Press **Enter** when finish.

6.2 Set the Toolpath Parameters

- Select a **OD Groove Center width** of **0.25"**.
- Set the **Tool/Offset Number** to **3**.
- Set the **Coolant On**.



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