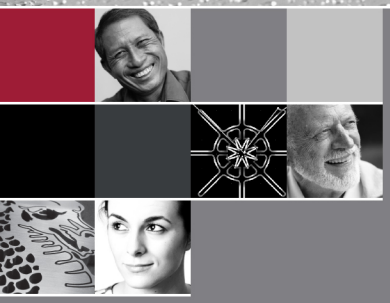


MAXIEM Operator Training

OMAX Corporation

OMAX Corporation believes the information described in this manual is accurate and reliable. From time to time, design improvements will be made to the MAXIEM® JetCutting Center. Photographs, text, and sketches within the body of this manual may not exactly represent your equipment. In general, this manual contains the most up-to-date information available. However, OMAX Corporation cannot accept any responsibility, financial or otherwise, for any consequences arising out of the use of this material. The information contained herein is subject to change, and revisions may be issued to advise of such changes or additions. OMAX strives to continually improve user documentation. If you have any questions or concerns about the content of this user's guide, please e-mail us at tech_writing@omax.com, or contact us by mail at:

OMAX Corporation
Technical Publications
21409 72nd Avenue South
Kent, WA, USA 98032

OMAX Corporation is continually improving their equipment to bring you the best in abrasivejet machining technology. For that reason, your MAXIEM JetCutting Center may differ slightly from what is described in this document. If you have any questions, please feel free to contact us at 1-800-838-0343 or e-mail us at techsupport@omax.com. You can also receive technical support on-line at: http://www.omax.com/support (user name and password required for access)

Overview

- Welcome and introductions
- Training objectives
- MAXIEM abrasive waterjet system overview
- Steps in making parts
- Learning resources
- MAXIEM Intelli-MAX Standard Software
  - **LAYOUT**
  - **MAKE**

What's included in the training packet

Training Materials

Training Materials

- ✓ Course outline
- ✓ USB Flash Drive
  - ✓ MAXIEM Documentation
  - ✓ Component Diagrams
  - ✓ WJTA Warning cards
- ✓ Copy of this Presentation
- ✓ Safety Checklist

Equipment components and the part cutting process

MAXIEM Abrasive Waterjet System Overview

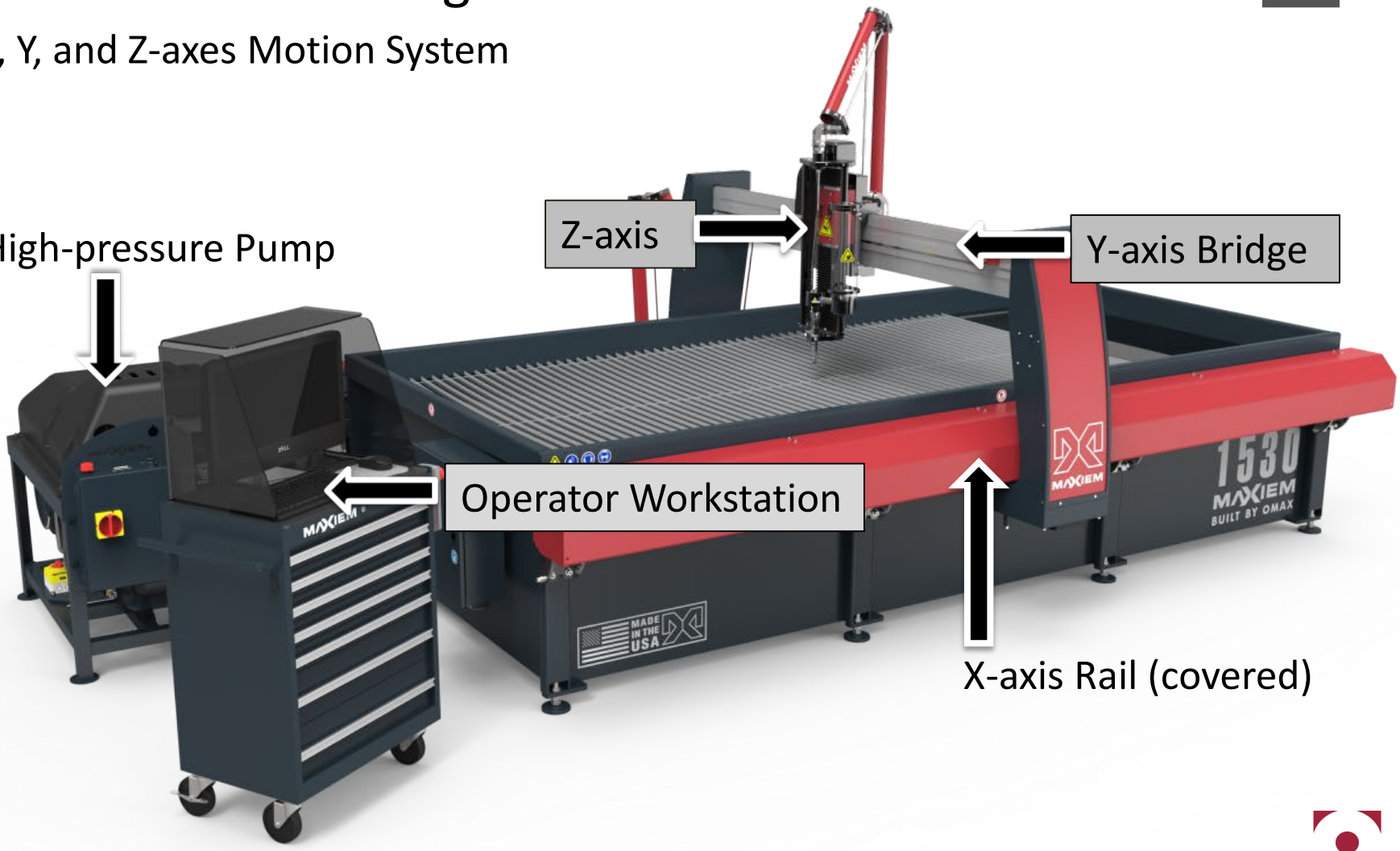
MAXIEM Abrasive Waterjet Overview

- Table
  - Purpose
  - Sizes
  - Components
- Controller
  - Purpose
  - Software

MAXIEM Abrasive Waterjet Overview

The MAXIEM Cutting Table

X, Y, and Z-axes Motion System



MAXIEM Abrasive Waterjet Overview

- Nozzles
  - Purpose
  - Types
    - MAXJET 5i
    - MiniJet nozzles
    - Water Only nozzle
- Direct drive pumps
  - Purpose
  - Sizes (M20, M30, M40)

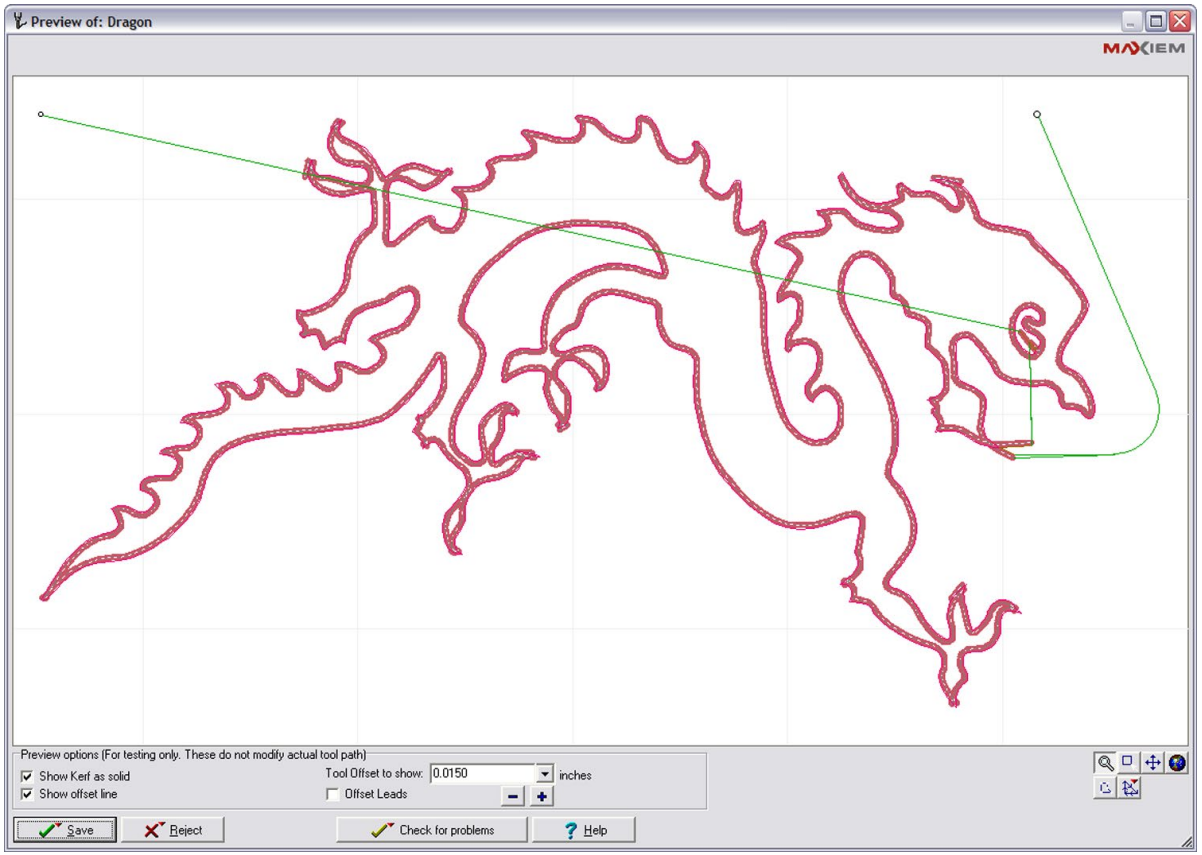
MAXIEM Abrasive Waterjet Overview

- Abrasive Delivery Systems
  - Purpose
  - Sizes (15 lb, bulk feed)
- High-pressure System
  - Purpose
  - Components (tubing, fittings, swivels)

Part Cutting Process

The MAXIEM software creates a machine tool path file from a CAD drawing file

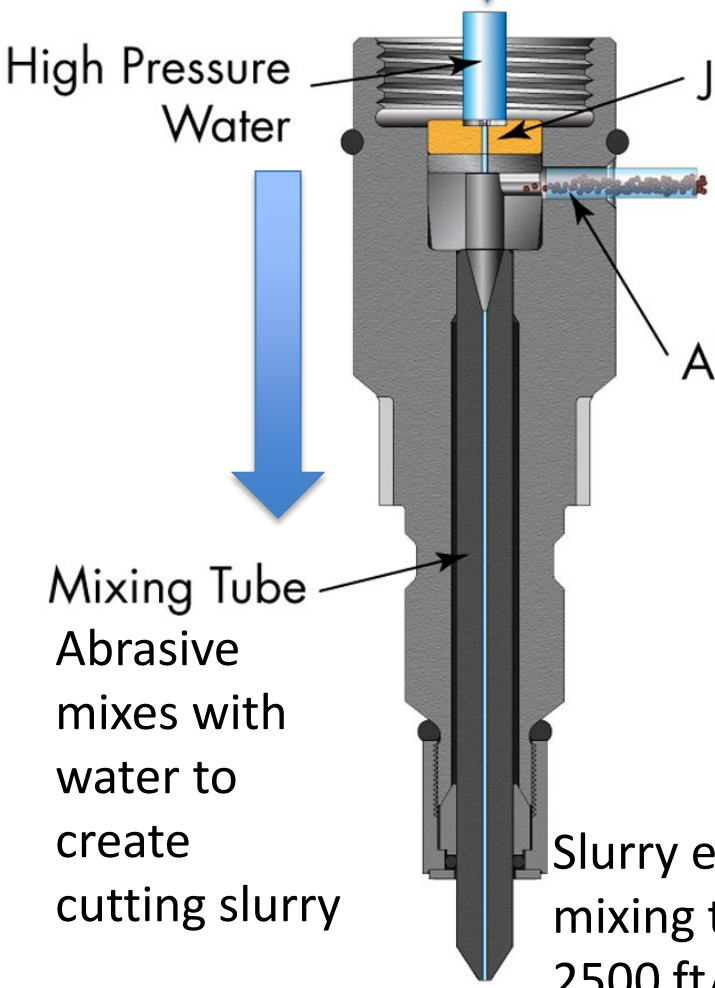
- The cutting head follows the machine tool path along X, Y, and Z-axes coordinates specified in the **MAKE** machining file.
- The nozzle speed determines the edge quality of the part.



Part Cutting Process

UHP water travels through the plumbing to the cutting head

Direct drive pump generates 50,000 psi Ultra high-pressure (UHP)

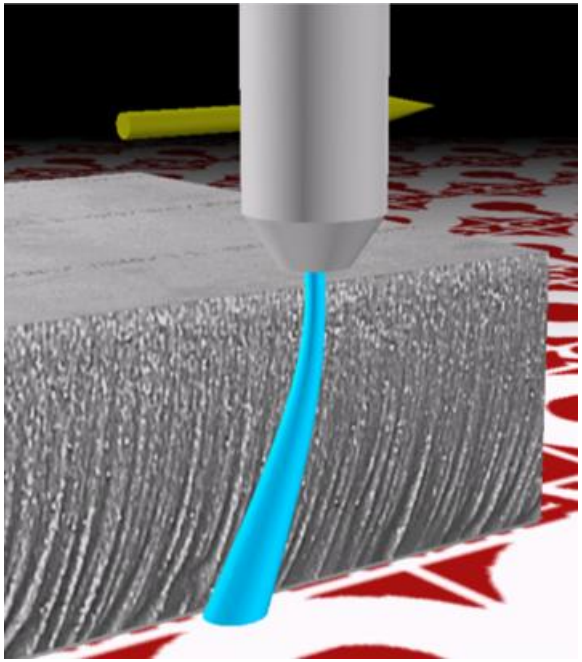


Abrasive mixes with water to create cutting slurry

Slurry exits mixing tube at 2500 ft/sec to cut the part

Edge Quality

Demo: Jet Simulator



Installation and Registration

Intelli-MAX Software Suite

Install Intelli-MAX Standard

- The Intelli-MAX Software Suite is preinstalled
  - One additional seat for offline use is included
  - Additional seats of software can be purchased if needed.
- Download upgrades from the omax.com support site (available to customers only)
- Use the installer to uninstall any previous versions of the software when upgrading
  - The installer will retain unique machine settings
- Follow the Install Wizard instructions
  - Install using the defaults in the process

Install Intelli-MAX Standard

How do I know the software is installed?

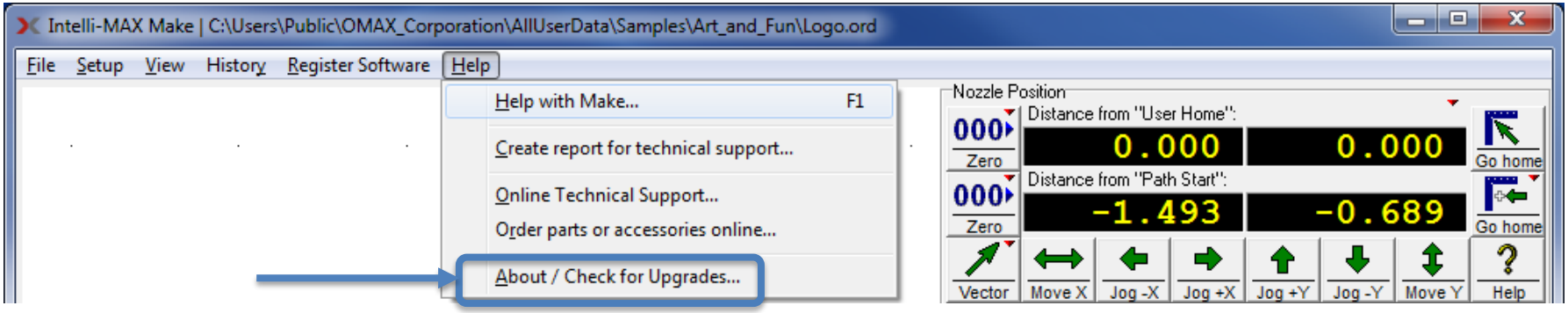
- After the installation process, you should see three icons on your desktop
  - **Intelli-MAX LAYOUT Standard**
  - **Intelli-MAX MAKE Standard**
  - **OMAX Marketplace**

help keyword “software”

Install Intelli-MAX Standard

Verify the version of software

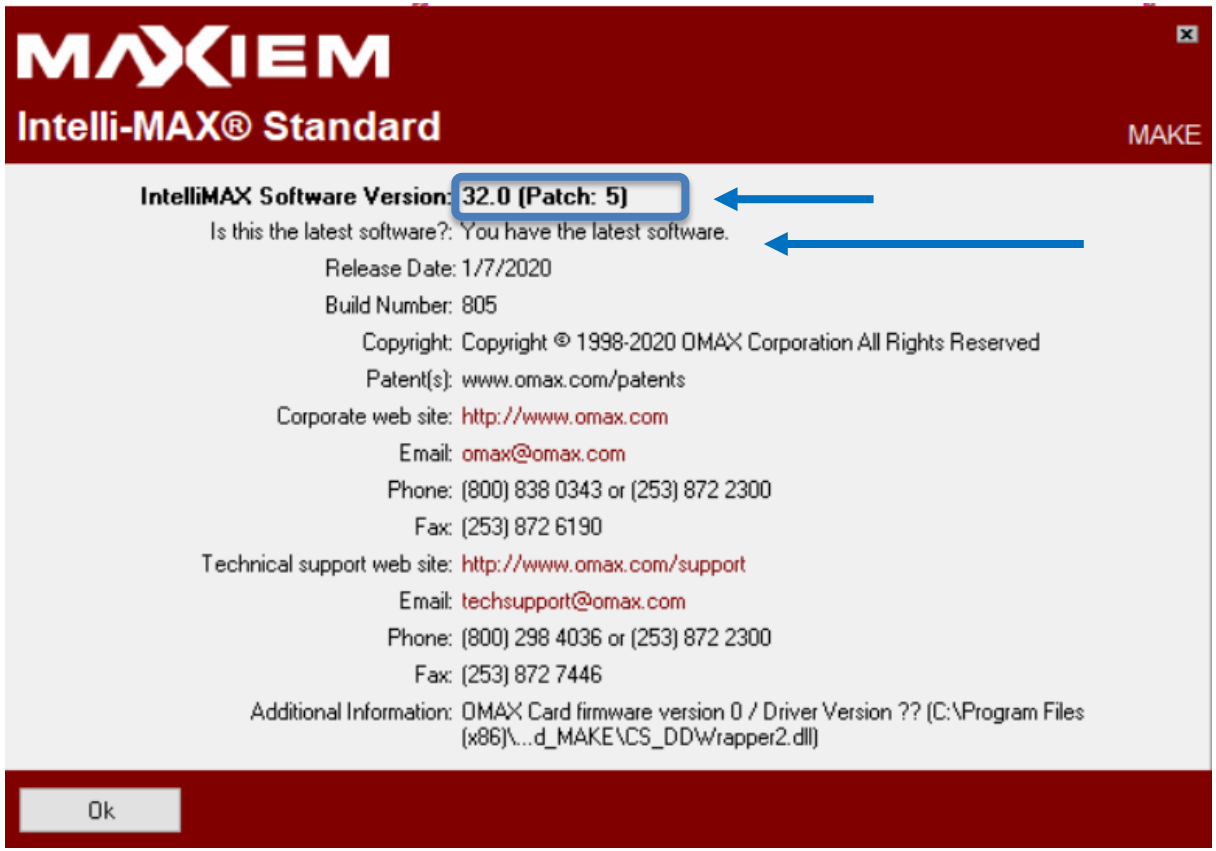
- In **LAYOUT** or **MAKE**, click **Help** on the main menu
  - Click **About / Check for Upgrades**



help keyword "software"

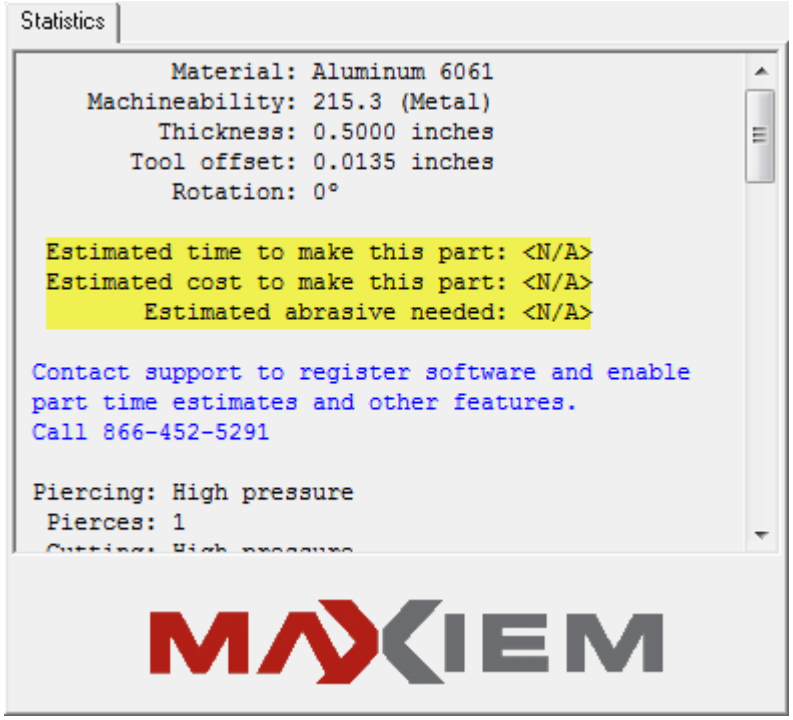
Install Intelli-MAX Standard

Help > About / Check for Upgrades



Register Intelli-MAX Standard

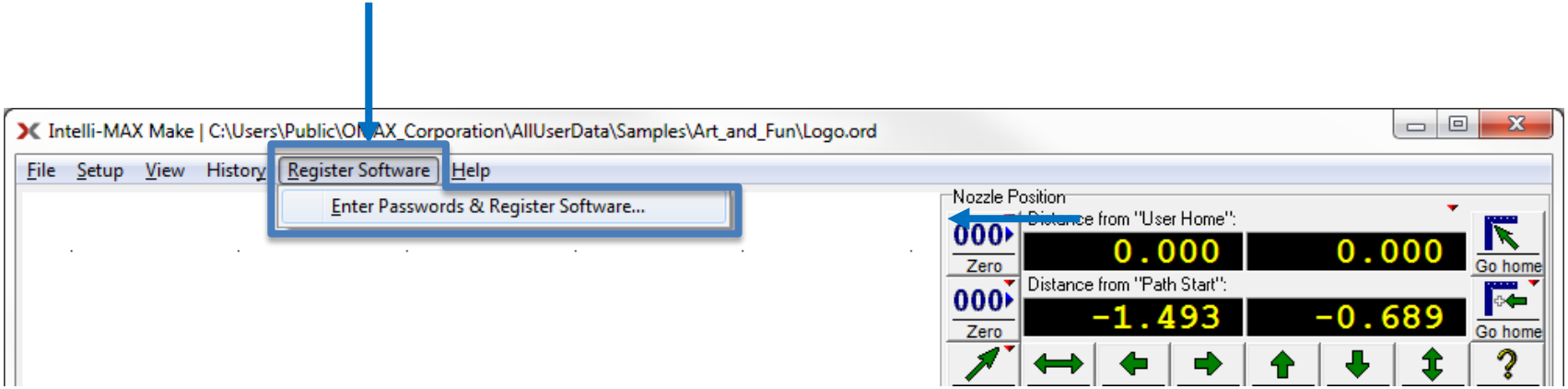
Register the Intelli-MAX software suite to enable additional features



Register Intelli-MAX Standard

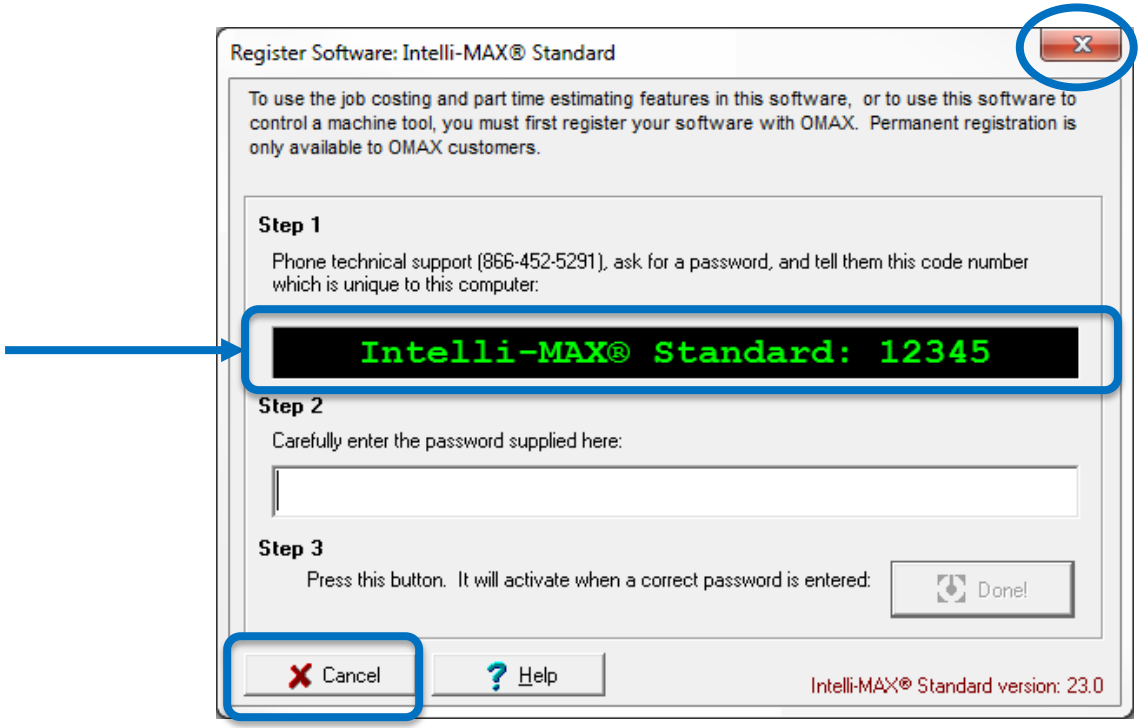
Register the software to enable all features

- Open **Intelli-MAX MAKE**
- Click **Register Software**
- Click **Enter Passwords & Register Software**



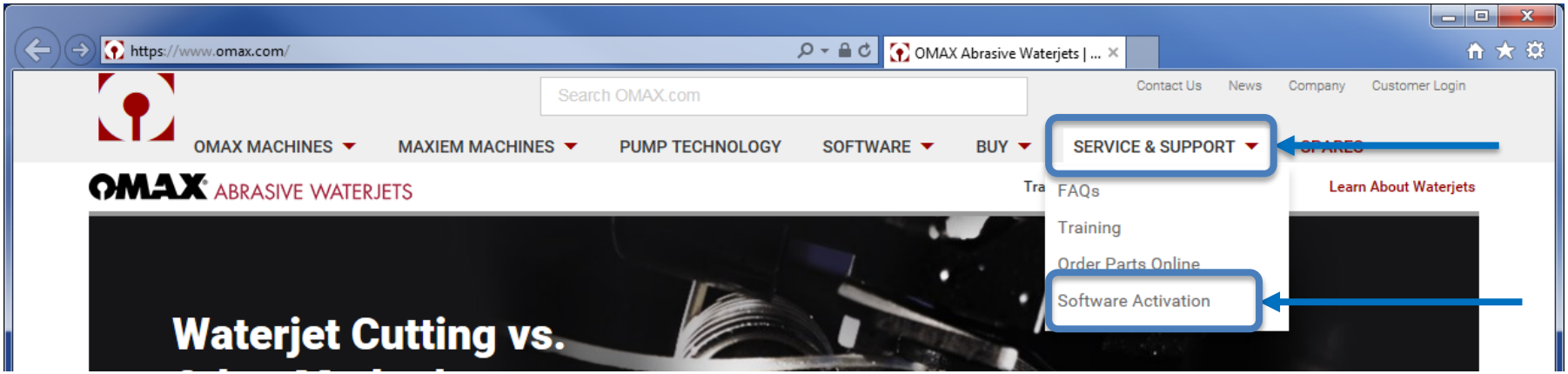
Register Intelli-MAX Standard

- Write down the **green code** shown in **Step 1**
- Close the registration window (click the X or click **Cancel**)



Register Intelli-MAX Standard

- Go to www.omax.com
- From the **Service & Support** menu, choose **Software Activation**

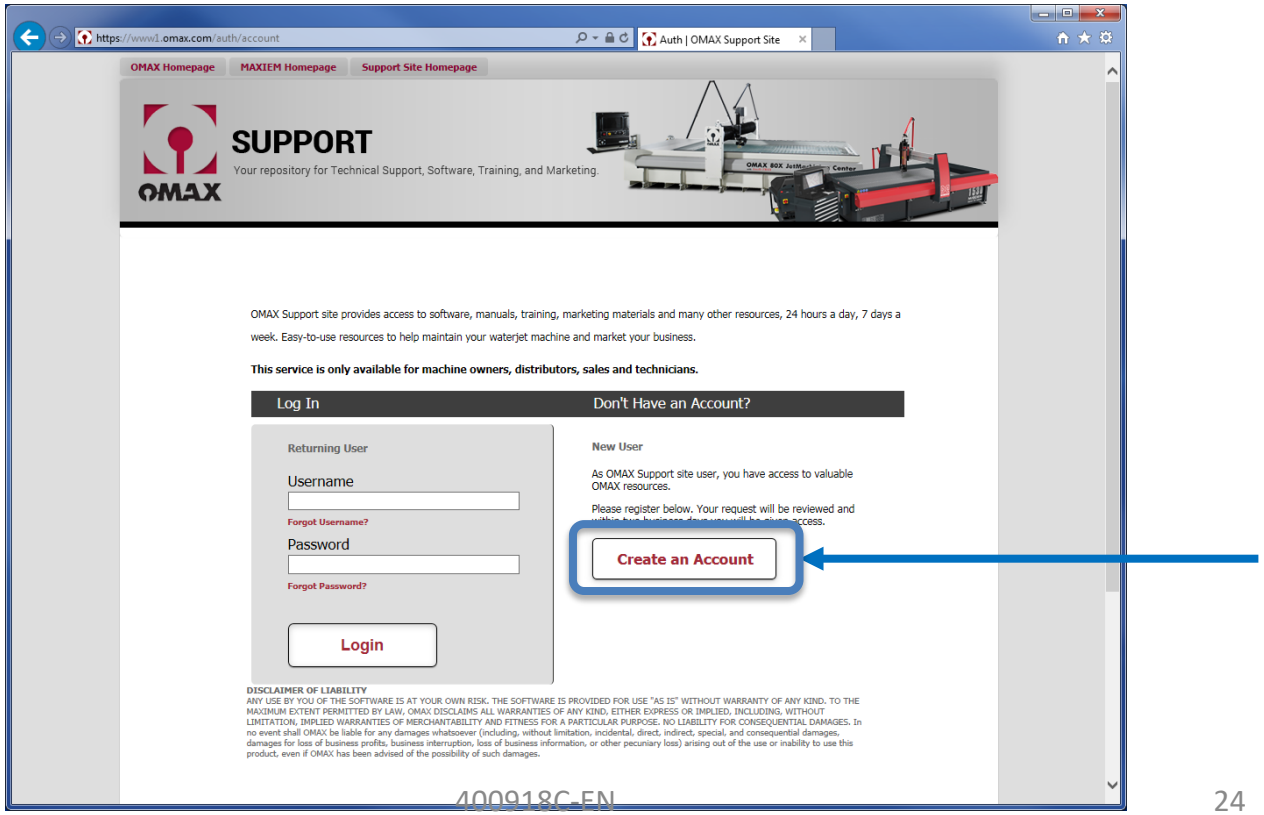


Register Intelli-MAX Standard

- Log in using your email address and password
- Click Login

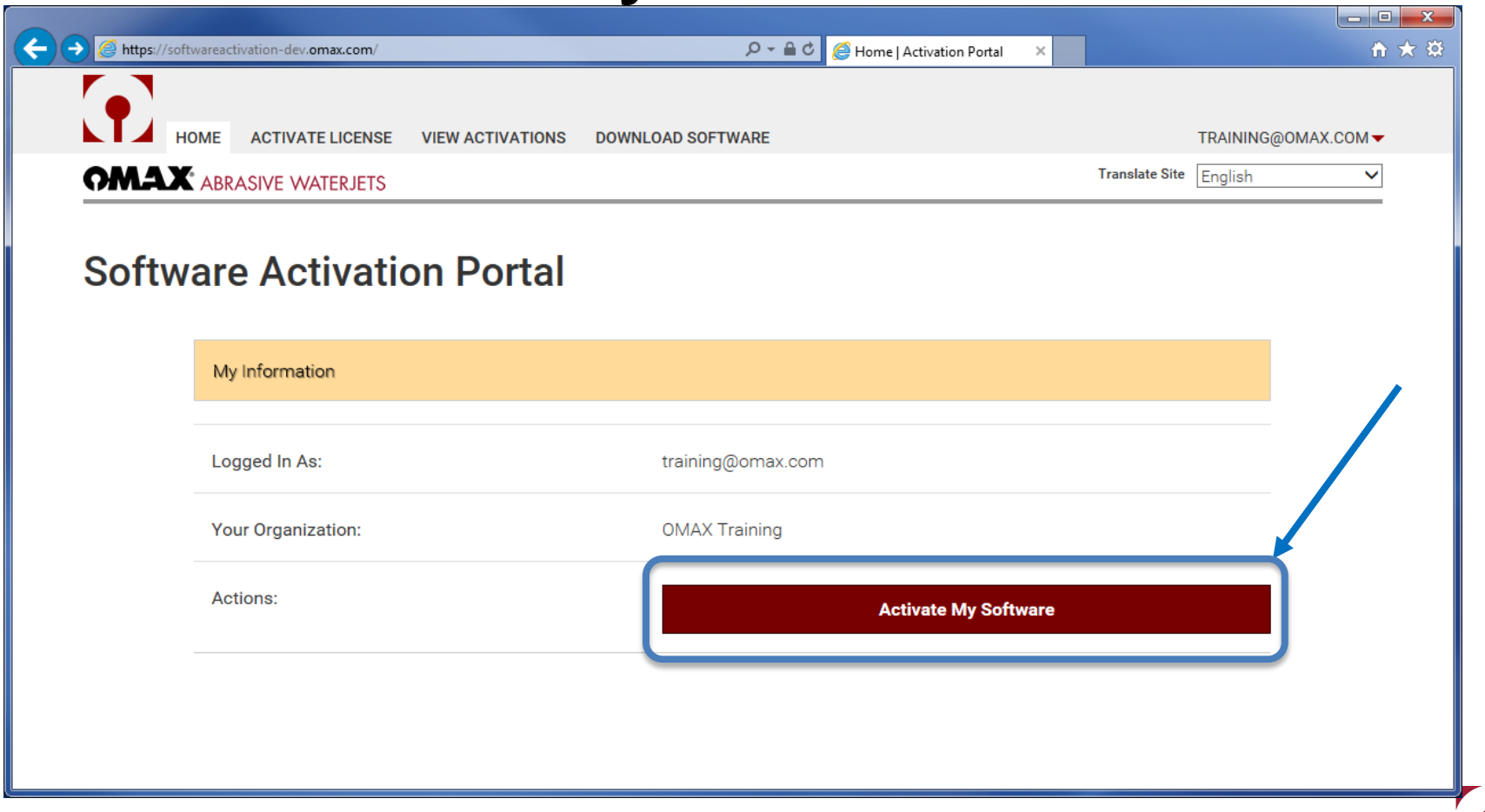
Register Intelli-MAX Standard

– If you do not have an OMAX support account, click the **Create an Account** button and follow the on-screen instructions



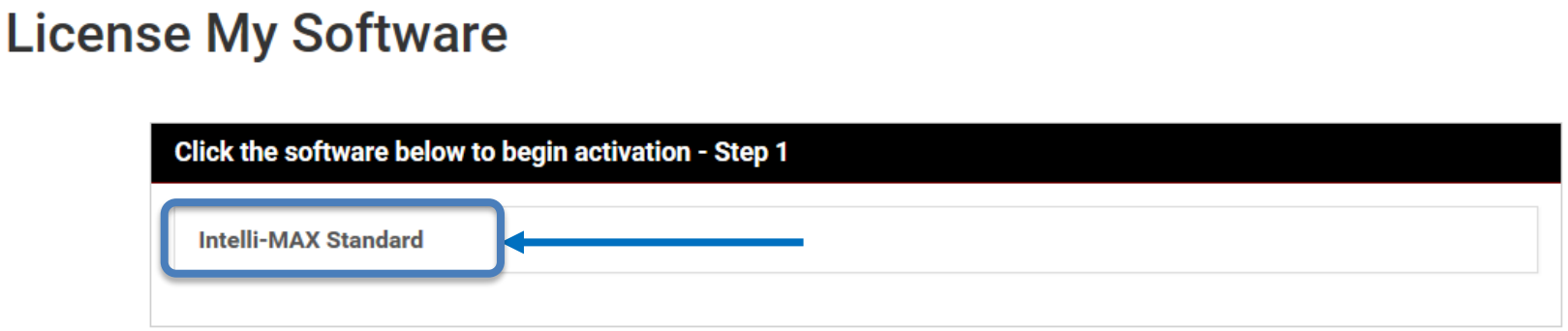
Register Intelli-MAX Standard

– Click **Activate My Software**



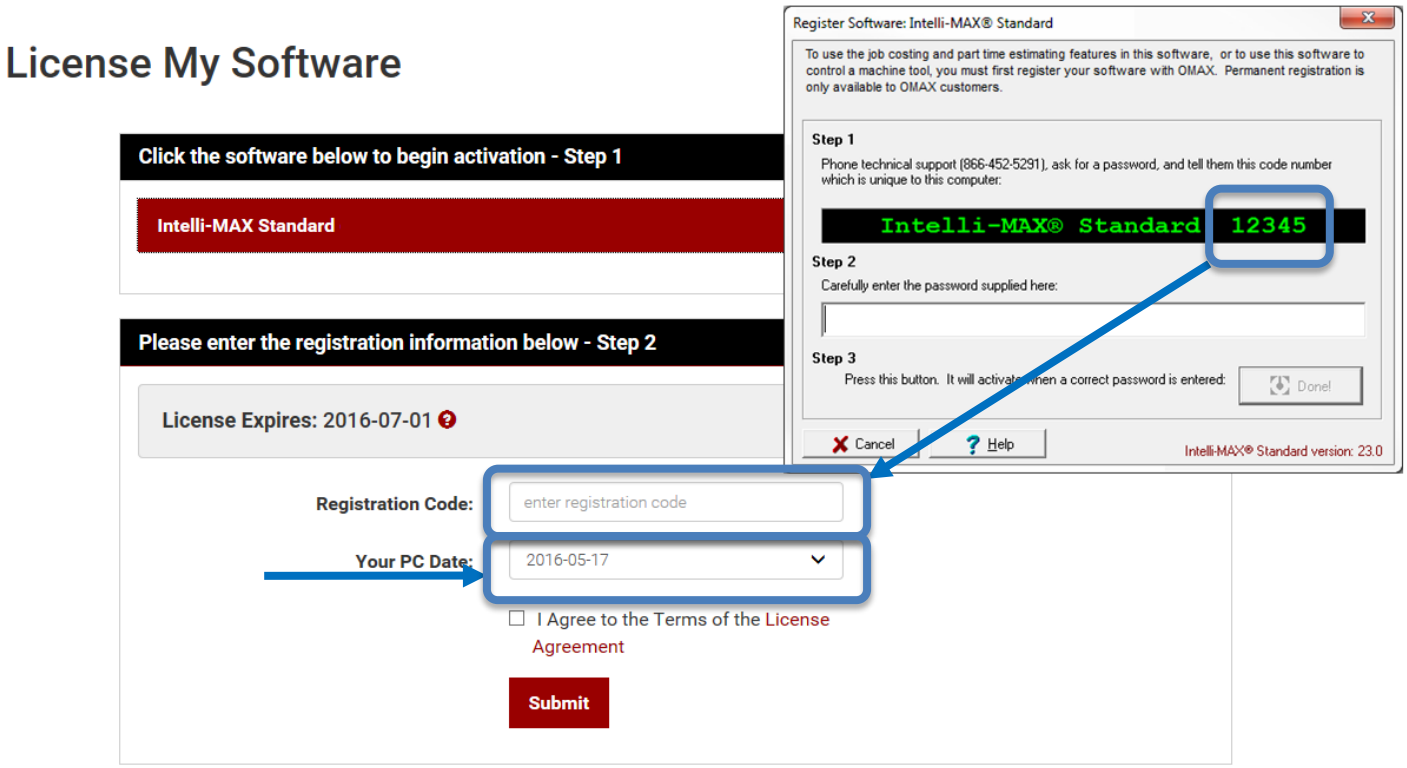
Register Intelli-MAX Standard

– Click Intelli-MAX Standard



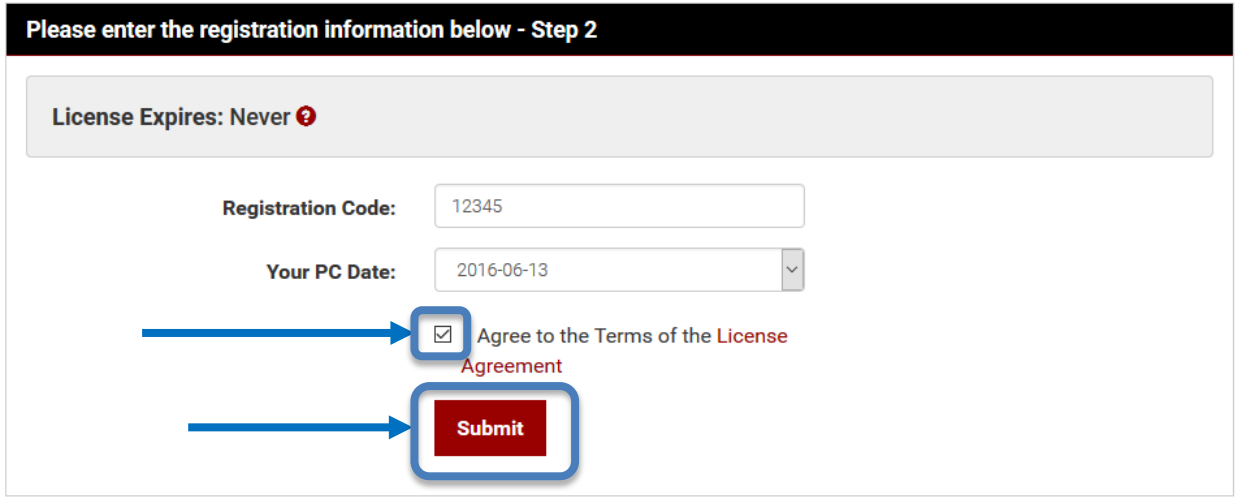
Register Intelli-MAX Standard

- Enter the registration code
- Verify the date shown in the **Your PC Date**



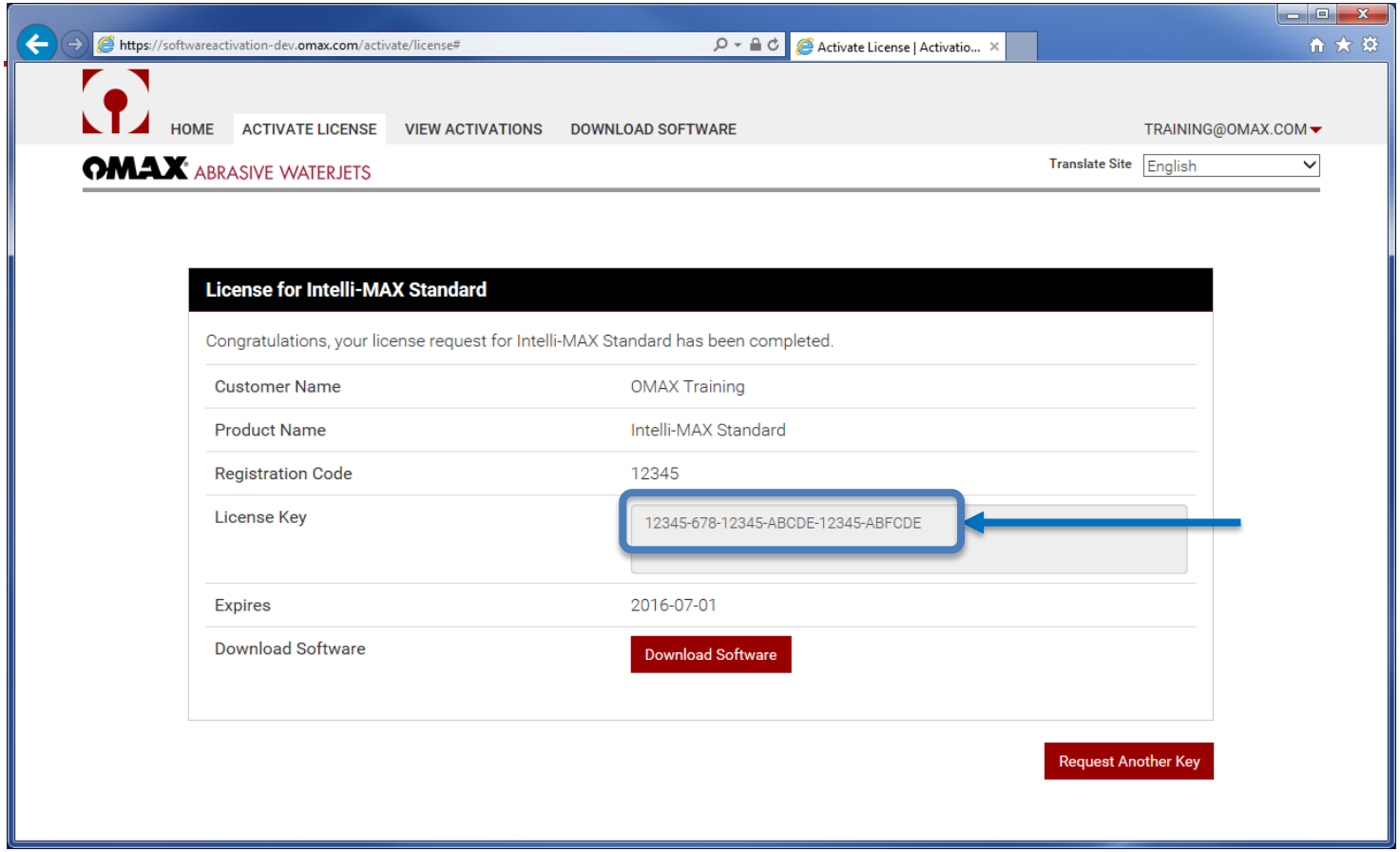
Register Intelli-MAX Standard

- Check **I Agree to the Terms of the License Agreement** box
- Click the **Submit** button



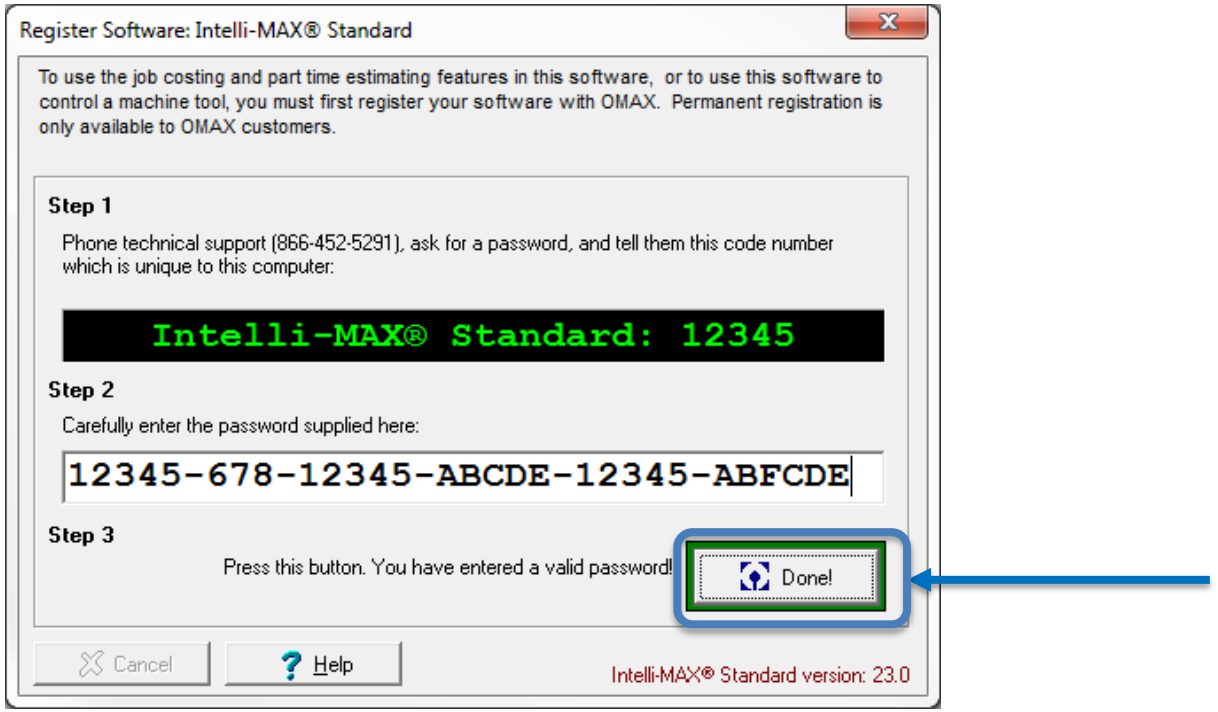
Register Intelli-MAX Standard

– Copy the **License Key** from this page



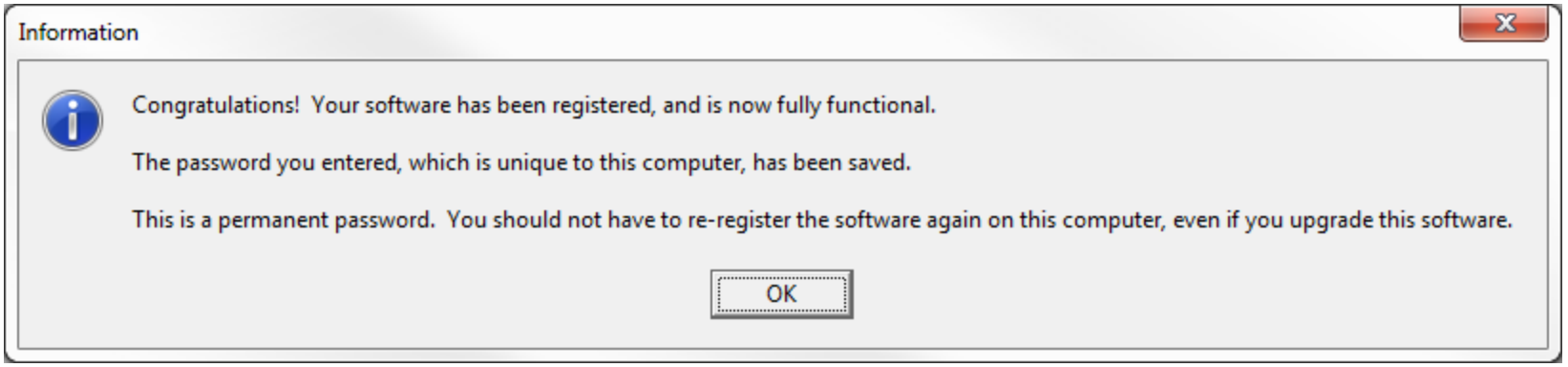
Register Intelli-MAX Standard

- Paste the License Key into the Intelli-MAX software registration dialog box
- Click **Done**



Register Intelli-MAX Standard

– Your software is registered!



Register Intelli-MAX Standard

- Other Notes
  - Permanent passwords are issued when the machine is released by OMAX accounting
  - A separate registration is required for each PC the software is loaded on
  - Passwords must be entered on the same calendar date they are issued or they are no longer valid

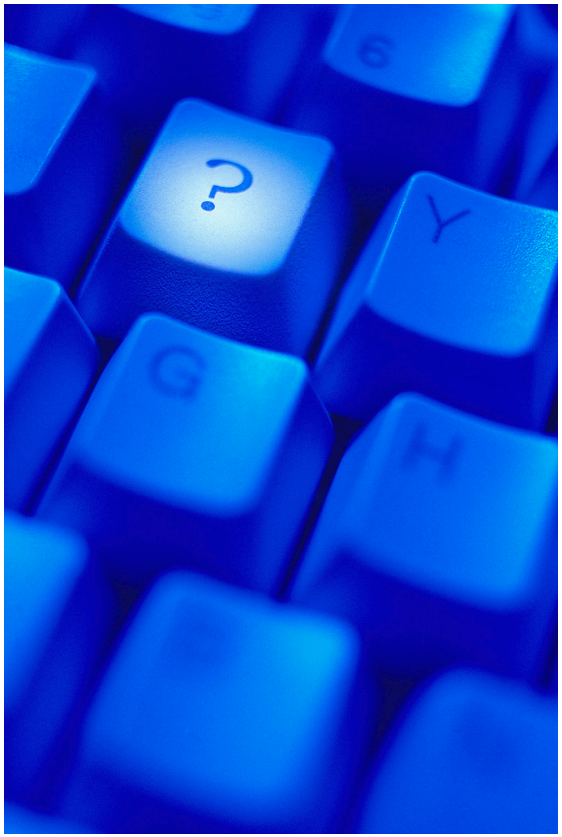
OMAX Technical Support (800) 298-4036

The MAXIEM Help System

MAXIEM Learning Resources

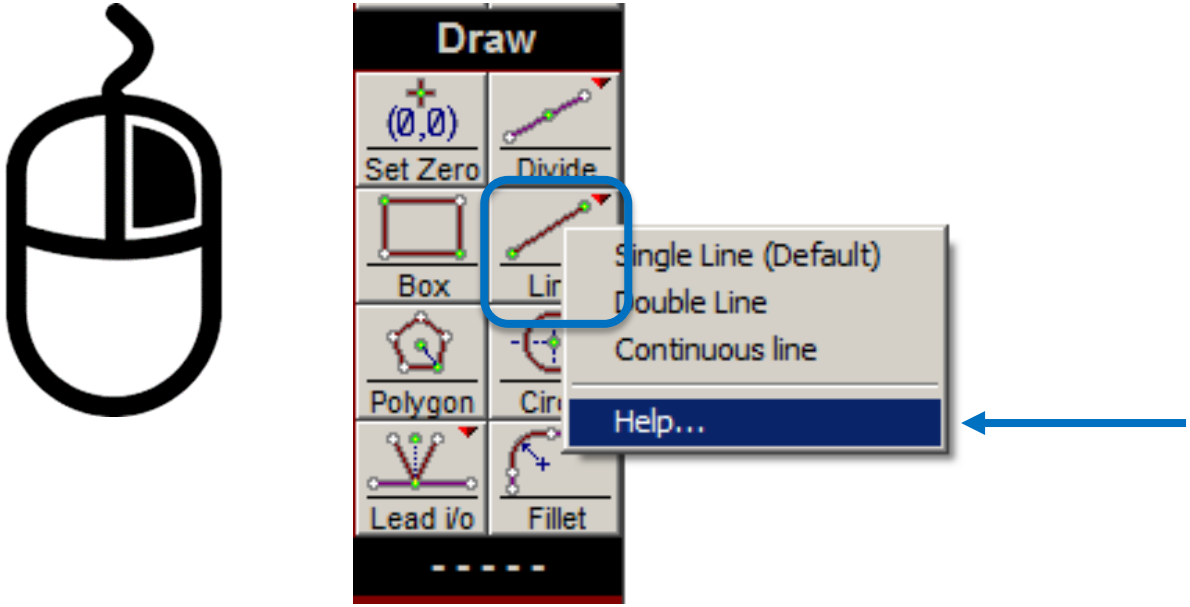
MAXIEM Help System

- Help when you want it on the topic you need!
  - Intuitive
  - Interactive
  - Help files



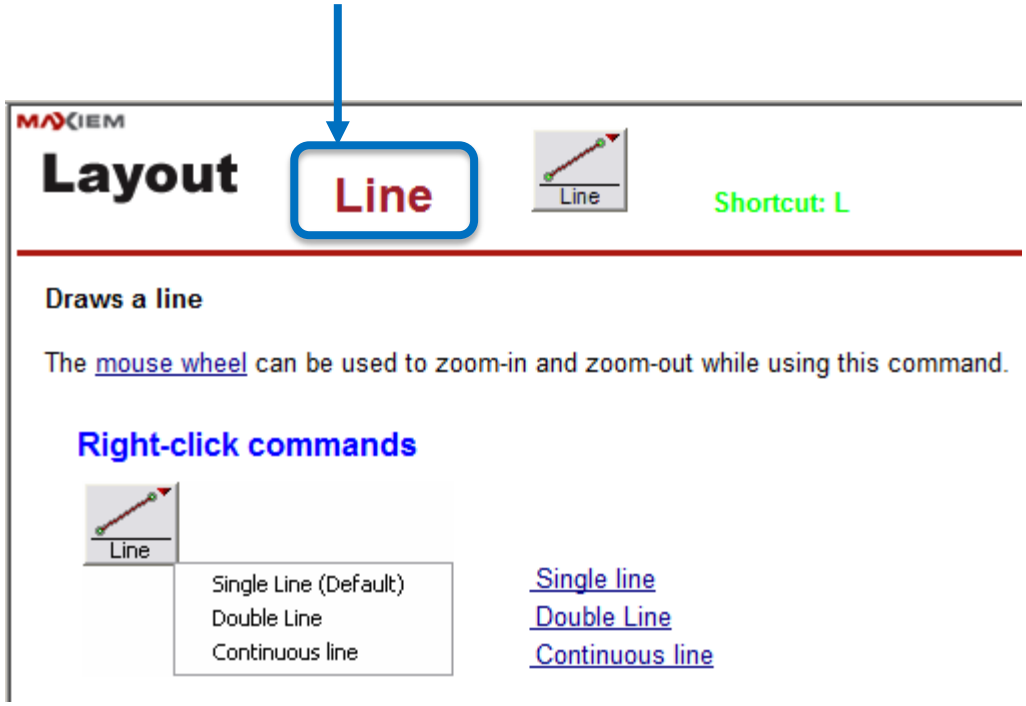
MAXIEM Help System

- Example
  - In **Intelli-MAX LAYOUT,** you are working with the **Line** tool
  - Right-click the **Line** icon, and then click **Help**



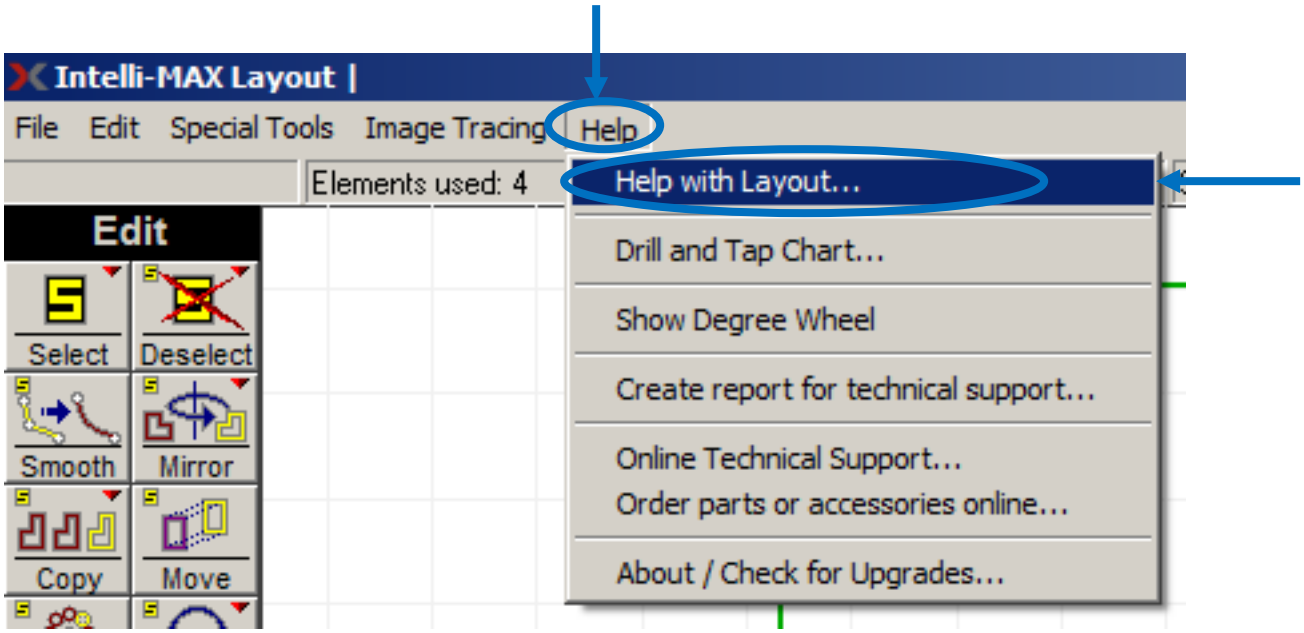
MAXIEM Help System

– You go to **Help** on drawing lines



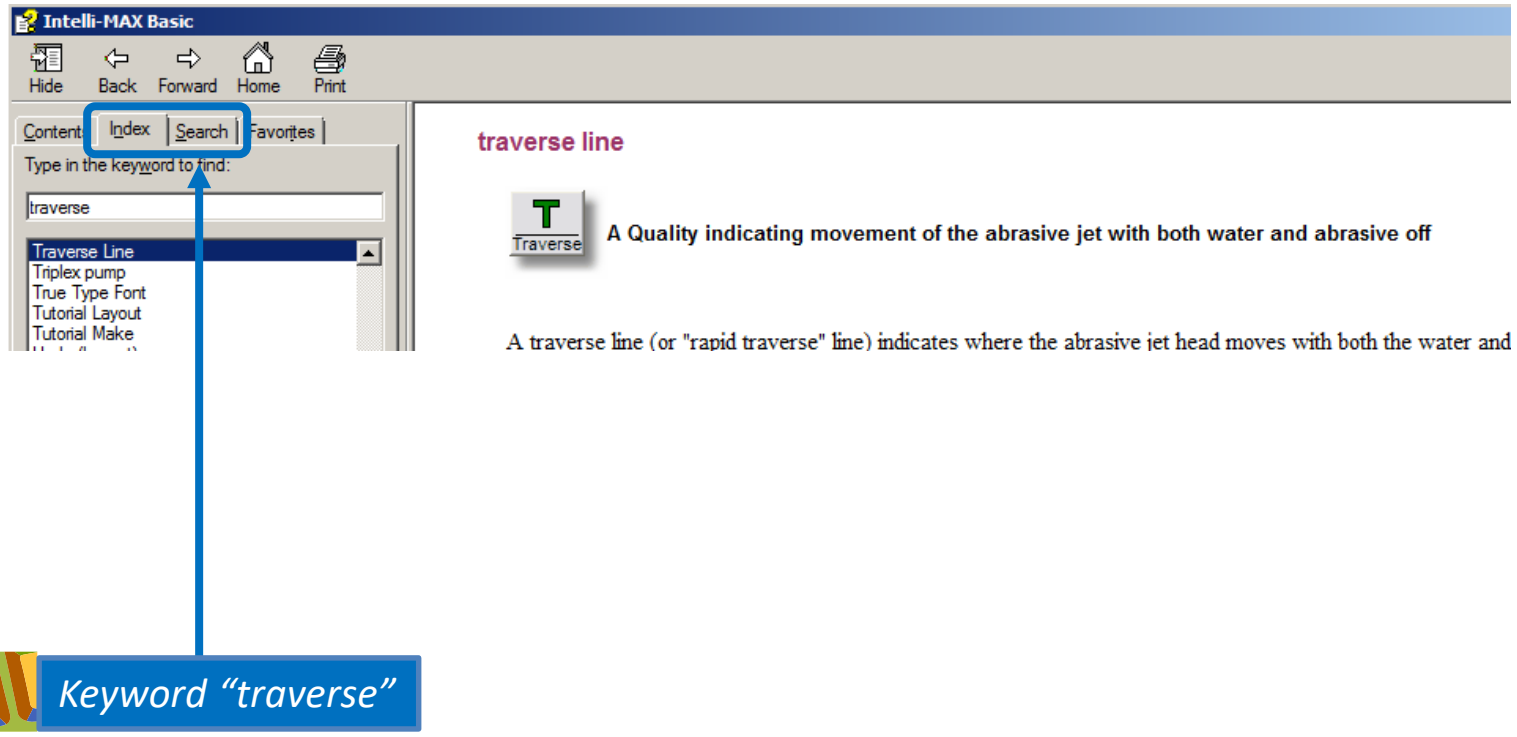
MAXIEM Help System

- Other ways to access **Help**
  - From the **Help** menu in **LAYOUT**



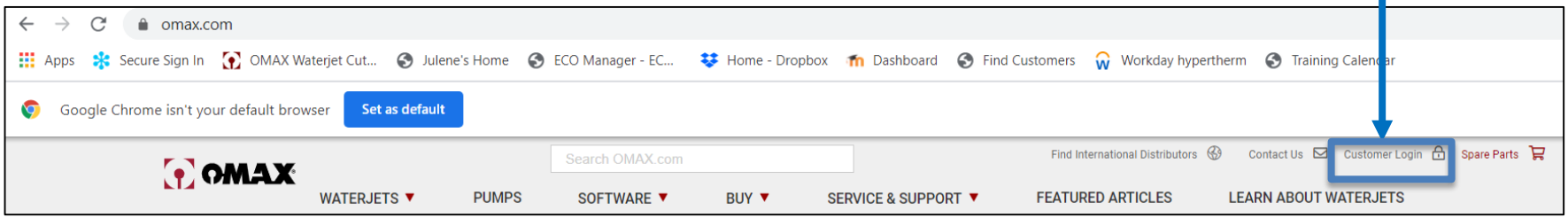
MAXIEM Help System

- Type keywords on the **Index** or **Search** tab to find help on a specific topic



OMAX Support Site

- The OMAX Support Site (Dashboard) provides access to software, the eLearning Portal, marketing materials and many other resources
- To create an account on the Support Site:
  - Open an internet browser
  - Go to www.omax.com
  - Click **Customer Login** and follow the on-screen instructions



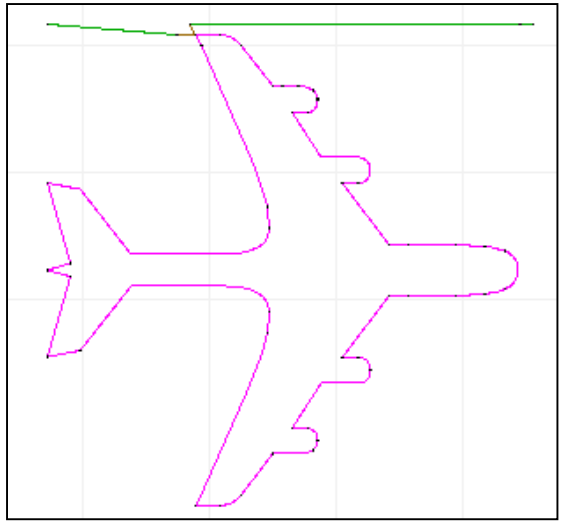
OMAX Support Site

- To watch how to create an account, watch the "How to Use the OMAX eLearning Portal" webinar

Terminology

- **DXF file** – a **d**rawing e**x**change **f**ile containing a drawing
- **Drawing** – a series of lines and arcs

Example: Airplane.dxf

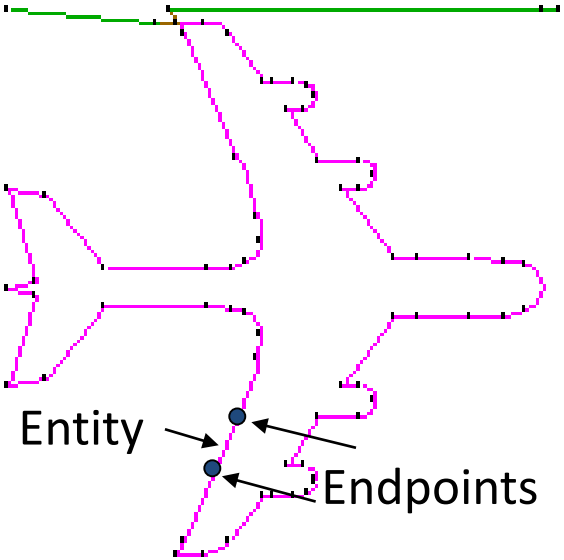


.dxf file icon

MAXIEM_FileType_DXF

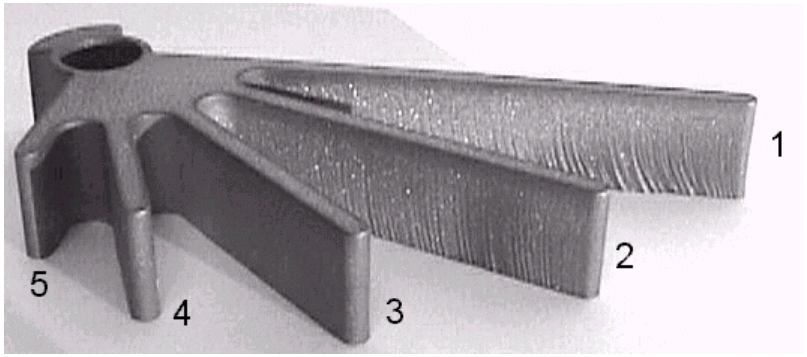
Terminology

- **Entity** or **element** – refers to each segment within a line or arc
  - defined as the solid geometry between two points
- **Endpoints** – dots designate the end of a given entity

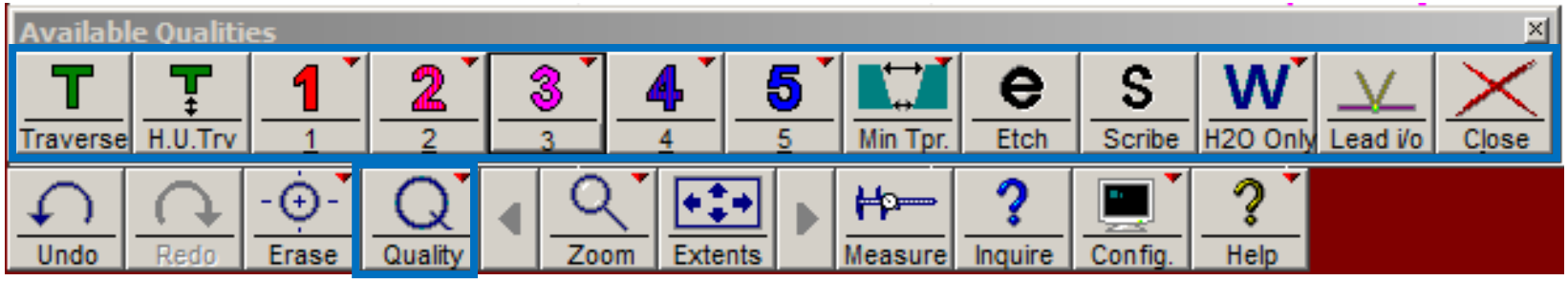


Terminology

- **Quality** – refers to the machined edge finish of the part



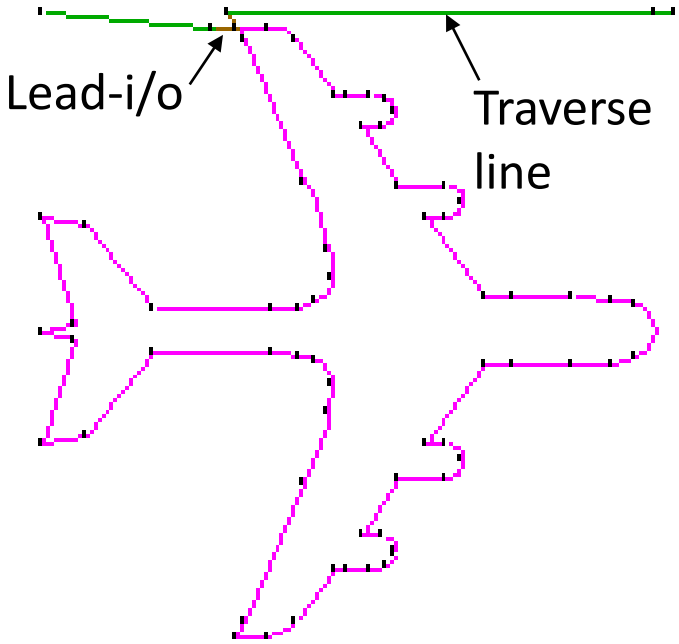
- Quality tools – commands for setting the quality of entities in the drawing



Terminology

Path Elements

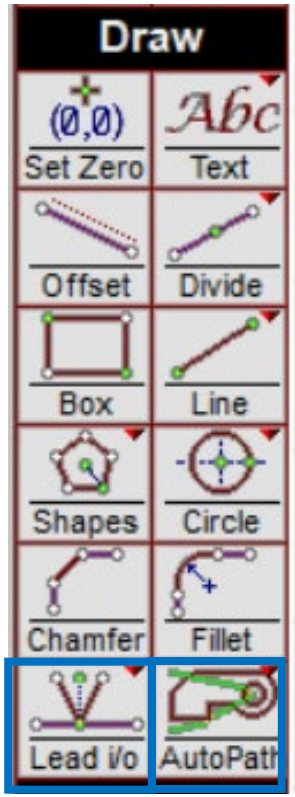
- Pierce and exit points,
- Lines where the nozzle moves but does not cut
- Part geometry
  - Consists of **Lead ins** and **Lead outs**, **Traverses,** and the **part geometry**



Part geometry (purple plane)

Terminology

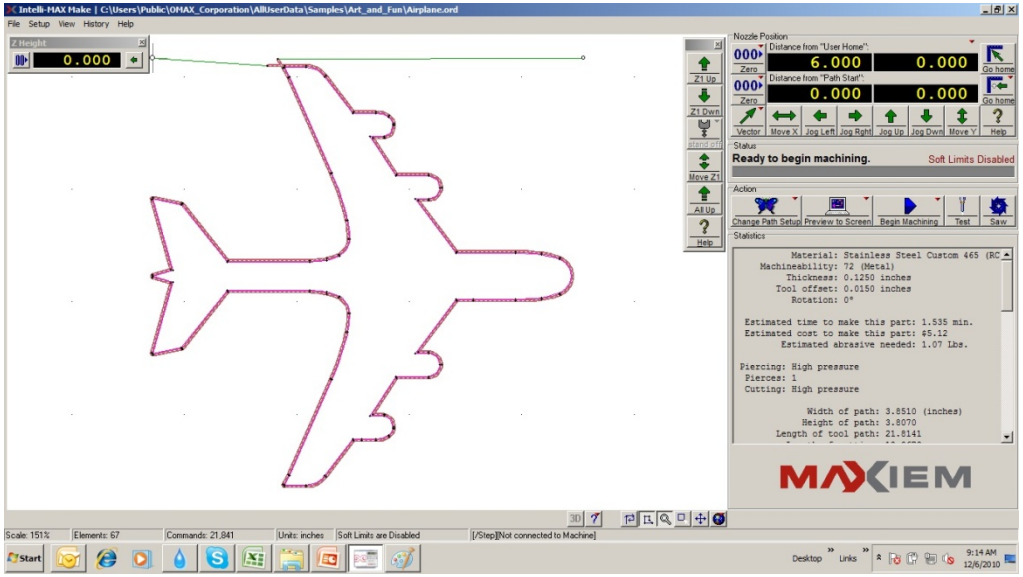
– The path elements are added to the drawing using the **Lead i/o or AutoPath** drawing tools



help *Keyword "lead i/o"*

Terminology

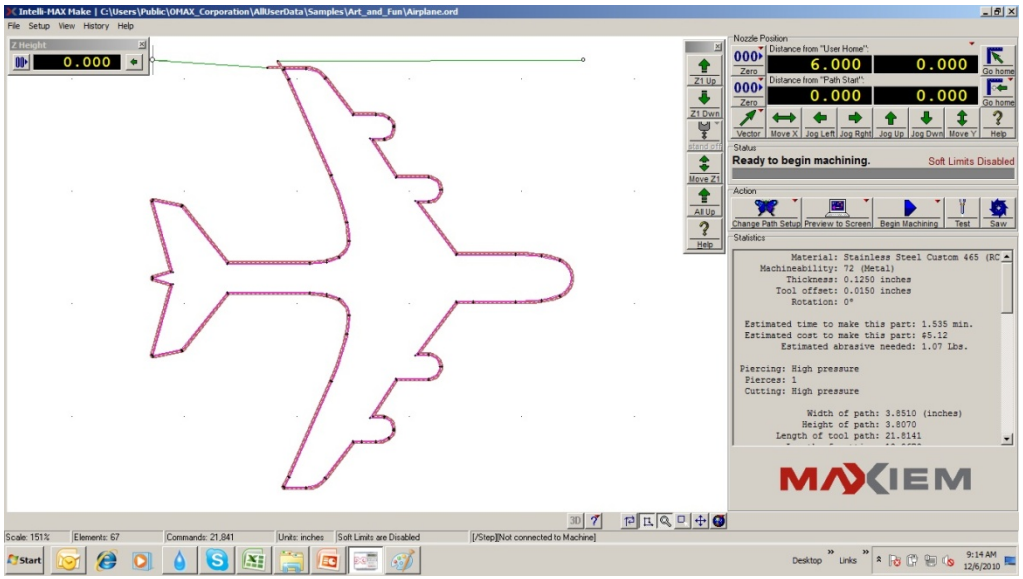
- **ORD file** – the **O**MAX **R**outed **D**ata file contains data that commands the MAXIEM machine to move the nozzle in the X and Y directions in motor step increments



MAKE uses the .ord file to machine the part

Terminology

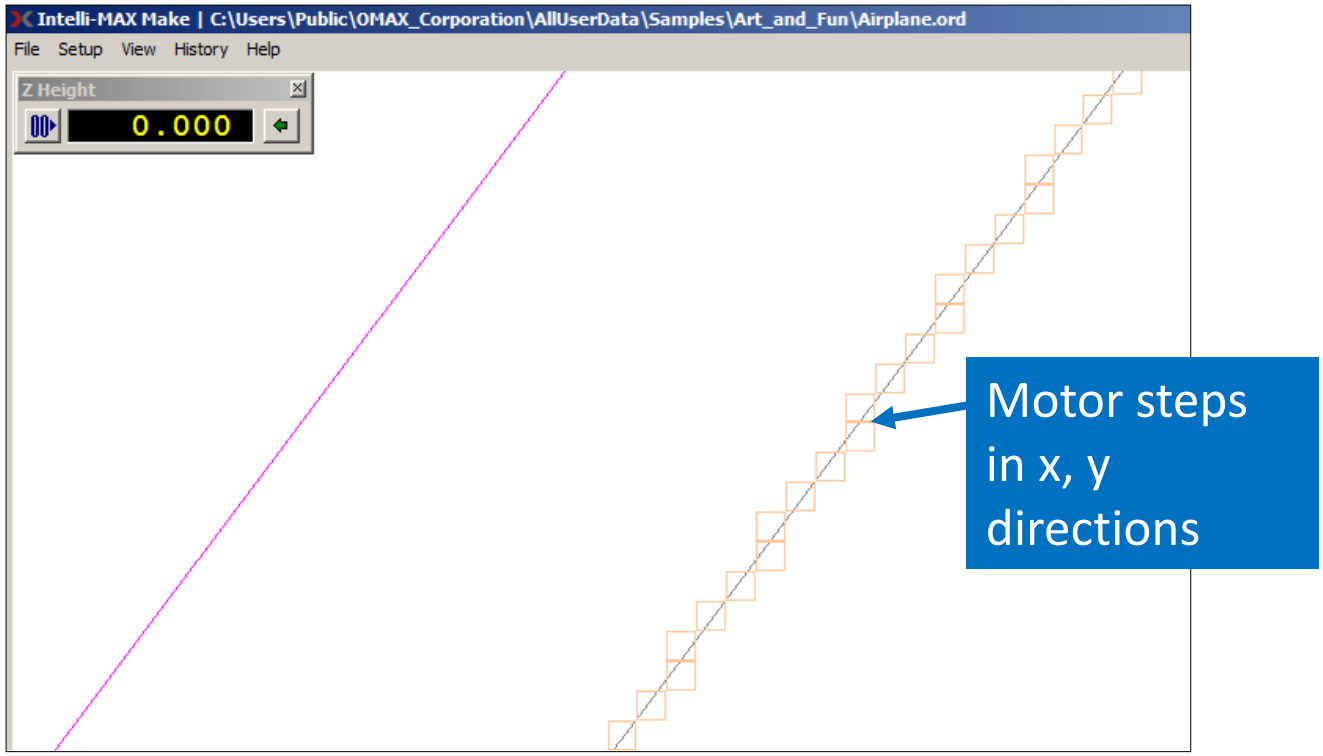
- **OMX file** – the **OMX** file contains e**X**tra data that commands the MAXIEM machine to do extra movements such as tilt, pause, speed up, etc.



MAKE uses the OMX file to machine the part with e**X**tra data in it

Terminology

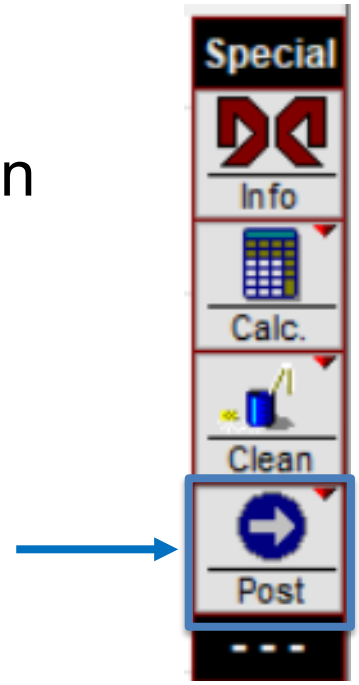
- **ORD file** – preview of the motor steps in **MAKE**



help *Keyword ".ord"*

Terminology

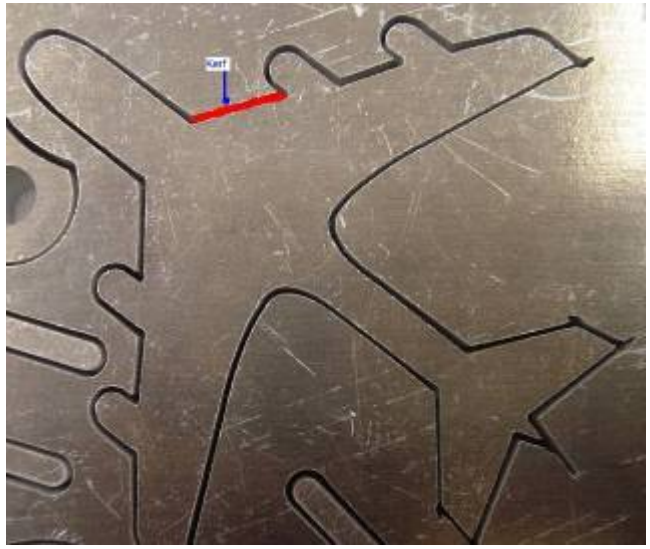
- **Machine tool path** – refers to the ORD file data (the x, y motor steps) used by **MAKE** to machine a part
  - The drawing (.dxf) file is converted to a machine (.ord) file using the **POST** tool in **LAYOUT**



help *Keyword "path"*

Terminology

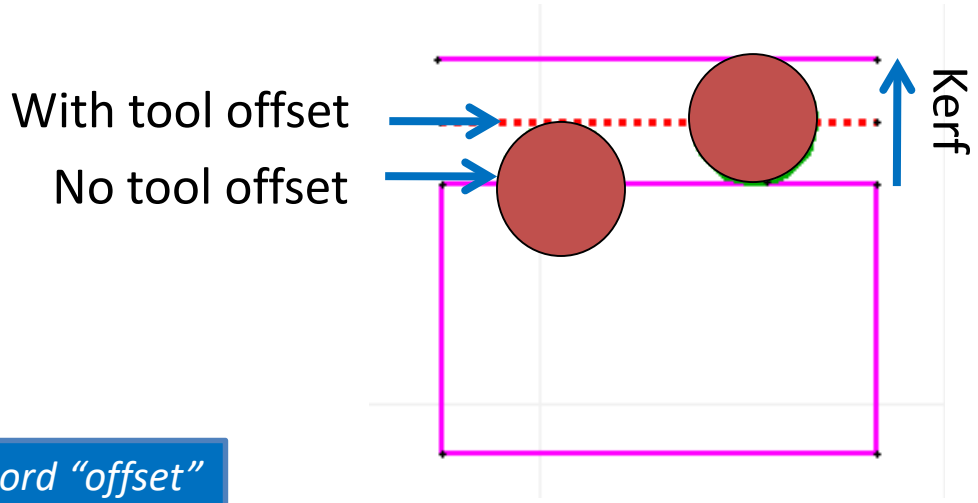
- **Kerf** – the width of the material eroded away by the abrasive waterjet stream
  - The kerf normally equals the width of the mixing tube used in the nozzle assembly (e.g. - .030 in. when using a .030 in. mixing tube)



help *Keyword "kerf"*

Terminology

- **Offset** – the distance the nozzle is shifted away from the geometry to compensate for the width of the jet stream
  - The offset normally equals half of the width of the kerf (e.g. - .015 in. when kerf is .030 in.)

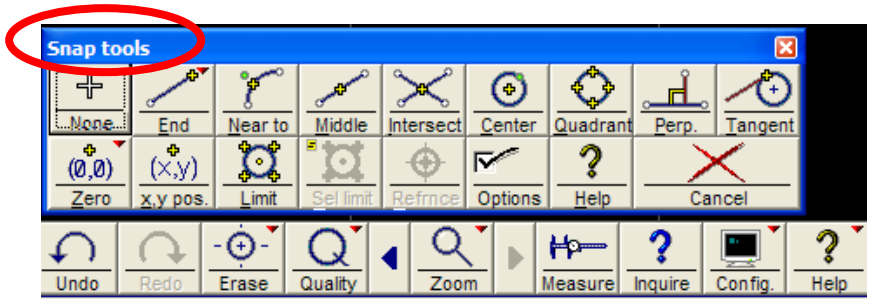


help Keyword "offset"

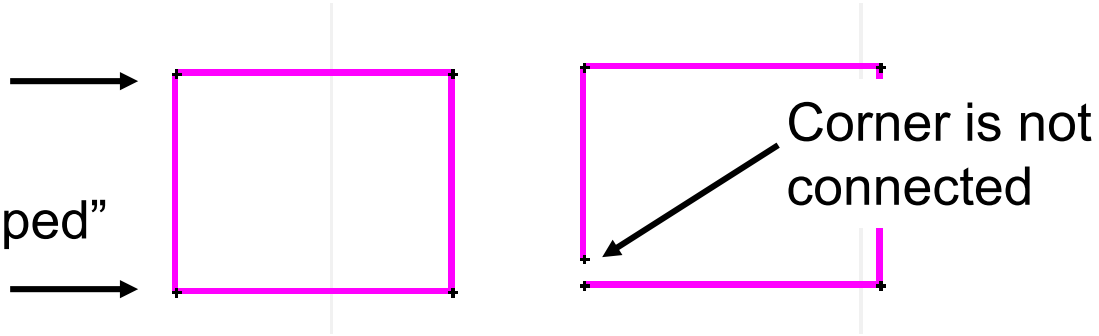
Terminology

- **Snap tools** – drawing tools that automatically connect geometry at some point when used

Used to make sure geometries are connected in a drawing



Corners are Connected, or “snapped”

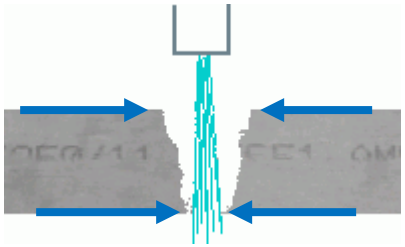


help *Keyword “snap”*

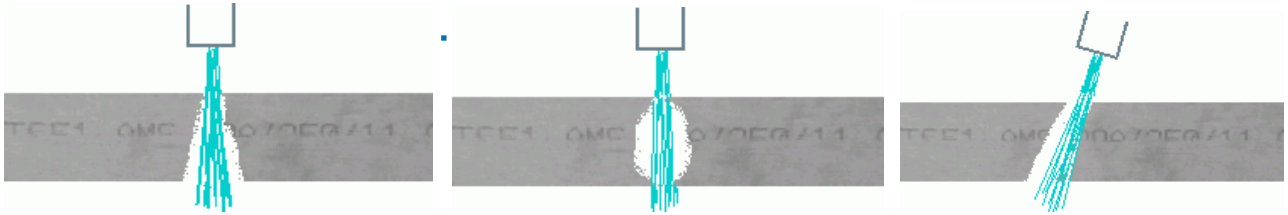
Terminology

- **Taper** - the difference in the width of the cut made by the abrasive waterjet from the top of the part to the bottom

Taper is inherent in all abrasive waterjet parts

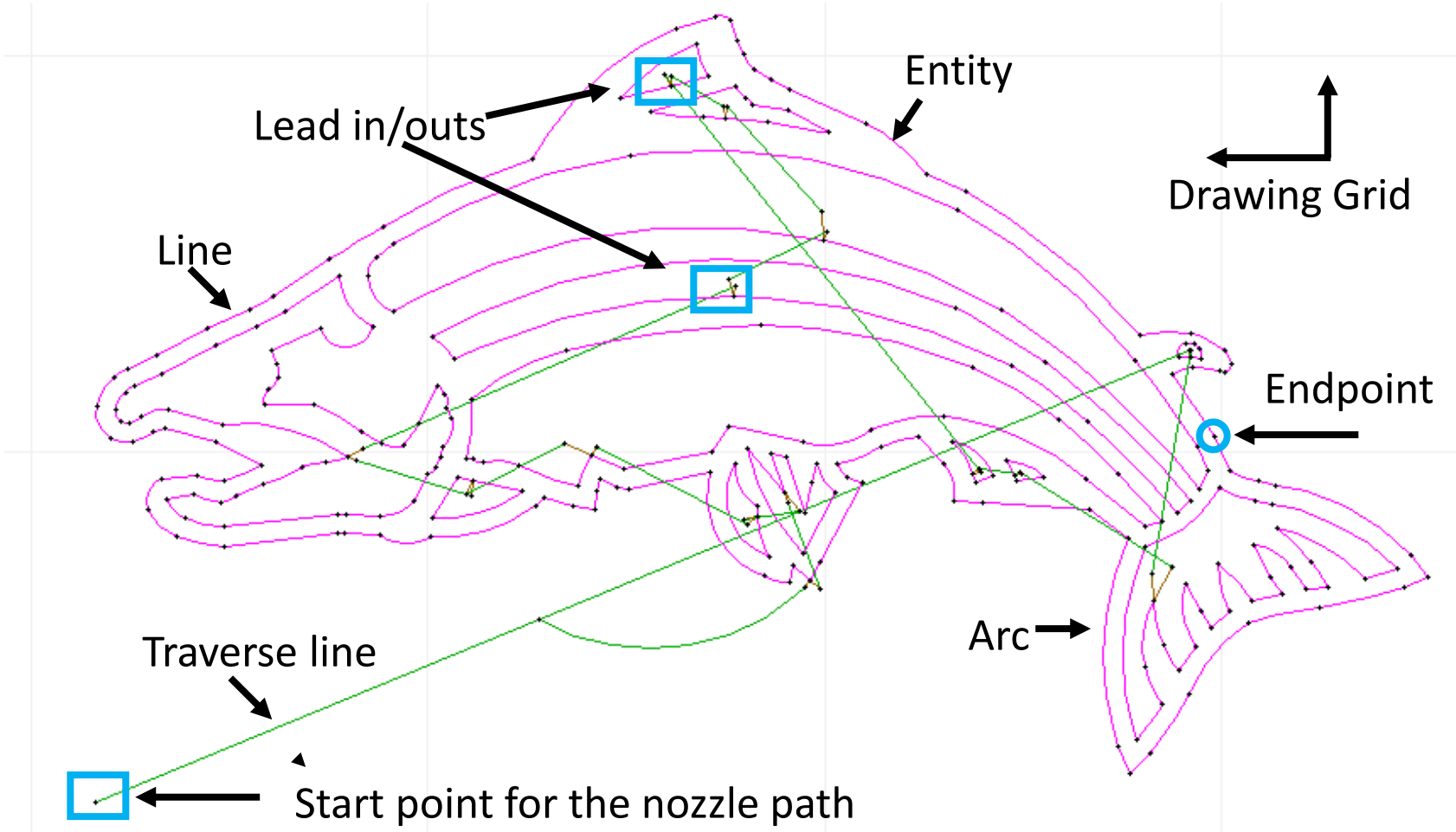


There are different types of taper



help *Keyword "taper"*

Anatomy of a Drawing



Intelli-MAX LAYOUT Standard

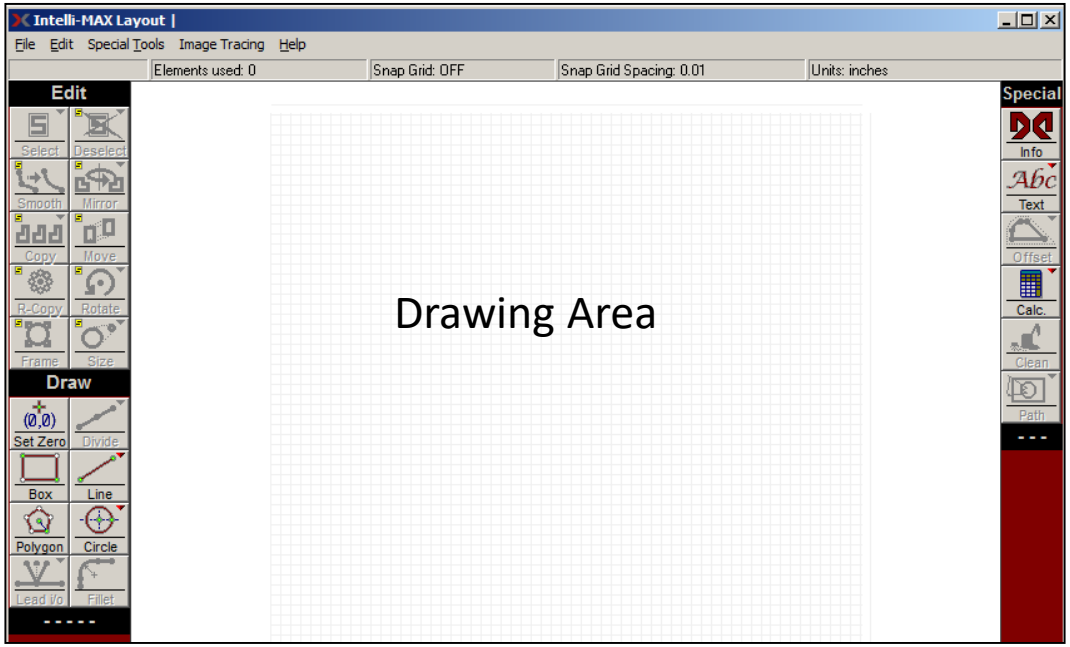
What **LAYOUT** does and how to use it

LAYOUT Standard

- What does **LAYOUT Standard** do?
  - **LAYOUT** is the CAD (Computer Aided Drawing) software program
  - It provides users with **Drawing**, **Editing**, and **Special** tools for creating, importing, modifying, and pathing drawings that can be machined on the MAXIEM abrasive waterjet
  - The purpose of **LAYOUT** is to draw a map for the MAXIEM machine to follow when cutting a part

LAYOUT Standard

- Drawing area - where you import, create or edit drawings (DXF files)



help *Keyword "display"*

LAYOUT Navigation

Drawing area

- The drawing area is configurable
  - Set your units of measure
  - Set your drawing grid size
  - Set drawing grid color
  - Set other display preferences such as zoom, file backups, and other options

LAYOUT Navigation

Drawing area configuration

- To change configuration settings
  - Click **File** > **Configure Preferences** > **Display** tab and/or **Snap/Reference** grid tab
  - Right-click the **Configure** icon at the bottom of the screen

- Specify a grid in the background or leave it blank
  - Specify your units of measure – inches, millimeters or other
  - The grid can be set up to correspond to your table size, however the drawing grid is independent of the cutting area (you can place your material anywhere in the cutting area on the table)

LAYOUT Navigation

How to get around in the **LAYOUT** drawing area

- Zoom in and out in the drawing area using the mouse
  - Zoom to the point where the pointer is placed on the screen
    - Click = zoom in
    - Right-click = zoom out
    - Wheel button (if available)
      - Wheel forward = zoom in
      - Wheel backward = zoom out

LAYOUT Navigation

How to get around in the **LAYOUT** drawing area

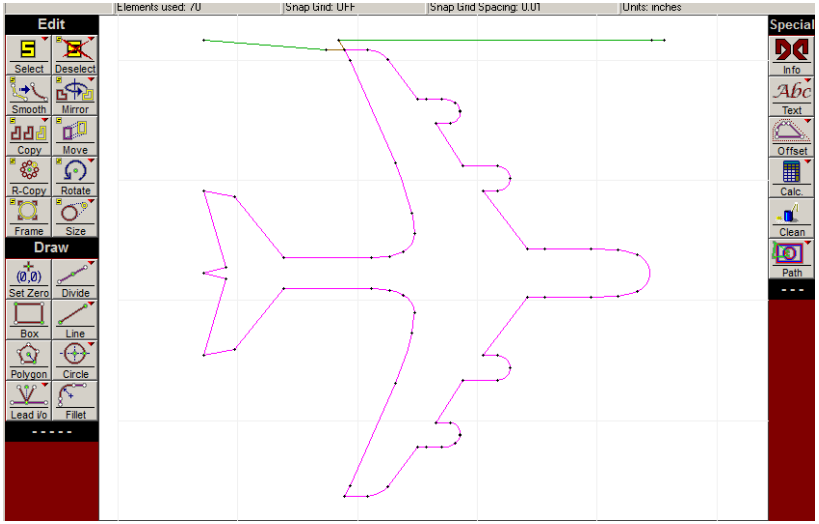
- Hold down the **Shift** key when zooming to slow down by 10X
- Pan
  - Hold both mouse buttons down to pan around in drawing area

LAYOUT Navigation

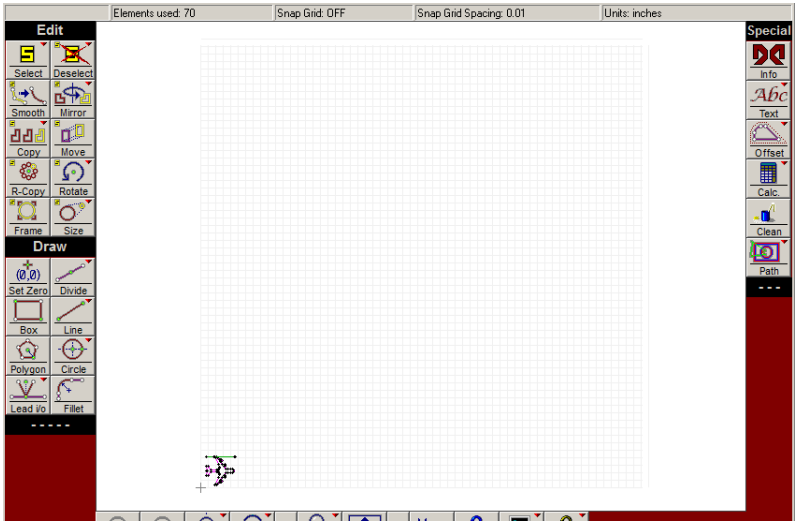
Centering drawings in the **LAYOUT** drawing area

- Pressing the **Home** key centers the drawing in the drawing area
- Pressing the **End** key centers the entire drawing area in the window

Home

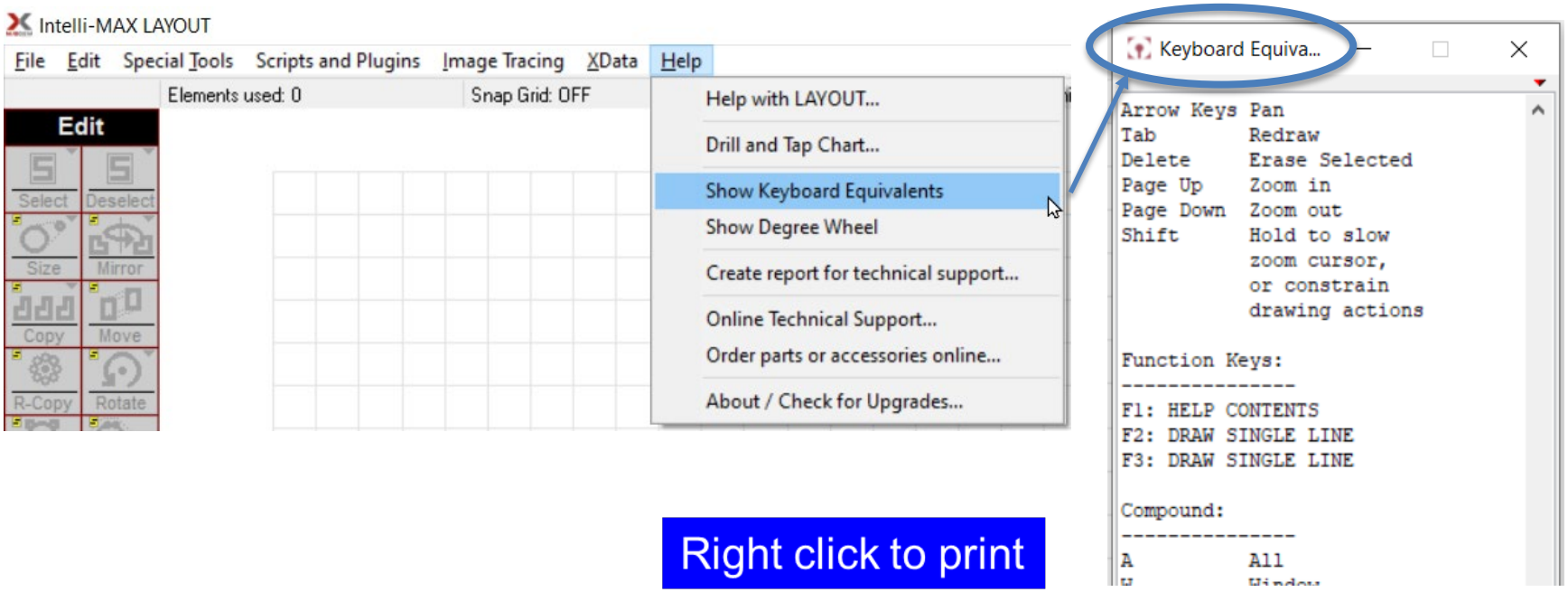


End



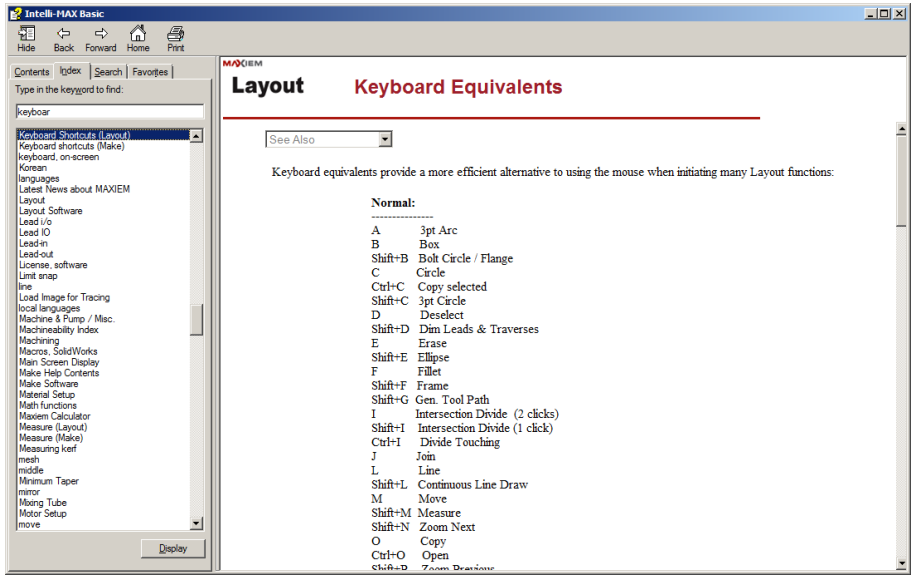
LAYOUT Navigation

- Use **Keyboard Shortcuts** to activate functions instead of using the mouse.
  - **Help and Reference > Show Keyboard Equivalents**



LAYOUT Navigation

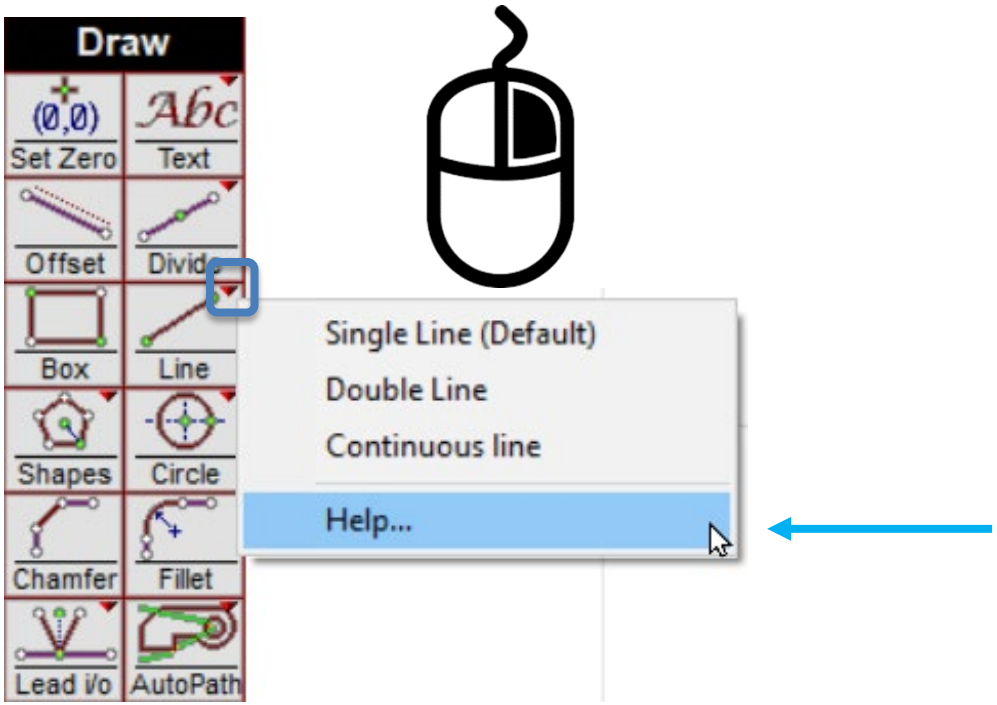
- Use Keyboard shortcuts to activate functions instead of using the mouse
  - **Help** > Help with **LAYOUT**



help *Keywords "keyboard shortcuts (LAYOUT)"*

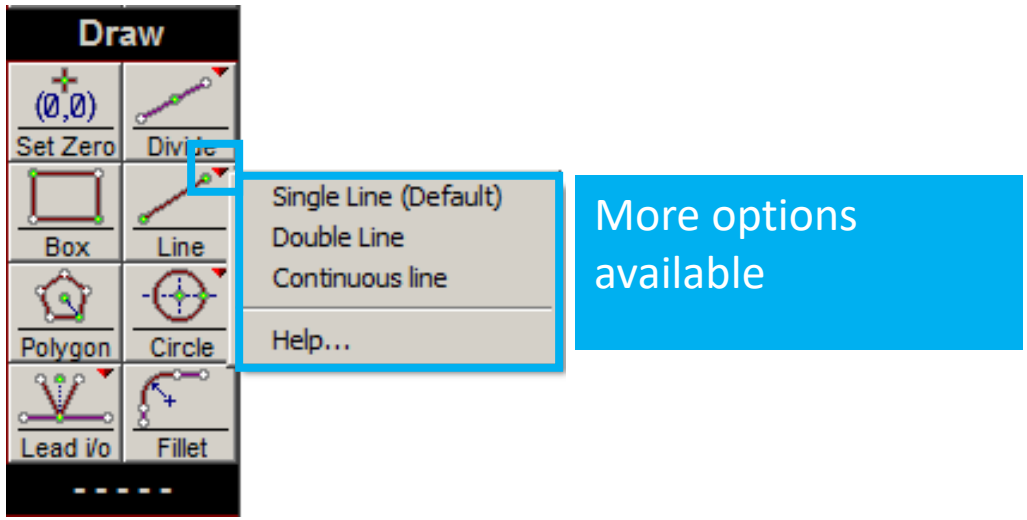
LAYOUT Navigation

- Keyboard shortcuts are also listed in the **Help** for each command or tool



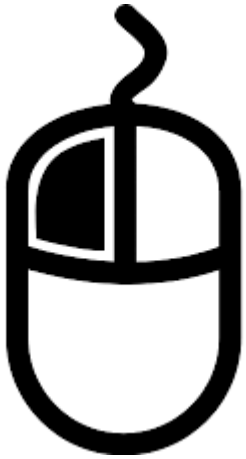
LAYOUT Navigation

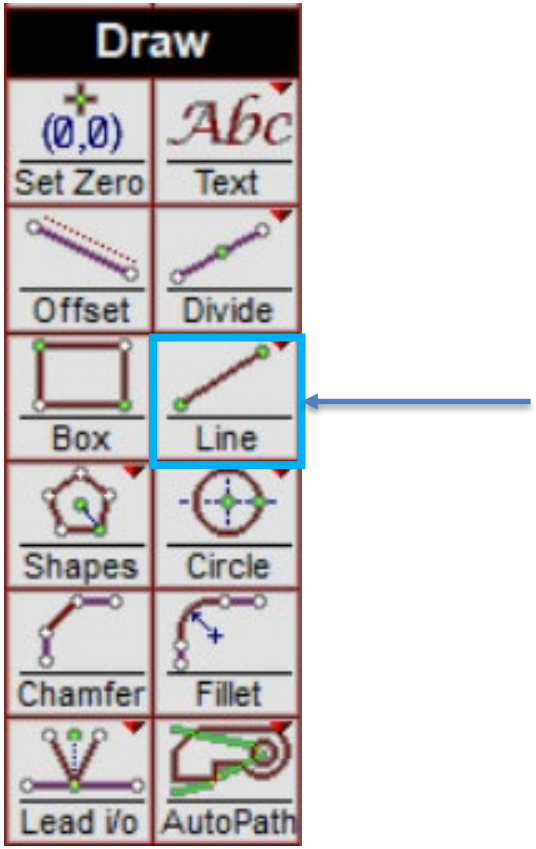
- A small red triangle inside an icon indicates there are more options available for that function
  - *Right-click* the red triangle to see the menu of options



LAYOUT Navigation

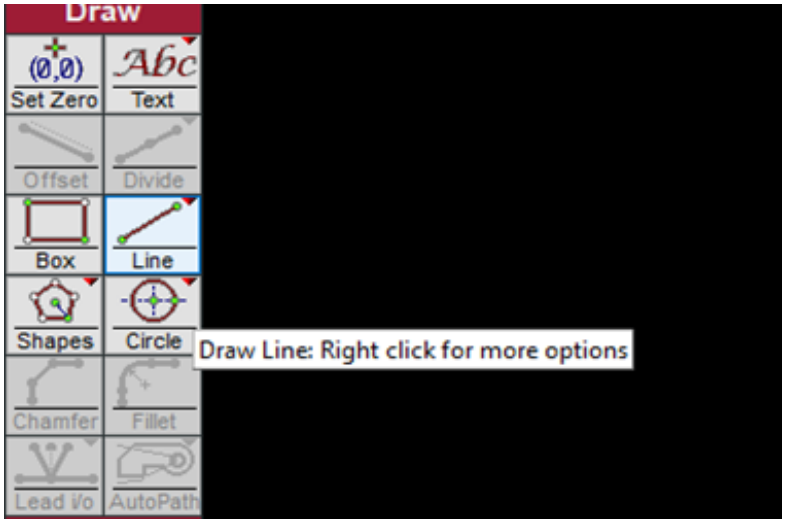
- **Click** an icon to activate the default function





LAYOUT Navigation

- If you hover the pointer over an icon, it displays a brief explanation of that function



LAYOUT Navigation

- Pressing the **ESC** key cancels a function
- Pressing the **Spacebar** repeats the previous function

Review Point 1

- What we've covered so far:
  - The major components of the MAXIEM equipment
  - How the MAXIEM machine works to cut parts
  - Where to find information on installing and registering the Intelli-MAX software
  - Learning resources available through the Help system
  - The basic steps involved in making parts on the MAXIEM
  - Terminology
  - **LAYOUT** navigation

Review Point

OMAX Corporation

Review Point 1 Questions

Q1: How many basic steps are there to making parts on the MAXIEM?

a. 15
b. 10
c. 9
d. 2

Q2: What is the ‘kerf’?

Q3: What term do we use to represent the distance the nozzle is moved over so it doesn’t cut into the geometry of our part?

Steps in Making Parts

- Intelli-MAX **LAYOUT**
  - **Step 1:** Obtain/create a Drawing File (DXF file).
  - **Step 2:** Assign machining Qualities (edge finish).
  - **Step 3:** Clean and save the drawing.
  - **Step 4:** Add Path Elements to the drawing and save it.
  - **Step 5:** Create the Machine Tool Path file (ORD/OMX file).
- Intelli-MAX **MAKE**
  - **Step 6:** Start up the machine.
  - **Step 7:** Configure Machine Settings.
  - **Step 8:** Open and configure the ORD/OMX file.
  - **Step 9:** Load and clamp the material.
  - **Step 10:** Begin machining and cut the part.

Step 1: Drawing Files

What is a drawing file?

- Drawing files are simply files that contain lines and arcs that represent something (shapes, geometry) that you want to cut
- Drawing files are commonly saved with a **.dxf** extension (**D**rawing e**X**change **F**ormat)
- **DXF** is a standard file format that is commonly used to exchange files between different CAD (Computer Aided Drawing) systems
- **LAYOUT** stores all drawing files as standard **DXF** files

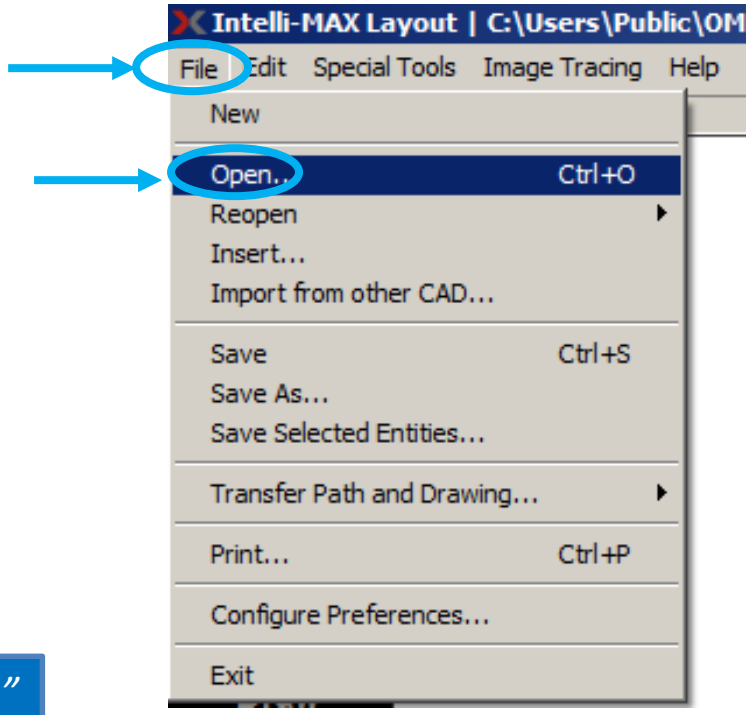
Step 1: Drawing Files

- There are three primary ways to create a drawing or DXF file
  1. Open an **existing** drawing file that is already saved in the system
  2. Create a **new** drawing using the **LAYOUT** tools from scratch
  3. **Import** a drawing file into **LAYOUT** from another CAD system

Step 1: Drawing Files

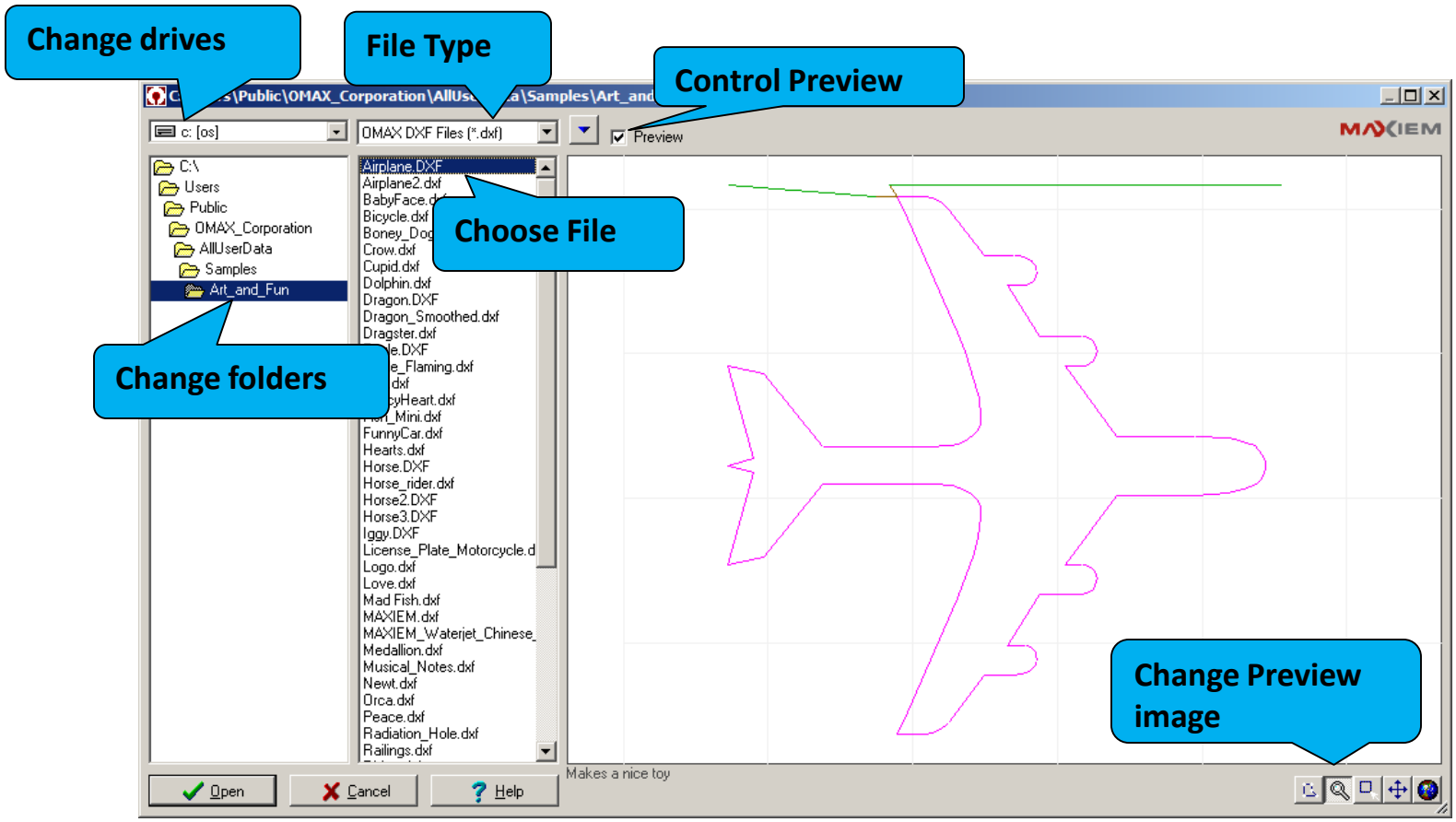
To open an existing file in **LAYOUT**

- Click **File**, and then click **Open**



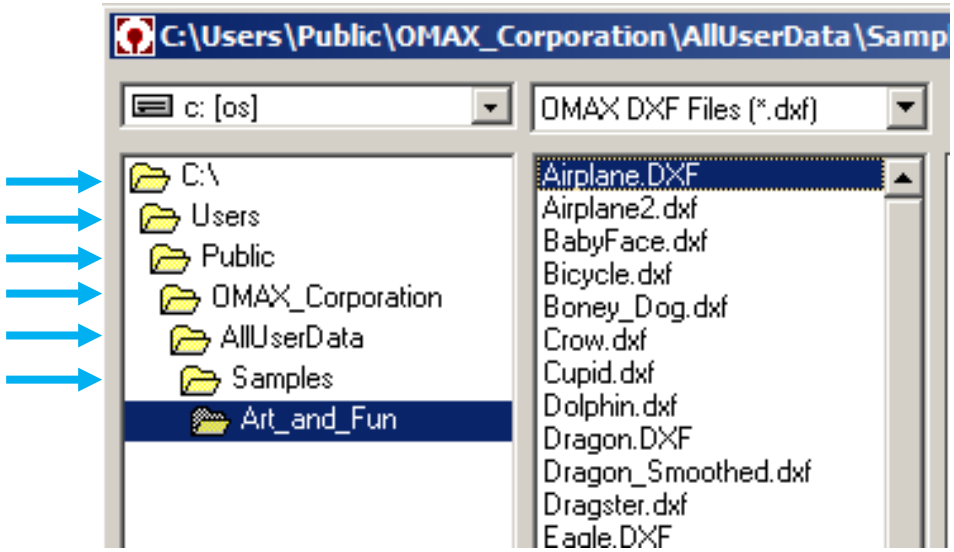
help *Keyword "open"*

Step 1: Drawing Files



Step 1: Drawing Files

- All existing files are located in folders in this path (in Windows 10):
  - C:/
  - Users
  - Public
  - OMAX Corporation
  - AllUserData
  - Samples…(select applicable folder)

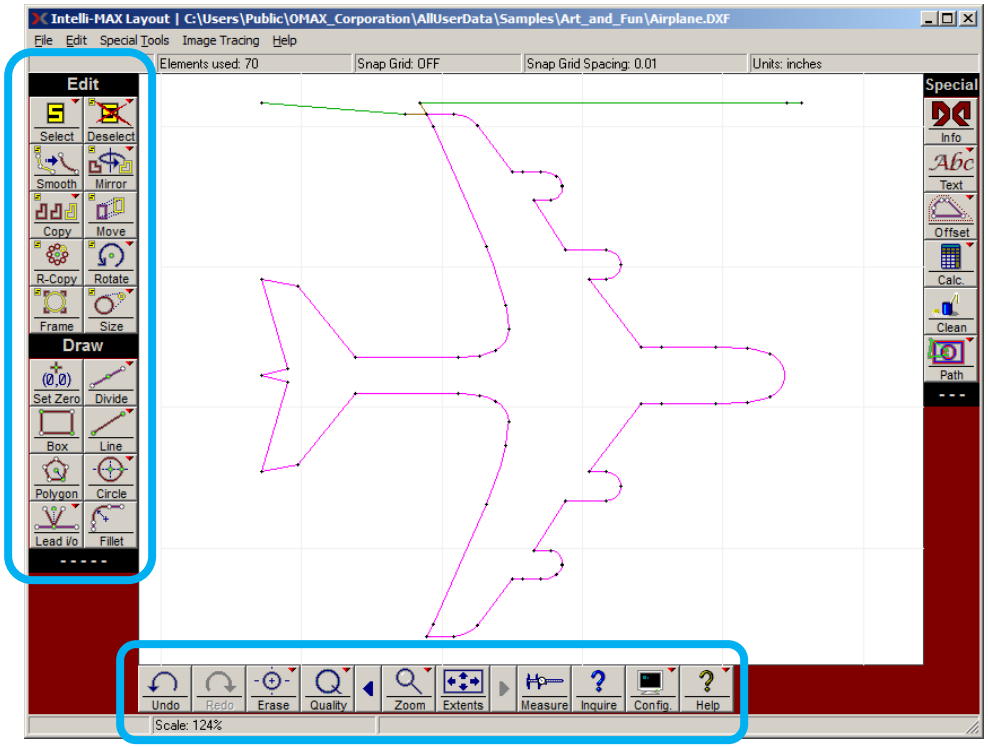


Exercise

*Open an existing file in **LAYOUT** in Samples/Art_and_Fun*

Step 1: Drawing Files

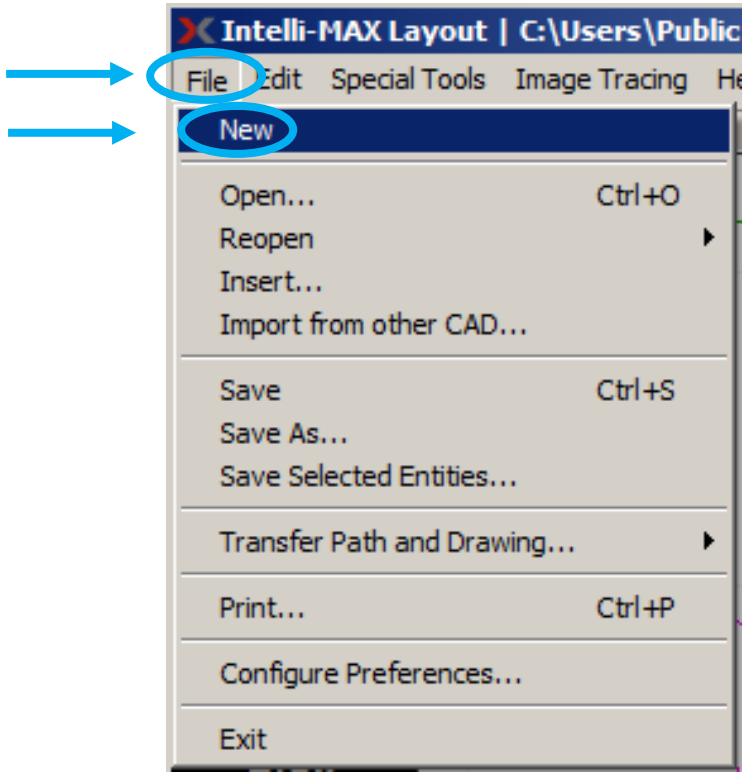
- **LAYOUT** provides sufficient tools to create and edit drawing files (DXF) if no other drawing program is available



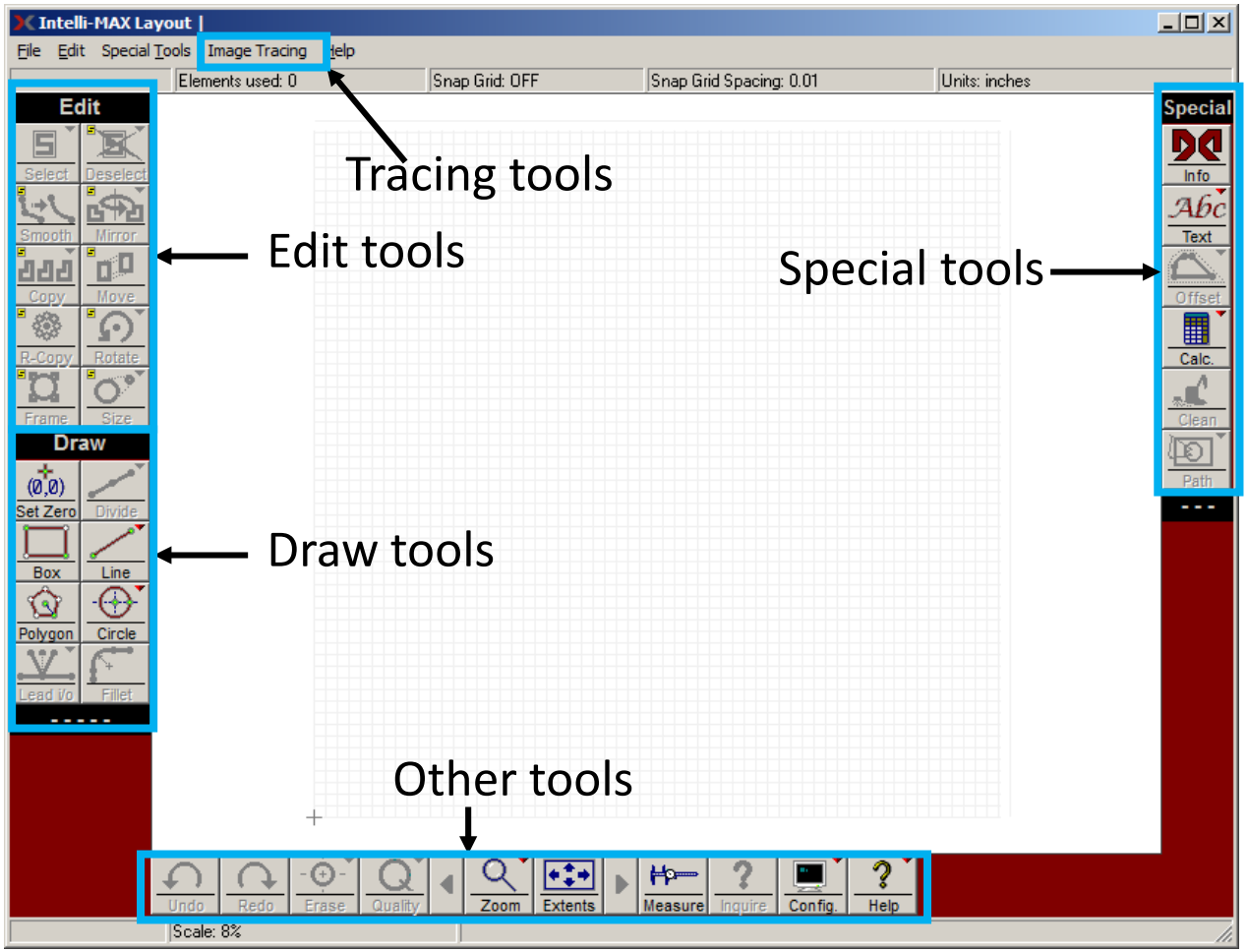
Step 1: Drawing Files

To create a new drawing file

- Click **File**, and then click **New**



Step 1: Drawing Files



Step 1: Drawing Files

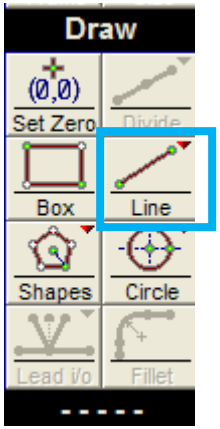
- Drawing Section Basics
  - Drawing lines, arcs, and shapes
    - free-form
    - Specified Dimensions
  - Using **Snap tools**

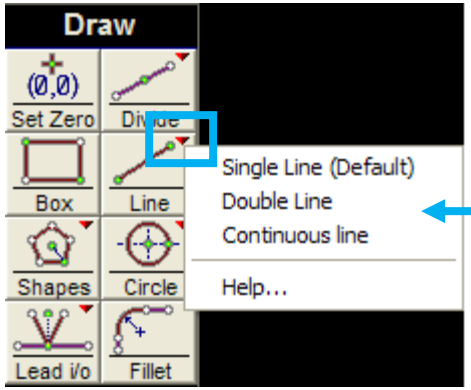
Step 1: Drawing Files

- Drawing Free-form lines
  - **Click** the **Line** tool to activate it
  - Move the pointer into the drawing area – note the pointer changes to **+From**
  - **Click** a point in the drawing area to start drawing the line – note the pointer changes to **+To**
  - Move the pointer to a point you want to draw the line to
  - **Click** the destination point to terminate the line

Step 1: Drawing Files

- Click the toolbar icon to select the **Line** tool
  - If there is a little red triangle on the icon, right-click to see a list of other **Line** tools



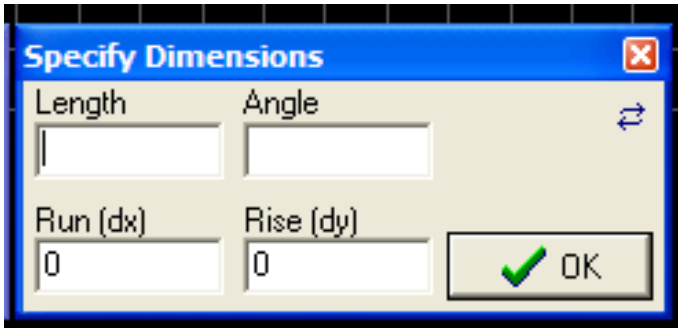


Other line drawing options

Exercise - *draw a free-form line using* **LAYOUT**

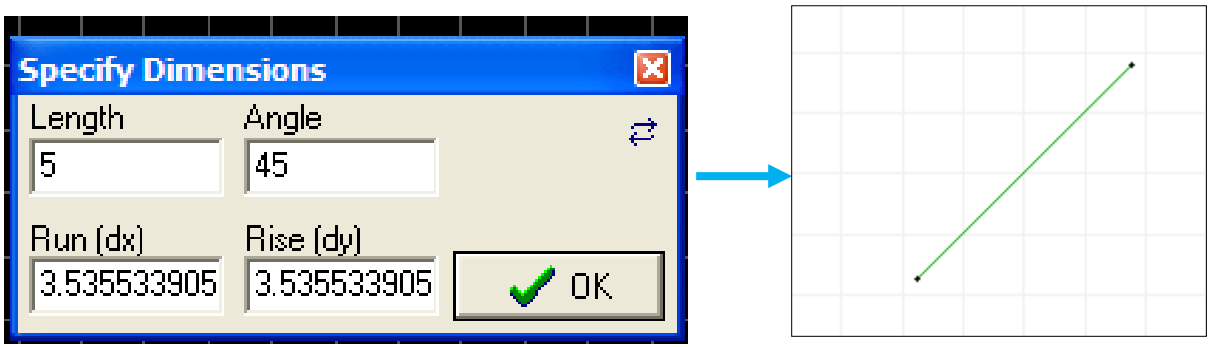
Step 1: Drawing Files

- Drawing a line to a *specified dimension*
  - **Click** the **Line** tool to select it
  - **Click** the point you want to start drawing the line
  - a **Specify Dimensions** dialog box opens at the bottom of the drawing area



Step 1: Drawing Files

- Press the **Tab** key, or move your pointer to the **Length** or **Angle** box
- Type the desired length or angle
- Press **Enter** or click **OK** to draw the line

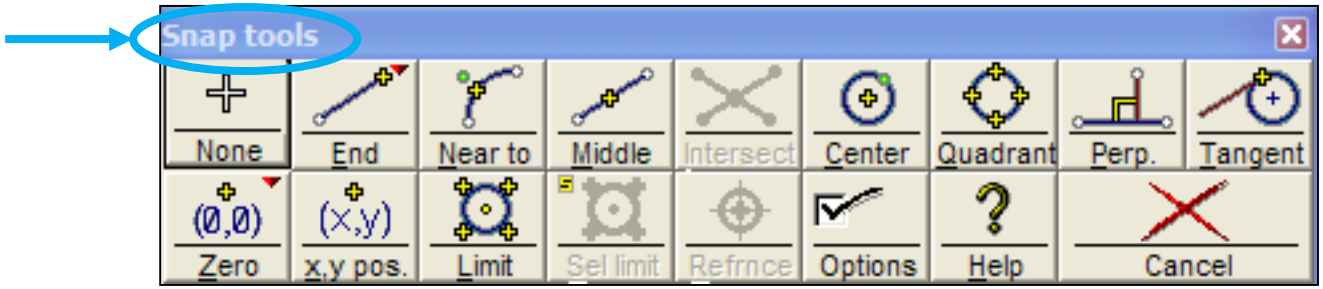


Exercise

Draw a 5-inch line at a 45-degree angle using **LAYOUT**

Step 1: Drawing Files

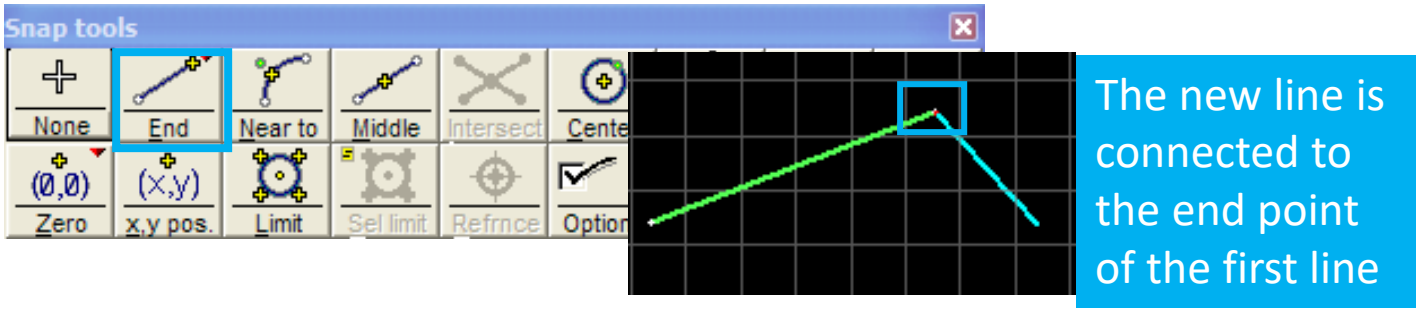
- Draw a line connected to another line using **Snap tools**
  - Click the **Line** tool to select it
  - Move the pointer into the drawing area
    - *Note - the **Snap tools** toolbar opens at the bottom of the drawing screen*



help *Keywords "snap toolbar"*

Step 1: Drawing Files

- Click the applicable **Snap** tool to select it
- Move the pointer to the geometry you want to "snap" to, and click it to begin the line
- Move your pointer to the endpoint of your line, or select another **Snap** tool and click the geometry you want to terminate the line on

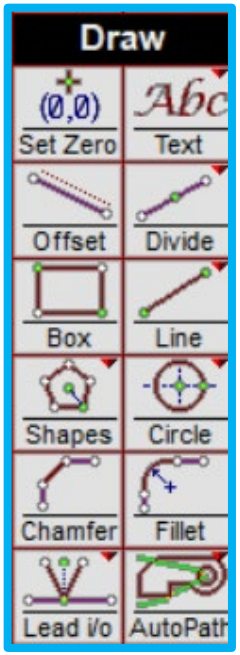


Exercise

Draw a second line connected to the end of an existing entity

Step 1: Drawing Files

- Other **Draw** tools
  - **Set Zero**
  - **Abc Text**
  - **Offset**
  - **Divide**
  - **Box**
  - **Shapes**
  - **Circle**
  - **Chamfer**
  - **And more**



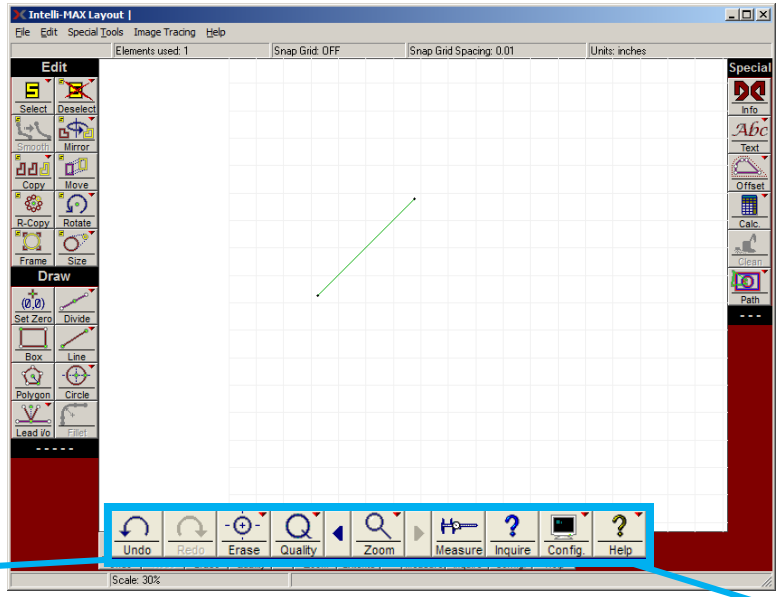
Exercise

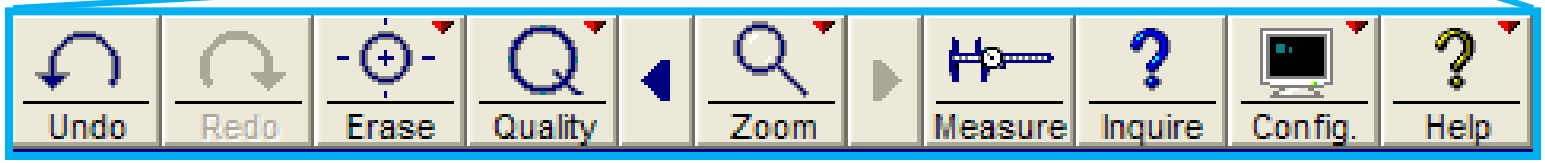
- *Draw a box using the **Box** tool*
- *Change the corners on the box to a radius using the **Fillet** tool*
- *Draw a circle inside the box using the **Circle** tool*

help *Keywords "drawing commands"*

Step 1: Drawing Files

- Other helpful tools
  - **Undo** and **Redo**
  - **Erase**
  - **Measure**
  - **Inquire**

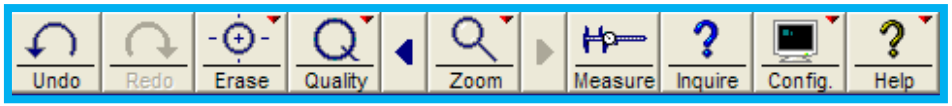




help *Keywords "undo, redo, measure, inquire"*

Step 1: Drawing Files

- **Undo** and **Redo**
  - "Undoes" or cancels the last action. **Redo** recreates the last action
- **Erase**
  - Allows you to erase entities
- **Measure**
  - Measures the straight-line distance between two points
- **Inquire**
  - Provides information about an entity, and allows some changes to be made in an entity

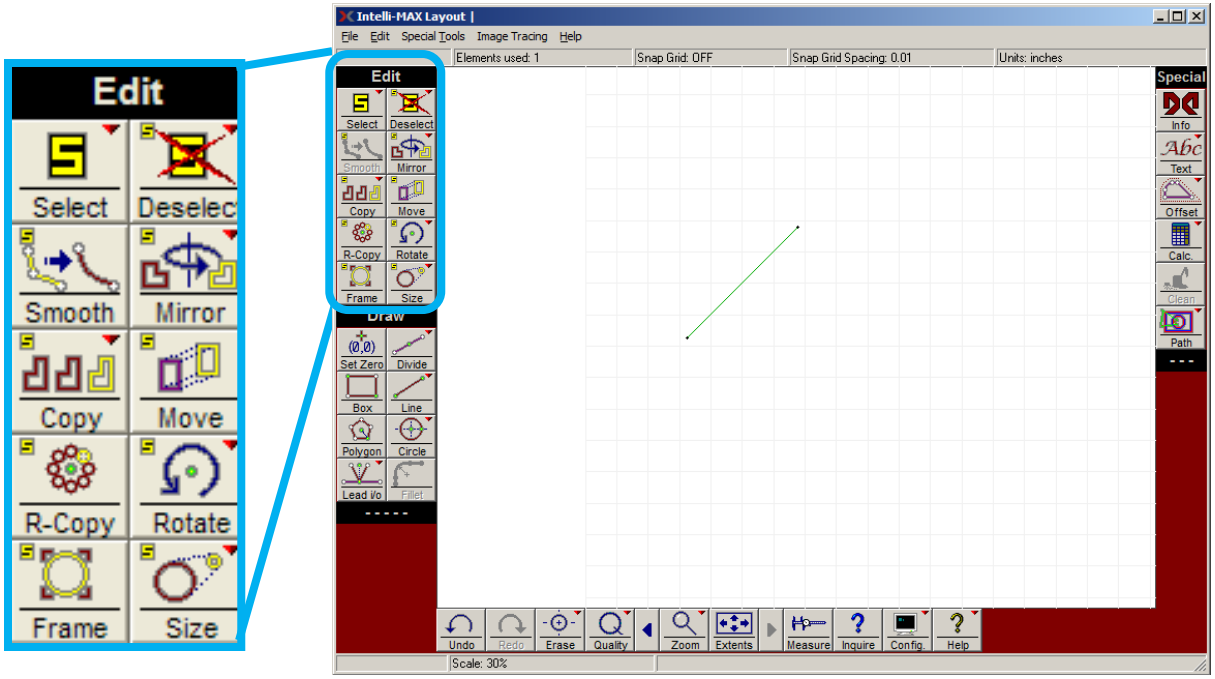


Exercise

Demonstrate using these tools

Step 1: Drawing Files

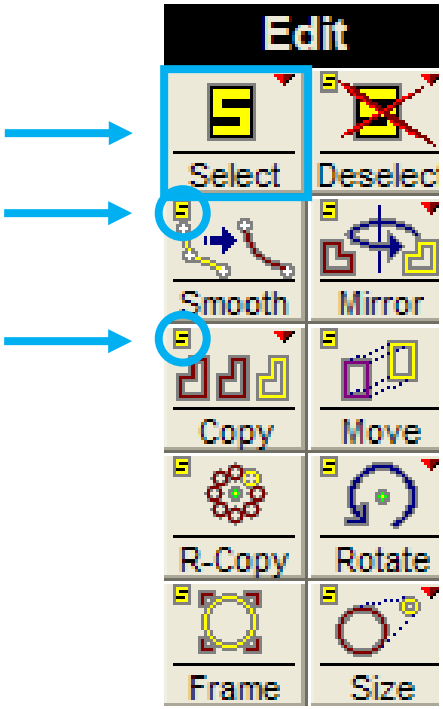
- **Edit** tools
  - **Select/Deselect**
  - **Smooth**
  - **Mirror**
  - **Copy**
  - **Move**
  - **R-Copy**
  - **Rotate**
  - **Frame**
  - **Size**

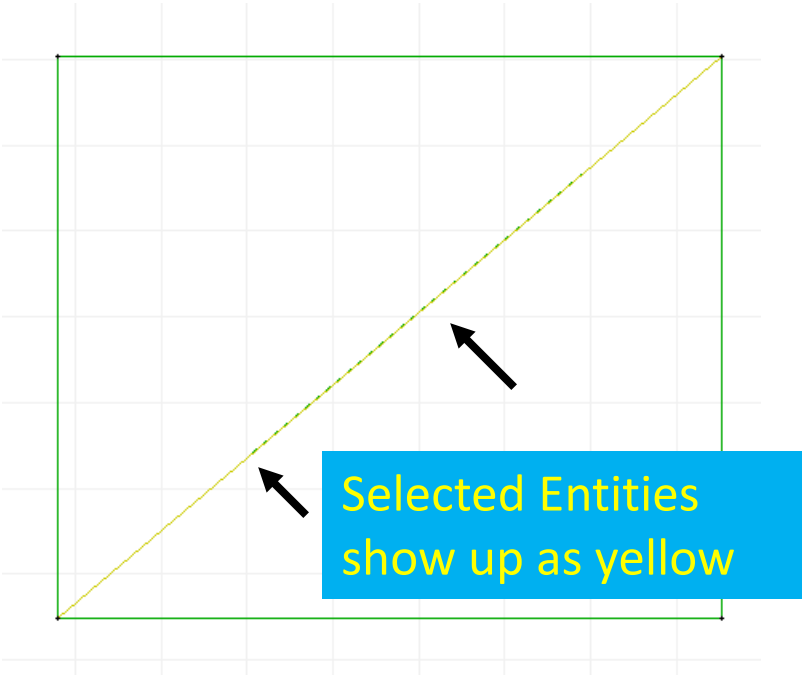


help *Keywords "edit commands"*

Step 1: Drawing Files

- Select means to highlight specific entities within the drawing using the **Select** tool

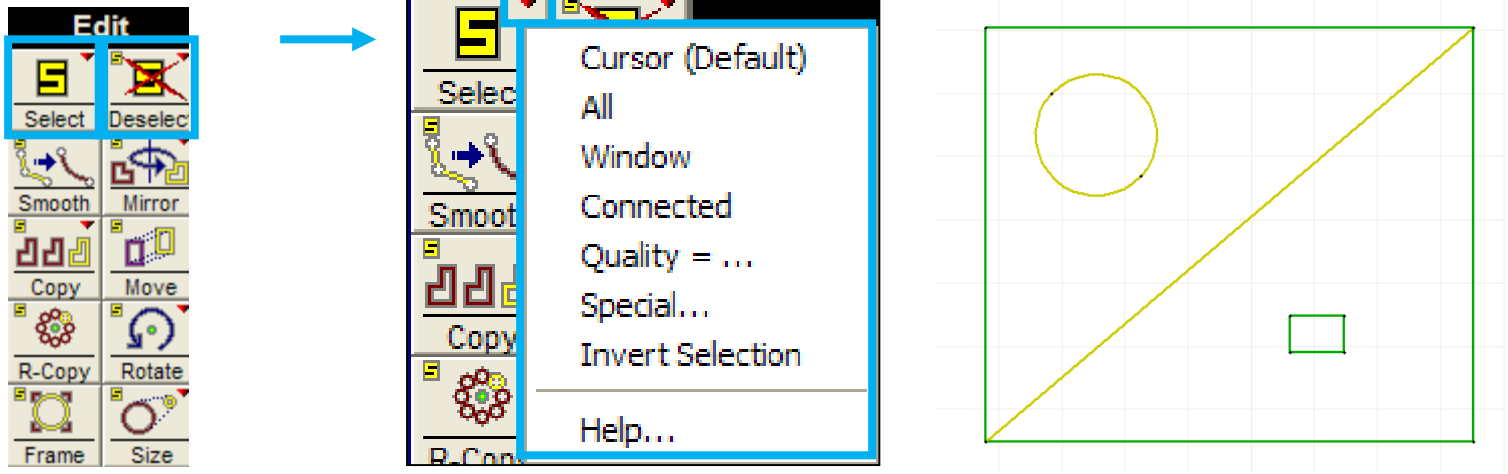




Step 1: Drawing Files

Exercise

- *Practice with the **Select** and **Deselect** default tools*
- *Practice with the **Select** and **Deselect** tool options*



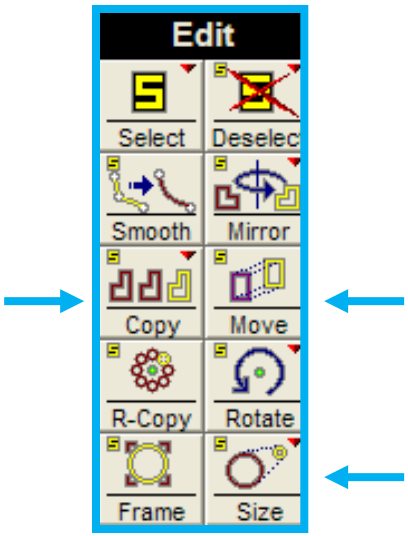
help *Keywords "select, deselect"*

Step 1: Drawing Files

- **Edit** tools
  - **Copy** – creates one or more copies of selected entities
  - **Move** – moves selected entities to a different location
  - **Size** – changes the size of selected entities

Exercise

- *Use the **Copy** command to make a small box inside the bigger box*
- *Use the **Move** command to move the circle outside the box*
- *Use the **Size** command to make the circle ½ the original size*



help *Keywords "edit commands, copy, move, size"*

Step 1: Drawing Files

Importing files from other CAD systems

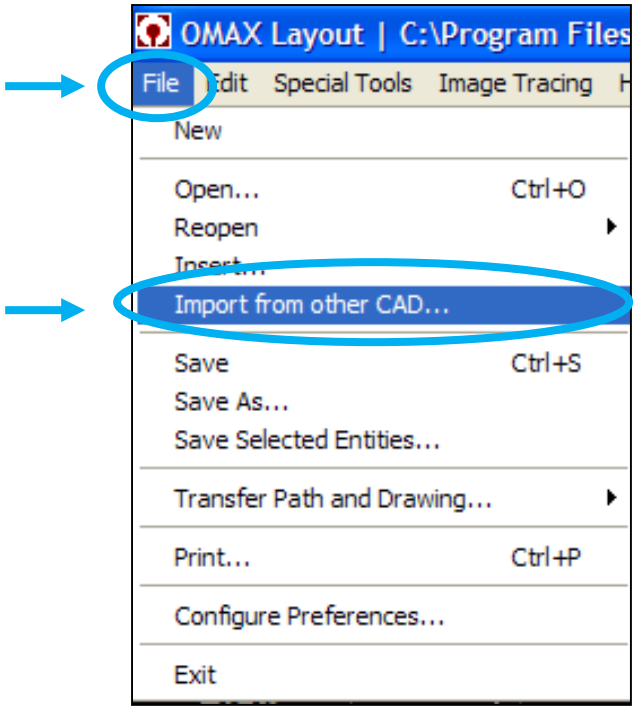
- *Importing* refers to bringing a drawing into **LAYOUT** created in another CAD program
- Many file types can be imported into **LAYOUT** including .dxf, .dwg, .dwf, .ai, .pdf, and .svg.
- The **Import** tool in **LAYOUT** runs files from other CAD systems through filters prior to opening as a DXF in **LAYOUT**

Keyword "import, file formats supported"

Step 1: Drawing Files

How to import a file

- In **LAYOUT**, click **File**, and then click **Import from Other CAD**
- Choose the file you want to import to open the **Import** dialog box



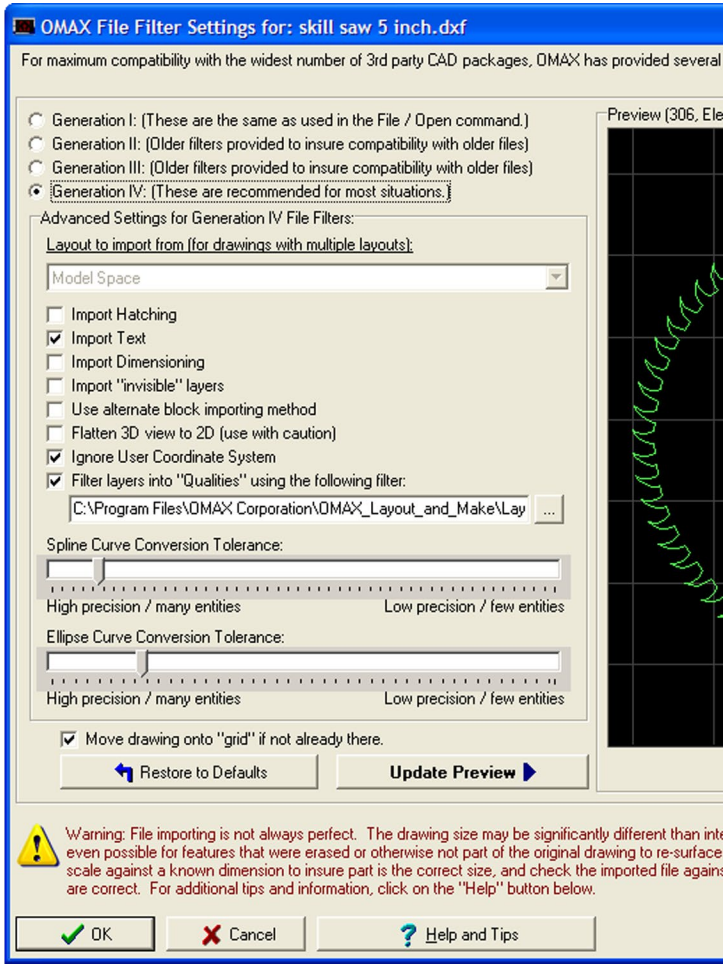
help *Keyword "import"*

Step 1: Drawing Files

Import dialog box

- Filter choices
- Advanced filter options
- Drawing settings
- Drawing preview window

Have a file that won't import?
Send to:
techsupport@omax.com



help *Keyword "import"*

Step 1: Drawing Files

Step 1 Review

Q1: There are three ways to create a drawing file in **LAYOUT** – do you remember what they are?

1. Open an _____ drawing file that is already saved in the system
2. Create a _____ drawing using **LAYOUT** drawing tools
3. _____ a drawing file into **LAYOUT** from another CAD system

Step 1 Review

Q2: How do you know when you need to use the **Select** tool for editing your drawing?

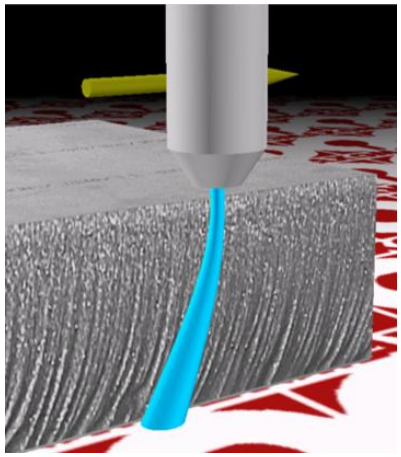
Steps in Making Parts

- Intelli-MAX **LAYOUT**
  - **Step 1:** Obtain/create a Drawing File (DXF file).
  - **Step 2:** Assign machining Qualities (edge finish).
  - **Step 3:** Clean and save the drawing.
  - **Step 4:** Add Path Elements to the drawing and save it.
  - **Step 5:** Create the Machine Tool Path file (ORD/OMX file).
- Intelli-MAX **MAKE**
  - **Step 6:** Start up the machine.
  - **Step 7:** Configure Machine Settings.
  - **Step 8:** Open and configure the ORD/OMX file.
  - **Step 9:** Load and clamp the material.
  - **Step 10:** Begin machining and cut the part.

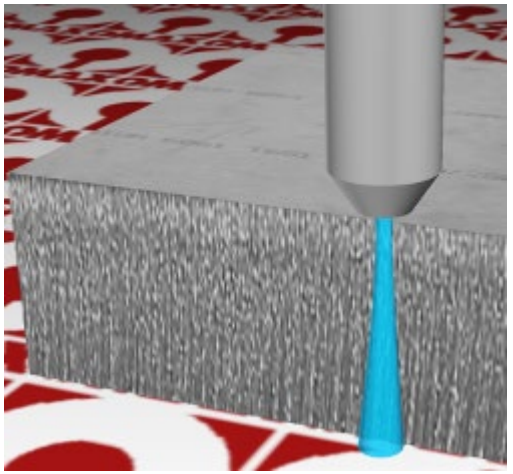
Step 2: Assign Cut Qualities

Assign cut qualities to a drawing

- Cut qualities tell the nozzle how fast or slow to move to achieve a certain edge finish



Faster – rougher part edge



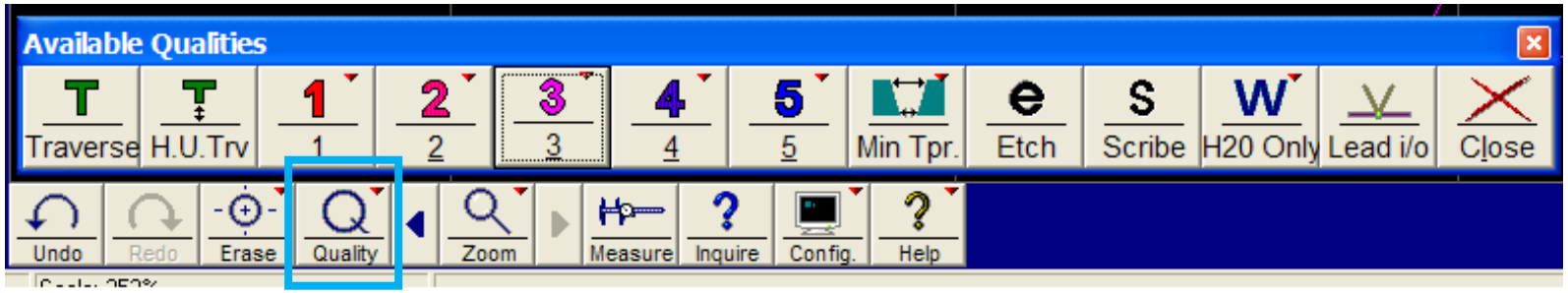
Slower – smoother part edge

help *Keywords "quality, quality numbers"*

Step 2: Assign Cut Qualities

Available Qualities toolbar

- Click the **Q** (**Quality**) icon to select the **Available Qualities** toolbar, or right-click to see more options

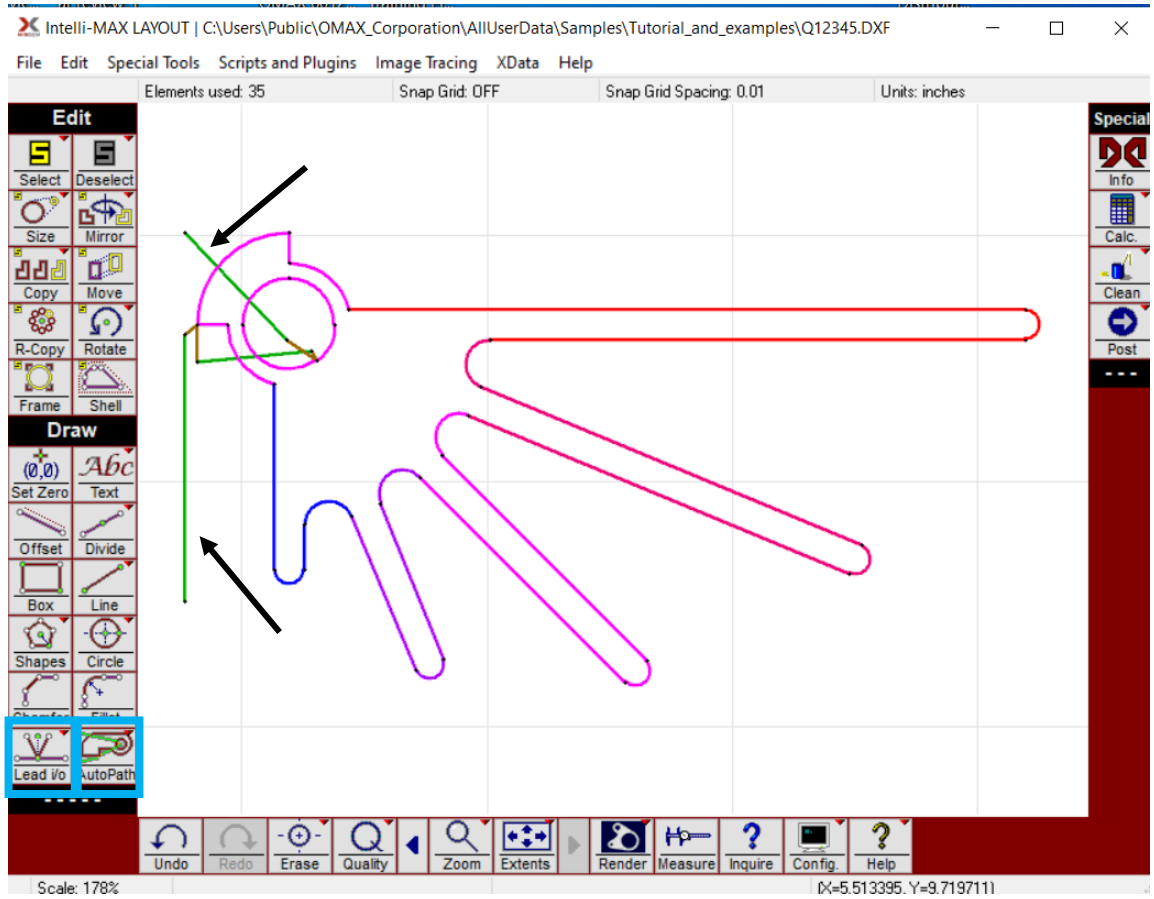


help *Keywords "quality, quality numbers"*

Step 2: Assign Cut Qualities

Traverse

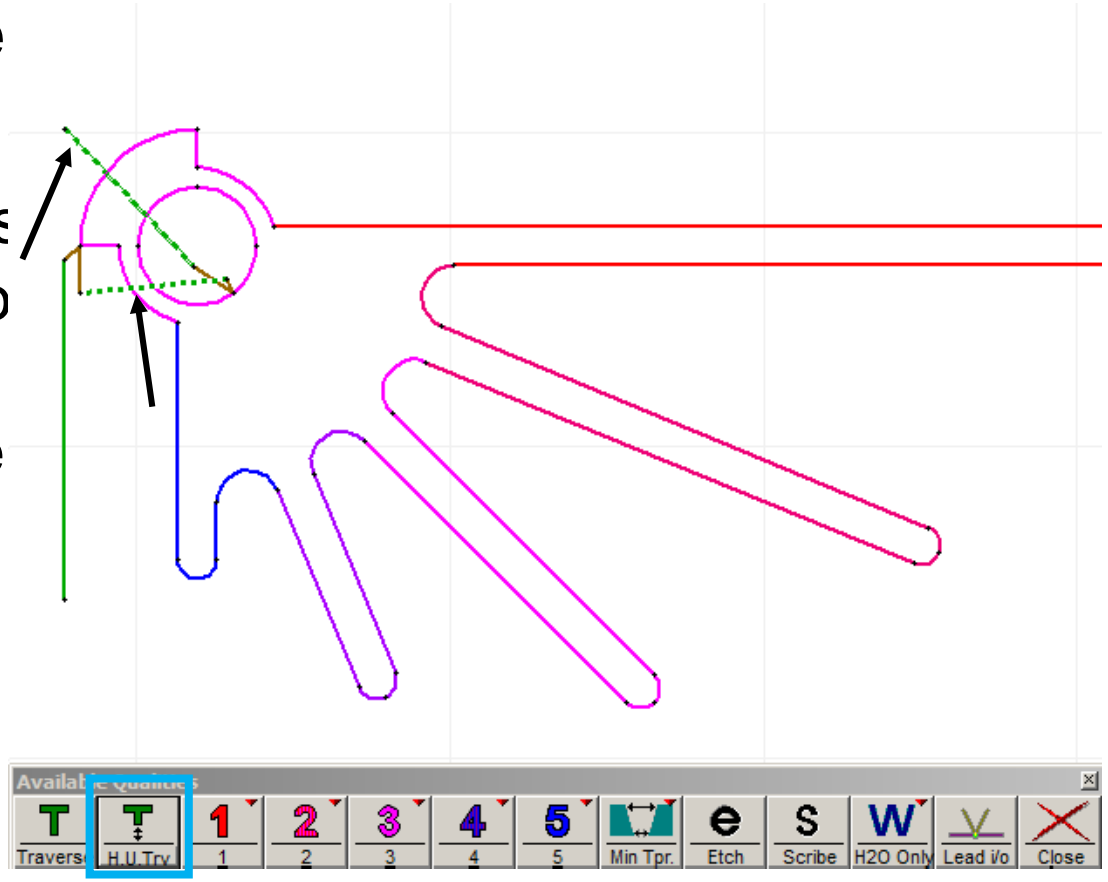
- Solid green line
- Moves the nozzle without cutting
- No water, no abrasive



Step 2: Assign Cut Qualities

Heads-up traverse

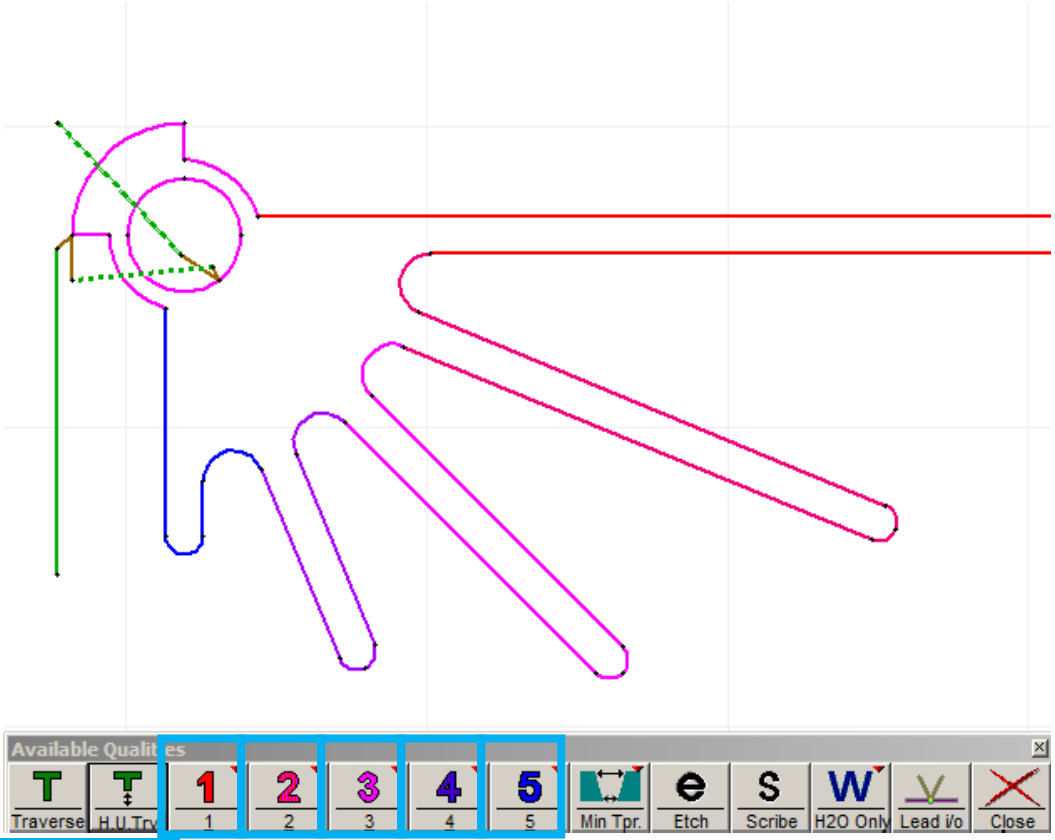
- Dotted green line
- Cutting head raises first, then moves to the next point without cutting, the lowers
- Used to avoid nozzle collisions



Step 2: Assign Cut Qualities

Qualities 1-5

- Different colors for different qualities
- Number and color on the toolbar corresponds to colored entities in the part

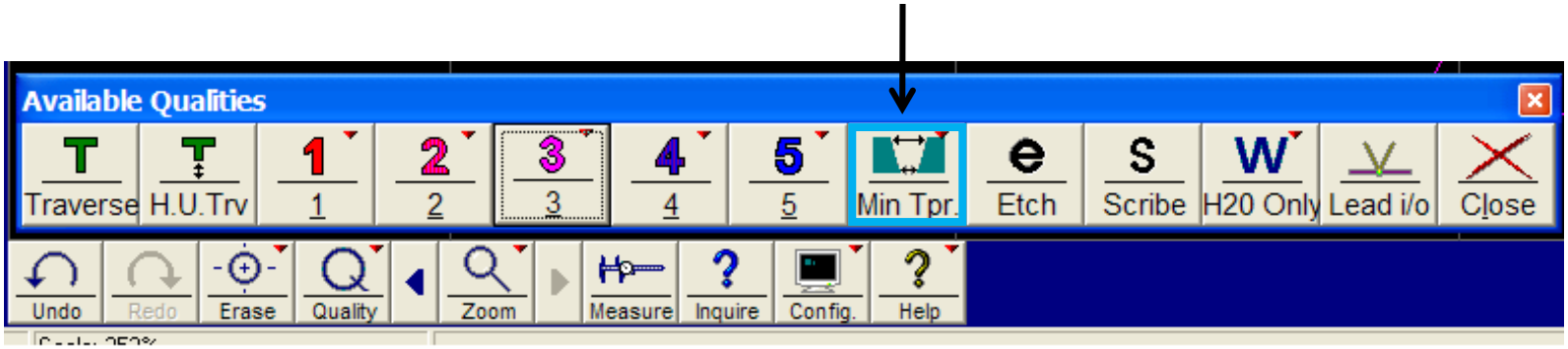


Higher number = higher quality
Lower number = lower quality

Step 2: Assign Cut Qualities

Minimum Taper

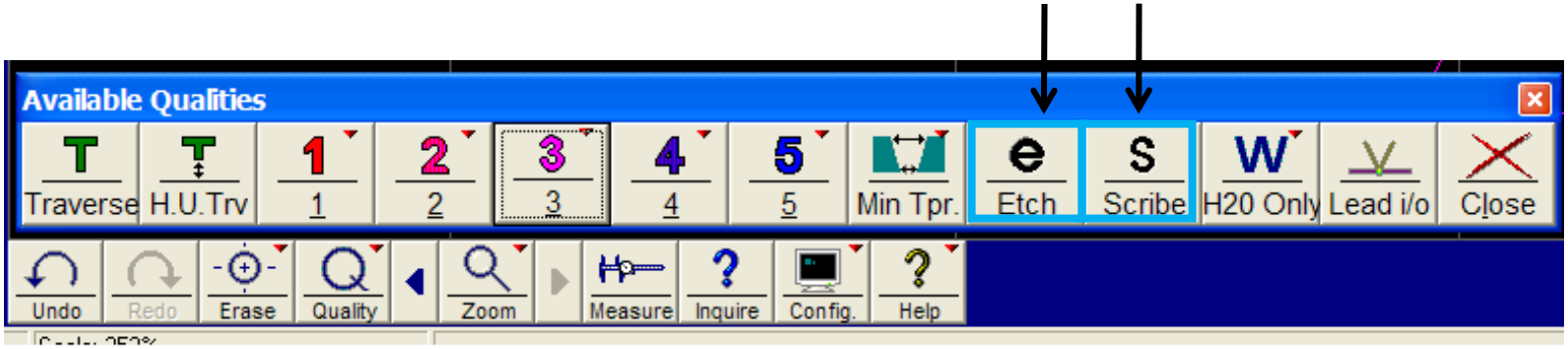
- Moves even slower than a Q5
- Used when you want to minimize taper
- Caution! Increases cutting time significantly!



Step 2: Assign Cut Qualities

Etch and Scribe

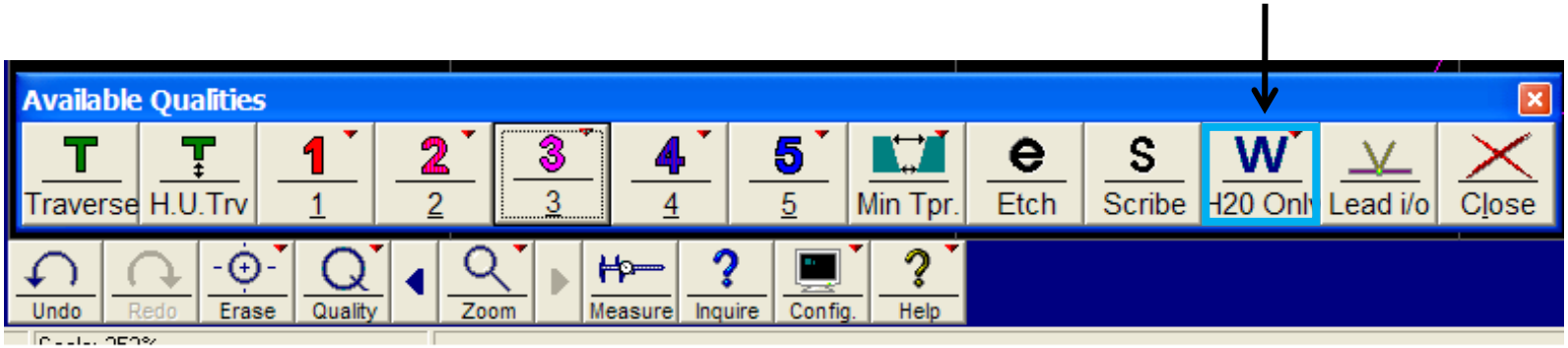
- Move faster than Q1
- Inches per minute determines depth of cut
- **Etch** uses abrasive, **Scribe** uses water only



Step 2: Assign Cut Qualities

Water Only

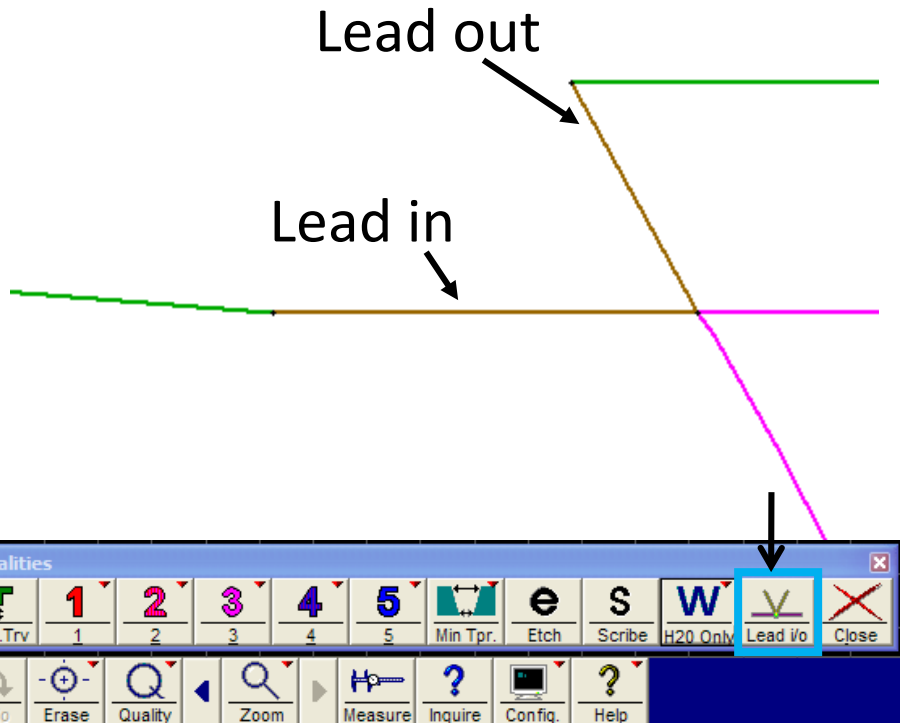
- Used in cutting softer materials, such as sponge or foam, that can be pierced with high-pressure water
- Uses a water only nozzle to get a better cut



Step 2: Assign Cut Qualities

Lead in and Lead outs

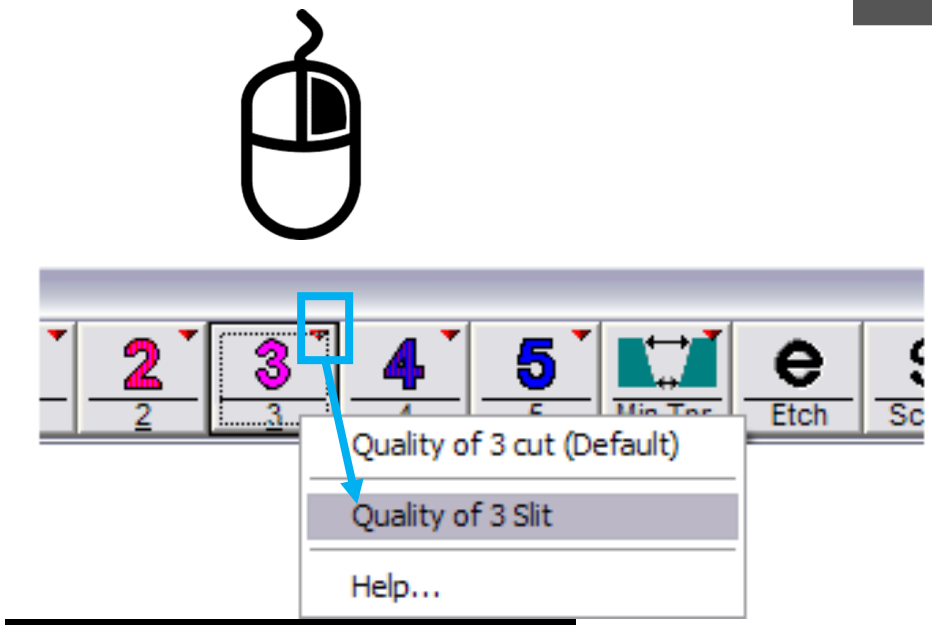
- Drawn in **brown**
- Lead ins (usually drawn longer) use water and abrasive to pierce the material before cutting
- Lead outs (usually drawn shorter) allow the jet stream to catch up and finish the cut before turning off the water and abrasive



Step 2: Assign Cut Qualities

Slit Quality

- There is no tool offset applied to cutting these lines (the nozzle travels down the center of the line)
- Right-click to access the slit quality
- Displayed as dotted or dashed lines
- Used for common line cutting

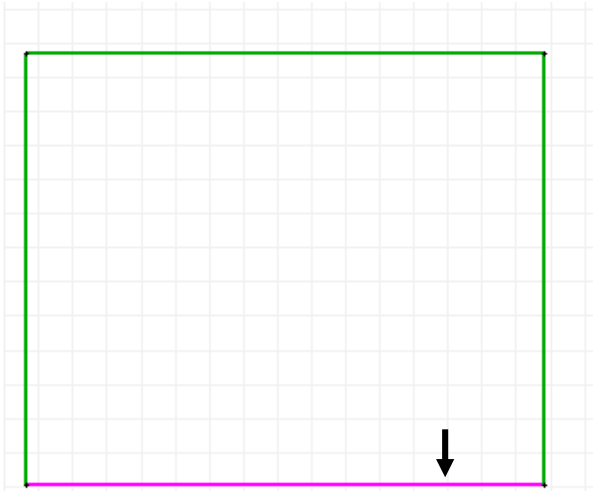


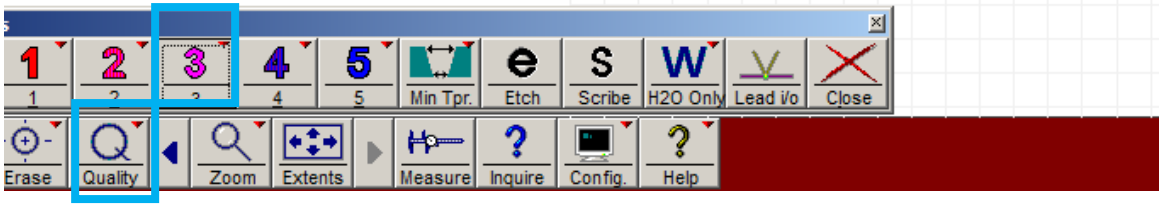
help *Keyword "slit"*

Step 2: Assign Cut Qualities

How to assign **Qualities**

- Open a drawing in **LAYOUT**
- Click to select the **Quality** tool bar (or right-click for more options)
- Click the **Quality** icon you want
- Click an entity to assign it the quality you selected

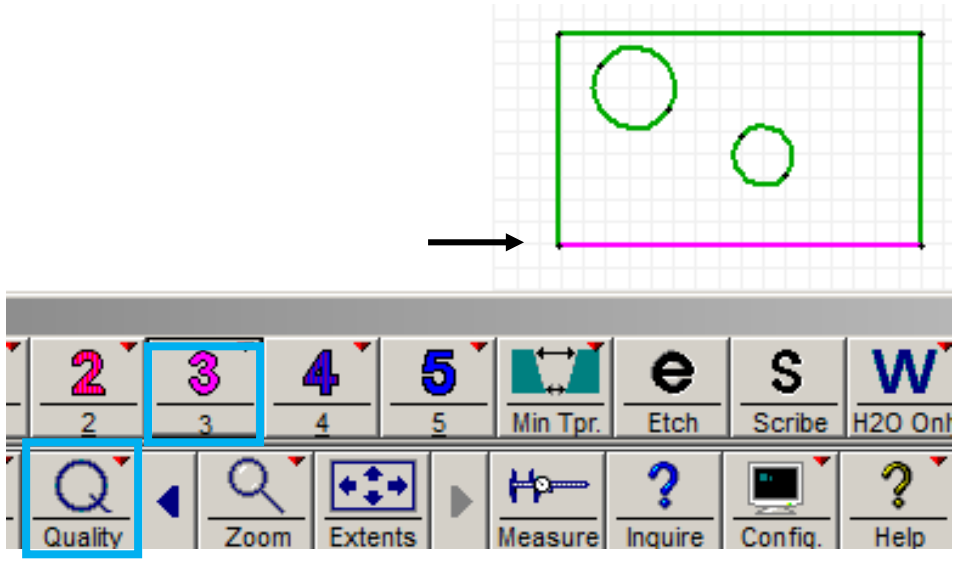




Step 2: Assign Cut Qualities

Exercise

- *Draw a box with 2 circles in it using the drawing tools*
- *Assign each entity a different cut quality using the **Quality** tool bar*

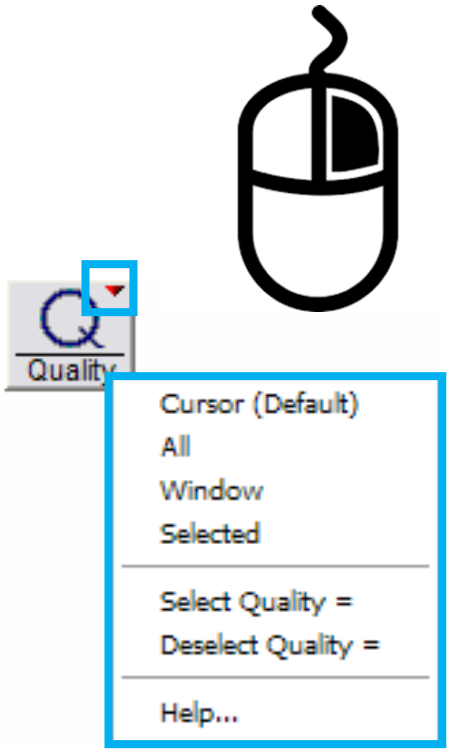


help *Keyword "quality"*

Step 2: Assign Cut Qualities

Other methods to assign qualities

- Right-click the **Quality** icon
- Use keyboard shortcuts such as:
  - **Q** for **Quality** (type the **Quality** number you want – for example, Q3 for quality 3)
  - **QA** for **Quality All**
  - **QW** for **Quality Window**



Exercise

- *Assign machining qualities using other options*

Step 2: Assign Cut Qualities

Quality toolbar review

1. What does the quality tool in **LAYOUT** allow you to do?
   a. Assign machining qualities to entities in the drawing
   b. Assign part accuracies to entities in the drawing
   c. Make the drawing look more colorful
   d. None of the above
2. A quality of 1 results in
   a. A very smooth edge finish on the part
   b. A medium smooth edge finish on the part
   c. A very rough edge finish on the part
   d. Nothing – it doesn't affect edge finish on the part

Session 1: Activities

1. Create a new drawing using **LAYOUT**.
2. Assign two or more machining qualities to the drawing you created using the **Quality** toolbar.
3. Use the **Select**, **Deselect**, and a couple of the other editing tools such as **Copy** or **Move,** to make changes to your drawing.
4. Look up the keyboard shortcut for drawing a circle

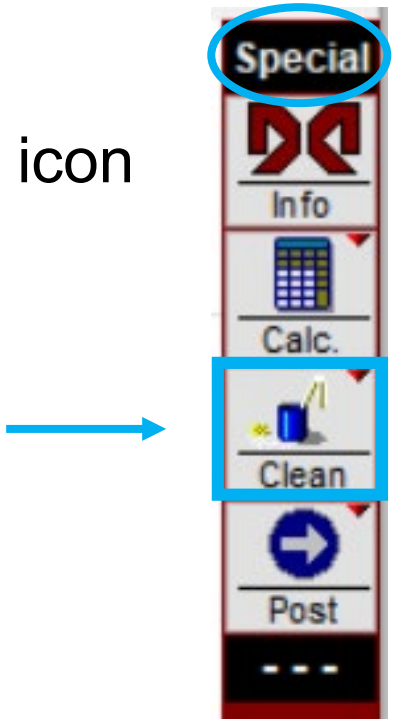
Steps in Making Parts

- Intelli-MAX **LAYOUT**
  - **Step 1:** Obtain/create a Drawing File (DXF file).
  - **Step 2:** Assign machining Qualities (edge finish).
  - **Step 3:** Clean and save the drawing.
  - **Step 4:** Add Path Elements to the drawing and save it.
  - **Step 5:** Create the Machine Tool Path file (ORD/OMX file).
- Intelli-MAX **MAKE**
  - **Step 6:** Start up the machine.
  - **Step 7:** Configure Machine Settings.
  - **Step 8:** Open and configure the ORD/OMX file.
  - **Step 9:** Load and clamp the material.
  - **Step 10:** Begin machining and cut the part.

Step 3: Clean and Save the Drawing

Clean and **Save** the DXF drawing file

- Open a saved DXF drawing file
- On the **Special** toolbar, click the **Clean** icon



help *Keyword "clean"*

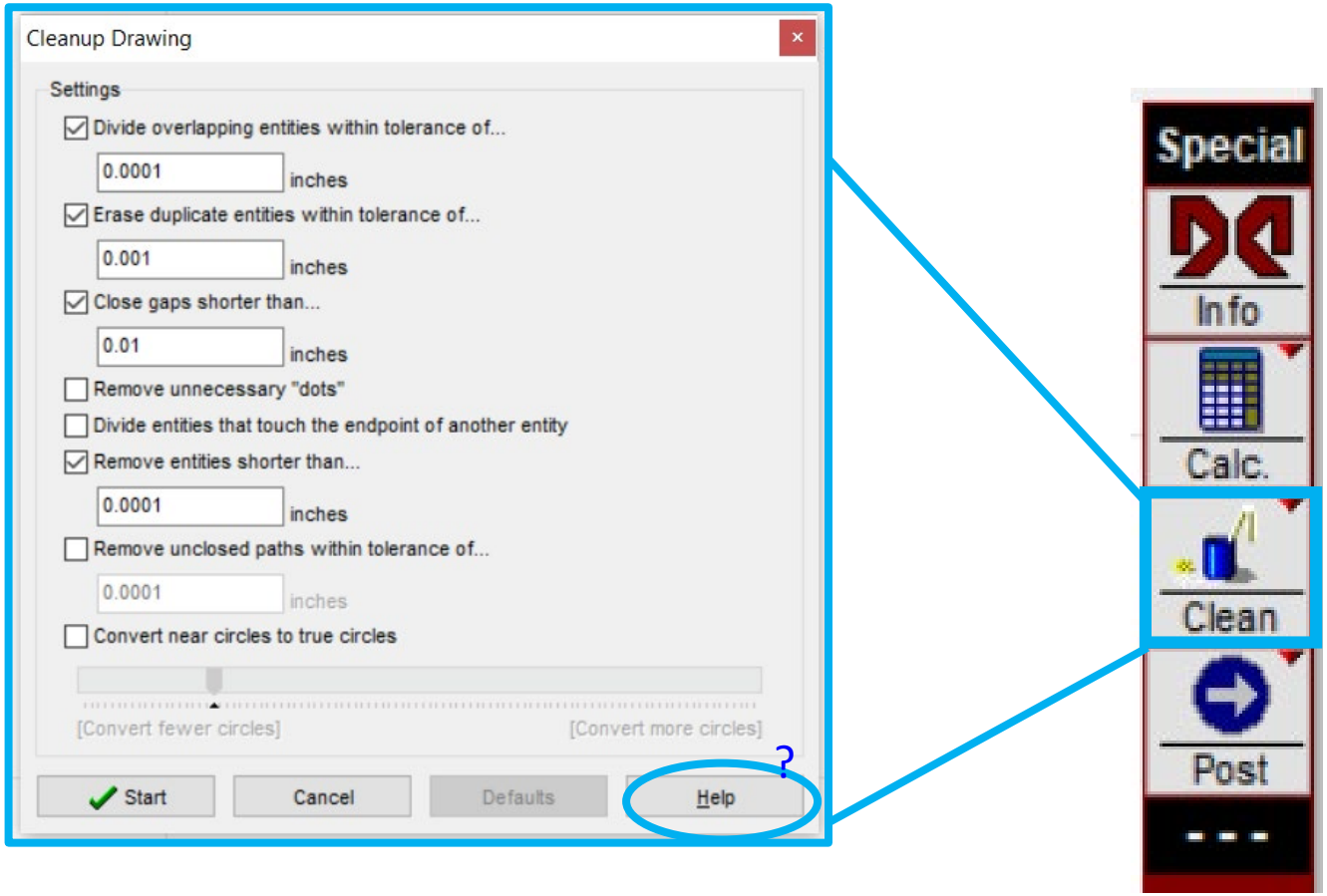
Step 3: Clean and Save the Drawing

Exercise

- *Run the **Clean** tool on the test box.dxf drawing and review results*
- *Open a new DXF file with known problems and run the **Clean** tool and review results*

Step 3: Clean and Save the Drawing

- Click the **Clean** icon to choose cleanup settings



Steps in Making Parts

- Intelli-MAX **LAYOUT**
  - **Step 1:** Obtain/create a Drawing File (DXF file).
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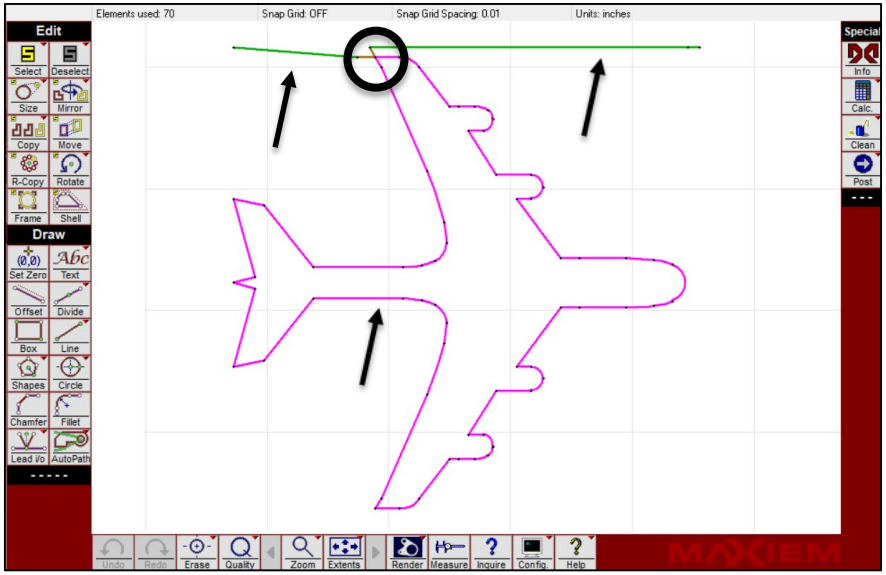
  - **Step 10:** Begin machining and cut the part.

Step 4: Add the Nozzle Path to the Drawing

Nozzle path

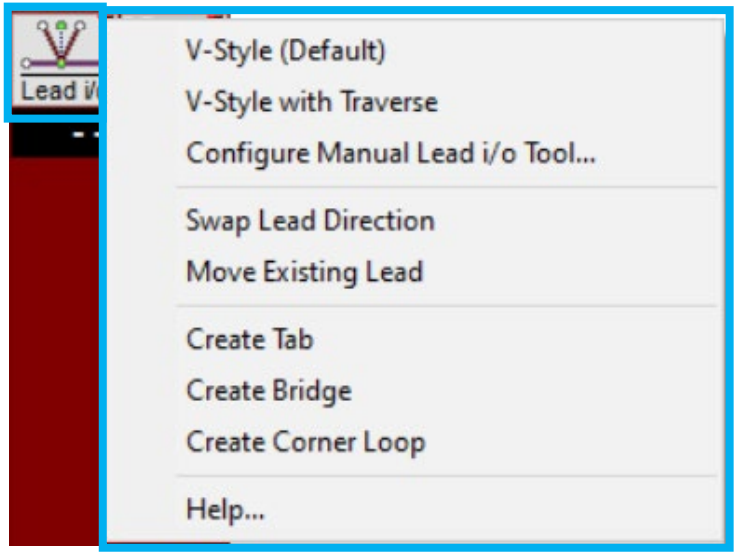
- The nozzle travel path consists of 3 components:
  - **Geometry** of your part
  - **Traverse lines**
  - **Lead in** and **Lead outs** (pierce and exit points)



Step 4: Add the Nozzle Path to the Drawing

Nozzle path

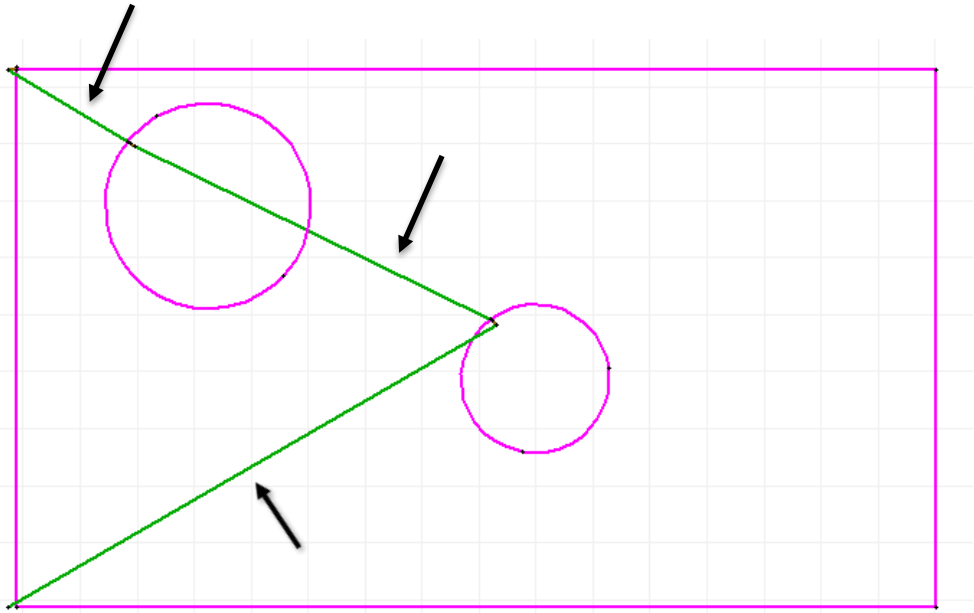
- Traverse lines and lead in/outs are added to your drawing using the **Lead i/o** drawing tool



Step 4: Add the Nozzle Path to the Drawing

Nozzle path

- **Traverses**
  - Can be lines *or* arcs
  - Color – green (solid or dashed)
  - Move the nozzle without turning on the water and/or abrasive
  - Typically connect to lead in/outs

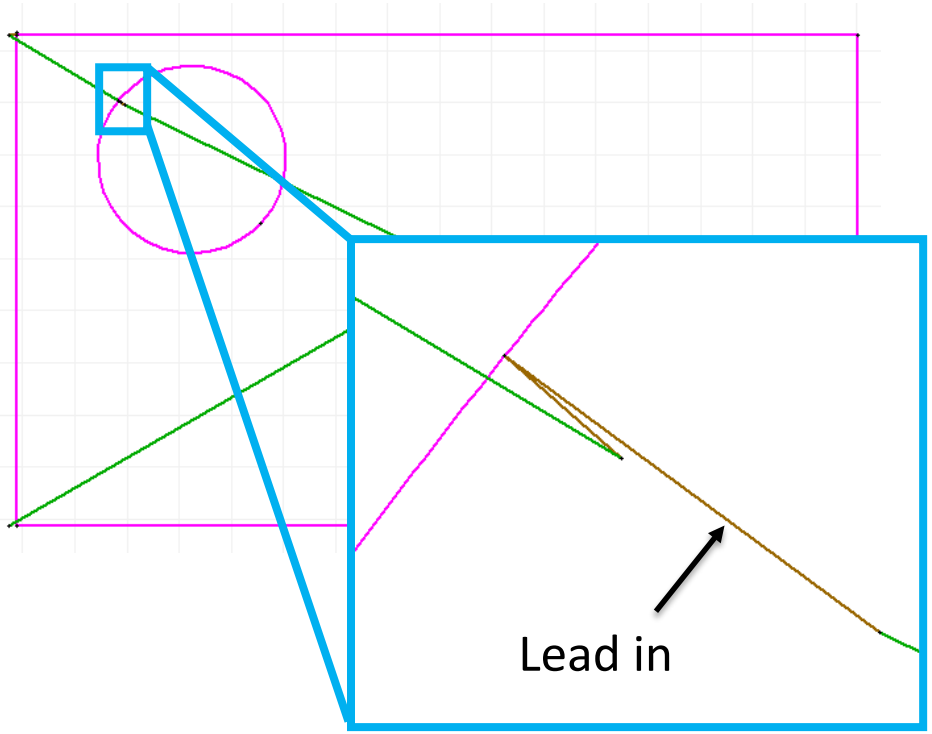


help *Keyword "traverse"*

Step 4: Add the Nozzle Path to the Drawing

Nozzle path

- **Lead ins**
  - Pierce points
  - Typically drawn longer
  - Turn on water and abrasive and pierce the material
  - Connected to lead outs
  - Determines nozzle travel direction

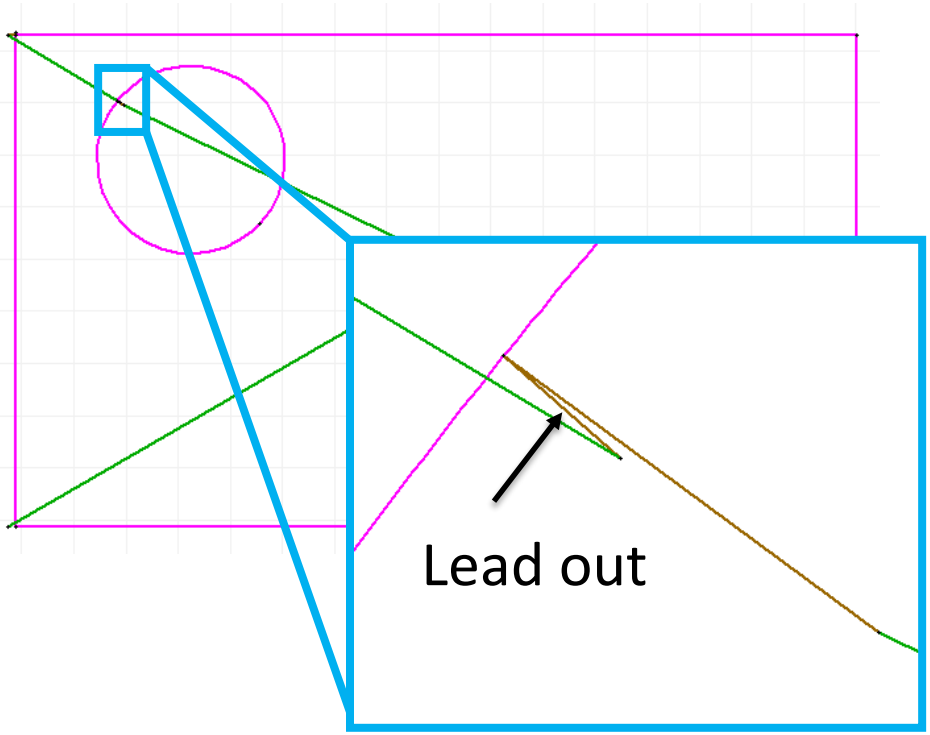


help *Keyword "lead i/o"*

Step 4: Add the Nozzle Path to the Drawing

Nozzle path

- **Lead outs**
  - Exit points
  - Typically drawn shorter
  - Turn off the water and abrasive and proceed to the next command
  - Connected to lead ins



Step 4: Add the Nozzle Path to the Drawing

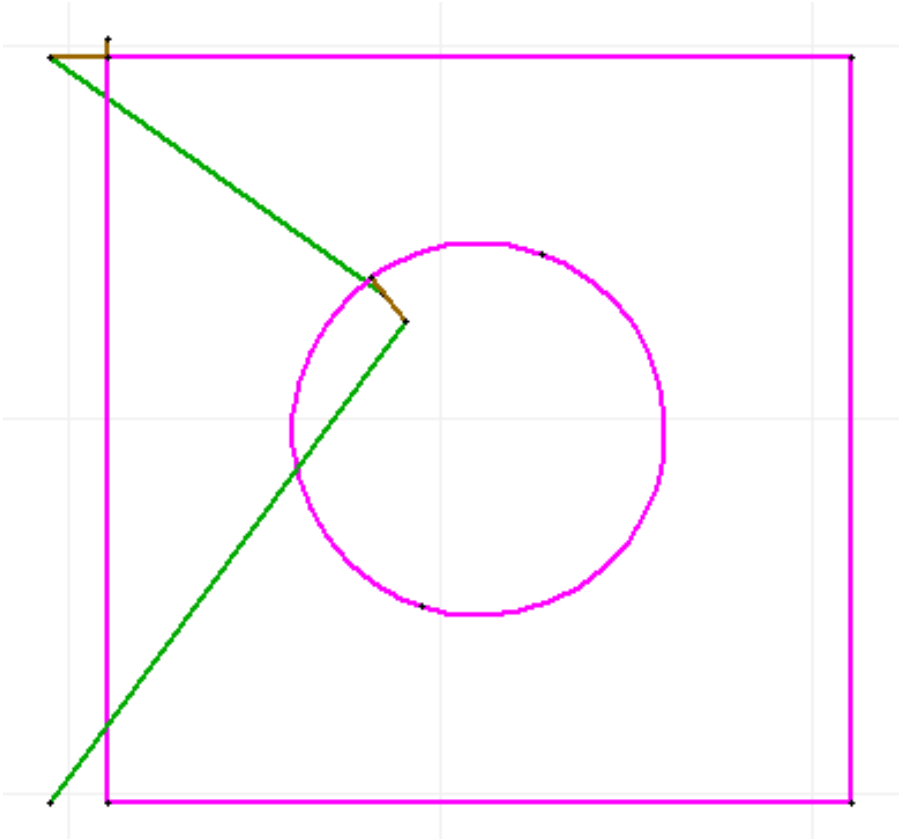
Best practices for adding the nozzle path

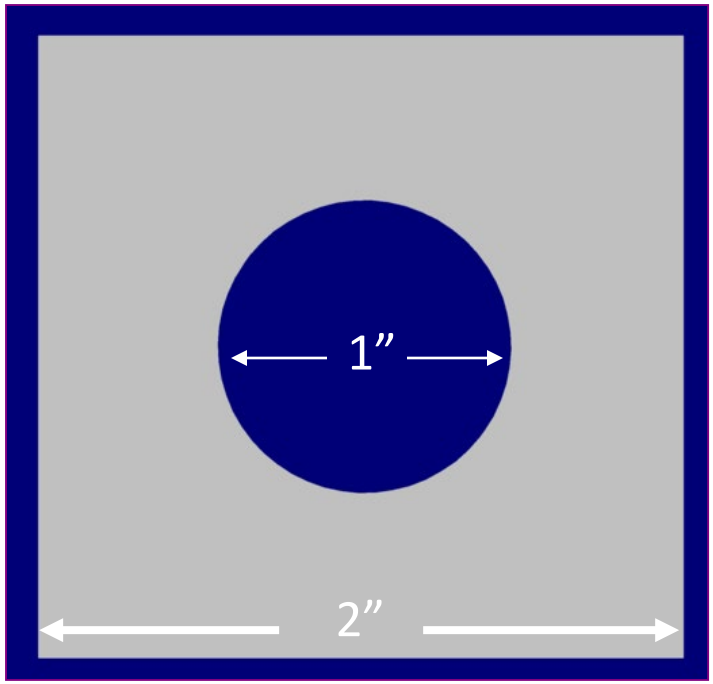
- Route the nozzle path to cut internal geometries first (keeps material stable during the cutting process)
- Place your lead i/o on the side of the geometry you want to cut out (place them in the scrap)
- Draw your lead in longer and your lead out shorter (helps you know which direction the nozzle is traveling)
- Draw your lead i/o and traverse lines to minimize nozzle travel (saves time when cutting)
- Draw the nozzle path to avoid traveling over already cut pieces (slugs) that may cause nozzle “collisions”

Step 4: Add the Nozzle Path to the Drawing

- Specify a narrow angle and use lines for your lead i/o to minimize machine marks where the nozzle finishes cutting
- The software will cut to the left of the line, by default
  - Internal geometries are cut to the left (counterclockwise)
  - External geometries are cut to the right (clockwise)
- The machine path will automatically route the nozzle in the direction of least resistance (the least sharp turn)
  - How you draw your lead-i/o will affect the direction the nozzle travels (clockwise or counterclockwise) – point the lead in the direction you want the path to go
- For best offset performance, avoid small entities in inside corners

Step 4: Add the Nozzle Path to the Drawing





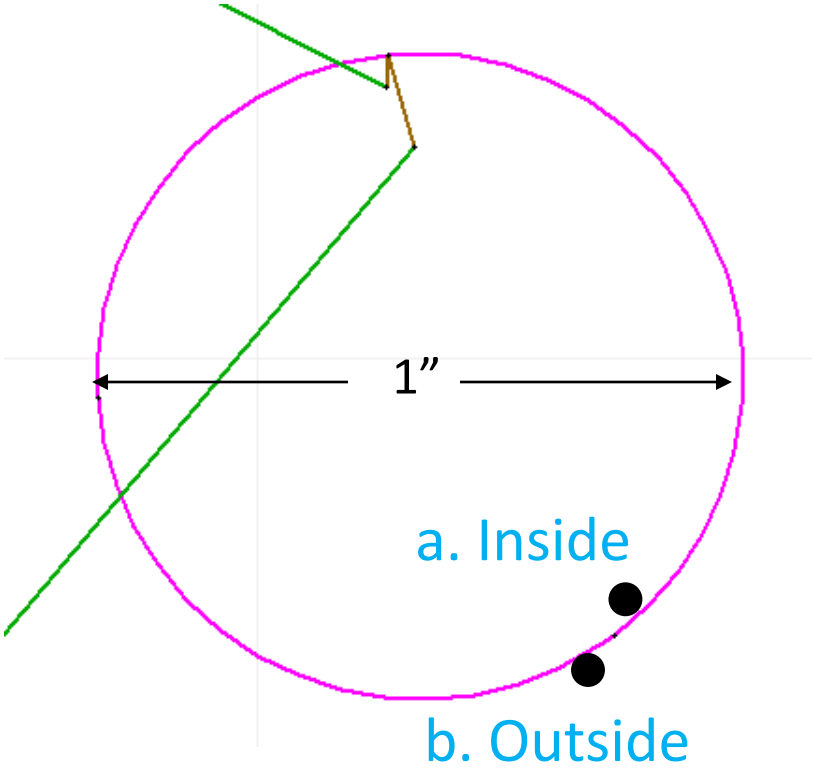
Final Part

Step 4: Add the Nozzle Path to the Drawing

Lead ins

(on *internal* geometry)

- Pierce on the inside
- The tool offset is programmed to cut to the left side of the line by default
- Q: If we look at this circle, which side do we want the nozzle to cut on?



Step 4: Add the Nozzle Path to the Drawing

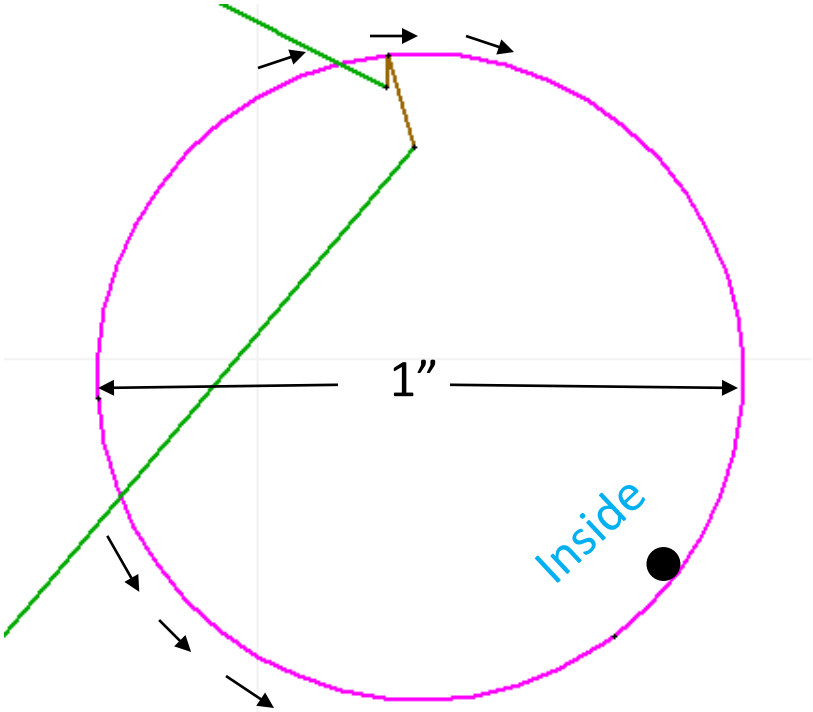
Lead ins

(on *internal* geometry)

A: Cut on the *inside* to maintain our hole diameter at 1 inch

Q: Which direction should the nozzle travel if we want it to cut **inside** the circle, knowing it will cut to the left of our line?

a. Clockwise



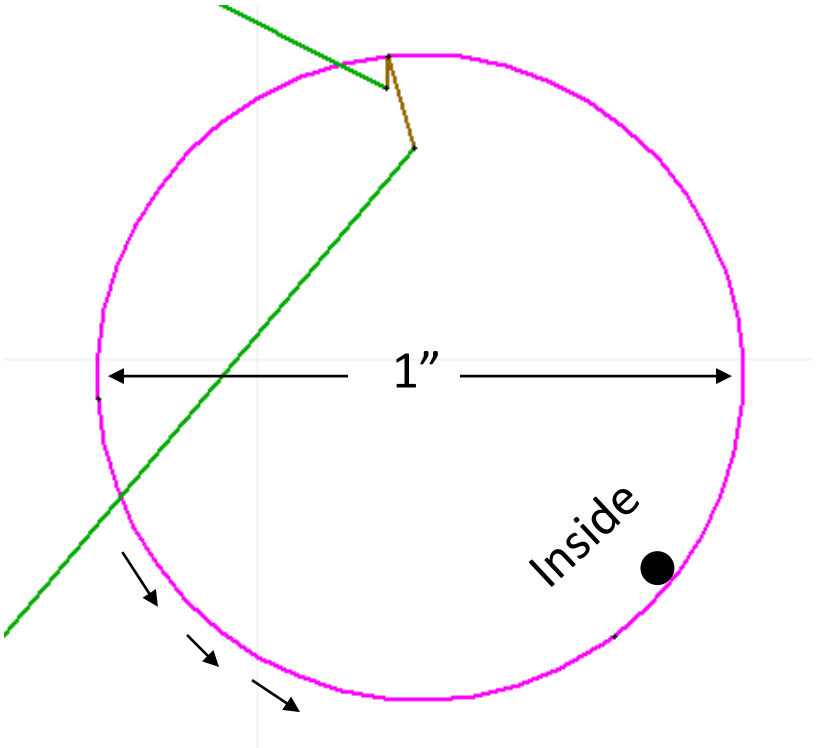
b. counterclockwise

Step 4: Add the Nozzle Path to the Drawing

Lead ins

(on *internal* geometry)

A: Travel in *a b. counterclockwise* direction so it cuts to the inside of internal geometry



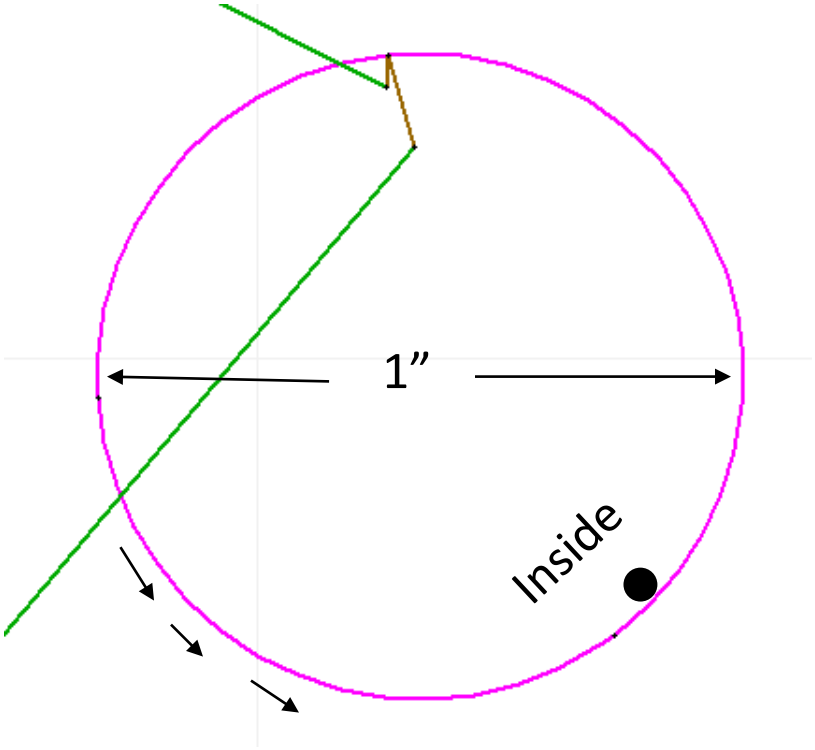
b. counterclockwise

Step 4: Add the Nozzle Path to the Drawing

Lead ins

(on *internal* geometry)

- Draw lead in longer than lead out
- Place pierce point in the scrap (inside)
- Cut in a counterclockwise direction so it cuts on the inside of the geometry

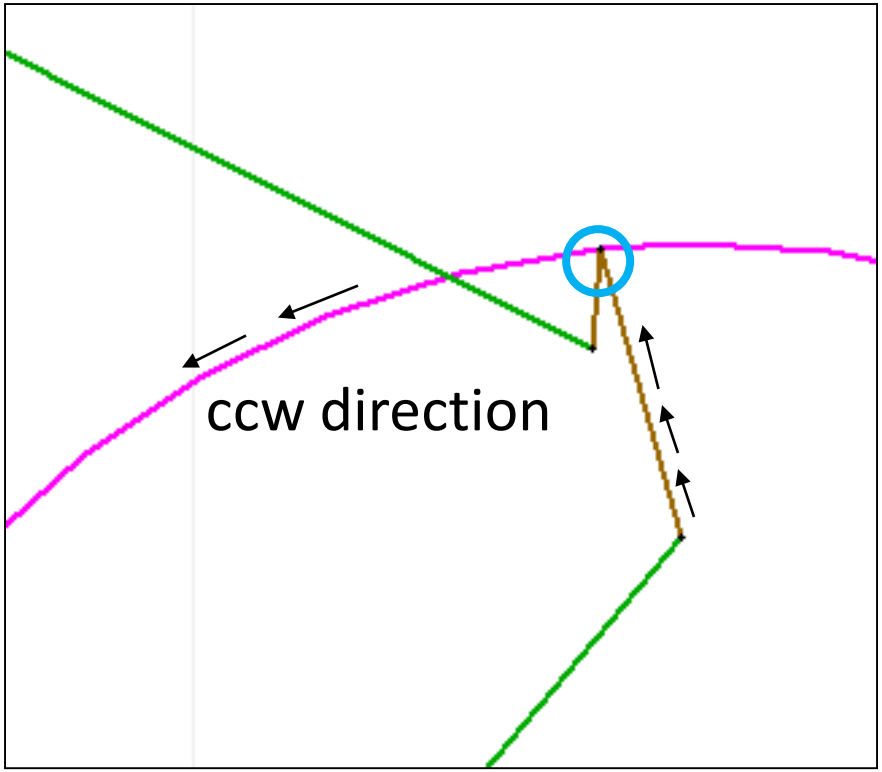


Step 4: Add the Nozzle Path to the Drawing

Lead ins

(on *internal* geometry)

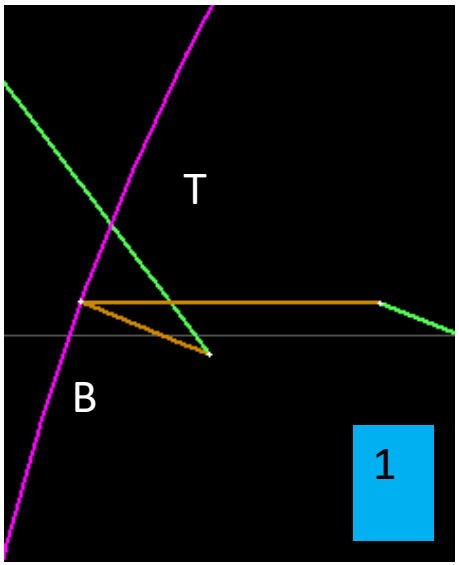
- Draw the lead in so the least sharp turn points in the counterclockwise (ccw) direction on internal geometry
- Point the lead in the direction you want the nozzle to travel (ccw)

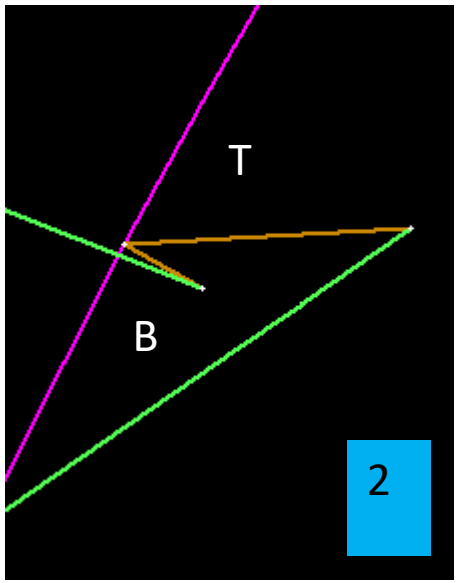


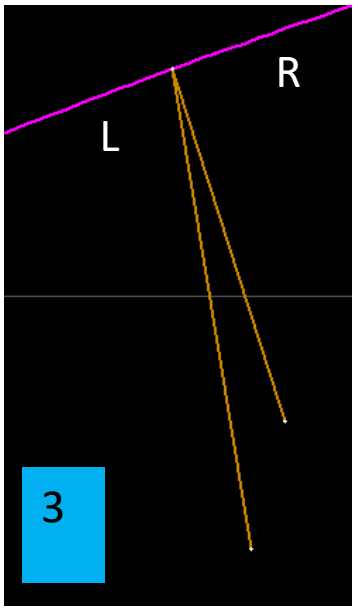
Step 4: Add the Nozzle Path to the Drawing

Lead ins on *internal* geometry

Q: Which direction will the nozzle travel in each of these examples of internal geometry?

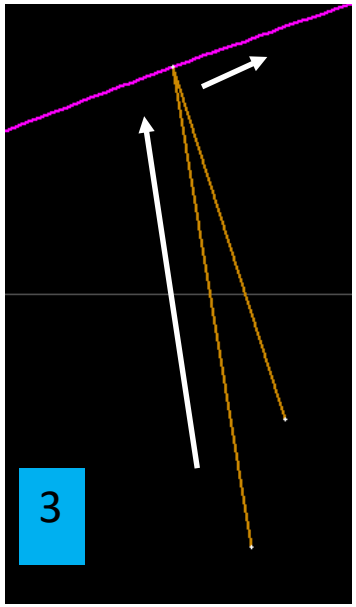




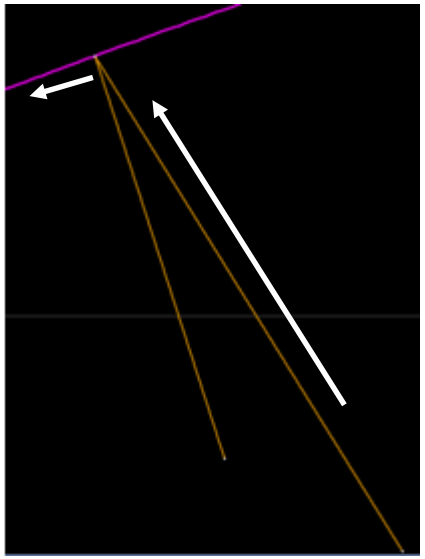


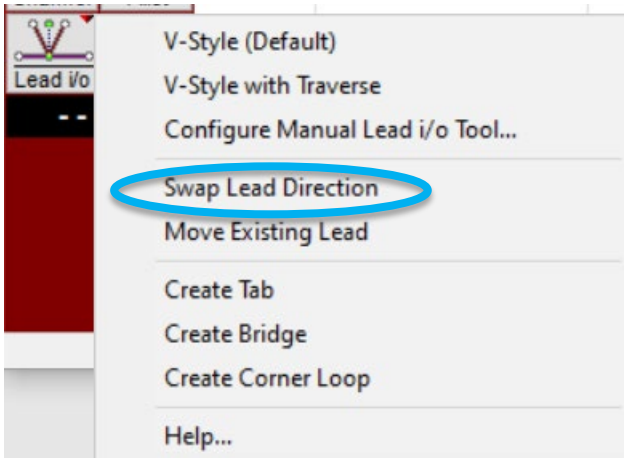
Step 4: Add the Nozzle Path to the Drawing

How to fix a **lead in** if it is cutting on the wrong side



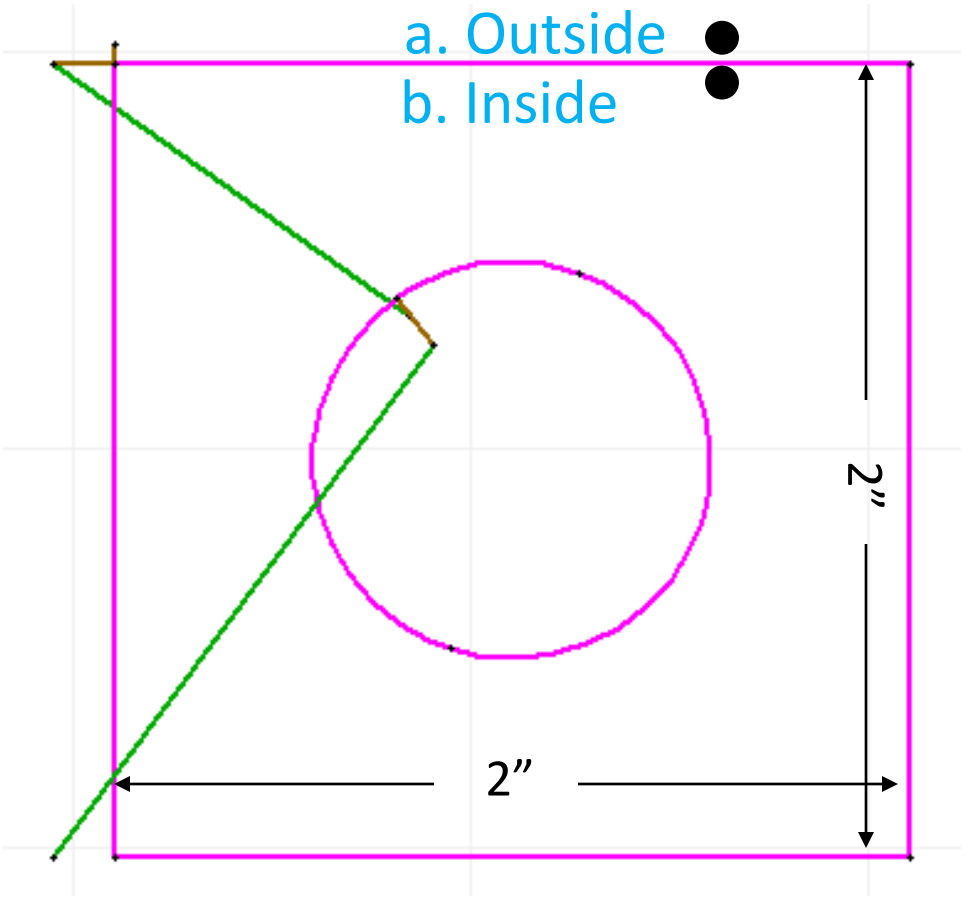
Lead in drawn in the wrong direction





Use the **Swap Lead Direction** tool

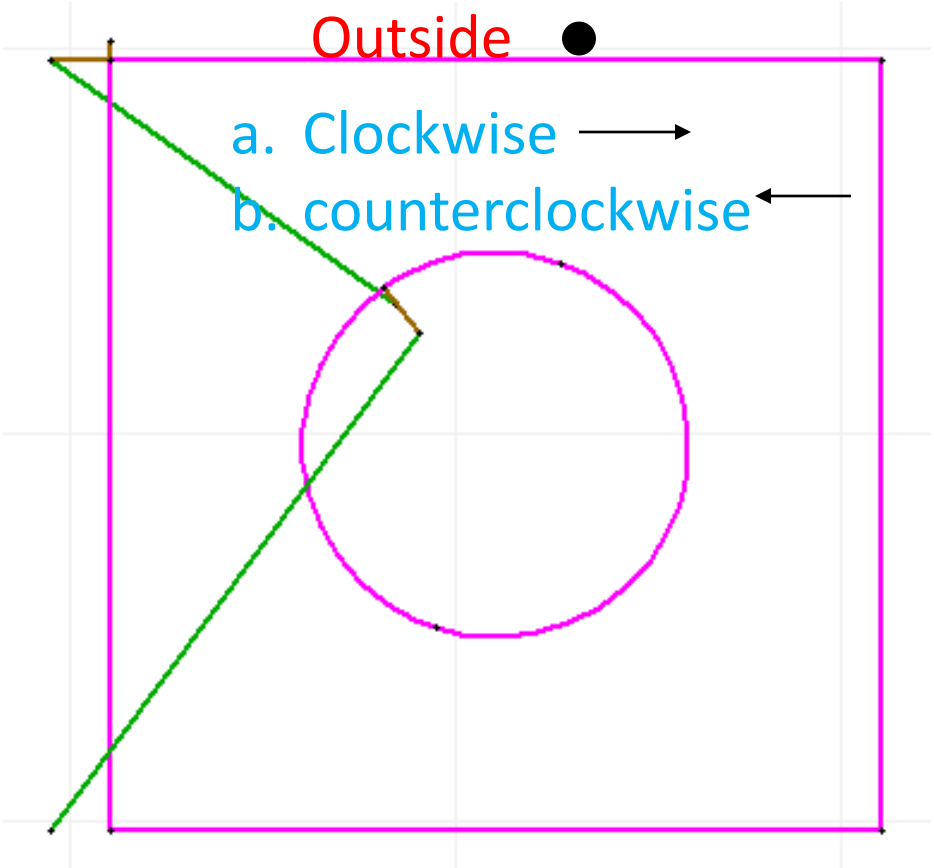
Step 4: Add the Nozzle Path to the Drawing



Q: Which side of the *external* geometry (the box) do we want the nozzle to cut if we want to maintain our part dimension as drawn?

a. Outside
b. Inside

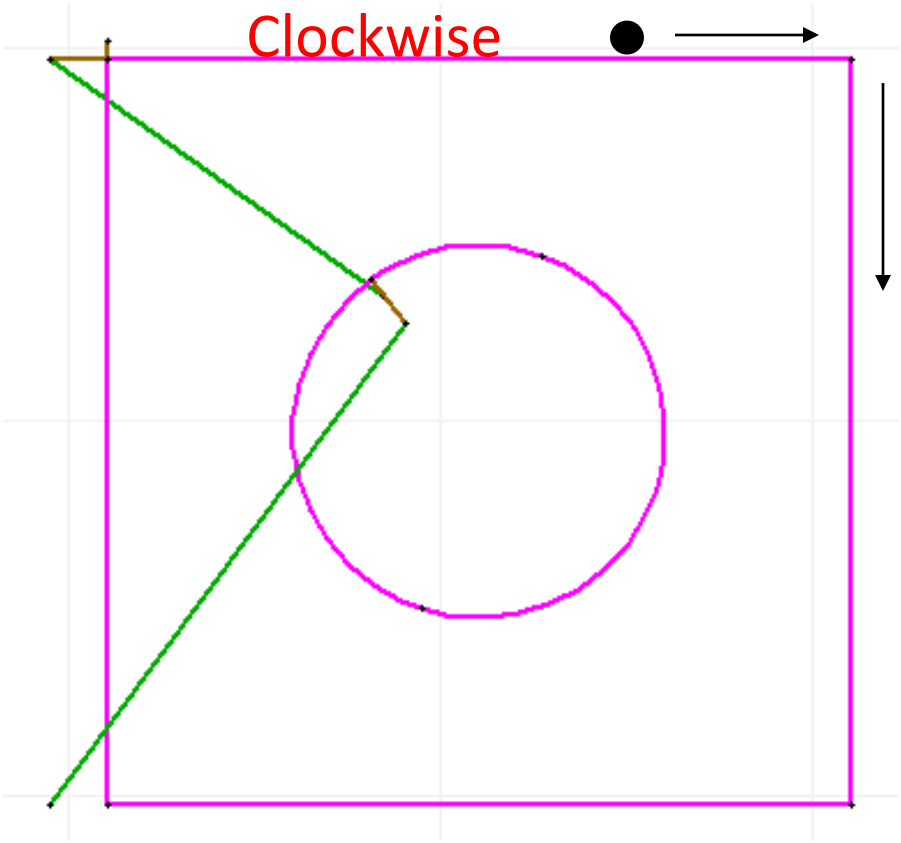
Step 4: Add the Nozzle Path to the Drawing



A: We want to cut on the outside of the box

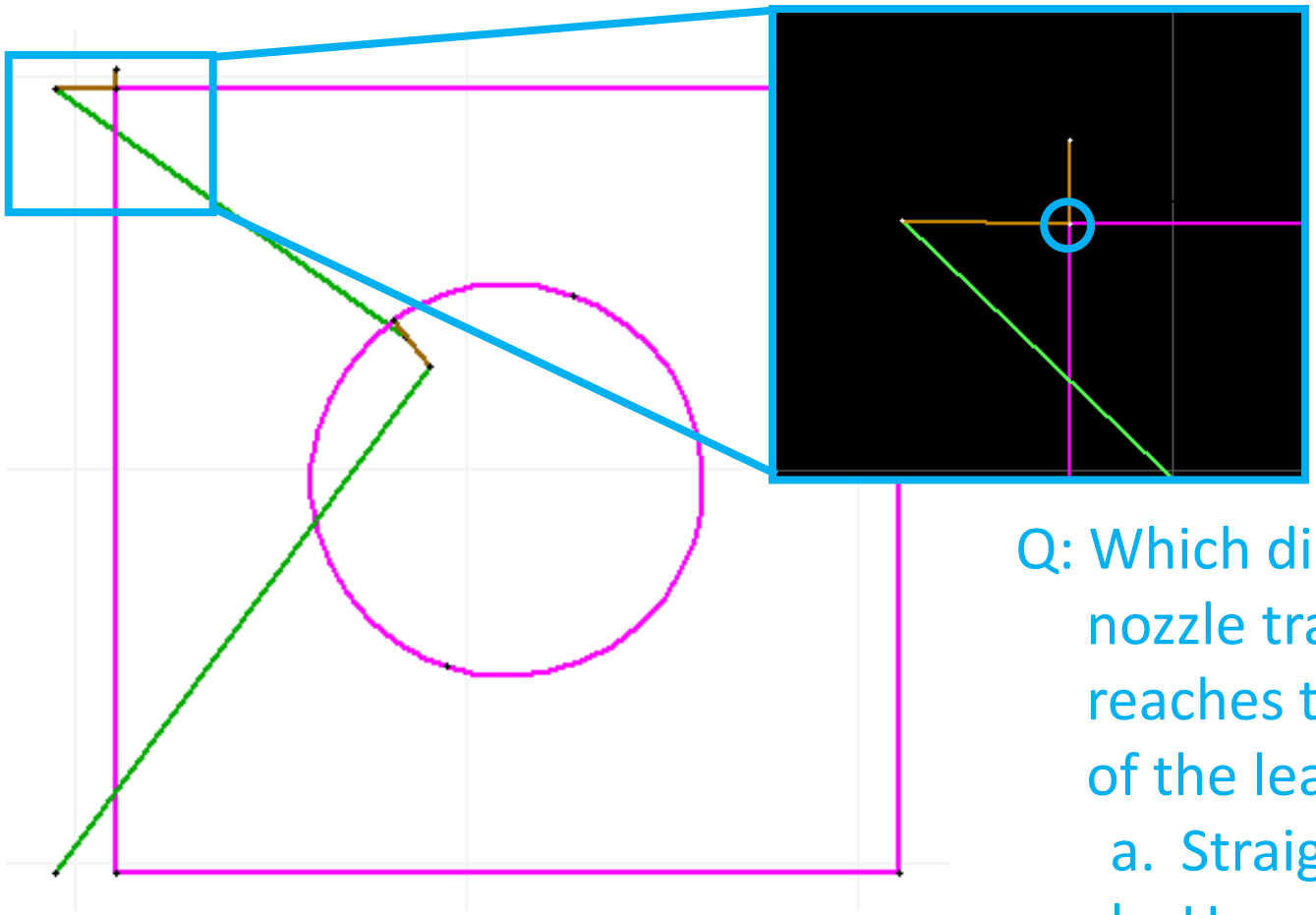
Q: Which direction does the nozzle need to travel to cut on the outside of our box?

Step 4: Add the Nozzle Path to the Drawing



A: We want the nozzle to travel in the *clockwise* direction on *external* geometry so the kerf is on the left, or outside the geometry

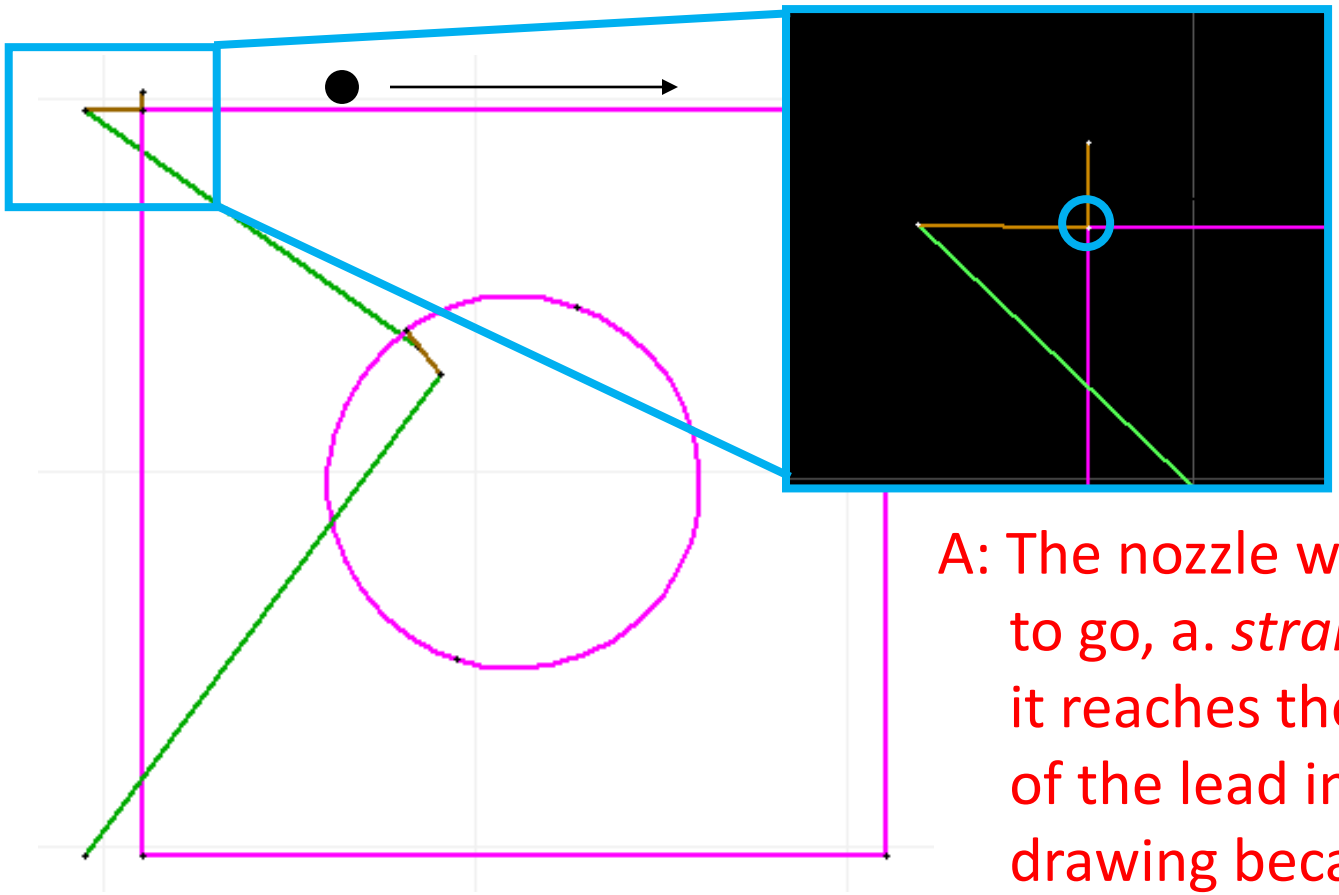
Step 4: Add the Nozzle Path to the Drawing



Q: Which direction will the nozzle travel when it reaches the end-point of the lead in?

a. Straight
b. Up
c. Down

Step 4: Add the Nozzle Path to the Drawing

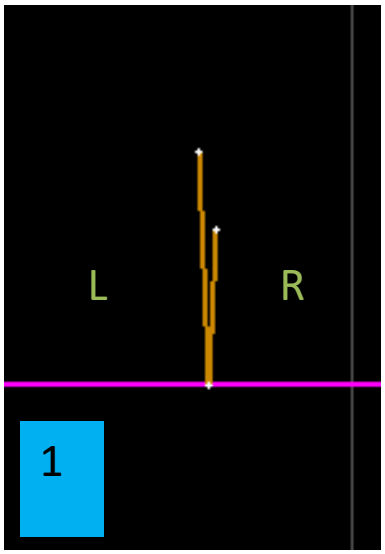


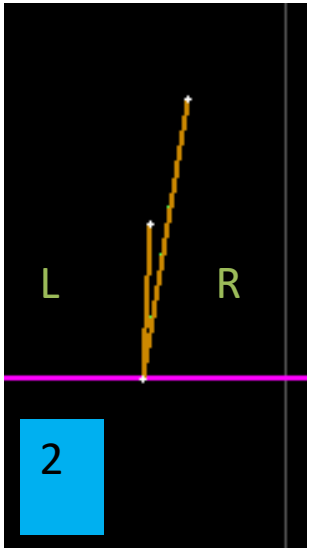
A: The nozzle will continue to go, a. *straight,* when it reaches the end-point of the lead in in this drawing because it is the least sharp angle or turn to follow

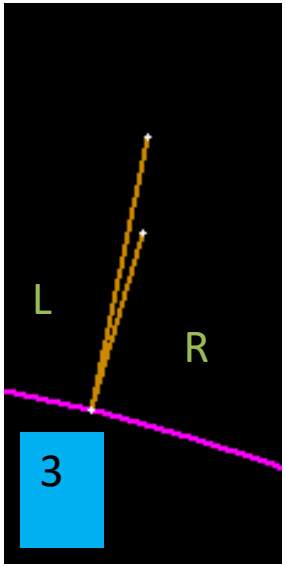
Step 4: Add the Nozzle Path to the Drawing

Lead ins on *external* geometry

Q: Which direction will the nozzle travel in each of these examples of *external* geometry?

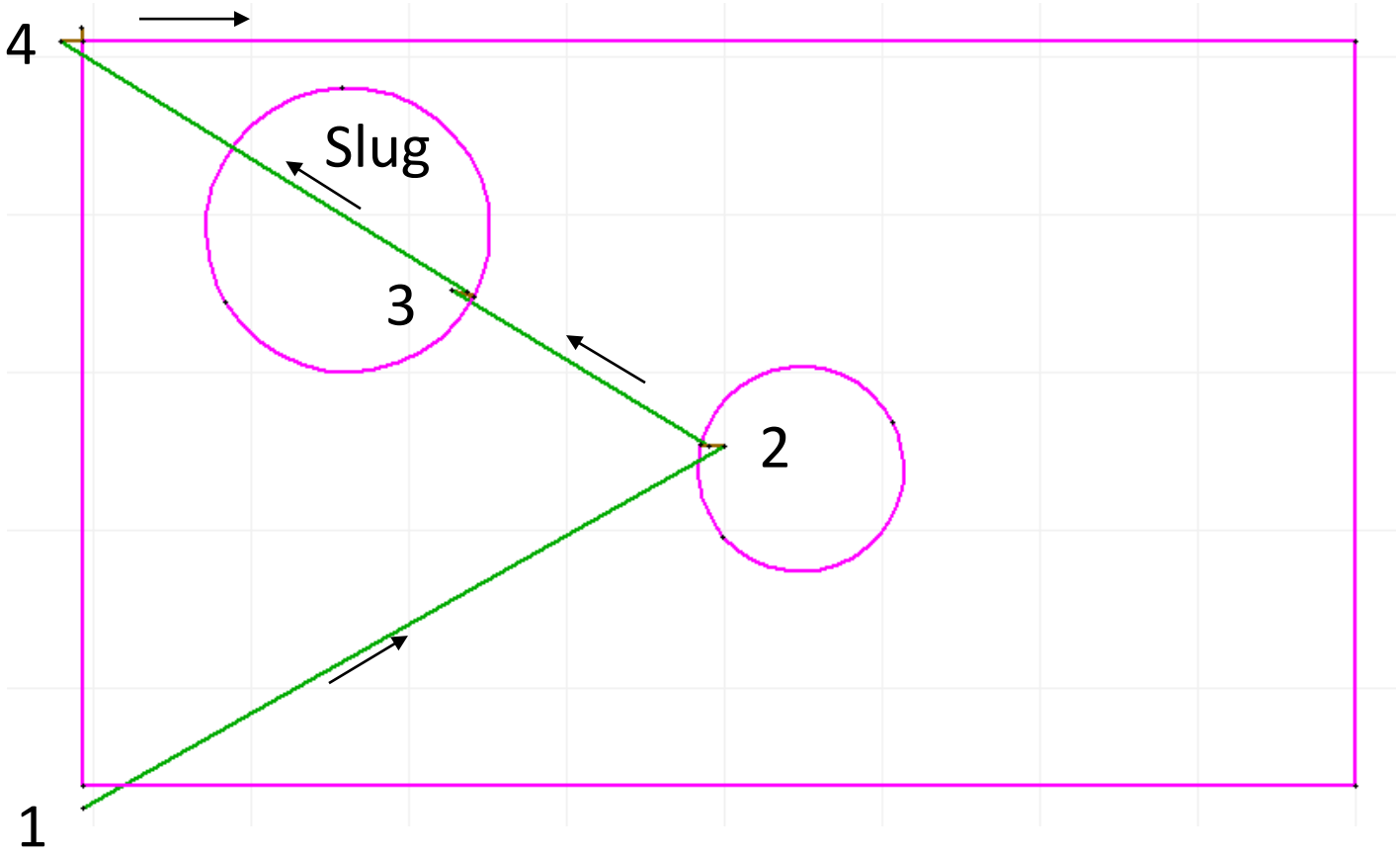






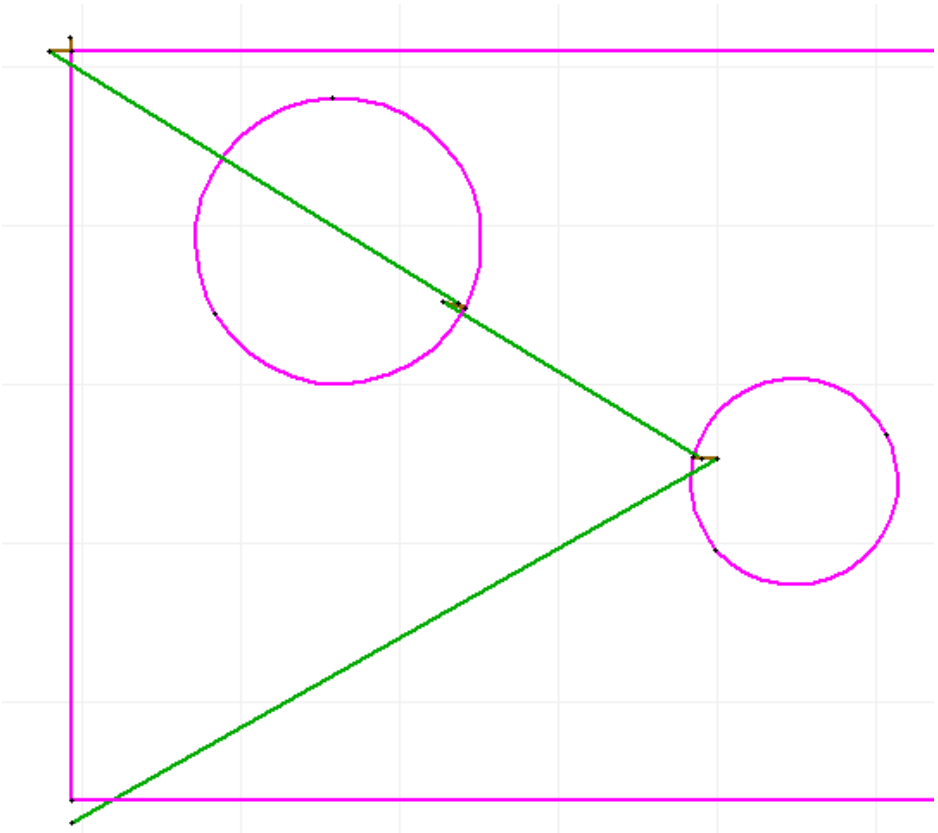
Step 4: Add the Nozzle Path to the Drawing

Avoid traveling over something already cut



Step 4: Add the Nozzle Path to the Drawing

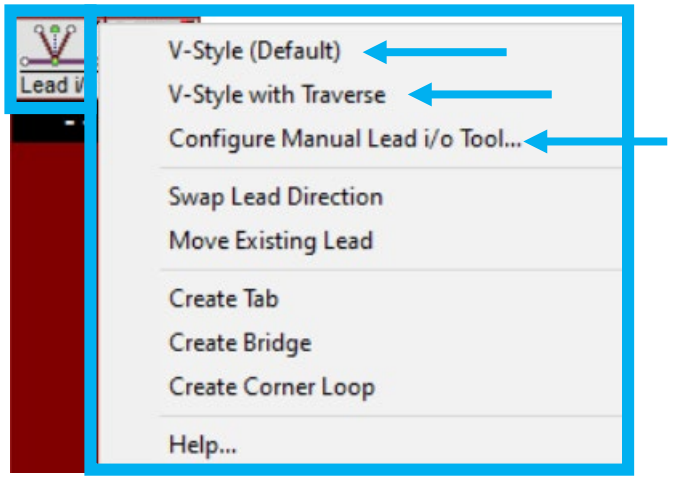
- To avoid a potential collision with the slug:
  - Move the lead in/out to the opposite side of the circle
  - Change the traverse line to a heads-up traverse
  - Move the lead in/out on the box to the lower left or the top right of the box



Step 4: Add the Nozzle Path to the Drawing

Manual Lead i/o tools

- The nozzle travel path can be added by drawing lines manually and assigning the applicable machining qualities
- Components can be added manually using the **V-style** tools
- These manual tools can be configured using the **Configure Manual Lead i/o Tool**



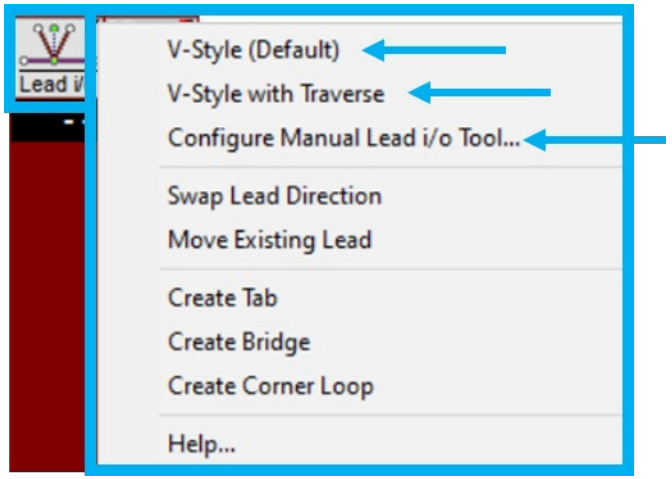
help *Keyword "lead i/o"*

Step 4: Add the Nozzle Path to the Drawing

Manual Lead i/o tools

Exercise

- *Draw a box with 2 circles in it and assign the drawing a machining quality of 3*
- *Add a* ***V-style Lead i/o*** *on internal and external geometry*



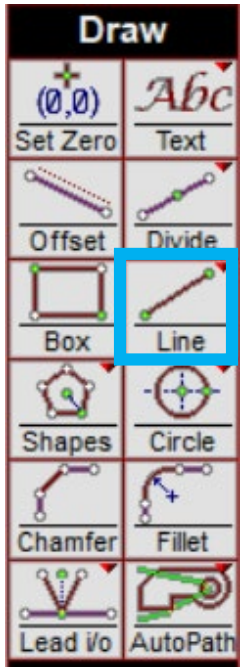
help *Keyword "lead i/o"*

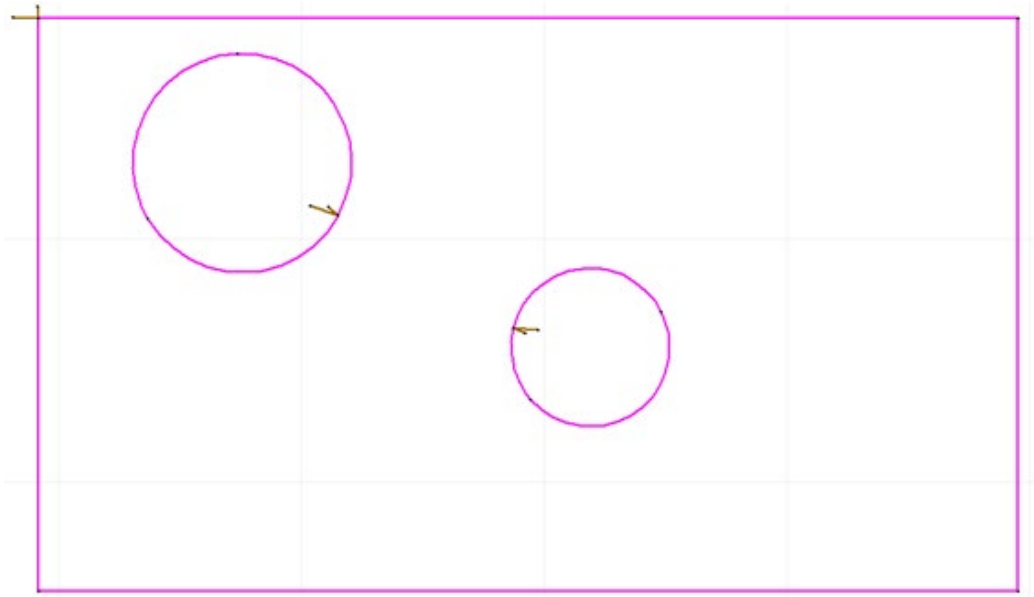
Step 4: Add the Nozzle Path to the Drawing

Manual Lead i/o tools

Exercise

- *Draw traverse lines using the* **Line** *tool*

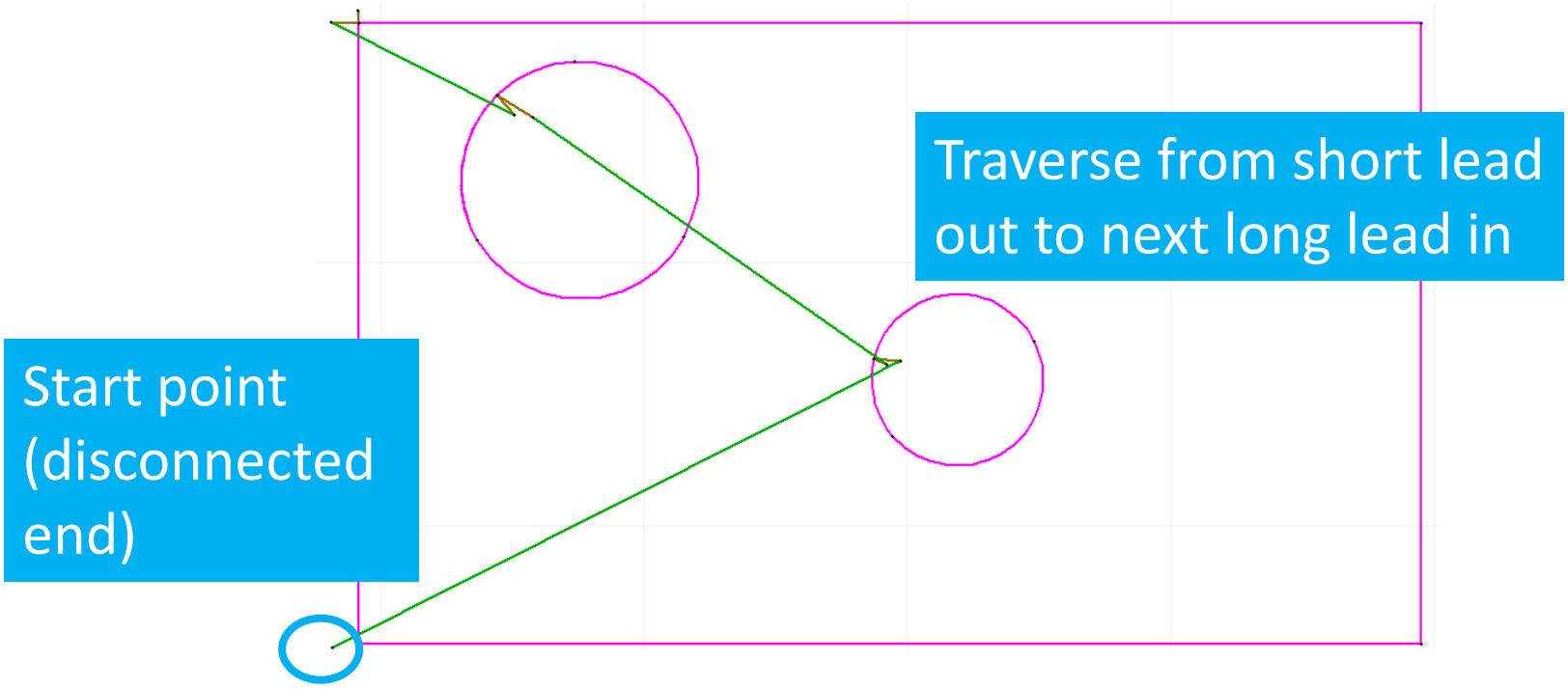




help *Keyword "traverse"*

Step 4: Add the Nozzle Path to the Drawing

Manual Lead i/o tools

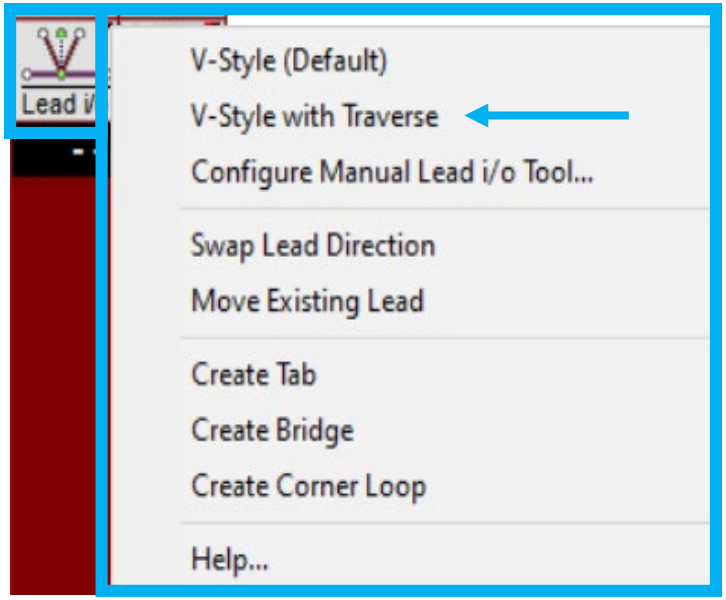


Step 4: Add the Nozzle Path to the Drawing

Manual Lead i/o tools

Exercise

- *Erase leads and traverses in the previous drawing using the* **Erase Leads & Traverses** *command*
- *Add leads and traverses using the* **V-Style with Traverse** *command*



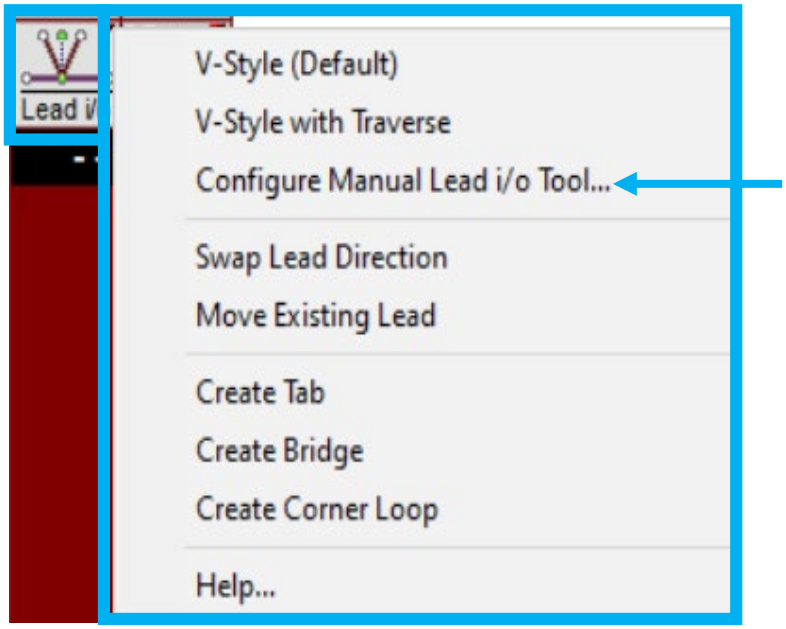
help *Keyword "lead i/o"*

Step 4: Add the Nozzle Path to the Drawing

Manual Lead i/o tools

Exercise

- *Use the* **Configure Manual Lead i/o Tool** *command*

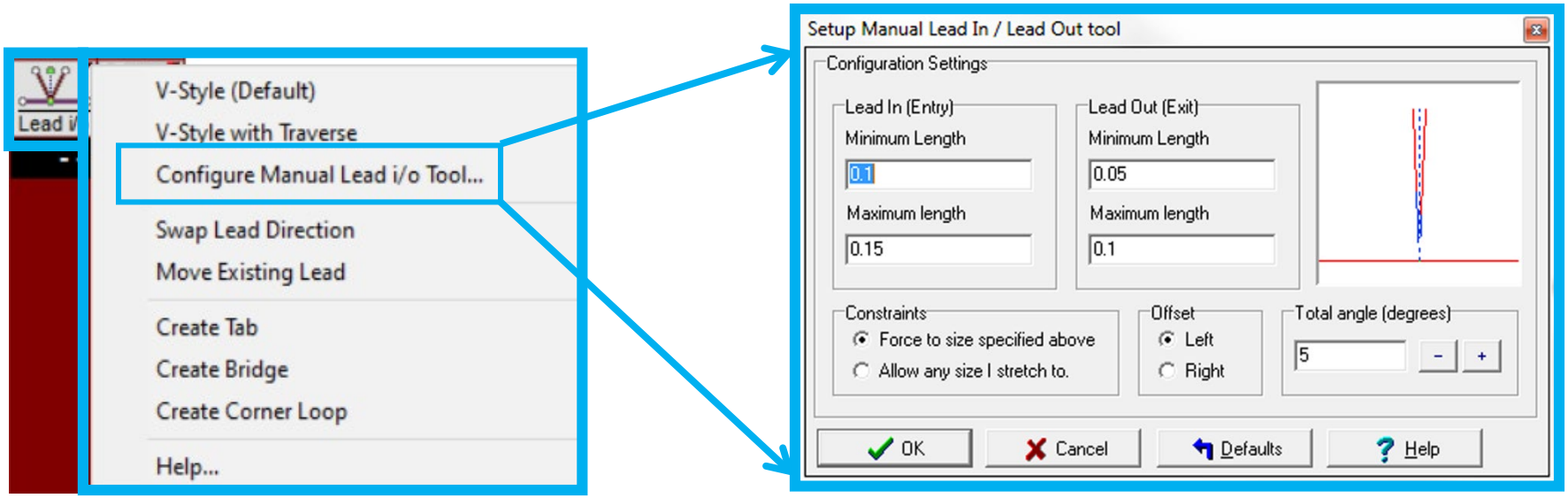


Step 4: Add the Nozzle Path to the Drawing

Manual Lead i/o tools

Exercise

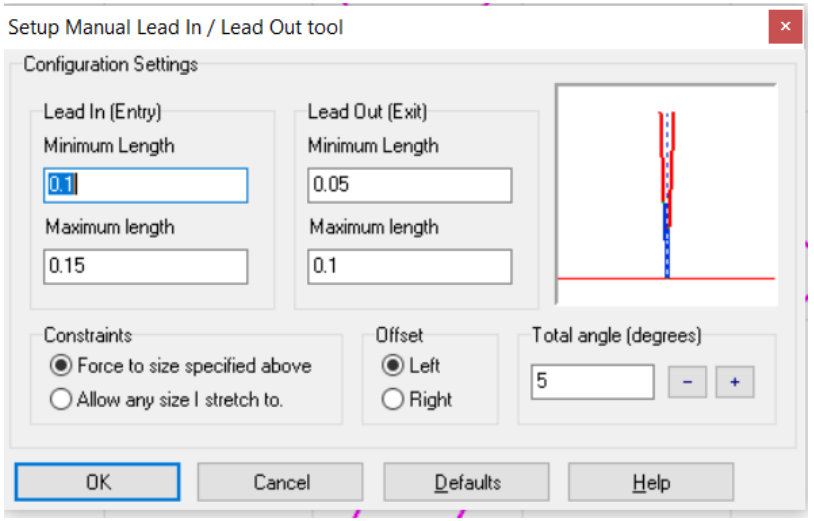
- Click **Configure Manual Lead i/o Tool**



Step 4: Add the Nozzle Path to the Drawing

Configure Manual Lead i/o tool

- Lead in/out lengths
- Stretch or constrain
- Offset (defaults to the left)
- Angle of the Lead in/out



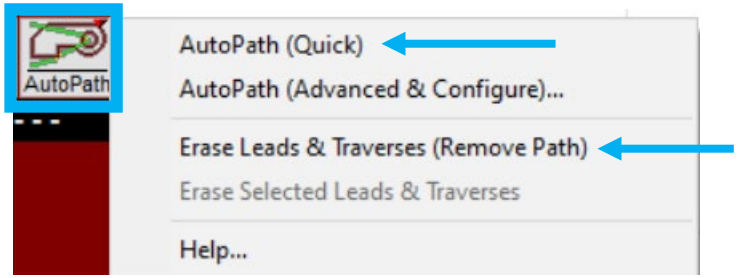
Best practice – leave at default settings

Step 4: Add the Nozzle Path to the Drawing

Automated Lead i/o tools

Exercise

- *Erase leads and traverses in the previous drawing using the* **Erase Leads & Traverses** *command*
- *Add leads and traverses using* **AutoPath (Quick)**



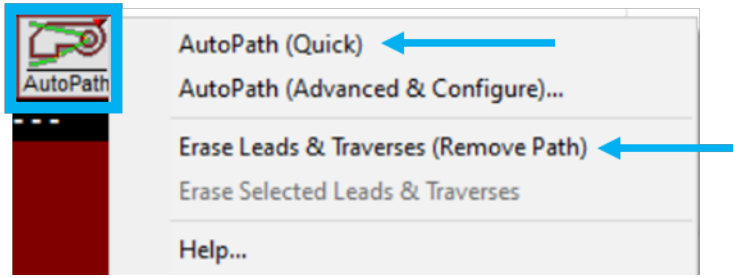
help *Keyword "autopath"*

Step 4: Add the Nozzle Path to the Drawing

Automated Lead i/o tools

Exercise

- *Erase leads and traverses in the previous drawing using **the* Erase Leads & Traverses** *command*
- *Add leads and traverses using* **AutoPath (Advanced & Configure)**
- *Show different settings and methods available*

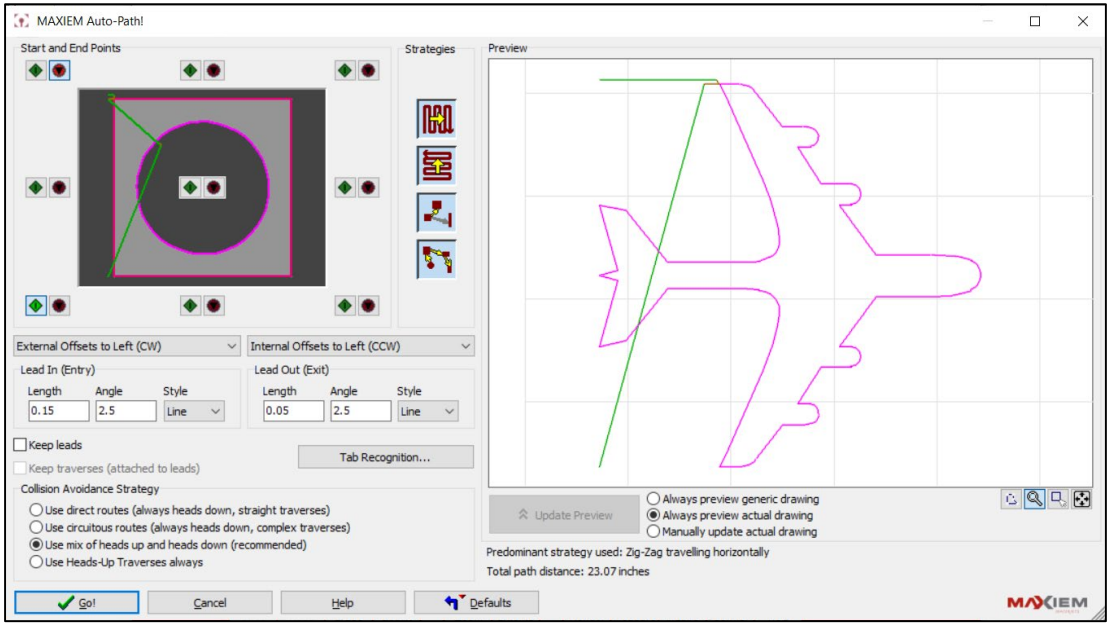


Step 4: Add the Nozzle Path to the Drawing

Automated Lead i/o tools

AutoPath Advanced & Configure

- Lead Settings, Path Direction Settings, and other



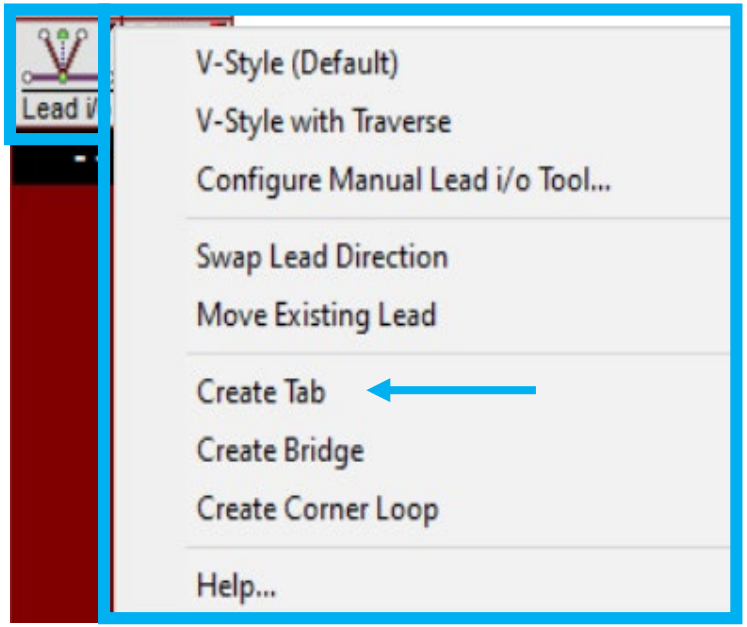
help *Keyword "autopath"*

Step 4: Add the Nozzle Path to the Drawing

Create Tab

Exercise

- *Add a tab to the existing drawing using the* **Create Tab** *command*
- *Access* **Tab Help**

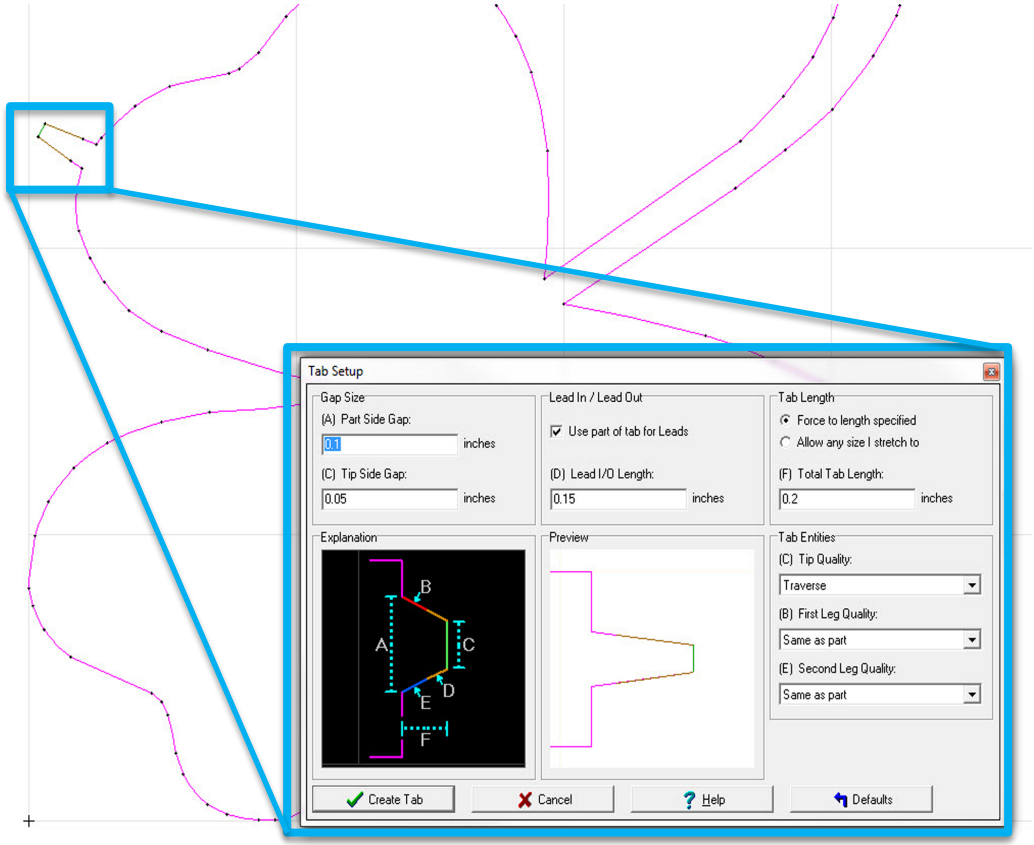


help *Keyword "tab"*

Step 4: Add the Nozzle Path to the Drawing

Tab Setup

- Gap Size
- Lead In / Lead Out
- Tab Length
- Tab Entities



Step 4: Add the Nozzle Path to the Drawing

Exercise

- *Step 1: Create a new drawing from scratch using **LAYOUT** (create the DXF file)*
- *Step 2: Assign machining qualities to the entities in the drawing*
- *Step 3:* **Clean** *and* **Save** *the drawing*
- *Step 4: Add path elements using the automatic pathing tools*

Step 4: Add the Nozzle Path to the Drawing

Review

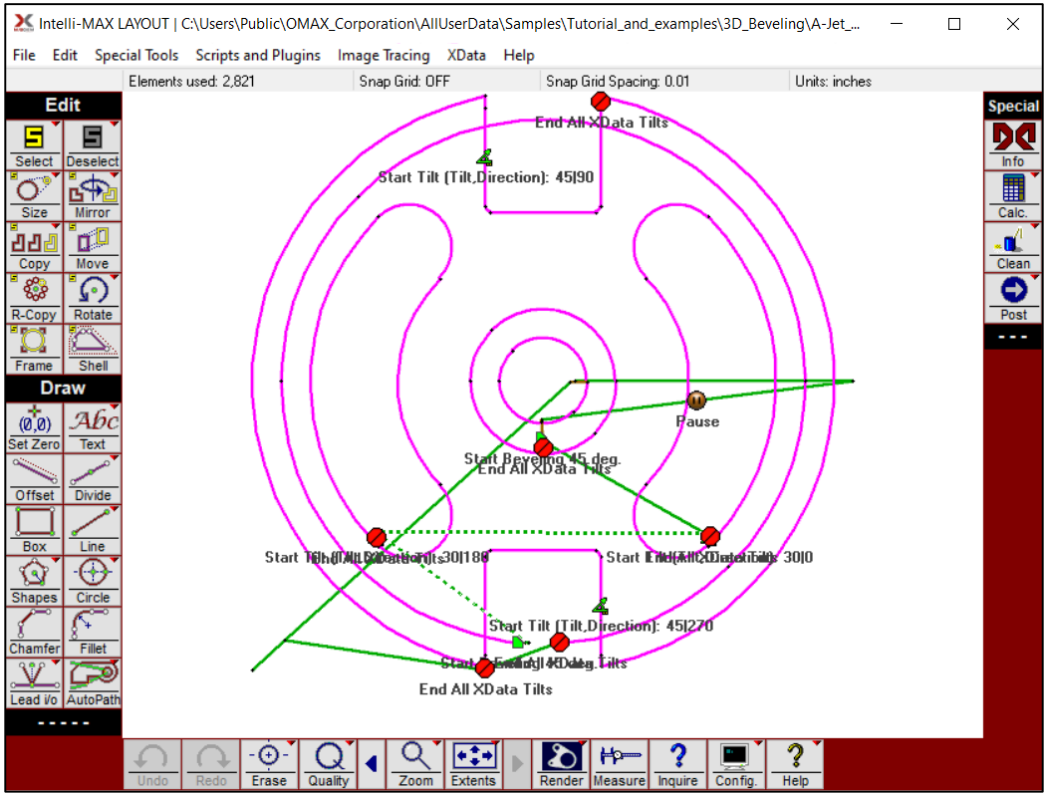
1. Which of the following items are considered part of the nozzle travel path?
   a. Traverses
   b. Lead ins and Lead outs
   c. Part geometry
   d. All of the above
2. Which **LAYOUT** tool do we use to add our V-style lead ins and lead outs?
   a. Line
   b. V
   c. Tab
   d. Lead i/o

Step 4: Add the Nozzle Path to the Drawing

3. On internal geometry, we want to pierce and cut on which side of the geometry?
   a. Inside
   b. Outside
   c. It depends on the part
4. What is one lead in/out tool that lets you easily fix a path that is traveling in the wrong direction?
   a. V-Style or V-Style with Traverse
   b. AutoPath Quick
   c. AutoPath Advanced & Configure
   d. Swap Lead Direction

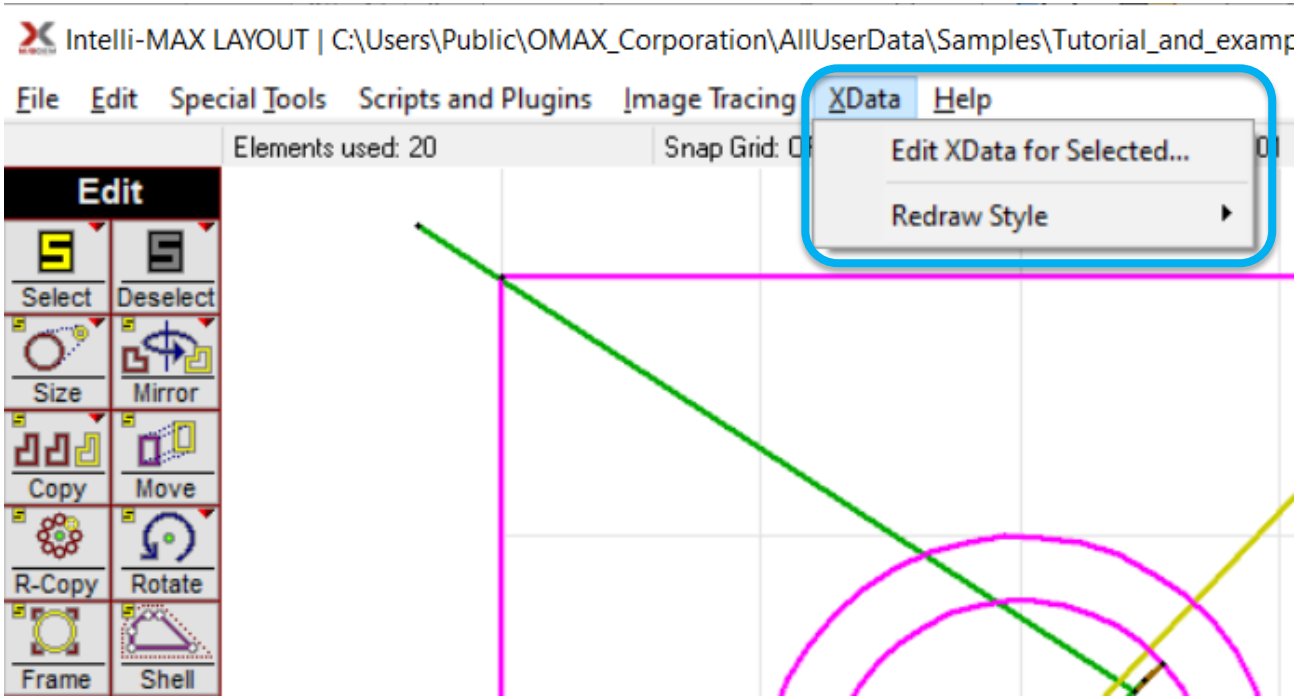
Step 4: Add XData to the Path

- XData is e**X**tra Data that can be assigned to entities in **LAYOUT** to command specific actions in the tool path



Step 4: Add XData to the Path

- The **XData** menu is on the main menu

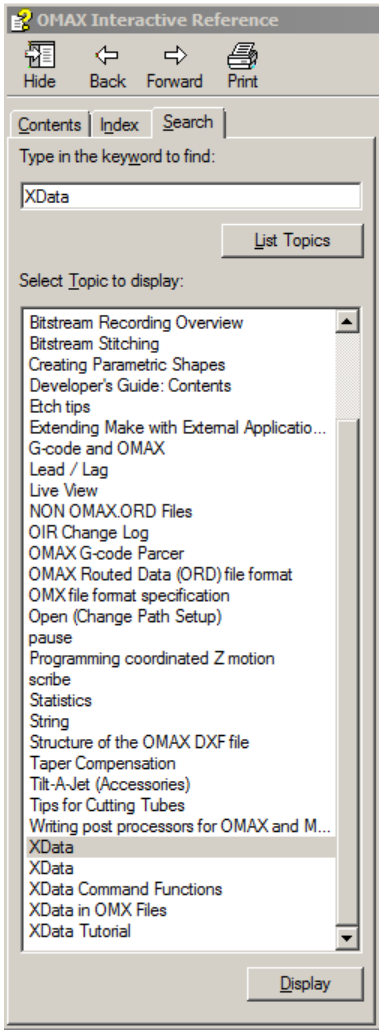


Step 4: Add XData to the Path

- Examples of how XData is used
  - Add pause points
  - Add a comment to an entity
  - Specify a different cut speed for an entity/entities
  - Specify nozzle tilt
  - and more…

Step 4: Add XData to the Path

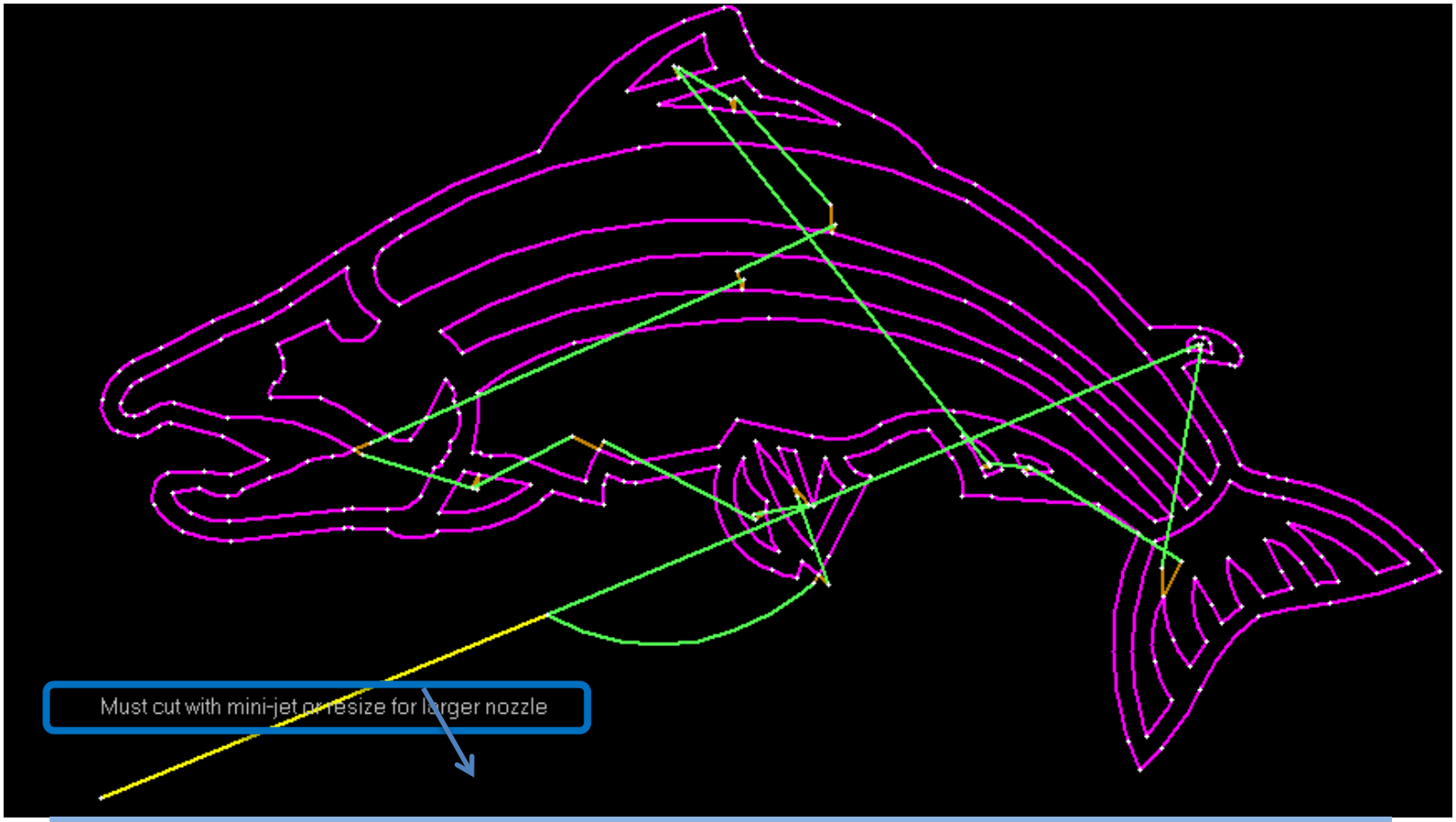
- Prerequisites for using XData
  - Understand how the XData command is designed to work prior to using it
    - Consult Help files
    - Review XData Overview video in the eLearning Portal



Step 4: Common XData Commands

- [002] – Comment on Entity
  - Allows a comment to display on entities in the **LAYOUT** drawing or tool path

Step 4: XData – Comment on Entity Example



"Must cut with mini-jet or size for larger nozzle"

Step 4: XData Z-Axis Commands

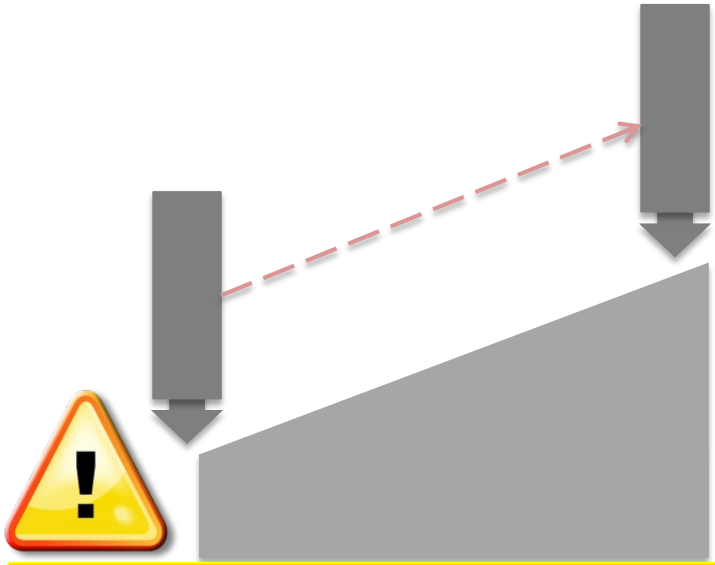
- [019] – Move Z Command
  - Moves the Z-Axis vertically (no horiz movement)
    - Positive (+) number moves Z up
    - Negative (-) number moves Z down

See the Help file for warnings related to using this command

Step 4: Z-Axis Movement Comparison

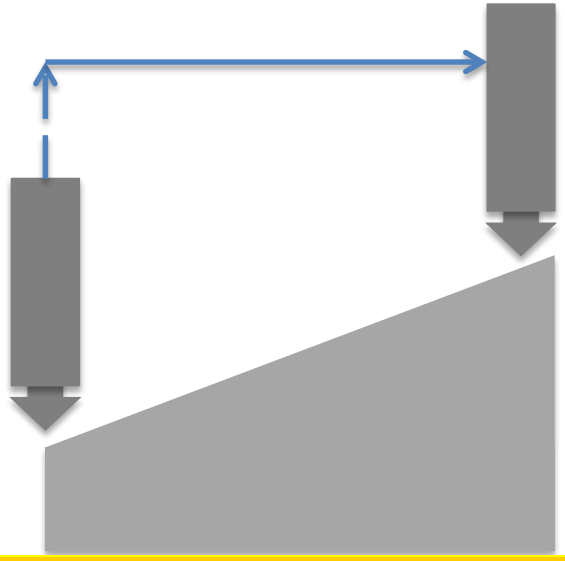
Z movement if programmed with the 3D Path Editor

Moves X,Y, and Z while cutting (can vector)



Z movement if programmed with XData

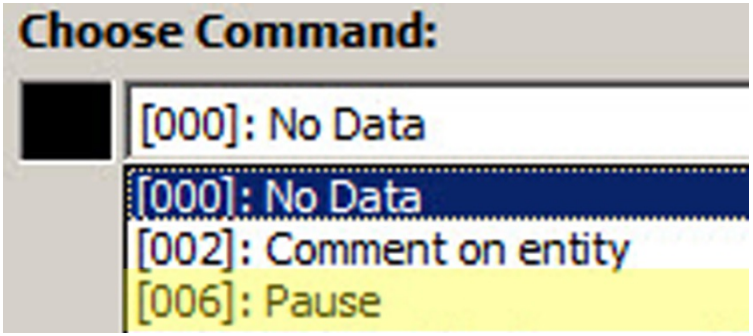
Moves Z up or down only. Relays stay active.



See the Help file for warnings related to using this command

Step 4: XData Speed and Pause Commands

- [006] – Pause Command



  - The pause will occur at the exact location specified (the starting point of the entity with Pause assigned)
  - Operator must press **Continue** for the machine to continue on the path

See the Help file for warnings related to using this command

XData Command

- [000] – No Data
  - No XData is assigned
    - Used to remove XData from an entity - simply set its XData to be “No Data”

Step 4: Best Practices When Using XData

- Avoid auto pathing when working with XData
- You cannot assign more than one XData item on a given entity
- You must select an entity or entities before you can assign XData
- All files with XData must be saved as OMX files when they are converted to machine tool files

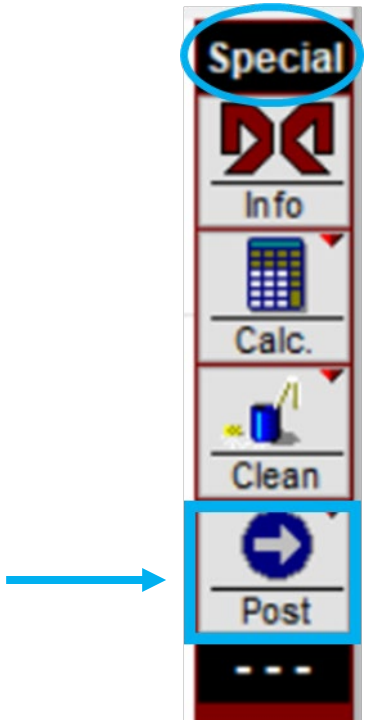
Steps in Making Parts

- Intelli-MAX **LAYOUT**
  - **Step 1:** Obtain/create a Drawing File (DXF file).
  - **Step 2:** Assign machining Qualities (edge finish).
  - **Step 3:** Clean and save the drawing.
  - **Step 4:** Add Path Elements to the drawing and save it.
  - **Step 5:** Create the Machine Tool Path file (ORD/OMX file).
- Intelli-MAX **MAKE**
  - **Step 6:** Start up the machine.
  - **Step 7:** Configure Machine Settings.
  - **Step 8:** Open and configure the ORD/OMX file.
  - **Step 9:** Load and clamp the material.
  - **Step 10:** Begin machining and cut the part.

Step 5: Create the Machine Tool Path File

Steps to Create the Machine File (ORD/OMX)

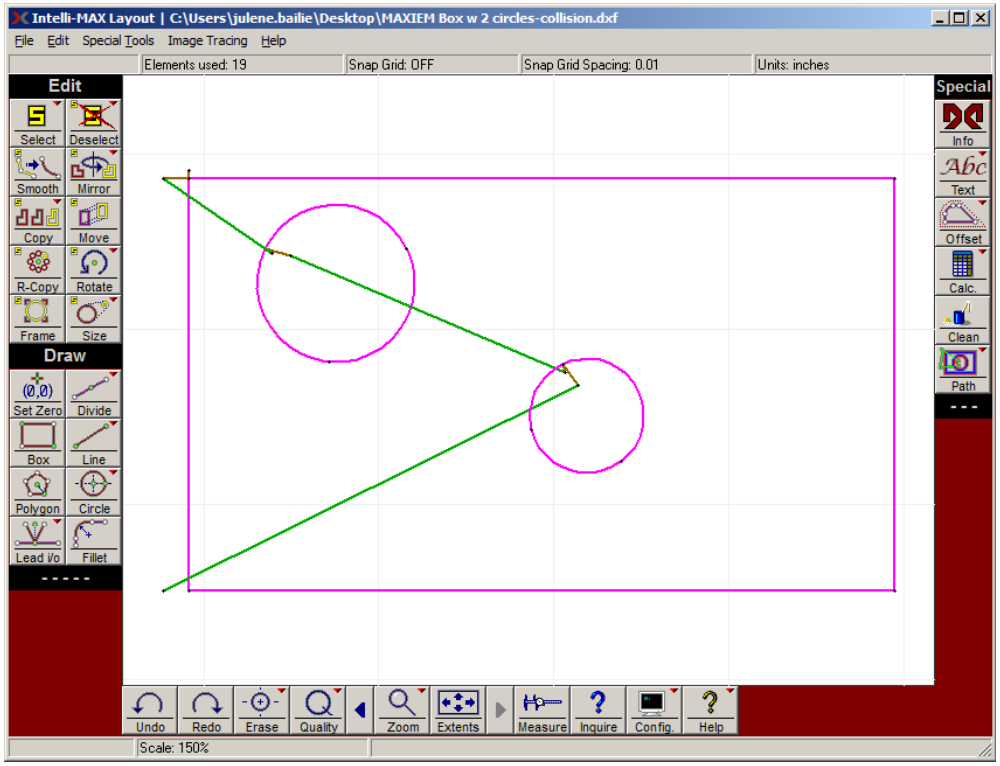
- Open a saved DXF drawing file
- Run the **Post** tool
  - Perform quality checks
- **Save** as an ORD or an OMX file



help *Keywords "clean, Post"*

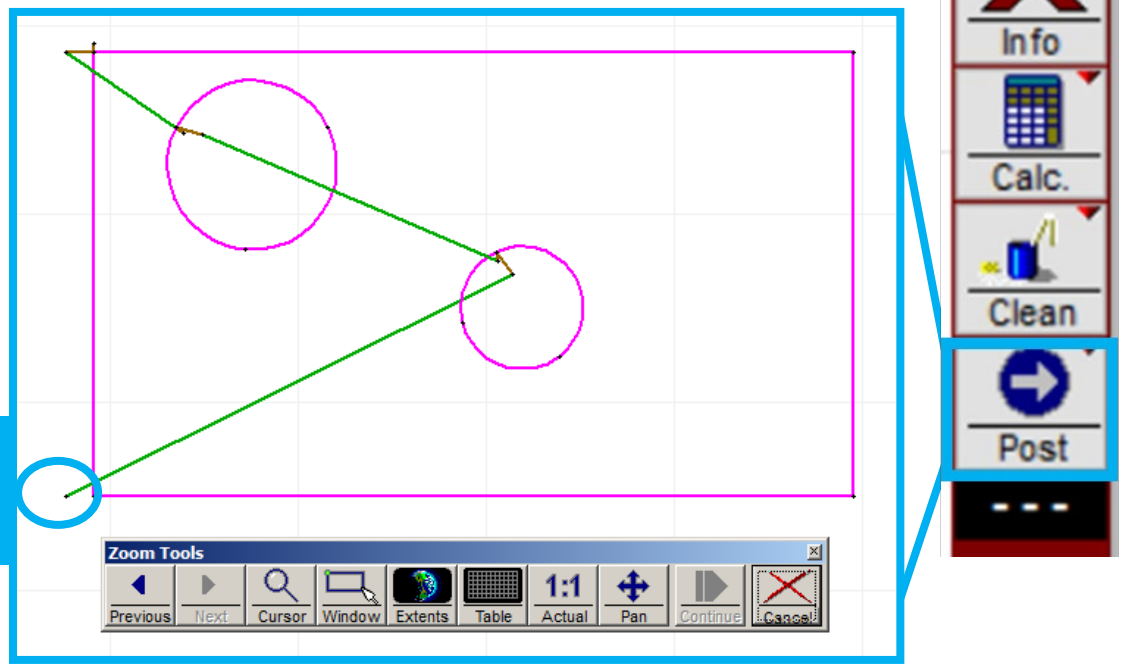
Creating the Machine File (ORD/OMX)

- Task 1: Open a saved DXF drawing file



Creating the Machine File (ORD/OMX)

- Task 2: Click the **Post** tool
  - **Zoom Tools** opens
  - Select start point



Creating the Machine File (ORD/OMX)

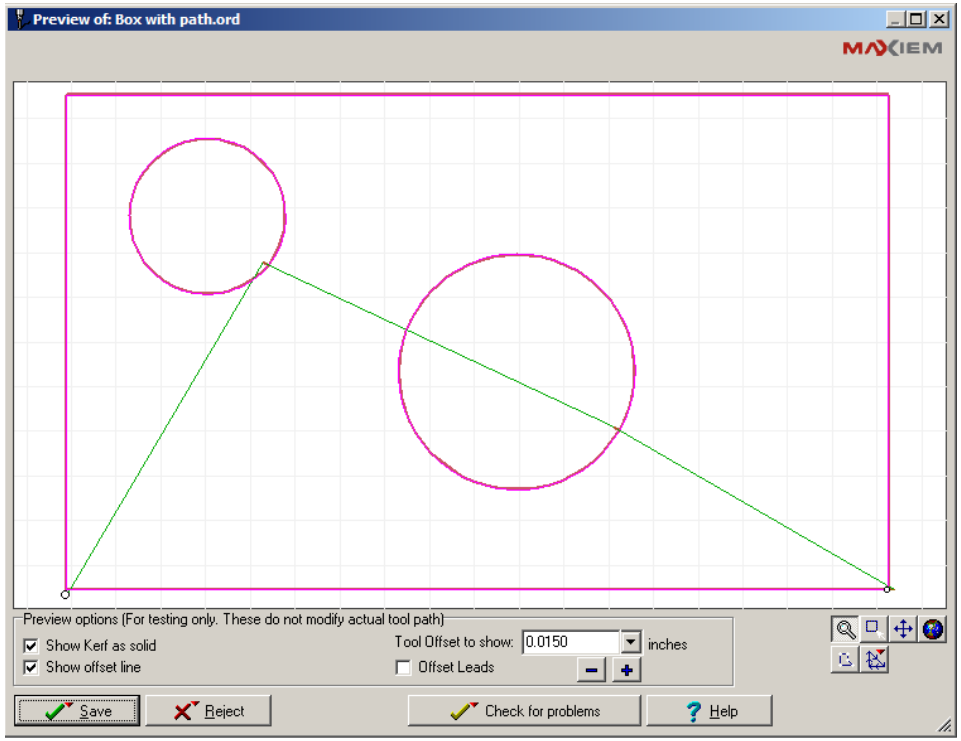
Exercise

- *Click to open the **Post** tool in the test box.dxf drawing (click for default tool)*
- *Place the **Pick Start** pointer at a path end, and click to display the **Path** preview window*

Creating the Machine File (ORD/OMX)

Path preview window

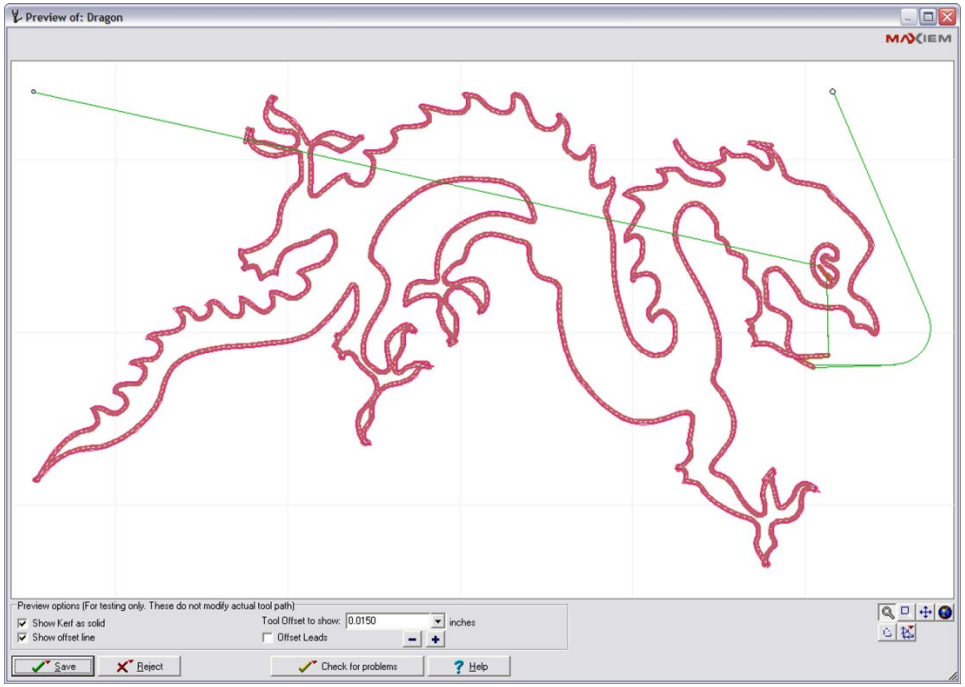
Shows the DXF file in the **Path** preview window



Step 5: Create the Machine Tool Path File

Path Preview Window Quality Checks

- Identify path errors
- Verify tool offset
- Check for collisions

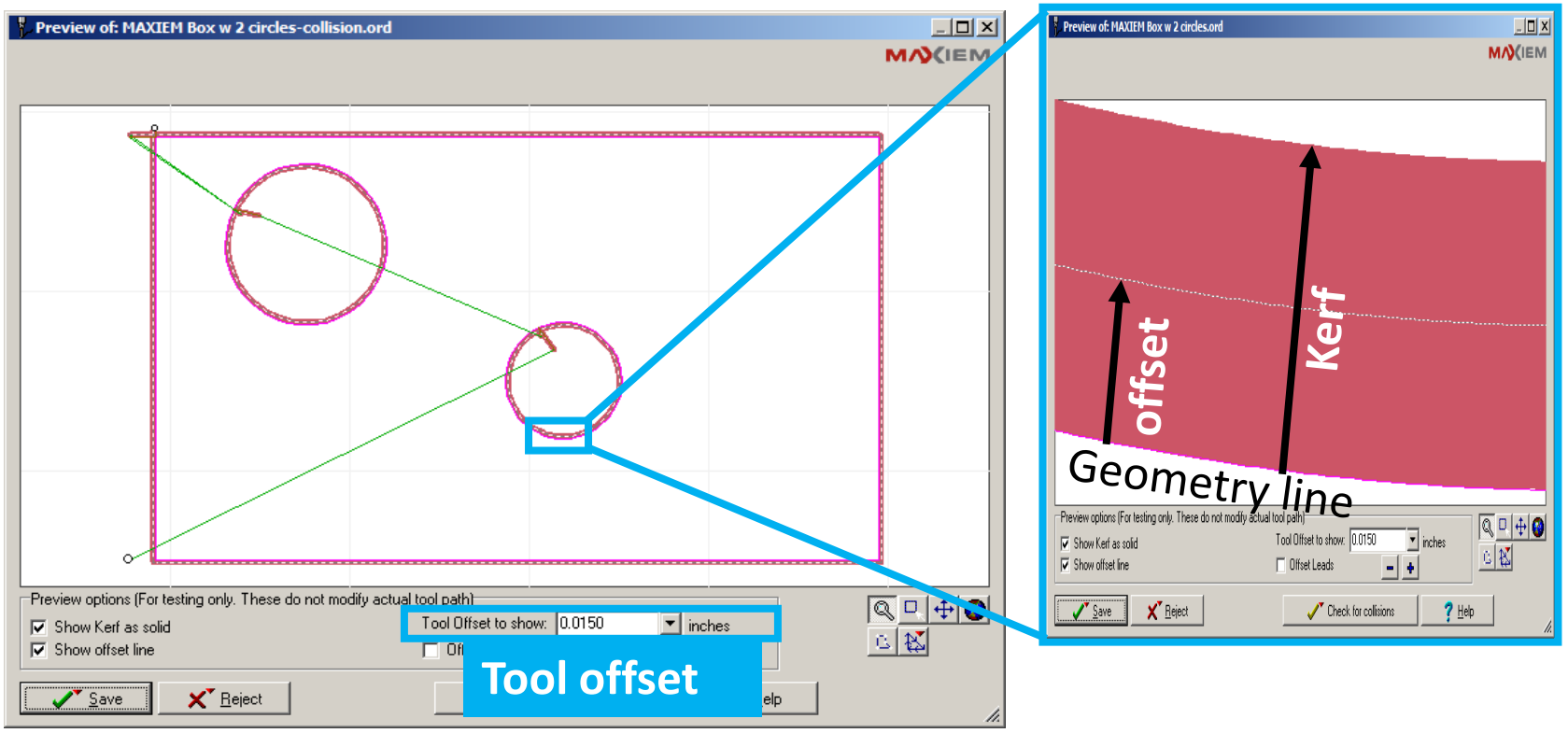


Creating the Machine File (ORD/OMX file)

Exercise

- *Run the **Post** tool*
- *In the Path preview window show and discuss each of the following quality checks:*
  - *Verify **tool offset** (using arrows, kerf, and tool offset settings)*
  - ***Check for problems***

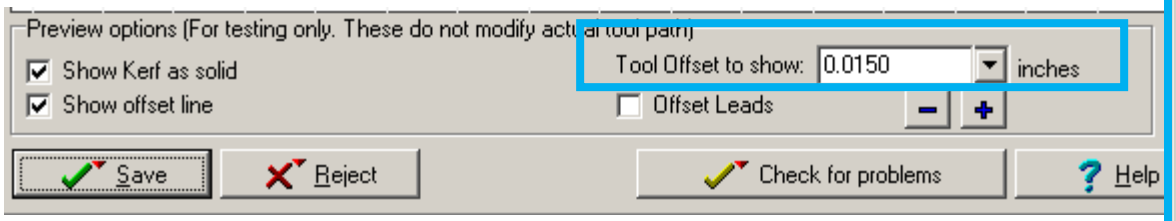
Perform Quality Checks in Path Preview

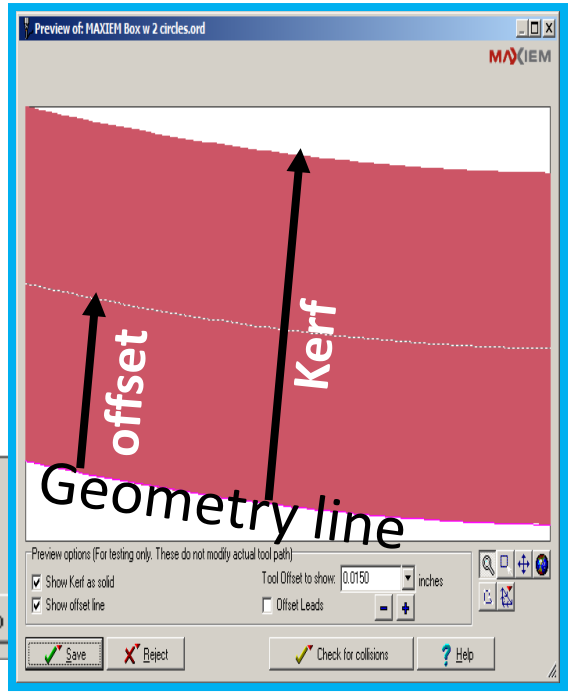


Perform Quality Checks in Path Preview

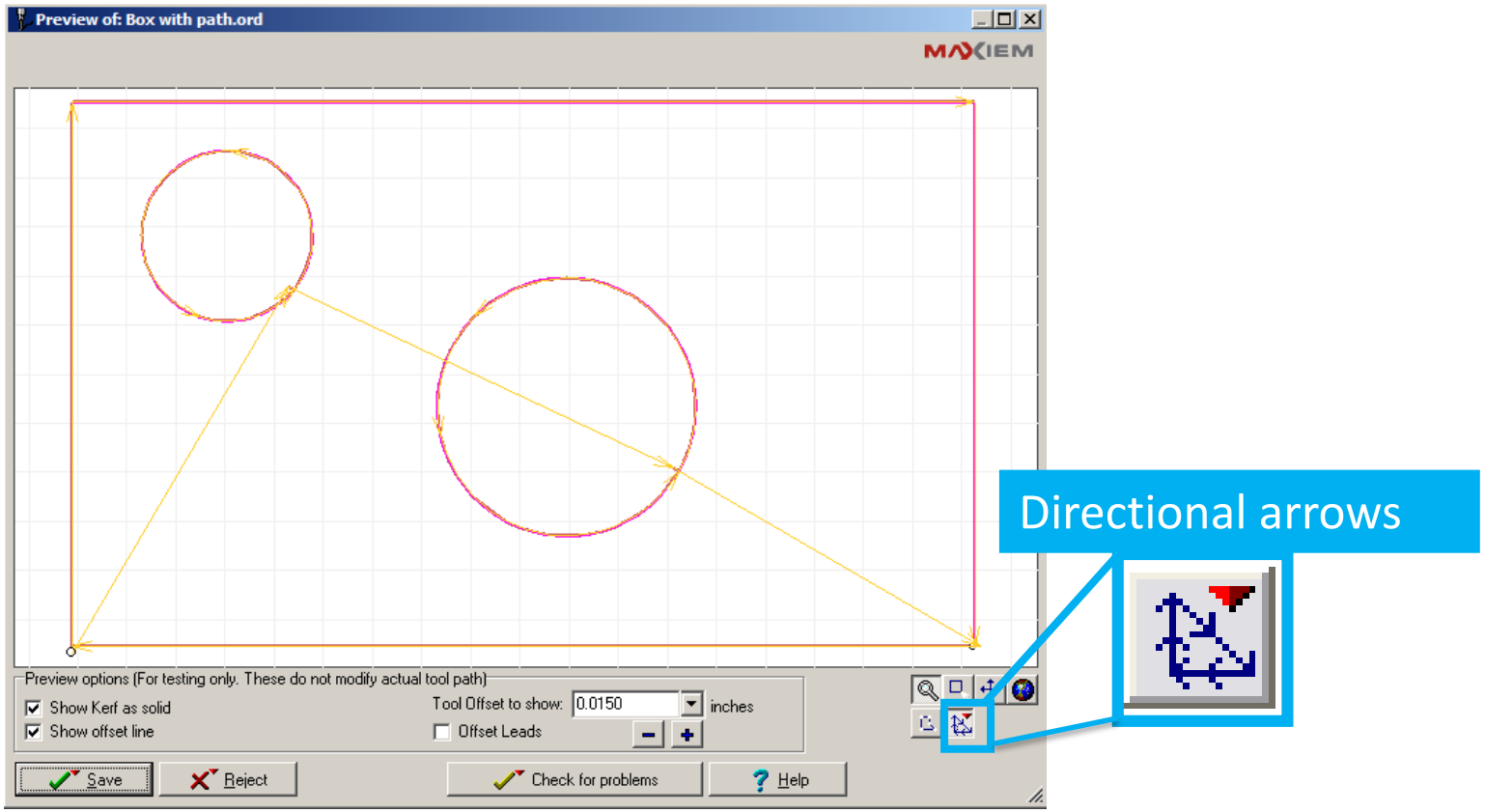
Exercise

*Run the **Post** tool and check the **Tool Offset***





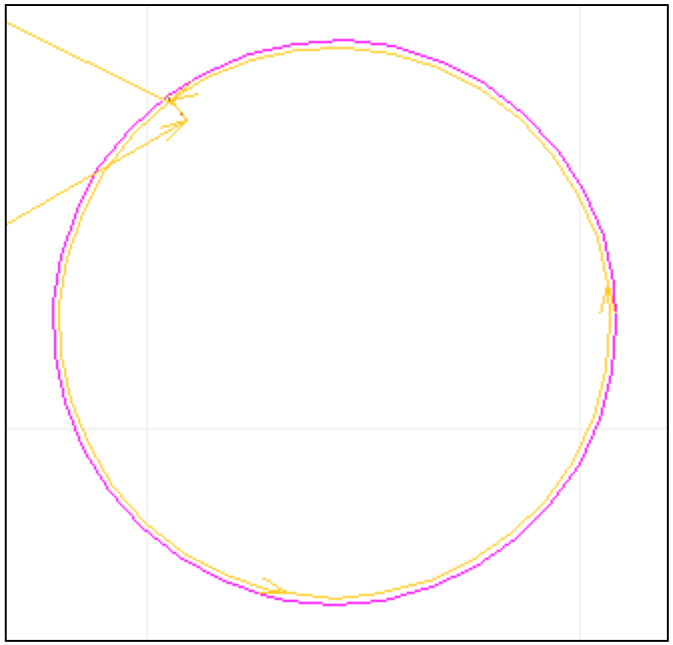
Perform Quality Checks in Path Preview



Perform Quality Checks in Path Preview

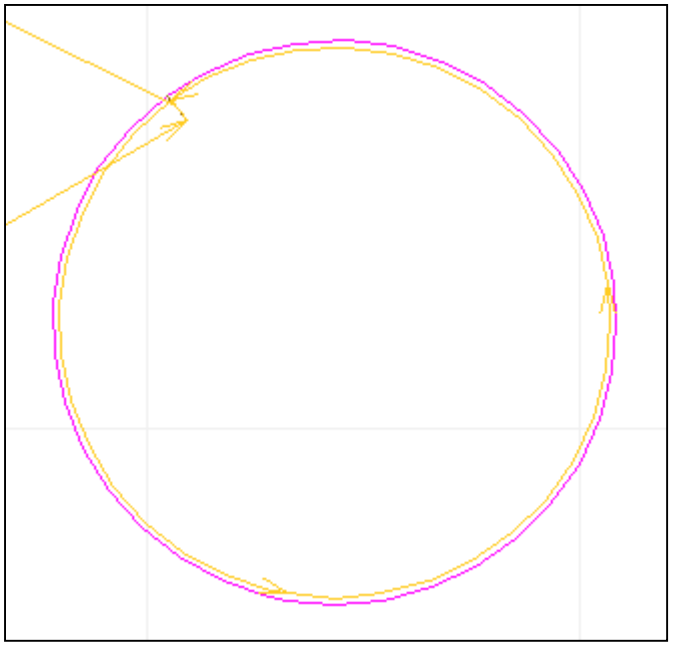
Q: Which direction should the nozzle travel when cutting internal geometry?

a. Clockwise
b. Counterclockwise



Perform Quality Checks in Path Preview

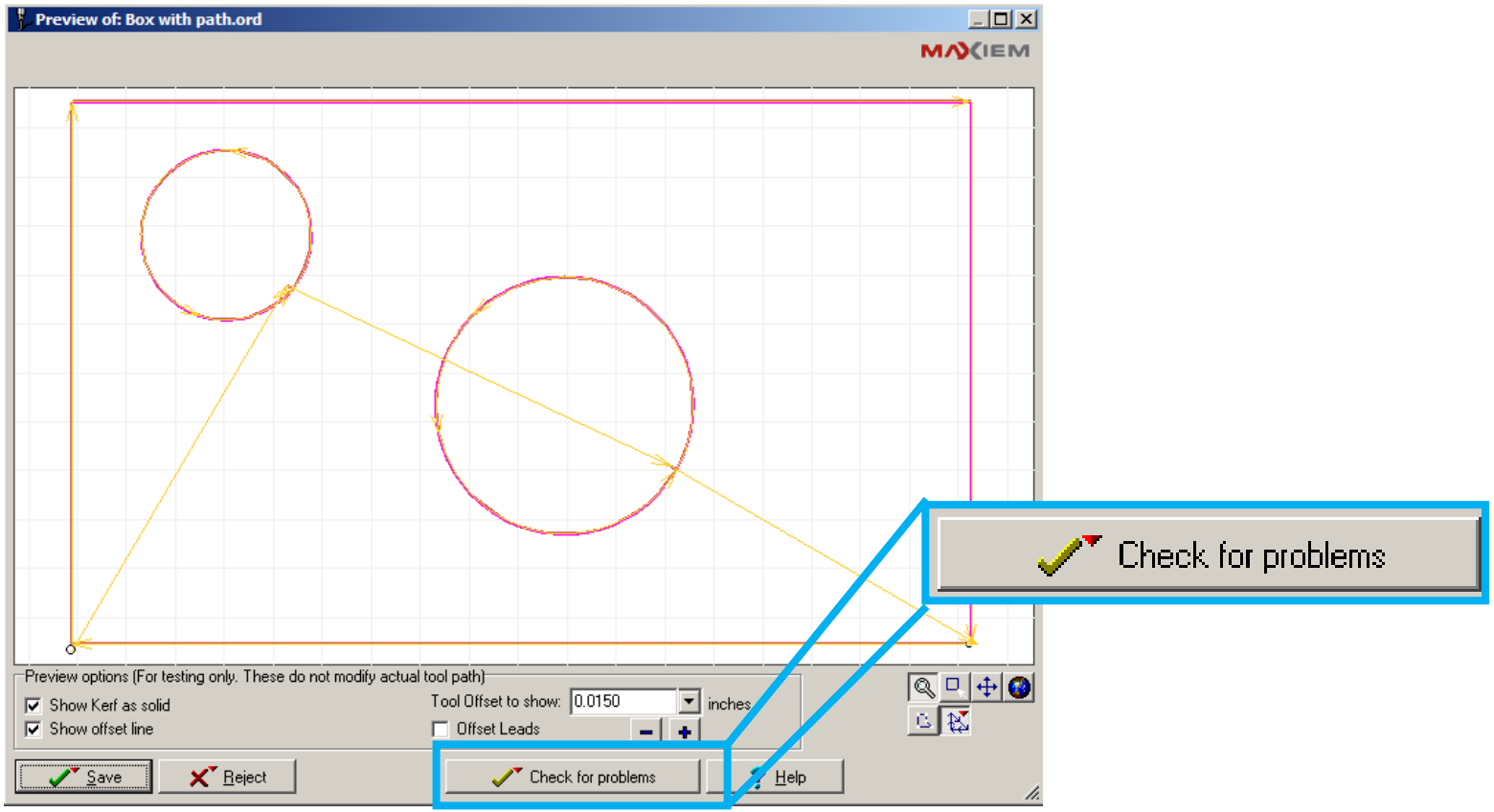
A: The nozzle should travel in the
b. *counterclockwise* direction
to cut internal geometry on the
inside



Exercise

- *Run the **Post** tool*
- *Run the **Arrow** tool*
- *Discuss the benefits of this tool*

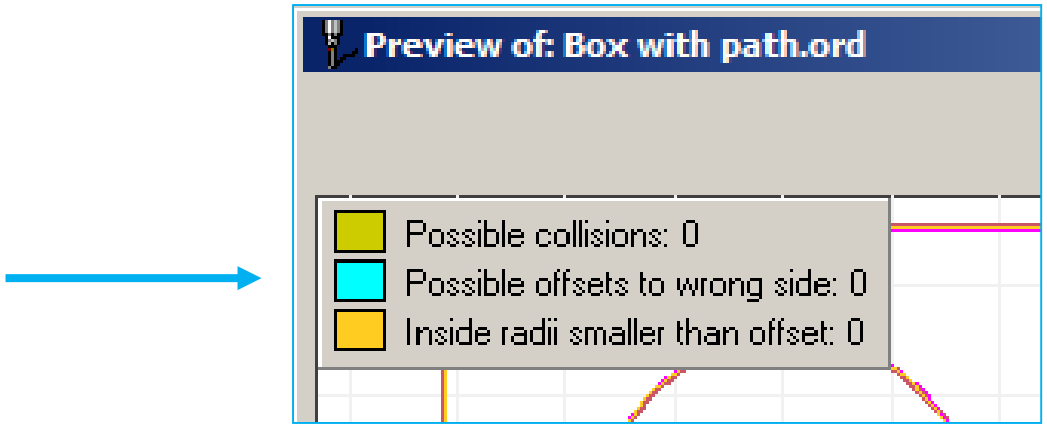
Perform Quality Checks in Path Preview



Step 5: Create the Machine Tool Path File

Demonstration

- *Run the **Post** tool on a known good part (no problems)*
- *Click **Check for problems***

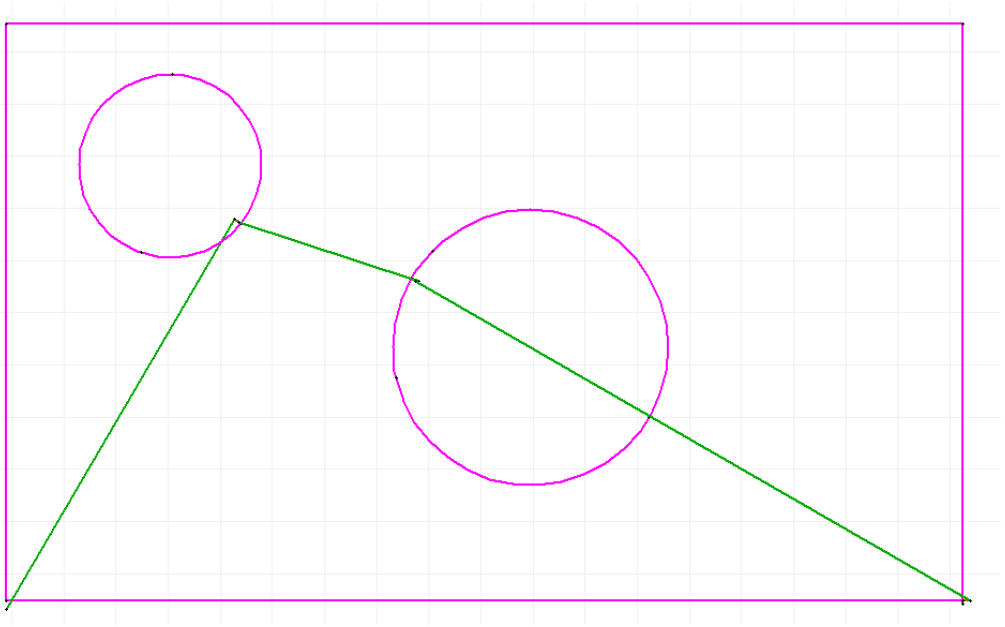


help *Keyword "collision"*

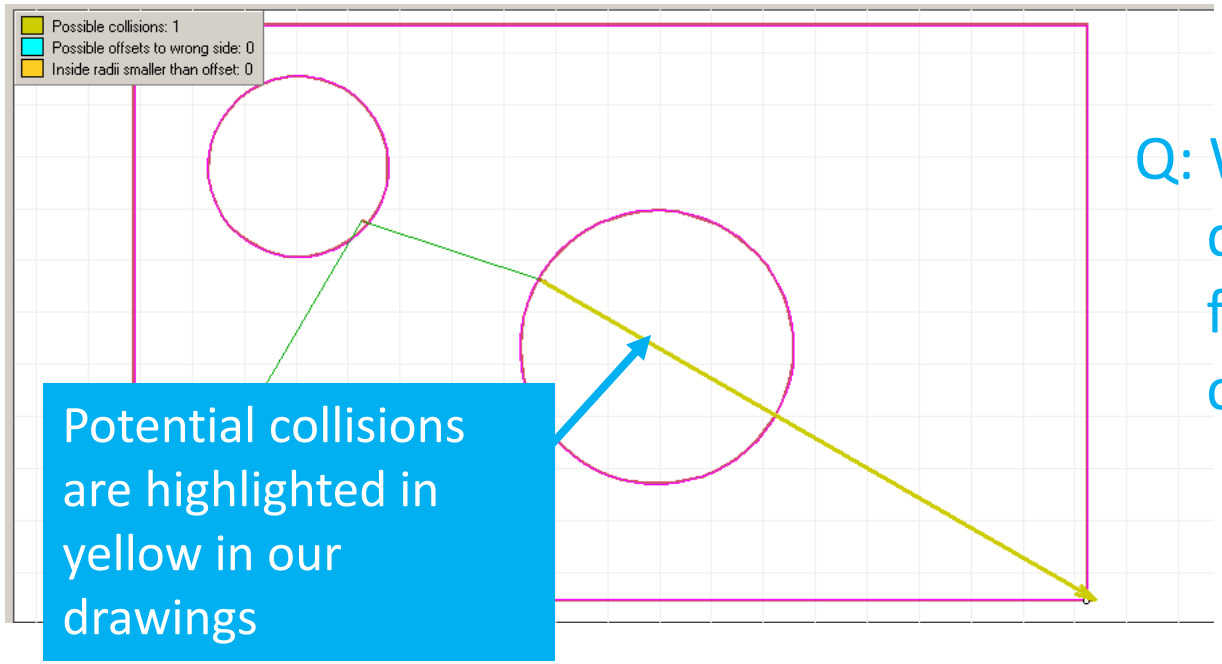
Step 5: Create the Machine Tool Path File

Demonstration

- *Run the **Post** tool on a DXF file that has a potential collision point*
- *Click **Check for problems***

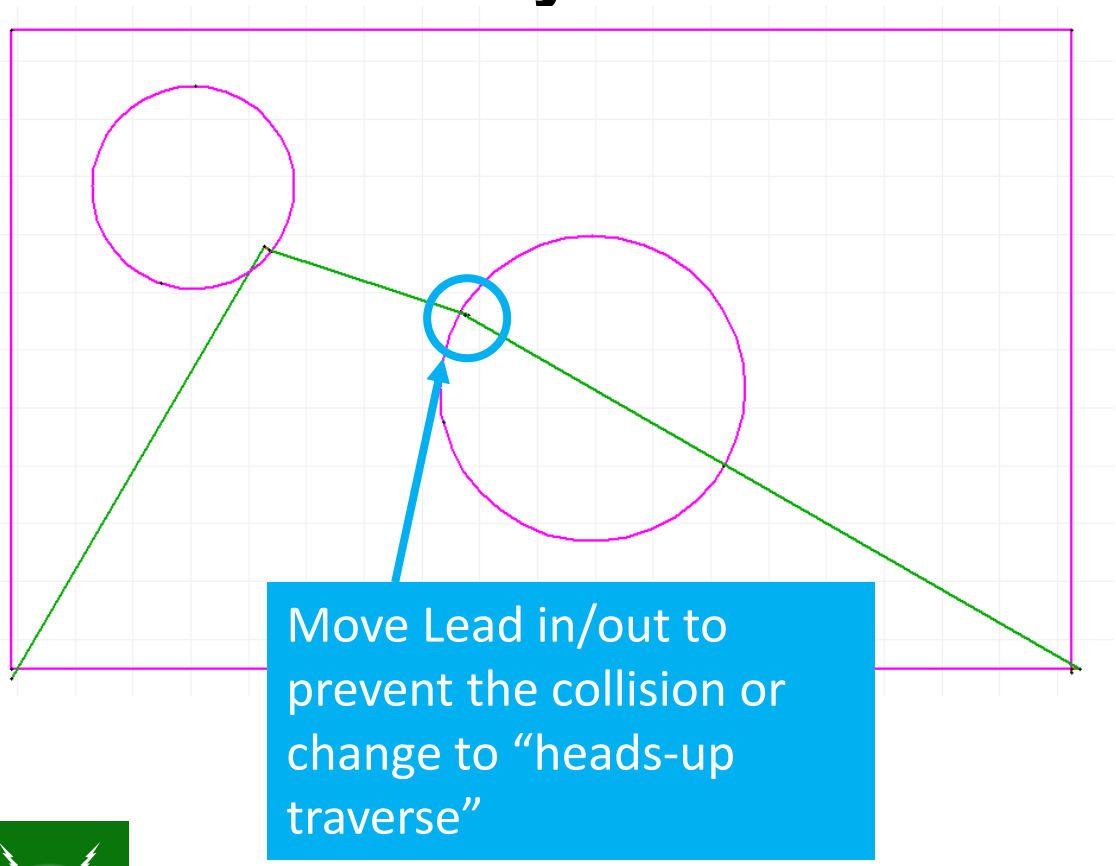


Perform Quality Checks in Preview



Q: What can we do to avoid or fix potential collisions?

Perform Quality Checks in Preview

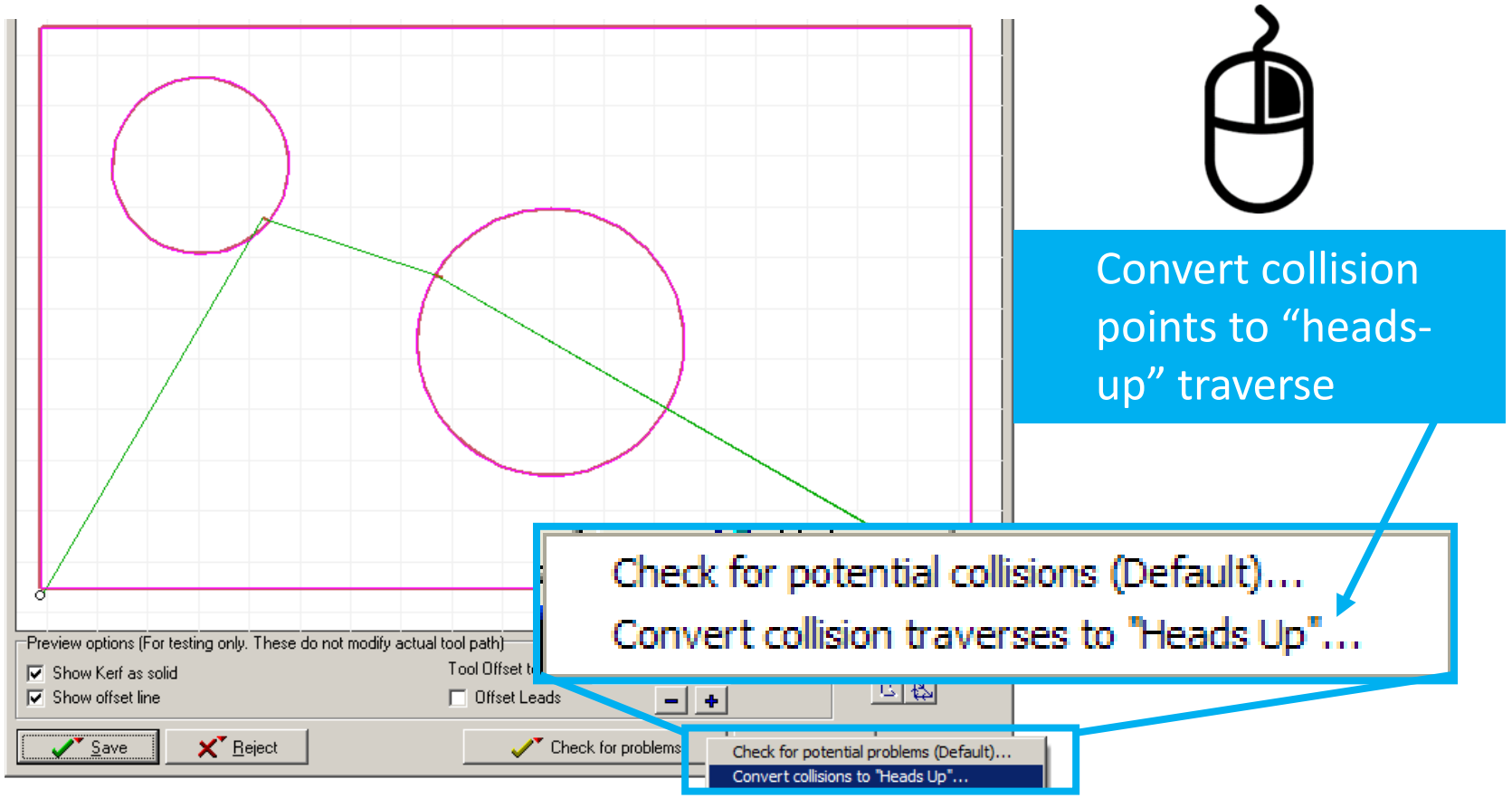


A: To avoid or fix potential collision points you can:

a. Fix the DXF drawing by moving the lead in/out point

b. Change the entity to a “heads-up traverse” quality

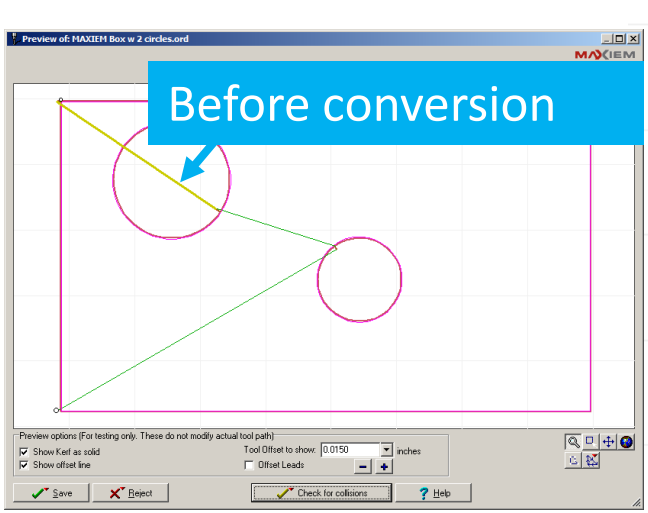
Perform Quality Checks in Preview

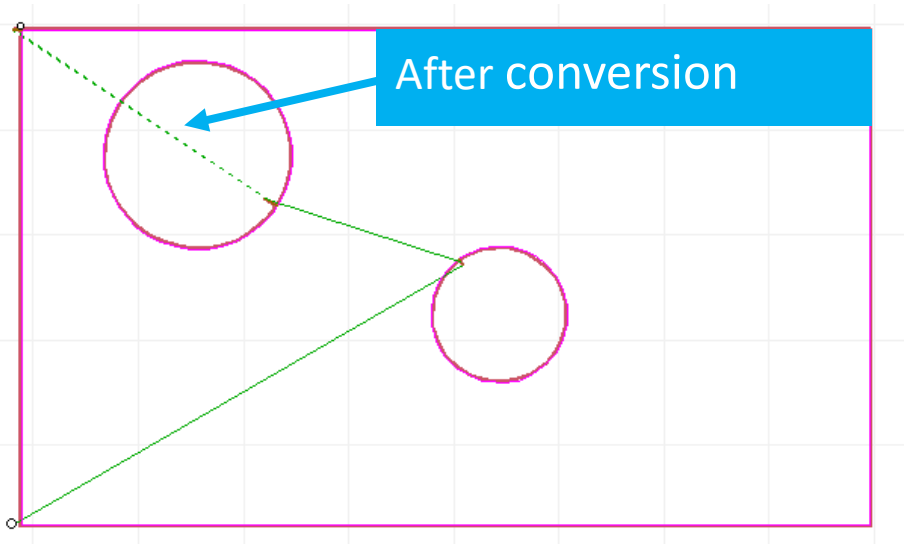


Step 5: Create the Machine Tool Path File

Exercise

- *Run the **Post** tool on a DXF file that has a potential collision point*
- *Click **Check for problems***
- *Convert the potential collision to a "**heads-up traverse**"*





Step 5: Create the Machine Tool Path File

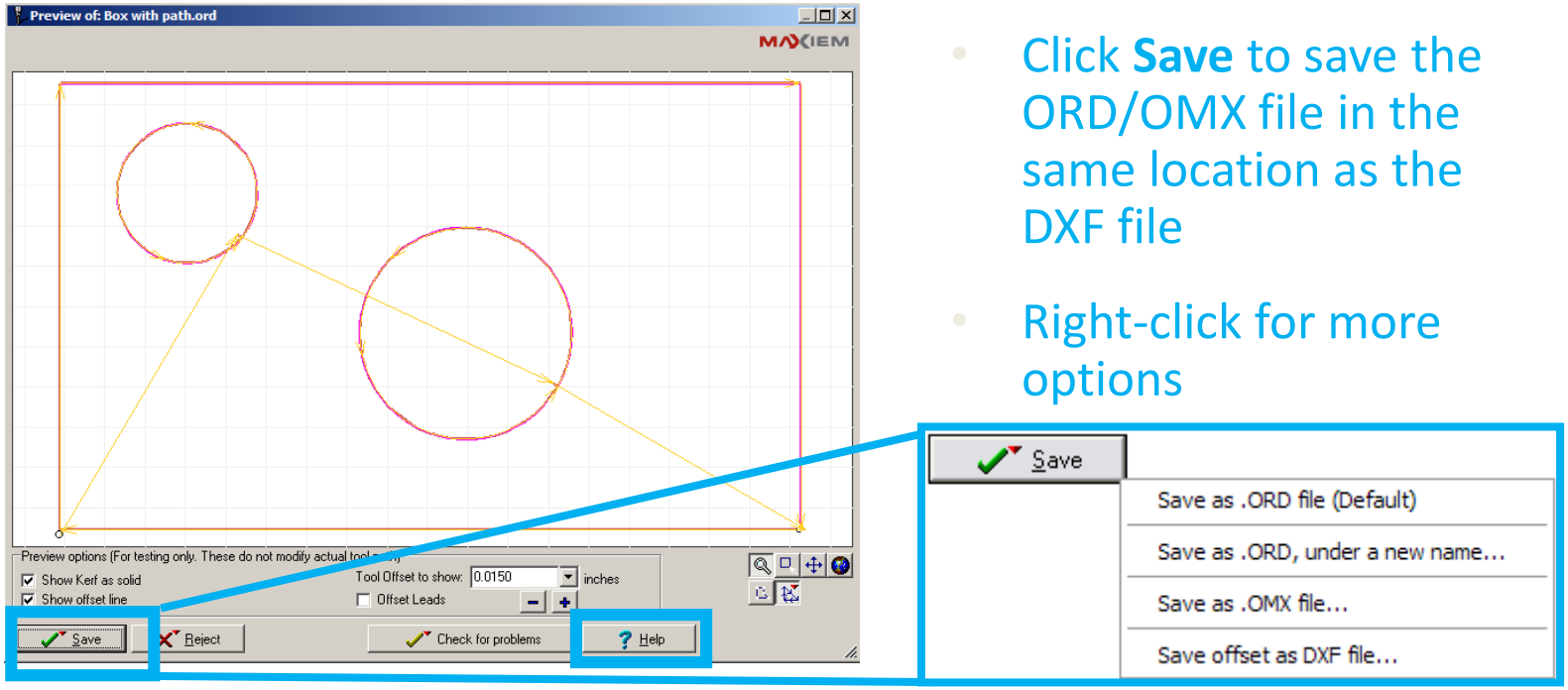
Create the Machine File (ORD/OMX)

- Open a saved DXF drawing file
- Run the **Post** tool
  - Perform quality checks
- **Save** the ORD file or save as an OMX file

help *Keyword "post"*

Create the Machine File (ORD/OMX)

- Save the file from the **Path preview** window



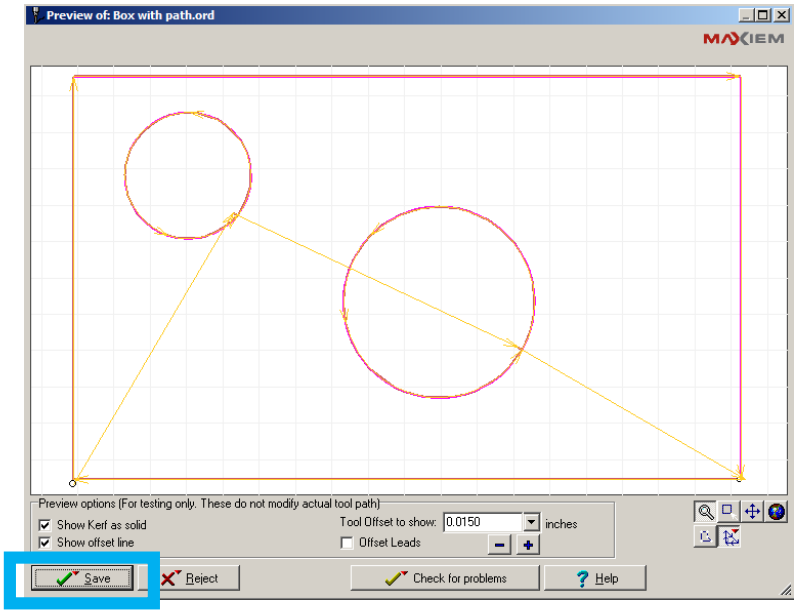
- Click **Save** to save the ORD/OMX file in the same location as the DXF file
- Right-click for more options

help *Keywords "Save, Post"*

Create the Machine File (ORD/OMX)

Exercise

- *Run the **Post** tool*
- *Click **Save** to save the ORD or OMX file in same location as the DXF file*



Create the Machine File ORD or OMX file)

Exercise

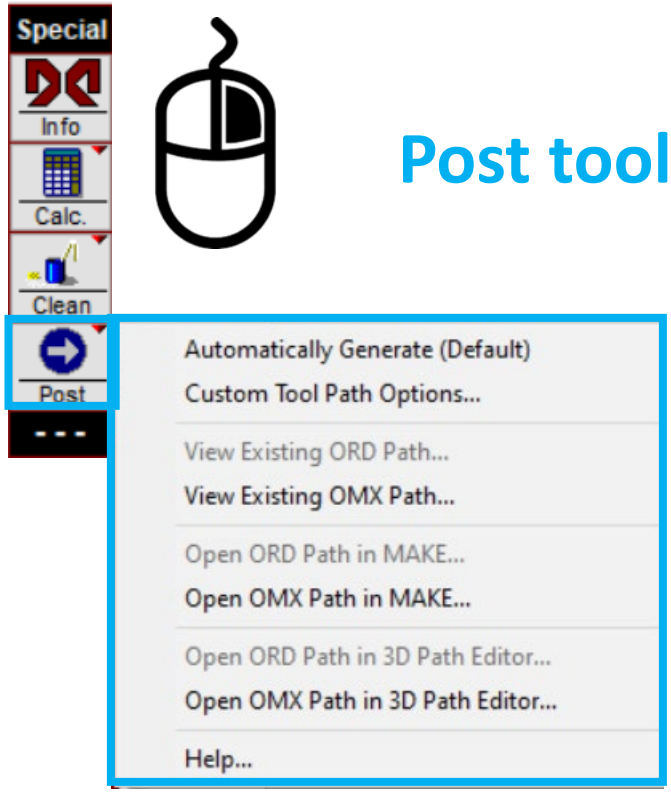
- *Look at the DXF and ORD or OMX file icons you created in the previous steps*

MAXIEM_FileType_DXF

MAXIEM_FileType_ORD

MAXIEM_FileType_OMX.ico

Create the Machine File (ORD or OMX file)



Post tool options

Step 5: Create the Machine Tool Path File

Review Steps 1-5

Exercise

- *Step 1: Create a new drawing from scratch using **LAYOUT** (create a DXF file)*
- *Step 2: Assign machining qualities to the entities in the drawing*
- *Step 3: **Clean** and **Save** the DXF file*
- *Step 4: Add a nozzle path using the automatic pathing tools*
- *Step 5: Run the **Post** tool, check for problems, and save the ORD or OMX file*

Machine Path Review

1. Which special tool performs tasks such as erase duplicate entities and/or close tiny gaps in our drawings?
   a. Lead i/o
   b. Clean
   c. Post
2. Which special tool do we use to convert a DXF drawing file to an ORD or OMX machine file?
   a. Lead i/o
   b. Special
   c. Post
   d. Clean

Machine Path Review

3. Which of the following are quality checks you should perform when previewing your part in the path preview window?
   a. Check the tool offset
   b. Check for problems
   c. All of the above
   d. None of the above
4. What are the three main tasks to do in Step 5 of our process, creating the machine tool path
   1. _____
   2. _____
   3. _____

Additional Features in **LAYOUT**

Other Tools in LAYOUT

- Image Tracing – capability to manually or automatically trace pixilated images
- Text Tools – capability to create text in drawings

Demonstration

- Show how to use the **Text** tool

Activities

1. Create a new DXF file, or use the one you created previously
2. Add Machining Qualities to the drawing using the **LAYOUT** Quality tools
3. Add a nozzle path using one of the Lead i/o tools (you can use one of the automated tools)
4. Save the DXF drawing
5. Run the **Clean** tool on the DXF file. Fix any issues if needed
6. Run the **Post** tool to convert your file to an ORD or OMX preview file

Activities

7. Perform the following quality checks on the file in Path preview
   a. Check the tool offset
   b. Check for problems
   c. Use the directional arrows to verify your nozzle is cutting on the correct side of each of the geometries in your drawing
8. Save the ORD or OMX file

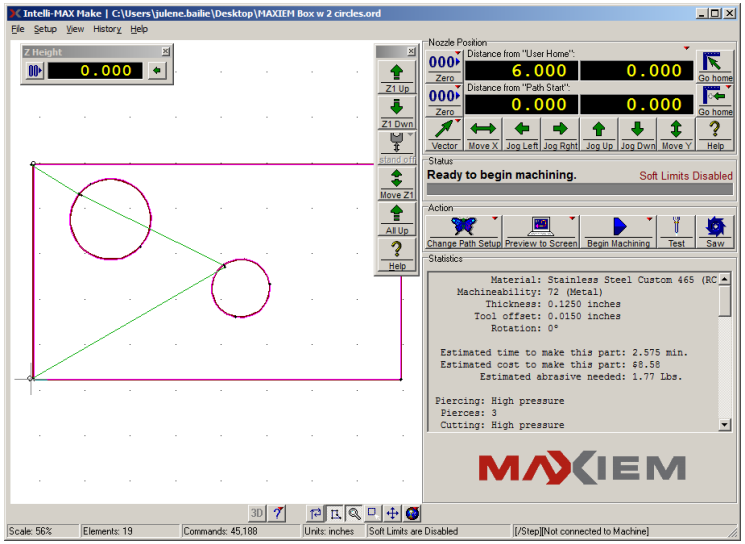
Steps in Making Parts

- Intelli-MAX **LAYOUT**
  - **Step 1:** Obtain/create a Drawing File (DXF file).
  - **Step 2:** Assign machining Qualities (edge finish).
  - **Step 3:** Clean and save the drawing.
  - **Step 4:** Add Path Elements to the drawing and save it.
  - **Step 5:** Create the Machine Tool Path file (ORD/OMX file).
- Intelli-MAX **MAKE**
  - **Step 6:** Start up the machine.
  - **Step 7:** Configure Machine Settings.
  - **Step 8:** Open and configure the ORD/OMX file.
  - **Step 9:** Load and clamp the material.
  - **Step 10:** Begin machining and cut the part.

Introduction to **MAKE** Standard

Intelli-MAX MAKE Standard

- Controls the movement and actions of the MAXIEM abrasive waterjet
- The controller sends the motor control commands that move the nozzle and control the timing of abrasive and high-pressure water events

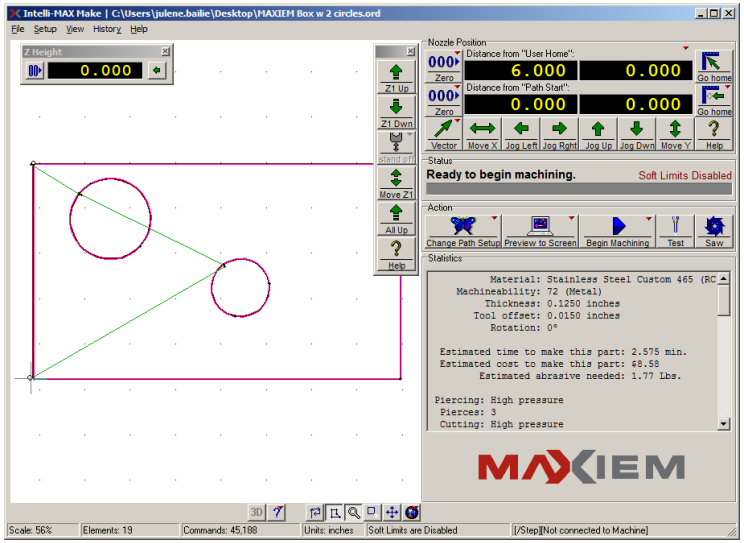


help *Keywords "**MAKE** Help Contents"*

Introduction to **MAKE** Standard

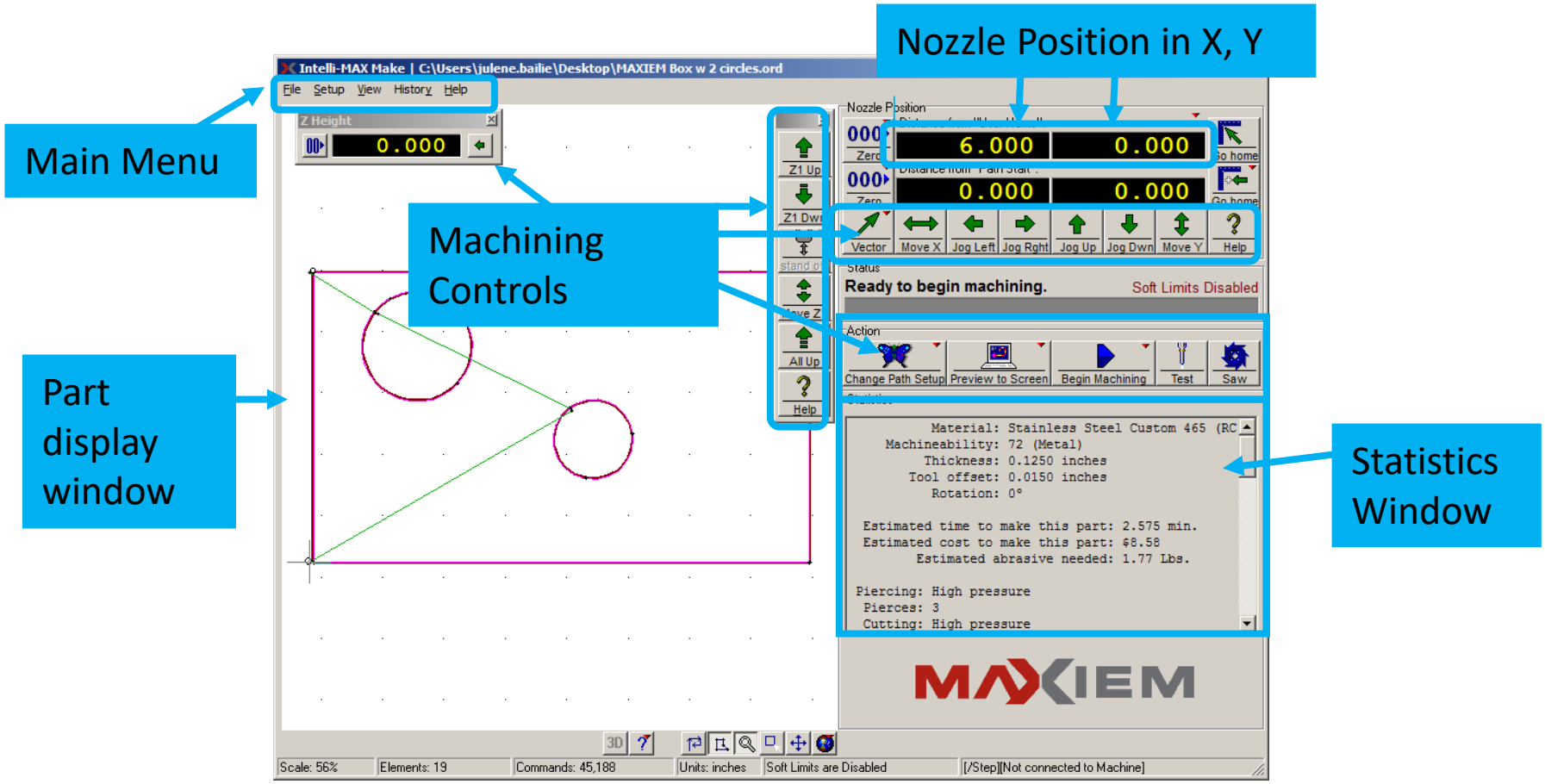
Use **MAKE** to:

- Set specific controls on your machine
- Specify material set up for each part you cut
- Change variables in your machining process, such as abrasive mesh size, nozzle orifice size, abrasive flow rate and more
- Track part status and statistics, and create reports



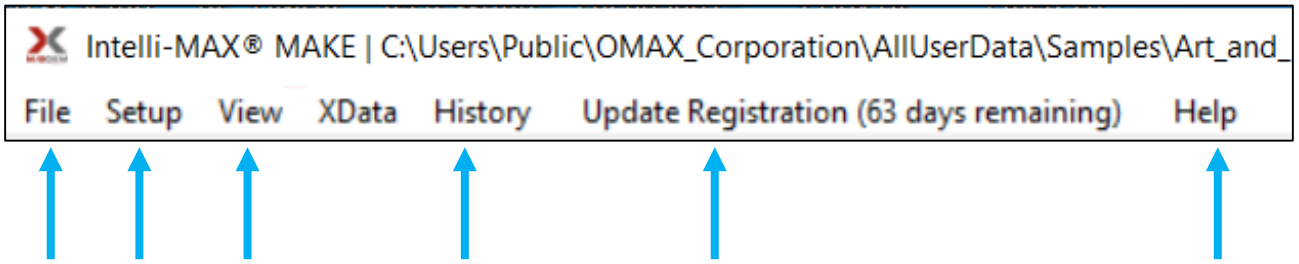
Introduction to **MAKE** Standard

MAKE window



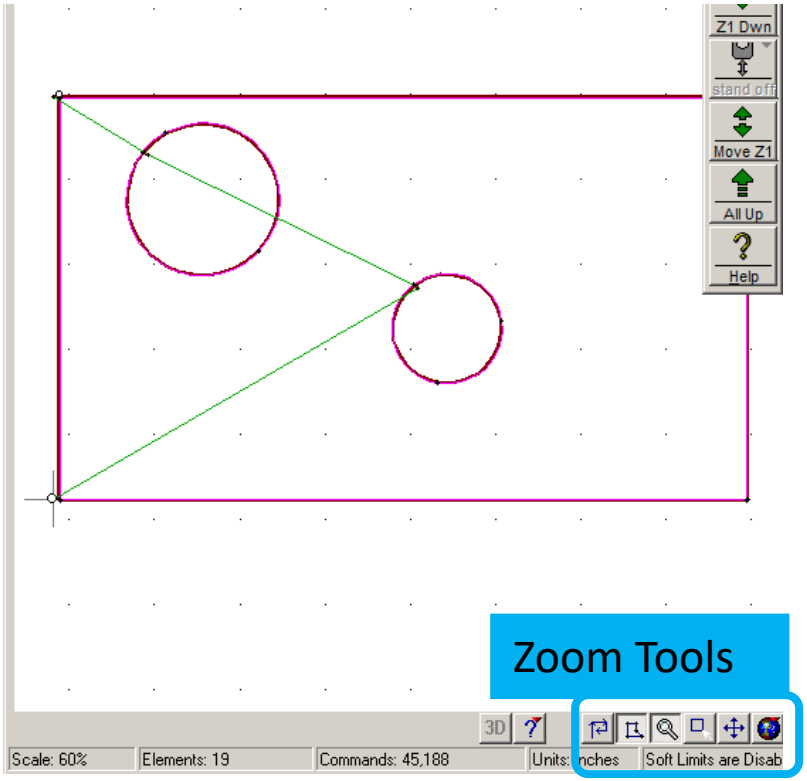
Main menu

- Gives you access to the functions available in **MAKE** such as
  - Open and configure files
  - Print statistics
  - Configure machine settings
  - View nozzle position data
  - Access part or machine history
  - Register your software
  - Access the Help system



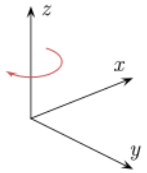
Part Display Window

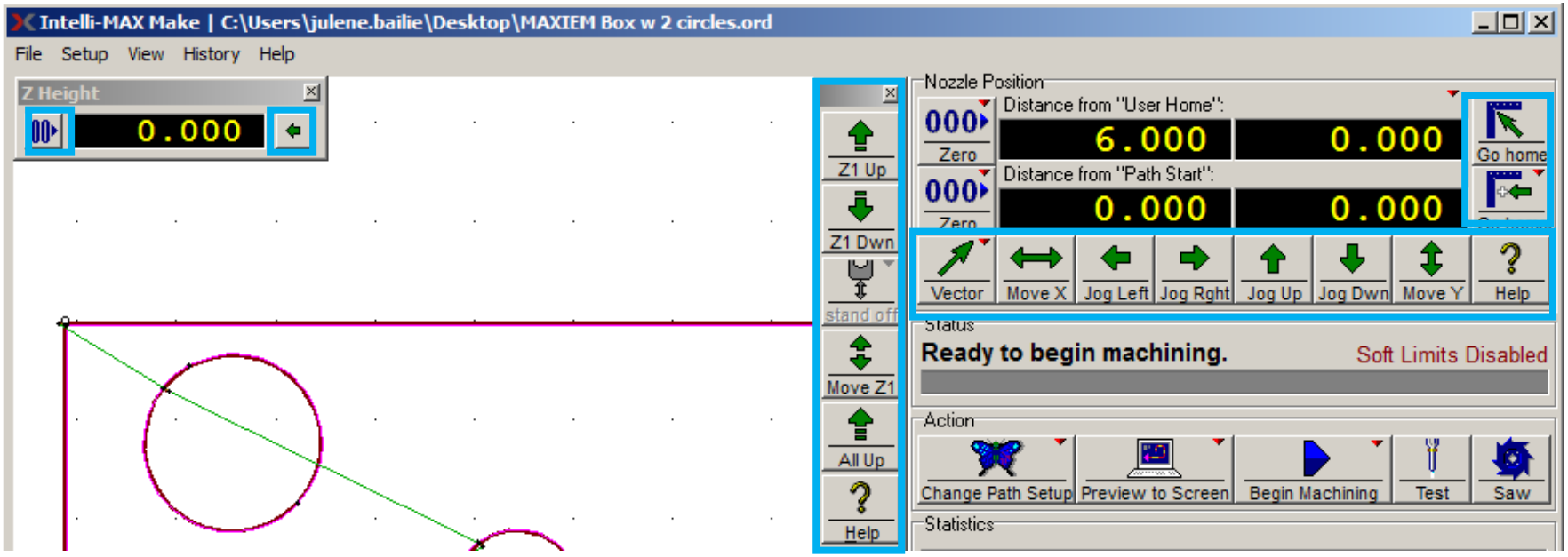
- Displays the current ORD file in different views
  - Drawing view (default)
  - Motor steps
  - Path sequence
  - Speed
  - Velocity profile
- Shows nozzle position as the part is cutting



Positioning Controls

- Move the cutting head in the X, Y, and Z directions

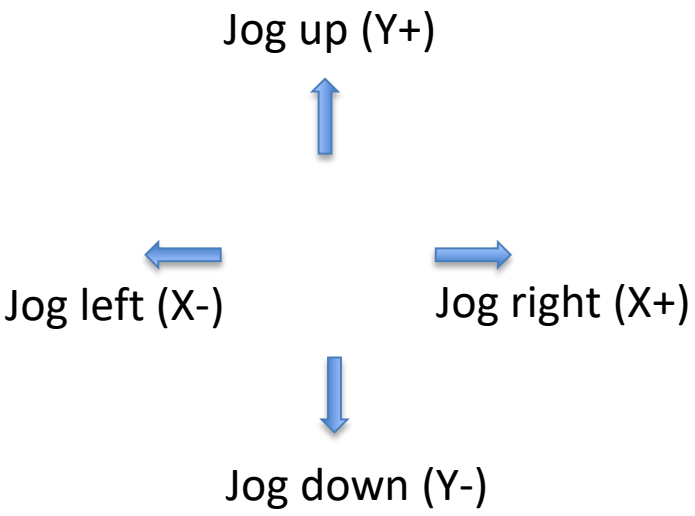


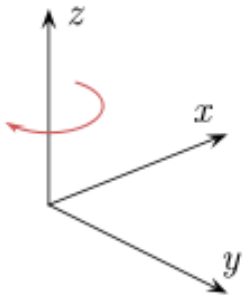


Keywords "Move, Jog, Homes"

Positioning Controls

- You can also use the **numeric keypad** on your keyboard to jog the machining head.





help *Keywords "Move, Jog, Homes"*

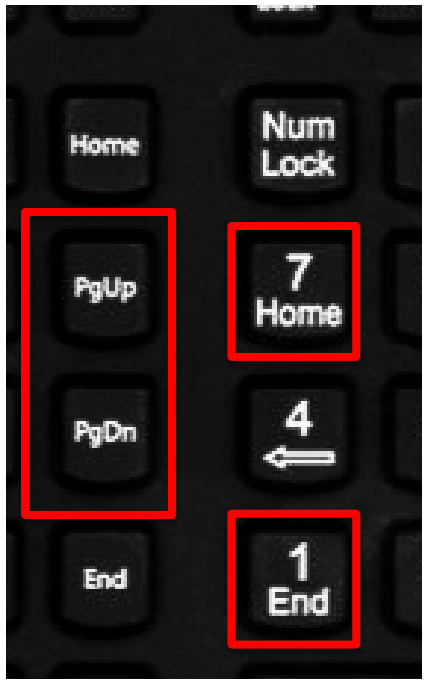
MAKE Positioning Controls

- Press **Shift** and the desired direction key to move the X and Y-axis more rapidly

MAKE Positioning Controls

- Z-Axis Keyboard Controls

  - Fine Increments:
    - Pg Up - Z-axis up
    - Pg Dn - Z-axis down
  - Course Increments:
    - 7 - Z-axis up
    - 1 - Z-axis down

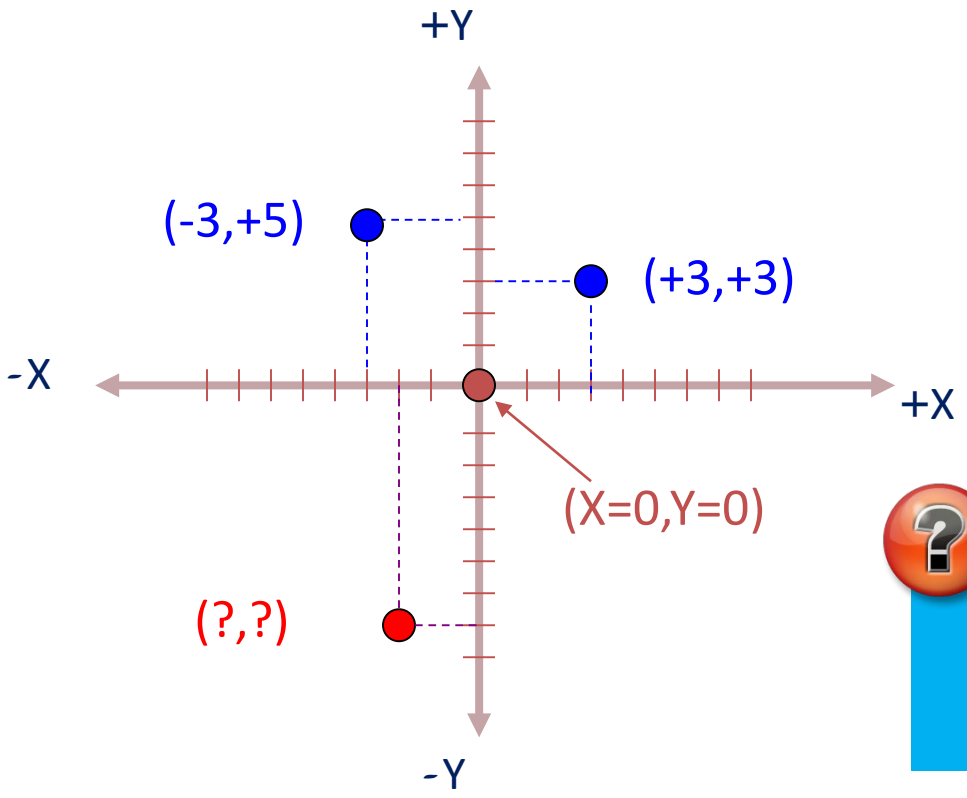


Nozzle Position

- Refers to a specific point where the nozzle is located on the machine
- The specific nozzle location point is referenced using X-Y coordinates
- The X-Y coordinates measure distance from some reference point (called a “Home”)

Nozzle Assembly

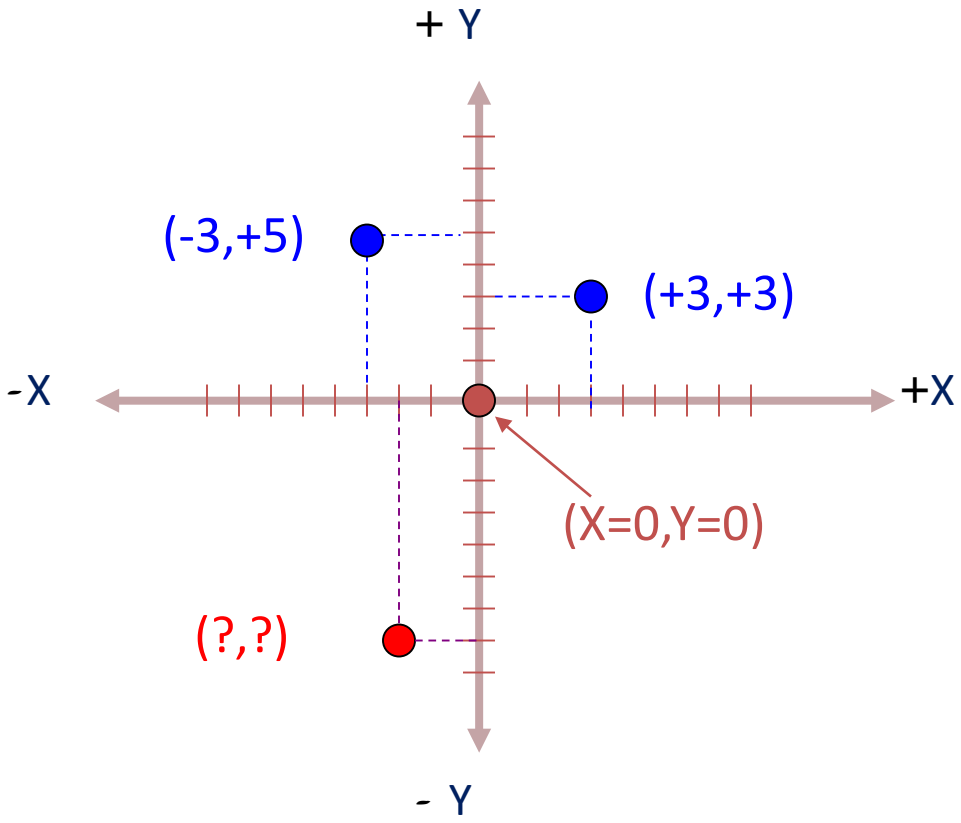
Two-dimensional coordinate system



All points in the grid have an associated X-Y coordinate

What are the X, Y coordinates of the red dot?

Introduction to **MAKE** Standard



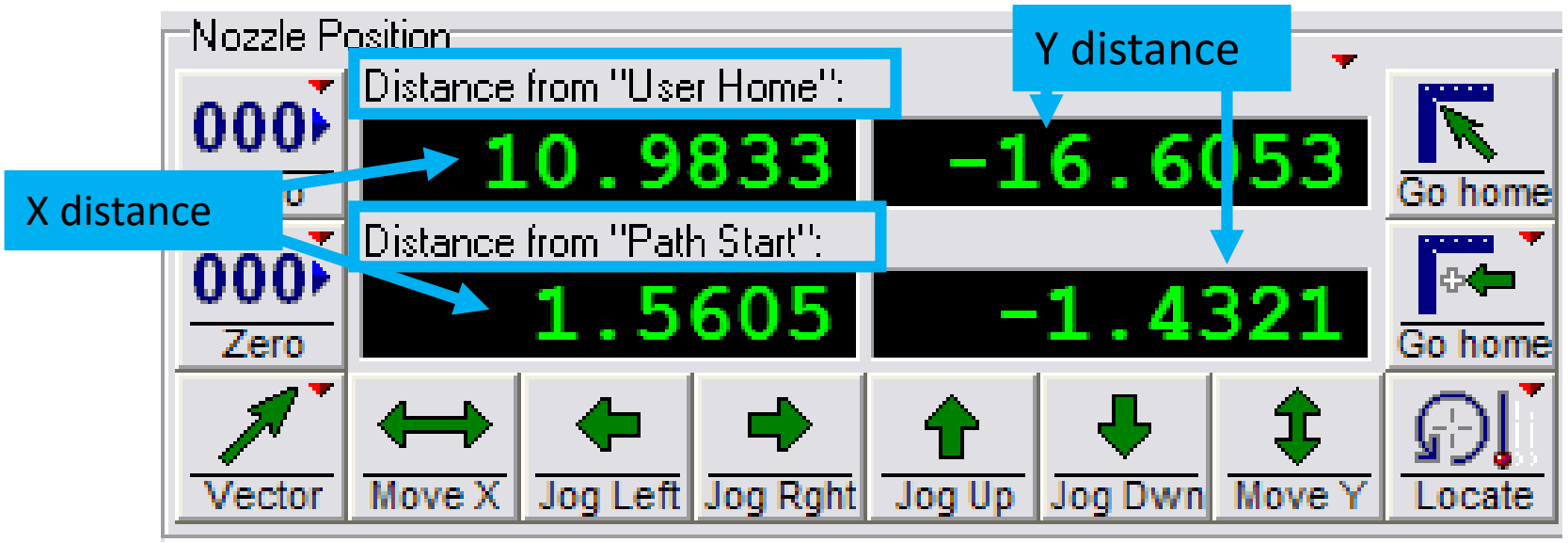
A: The X, Y coordinates of the red dot are

X = -2 and Y = -7

(-2, -7)

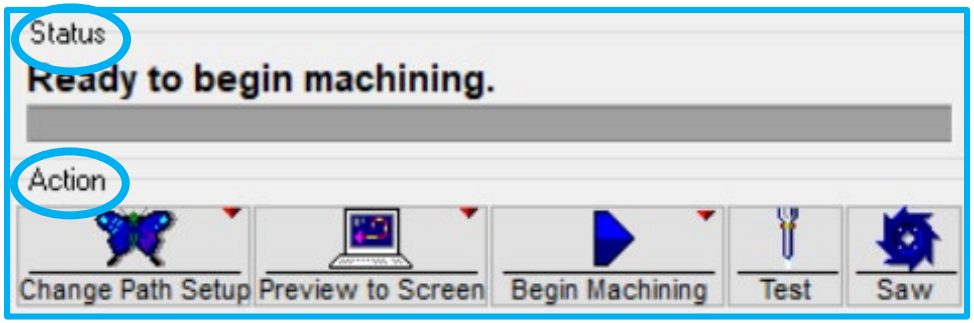
Nozzle Position Display

- Displays the distance (X and Y) from where the nozzle is currently positioned to a specific **Home** location



Machining Controls

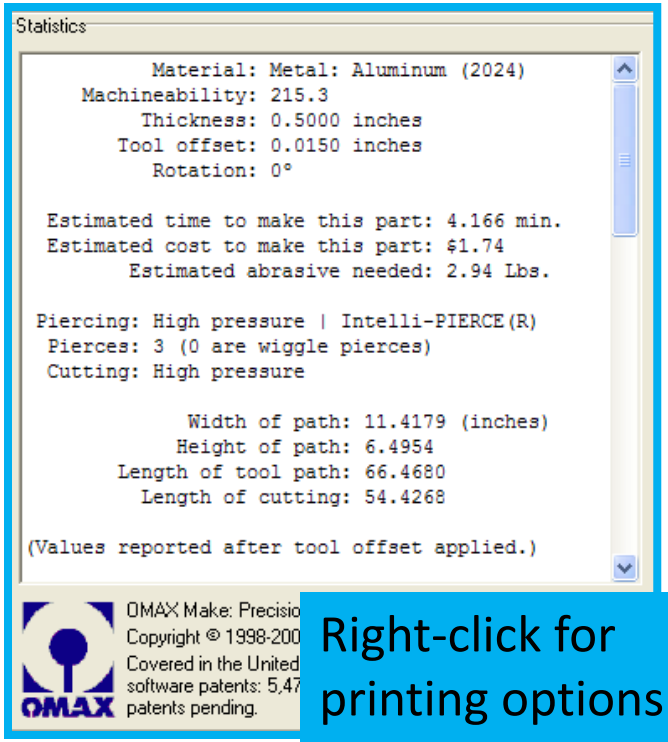
- Status
- Change Path Setup
- Preview to Screen
- Begin Machining
- Test
- Saw



help *Keywords "machining controls"*

Statistics window

- Gives specific statistics about the part file you open
  - Material type
  - Machinability
  - Material thickness
  - Tool offset
  - Time to make the part
  - Cost to make the part
  - Estimated abrasive needed



help *Keyword "statistics"*

MAKE Review

Review

1. In the **MAKE** window, where would we find information about how long it will take to cut the part?
   a. Machining Controls
   b. Part Display Window
   c. Statistics Window
   d. Nozzle Position Displays
2. Which machining control button would we use to move the nozzle left on the X axis?
   a. Jog up
   b. Jog Left
   c. Vector
   d. Jog Right

MAKE Review

Review

3. Which part of the **MAKE** screen tells us where the nozzle is positioned in reference to a specific home location?
   a. Statistics Window
   b. Part Display Window
   c. Machining Controls
   d. Nozzle Position Displays
4. Which of the following is not a machining control?
   a. Saw
   b. Test
   c. Preview
   d. Begin Machining

Steps in Making Parts

- Intelli-MAX **LAYOUT**
  - **Step 1:** Obtain/create a Drawing File (DXF file).
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  - **Step 10:** Begin machining and cut the part.

Step 6: Start the Machine

Machine Startup

- Safety First!
  - Safety Checklist
  - User's Guide Safety Section


MAXIEM® Gen 2
Operation Guide

OMAX Corporation
21409 72nd Avenue South
Kent, WA USA 98032

Information: 253-872-2300
Technical Support: 1-800-838-0343
E-Mail: techsupport@omax.com
Web: http://www.omax.com

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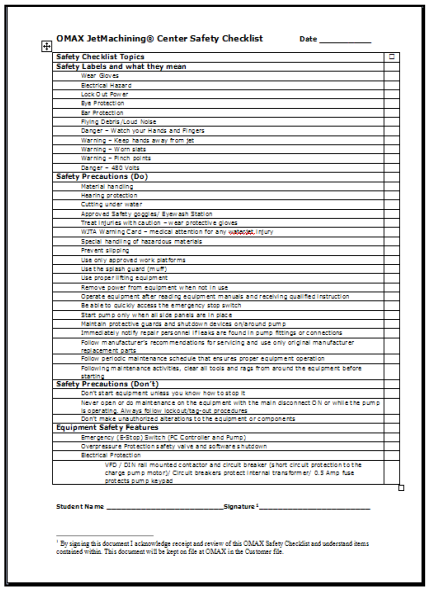
OMAX JetMachining® Center Safety Checklist Date _____

Safety Checklist Topics	☐
Safety Labels and what they mean	
Wear Gloves	
Electrical Hazard	
Look Out Below!	
Eye Protection	
Ear Protection	
Flying Debris/Loud Noise	
Danger – Watch your Hands and Fingers	
Warning – Keep hands away from jet	
Warning – Worn parts	
Warning – Pinch points	
Danger – 480 Volts	
Safety Precautions (Do)	
Material handling	
Hearing protection	
Cutting under water	
Approved Safety goggles/ Eyewash Station	
Treat injuries with caution – wear protective gloves	
WJTA Warning Card – medical attention for any waterjet injury	
Special handling of hazardous materials	
Prevent slipping	
Use only approved work platforms	
Use the splash guard (m-Jet)	
Use proper lifting equipment	
Remove power from equipment when not in use	
Operate equipment after reading equipment manuals and receiving qualified instruction	
Be able to quickly access the emergency stop switch	
Start pump only when all side panels are in place	
Maintain protective guards and shutdown devices on/around pump	
Immediately notify repair personnel if leaks are found in pump fittings or connections	
Follow manufacturer's recommendations for servicing and use only original manufacturer replacement parts	
Follow periodic maintenance schedule that ensures proper equipment operation	
Following maintenance activities, clear all tools and rags from around the equipment before starting	
Safety Precautions (Don't)	
Don't start equipment unless you know how to stop it	
Never open or do maintenance on the equipment with the main disconnect ON or while the pump is operating. Always follow lockout/tag-out procedures	
Don't make unauthorized alterations to the equipment or components	
Equipment Safety Features	
Emergency (E-Stop) Switch (PC Controller and Pump)	
Overpressure Protection-safety valve and software shutdown	
Electrical Protection	
VFD / DIN rail mounted contactor and circuit breaker (short circuit protection to the charge pump motor); Circuit breakers protect internal transformer; 0.9 Amp fuse protects pump keypad	

Student Name _____ Signature [1] _____

[1] By signing this document I acknowledge receipt and review of this OMAX Safety Checklist and understand items contained within. This document will be kept on file at OMAX in the Customer file.

Step 6: Start the Machine

Machine Startup Procedures

- Refer to the MAXIEM User's Guide for instructions on machine start-up

MAXIEM® Gen 2

Operation Guide

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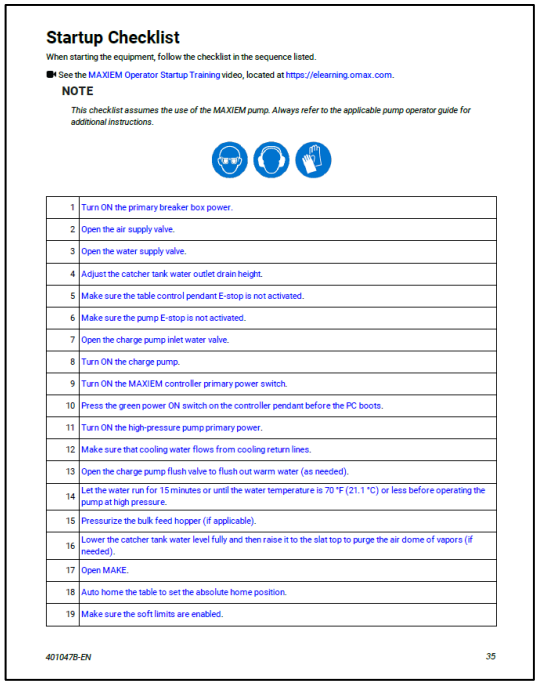

Startup Checklist

When starting the equipment, follow the checklist in the sequence listed.

See the MAXIEM Operator Startup Training video, located at https://elearning.omax.com.

NOTE

This checklist assumes the use of the MAXIEM pump. Always refer to the applicable pump operator guide for additional instructions.

1	Turn ON the primary breaker box power.
2	Open the air supply valve.
3	Open the water supply valve.
4	Adjust the catcher tank water outlet drain height.
5	Make sure the table control pendant E-stop is not activated.
6	Make sure the pump E-stop is not activated.
7	Open the charge pump inlet water valve.
8	Turn ON the charge pump.
9	Turn ON the MAXIEM controller primary power switch.
10	Press the green power ON switch on the controller pendant before the PC boots.
11	Turn ON the high-pressure pump primary power.
12	Make sure that cooling water flows from cooling return lines.
13	Open the charge pump flush valve to flush out warm water (as needed).
14	Let the water run for 15 minutes or until the water temperature is 70 °F (21.1 °C) or less before operating the pump at high pressure.
15	Pressurize the bulk feed hopper (if applicable).
16	Lower the catcher tank water level fully and then raise it to the slat top to purge the air dome of vapors (if needed).
17	Open MAKE.
18	Auto home the table to set the absolute home position.
19	Make sure the soft limits are enabled.

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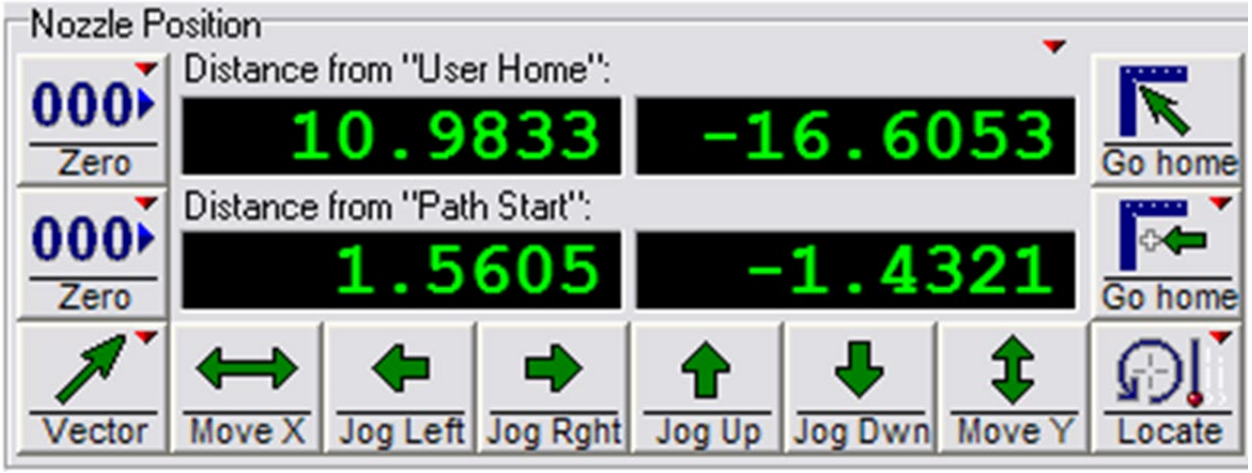
Step 6: Start the Machine

Nozzle Position and Homes

- Three types of **Homes** used on the MAXIEM
  1. **Absolute** Home
  2. **User** Home
  3. **Path Start** Home



help *Keyword "homes"*

Step 6: Start the Machine

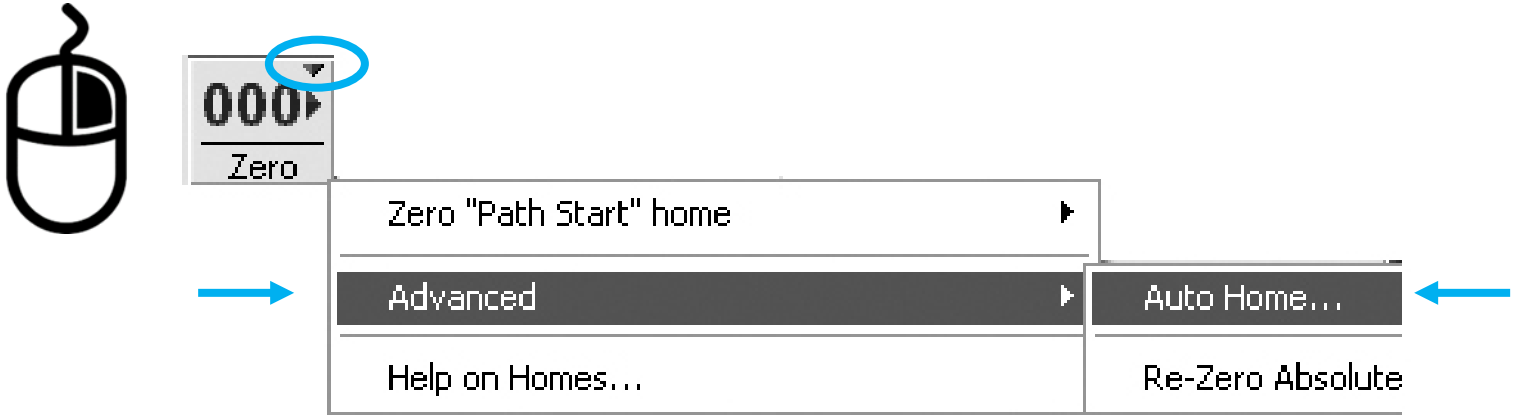
Nozzle Position

- Absolute Home
  - Mechanical X=0, Y=0 limits on the machine
  - The machine absolutely can not move any further than this in the -X or -Y direction
  - Every other **Home** position uses the Absolute Home as its reference point

Step 6: Start the Machine

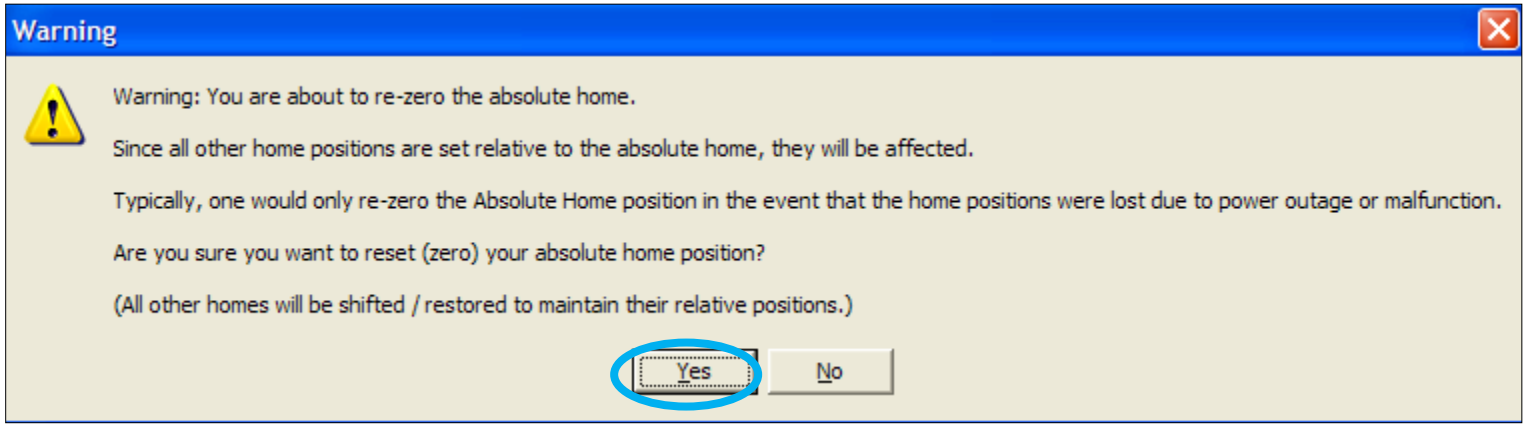
Nozzle Position

- Setting Absolute Home using Auto Home
  - Move the nozzle to within a 1-foot square of your machine's homing position
  - Raise the Z-axis to avoid obstacles
  - **Right**-click **Zero** > **Advanced** > **Auto Home**



Nozzle Position

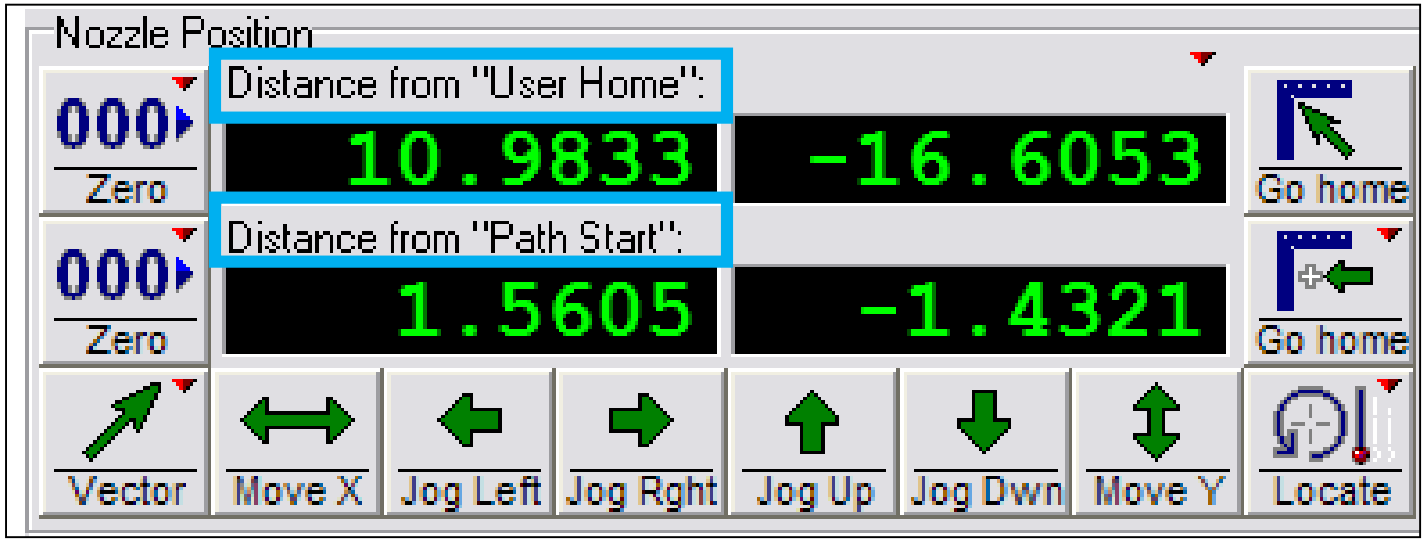
- Re-zero Absolute Home



Step 6: Start the Machine

Nozzle Position Displays

- The top row always displays the generic **User Home**
- The second row displays **Path Start** Home



Steps in Making Parts

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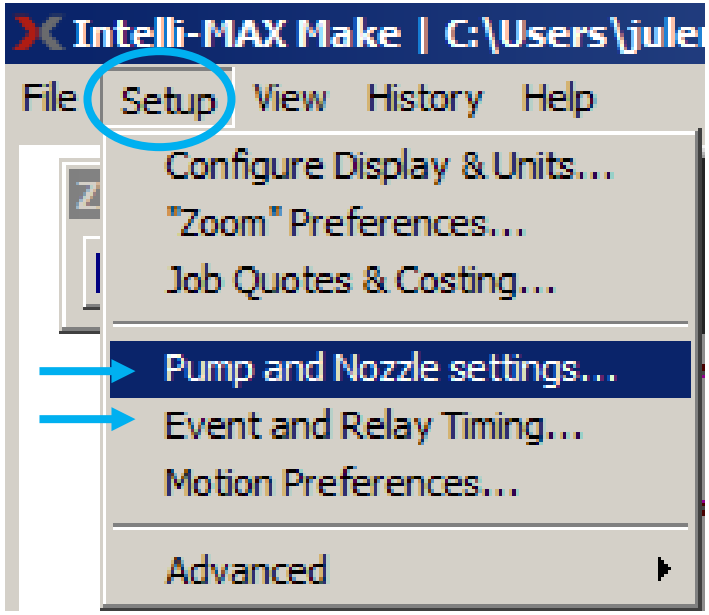
Step 7: Configure Machine Settings

Configure Machine Settings in MAKE

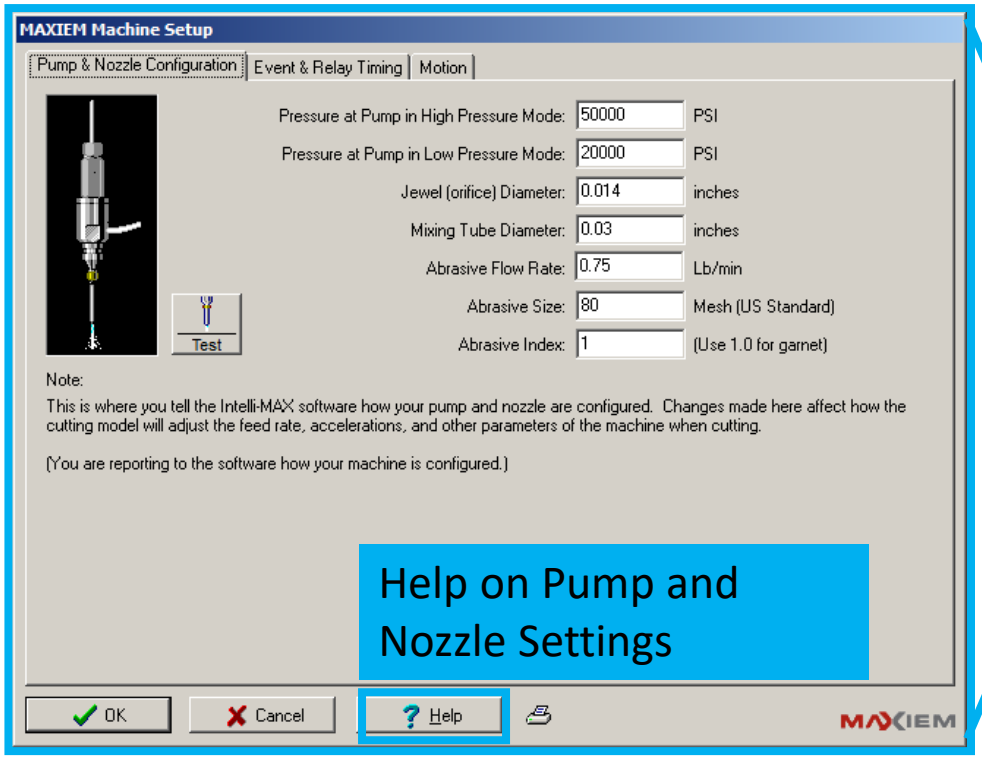
- Pump and Nozzle settings
- Event and Relay Timing

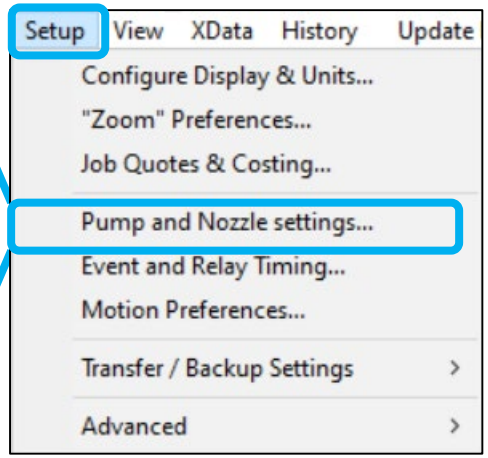


help *Keyword "MAKE Menu"*

Step 7: Configure Machine Settings

Pump and Nozzle Settings

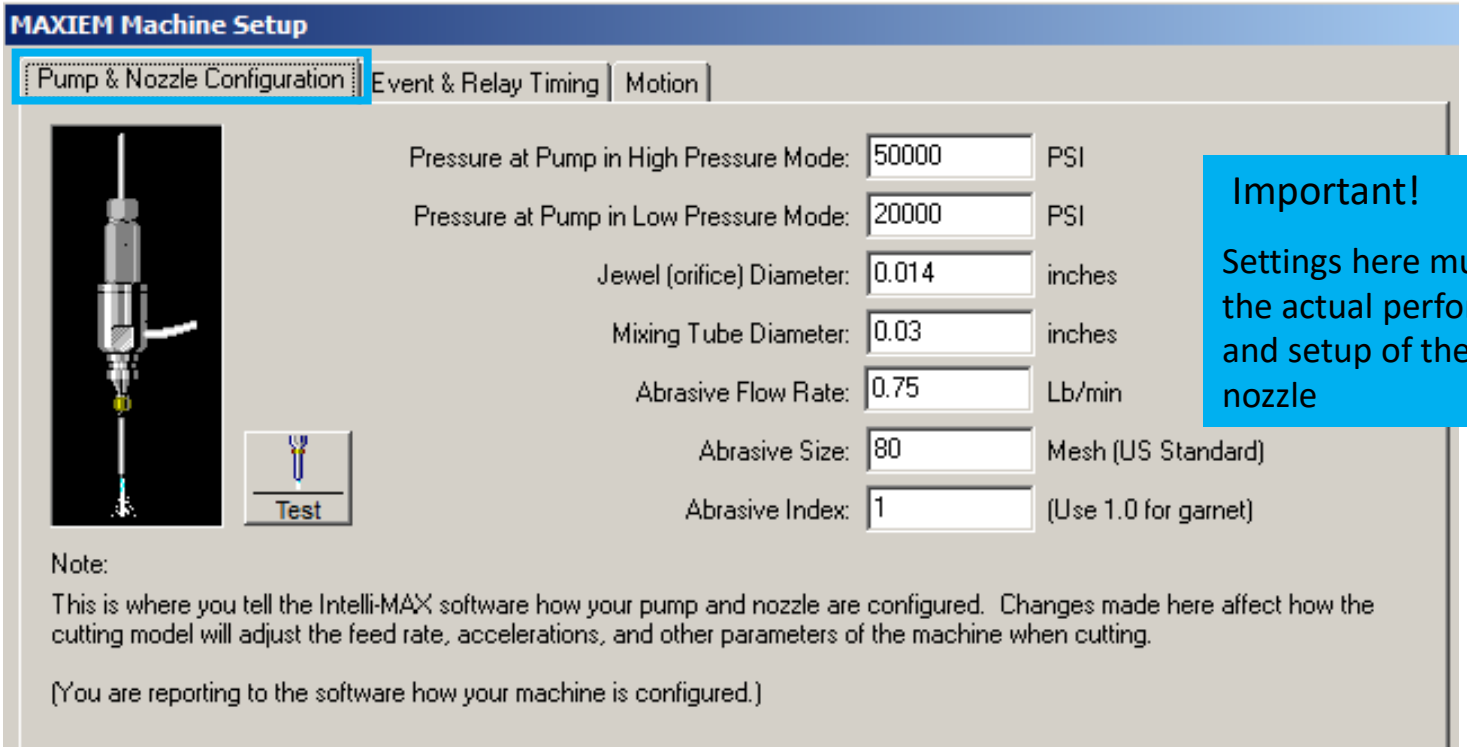




help *Keyword "Pump and Nozzle configuration"*

Step 7: Configure Machine Settings

Pump and Nozzle Settings

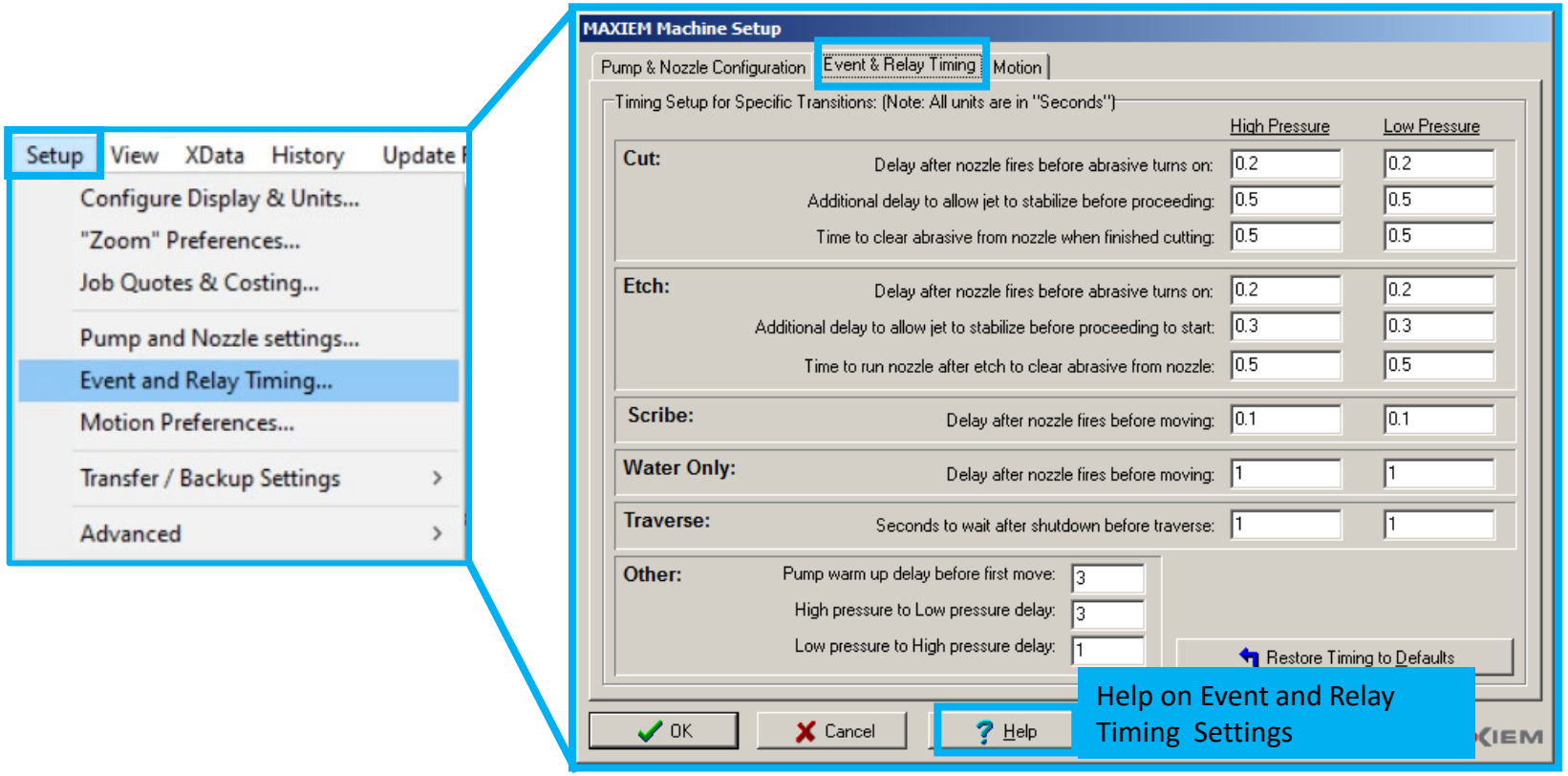


Important!

Settings here must match the actual performance and setup of the pump and nozzle

Step 7: Configure Machine Settings

Event and Relay Timing



help *Keyword "Event"*

Step 7: Configure Machine Settings

Machine Configuration Review

1. What are the two areas you need to configure or verify settings on each day during start-up?
   a. Motion Controls
   b. Pump and Nozzle Settings
   c. Event and Relay Timing
2. Why is it so important to enter actual data into the **Pump and Nozzle settings** each day?
3. How do you access the **Machine Setup** pages in **MAKE**?

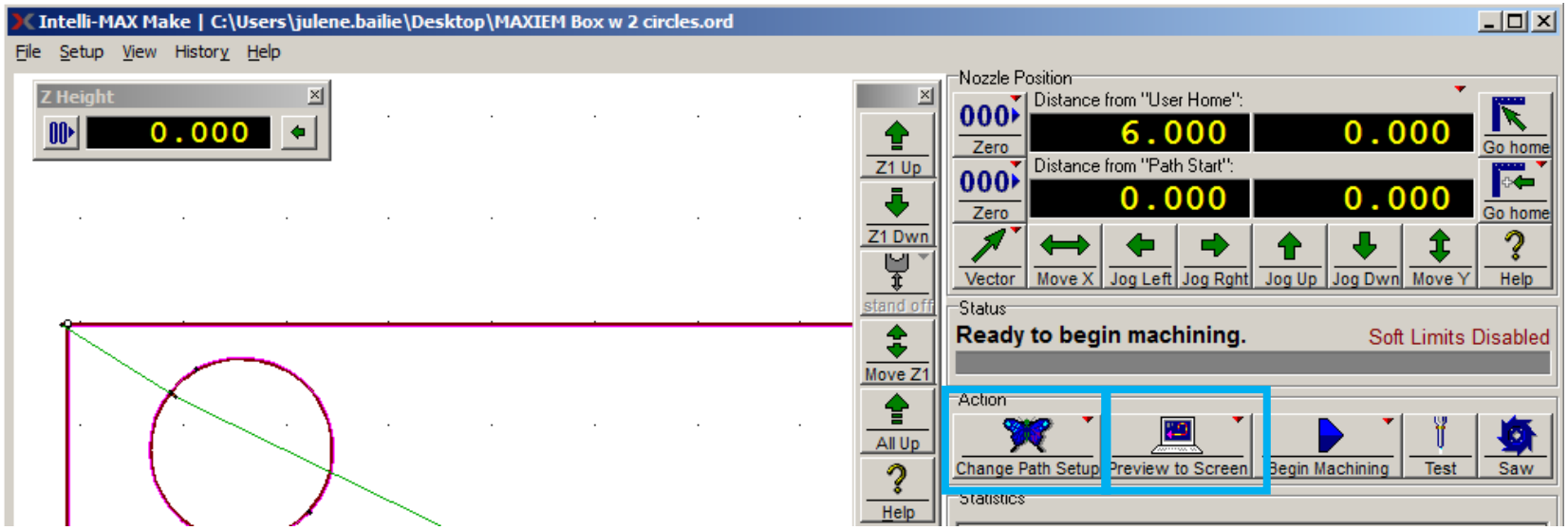
Steps in Making Parts

- Intelli-MAX **LAYOUT**
  - **Step 1:** Obtain/create a Drawing File (DXF file).
  - **Step 2:** Assign machining Qualities (edge finish).
  - **Step 3:** Clean and save the drawing.
  - **Step 4:** Add Path Elements to the drawing and save it.
  - **Step 5:** Create the Machine Tool Path file (ORD/OMX file).
- Intelli-MAX **MAKE**
  - **Step 6:** Start up the machine.
  - **Step 7:** Configure Machine Settings.
  - **Step 8:** Open and configure the ORD/OMX file.
  - **Step 9:** Load and clamp the material.
  - **Step 10:** Begin machining and cut the part.

Step 8: Open the ORD/OMX File

Open and Configure the Machine File

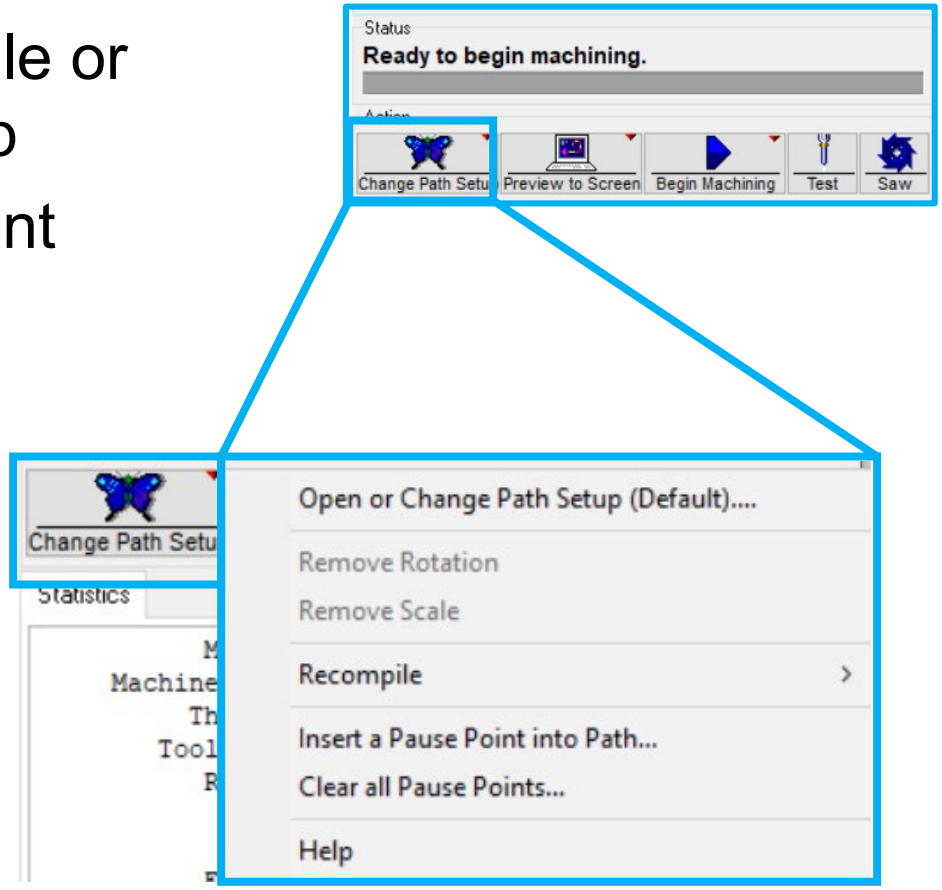
- Change Path Setup
- Preview to Screen



Step 8: Open the ORD/OMX File

Change Path Setup

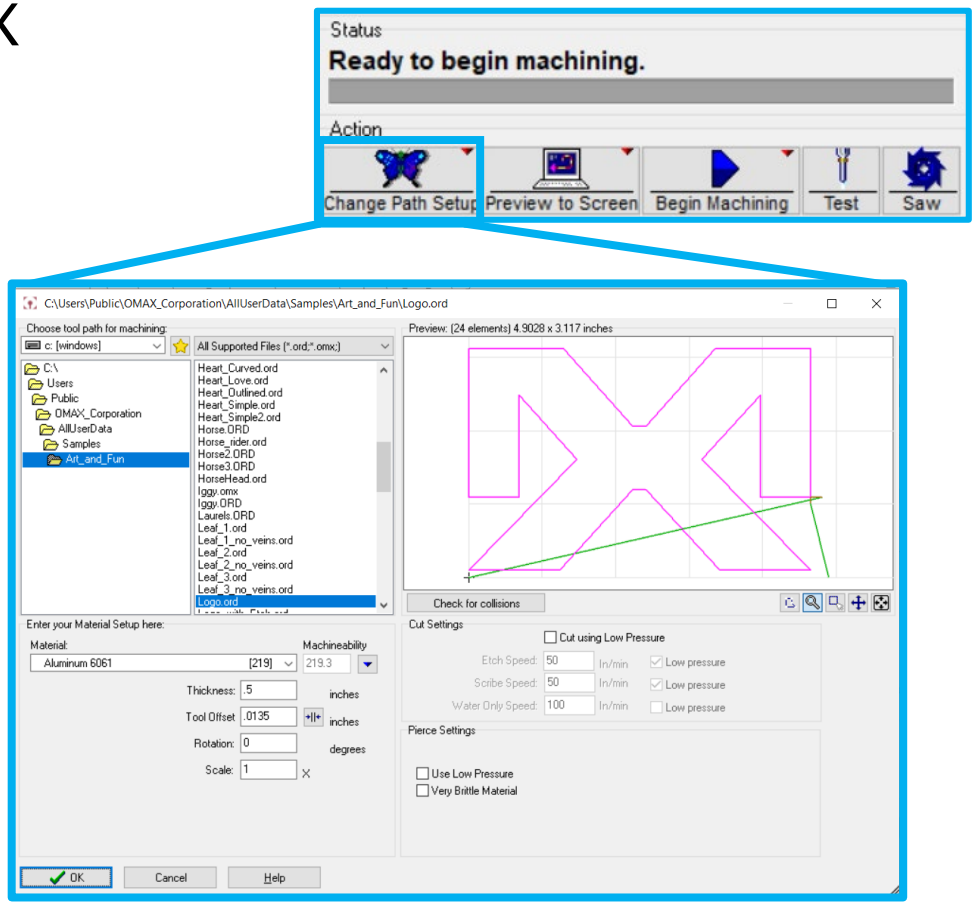
- Open an ORD/OMX file or change the path setup
- Recompile in a different machining quality
- Insert pause point



Step 8: Open the ORD/OMX File

Change Path Setup

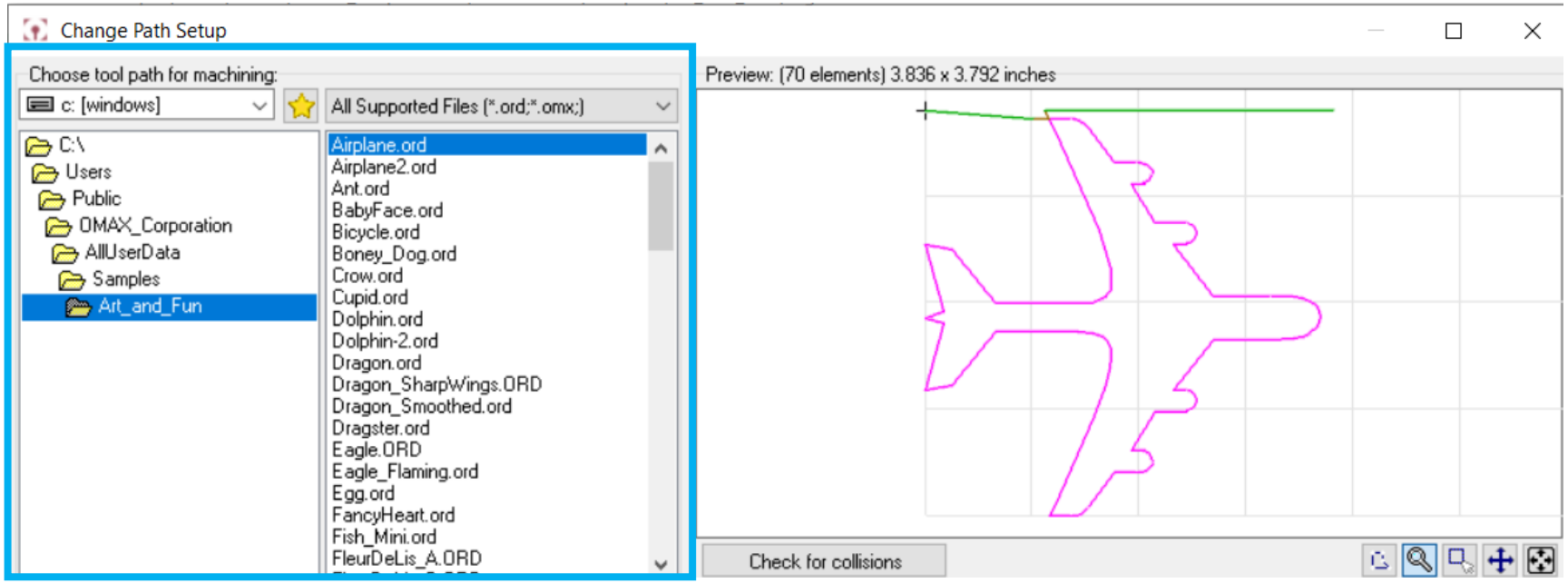
- Open a new ORD/OMX file
- Specify material setup
- Preview the part file
- Specify cut settings
- Specify pierce settings
- Activate accessories (such as the A-Jet or Terrain Follower)
- Access Help



Step 8: Open the ORD/OMX File

Open a new ORD/OMX file

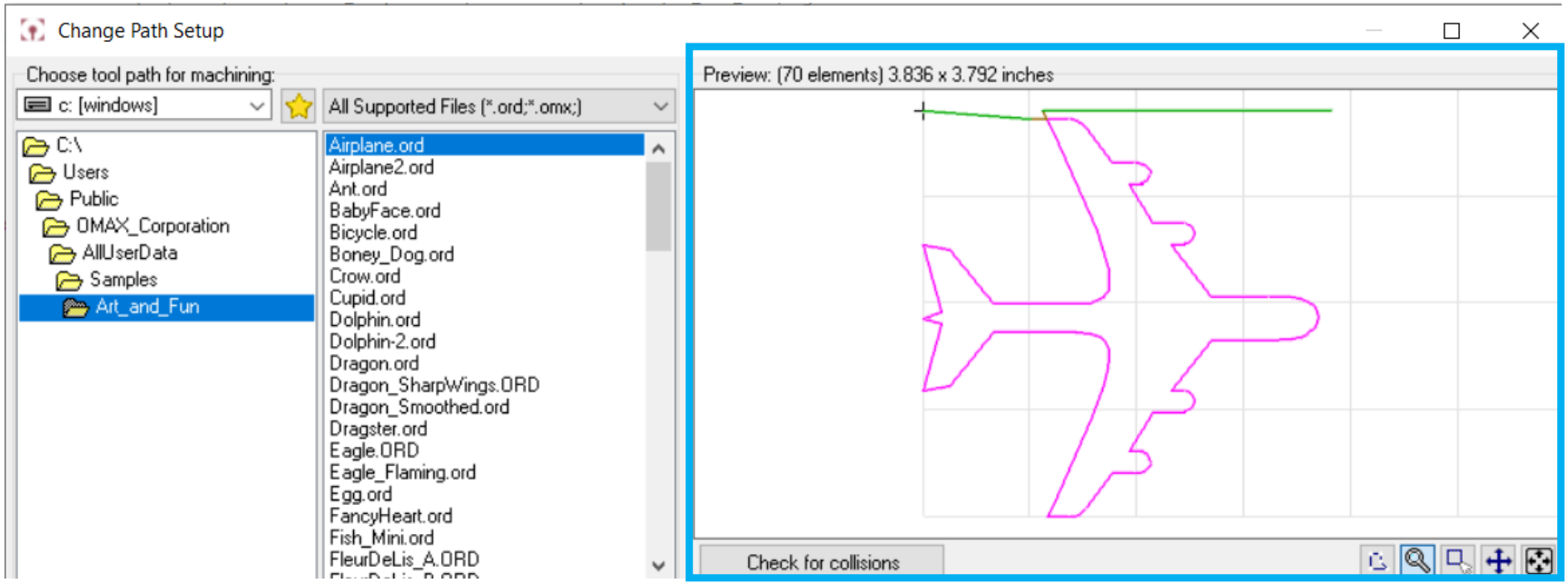
- You can select a new file for machining
- Note the files listed on the right below, are all ORD or OMX files



Step 8: Open the ORD/OMX File

Part Preview Window

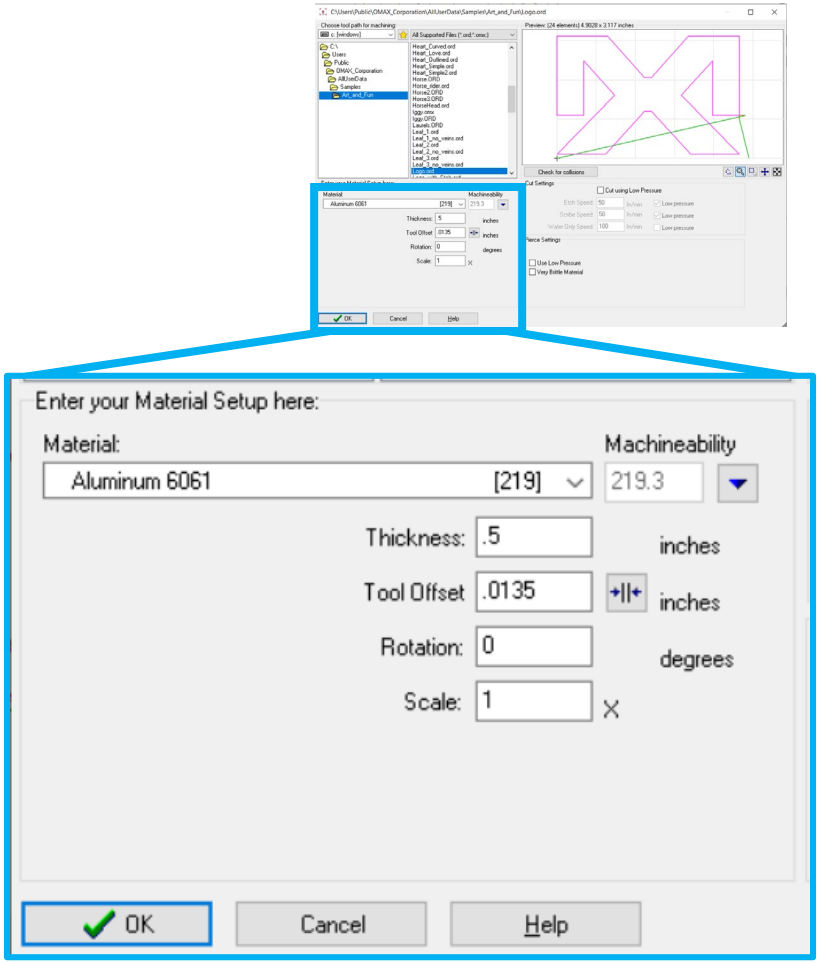
- Preview the part
- **Check for collisions**
- Use **Zoom tools**



Step 8: Configure the ORD/OMX File

Select Material Type

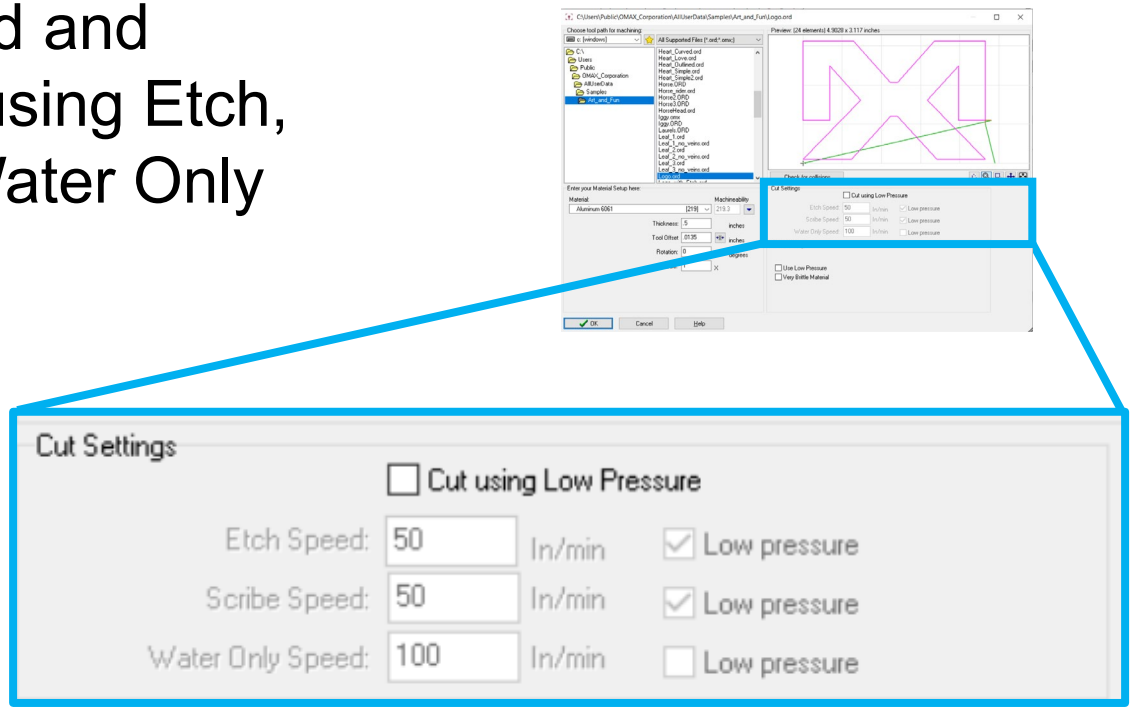
- Specify Material Thickness
- Specify Tool Offset
- Set Rotation
- Set Scale
- Enable the A-Jet (if applicable)



Step 8: Configure the ORD/OMX File

Cut Settings

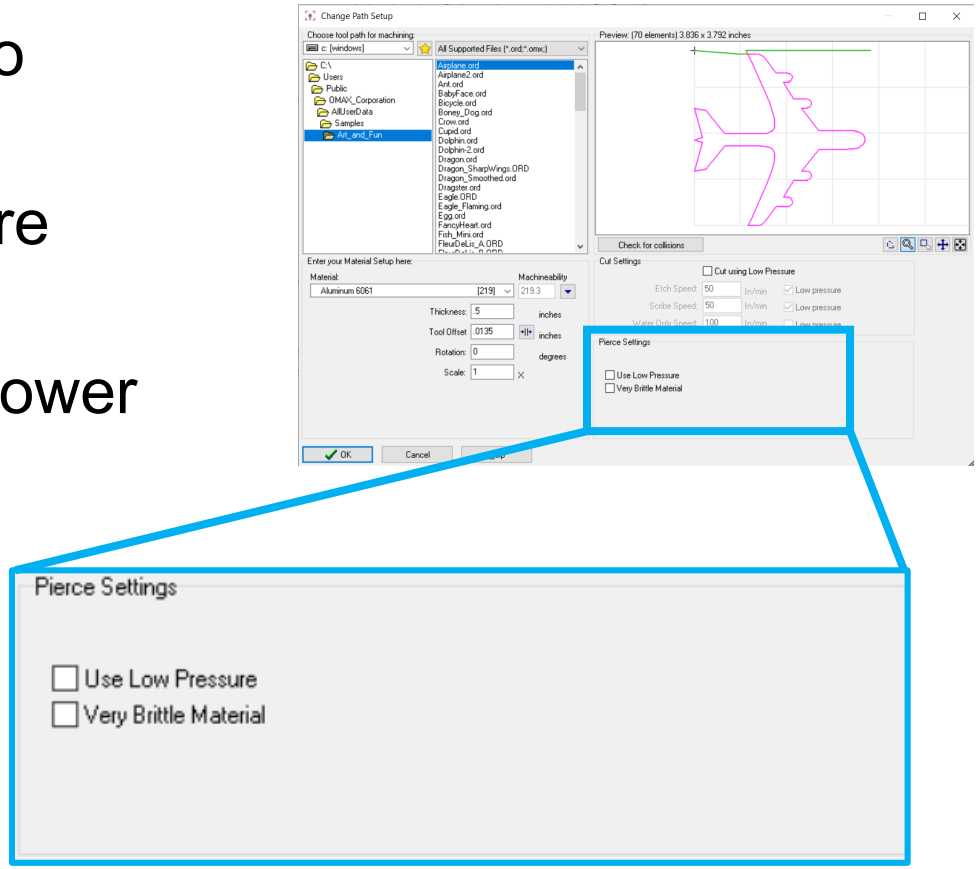
- Adjust speed and pressure if using Etch, Scribe, or Water Only settings



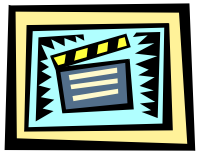
Step 8: Configure the ORD/OMX File

Pierce Settings

- Specify jet or drill to pierce
- Enable low-pressure piercing
- Enable Terrain Follower (if applicable)

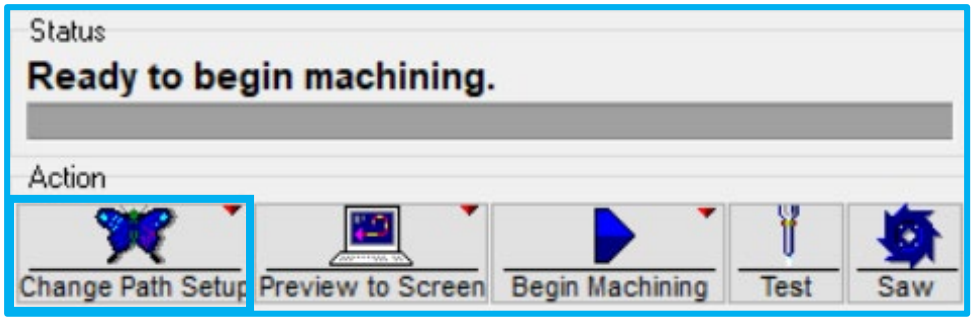


Step 8: Configure the ORD/OMX File



Activity

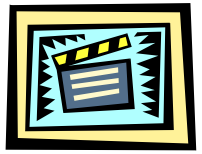
- Open **MAKE**
- Click **Change Path Setup**
- Review each area of **Change Path Setup**
  - Find and open a new file
  - Change **Material Setup**
  - Review **Cut** and **Pierce** settings
  - Open the part in **MAKE**

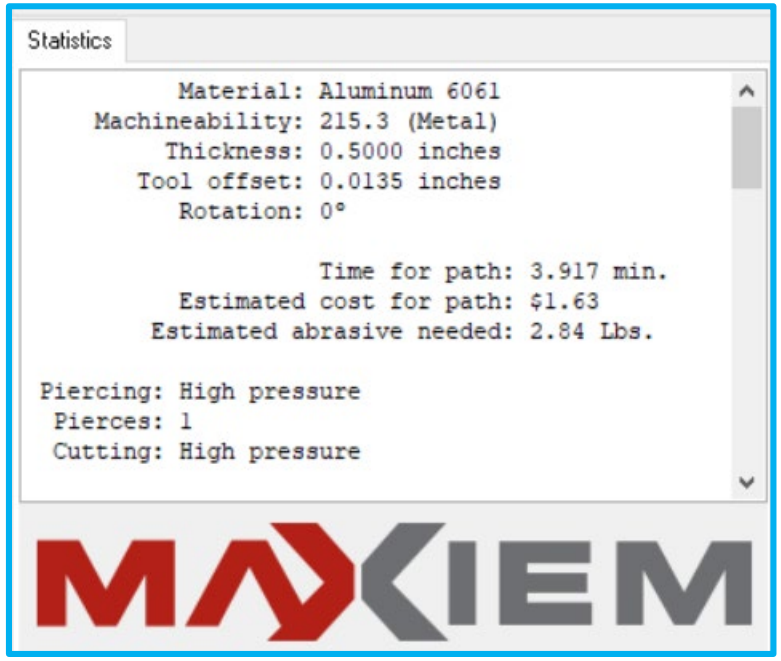


Step 8: Configure the ORD/OMX File

Activity

- Review the **Statistics** window for the new part
- Click **Change Path Setup**
  - Change **Material Type** and **Thickness**
  - Open the part in **MAKE**
- Review the **Statistics** window for the part with different material type and thickness

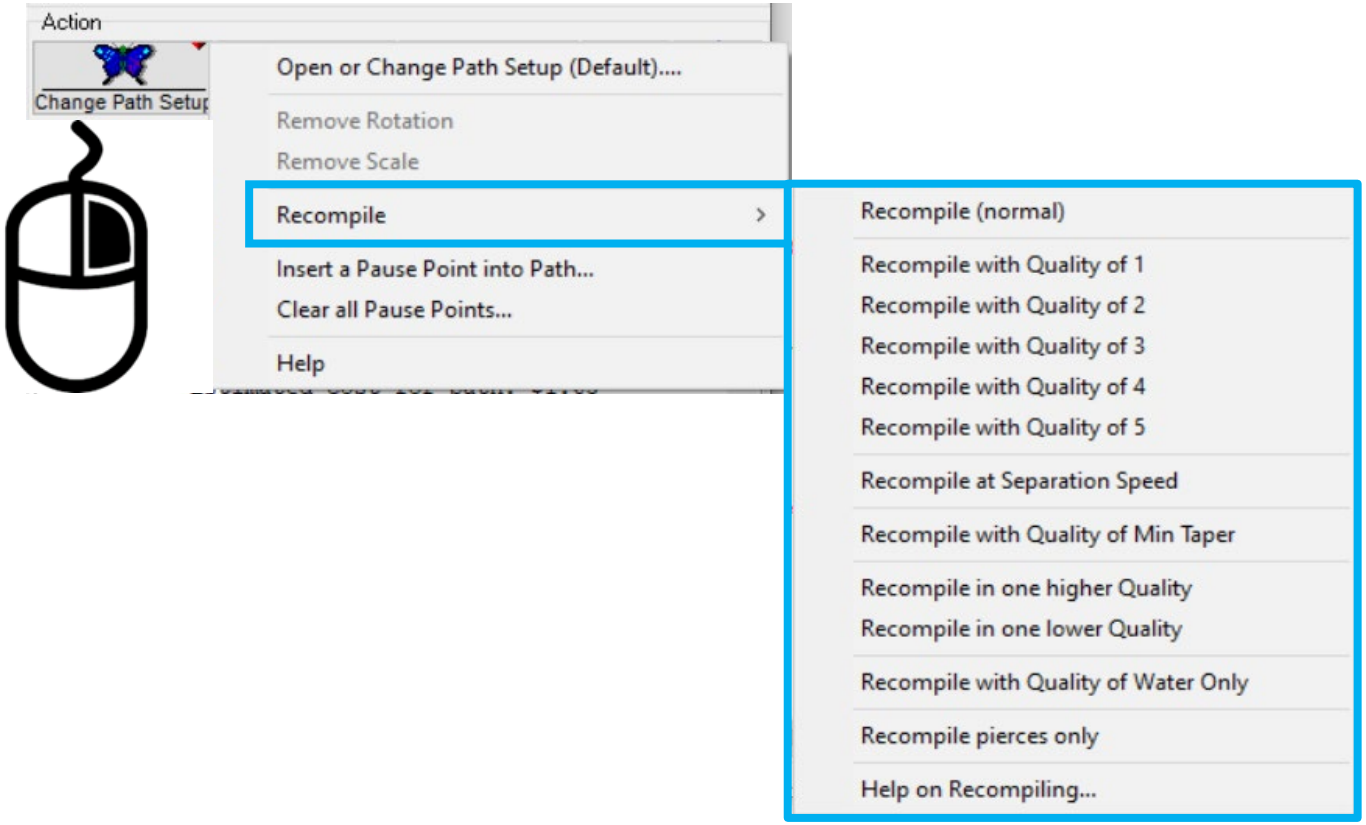




Step 8: Configure the ORD/OMX File

Recompile Options

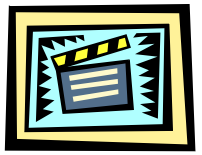
- Change the machining quality of the part in **Make**

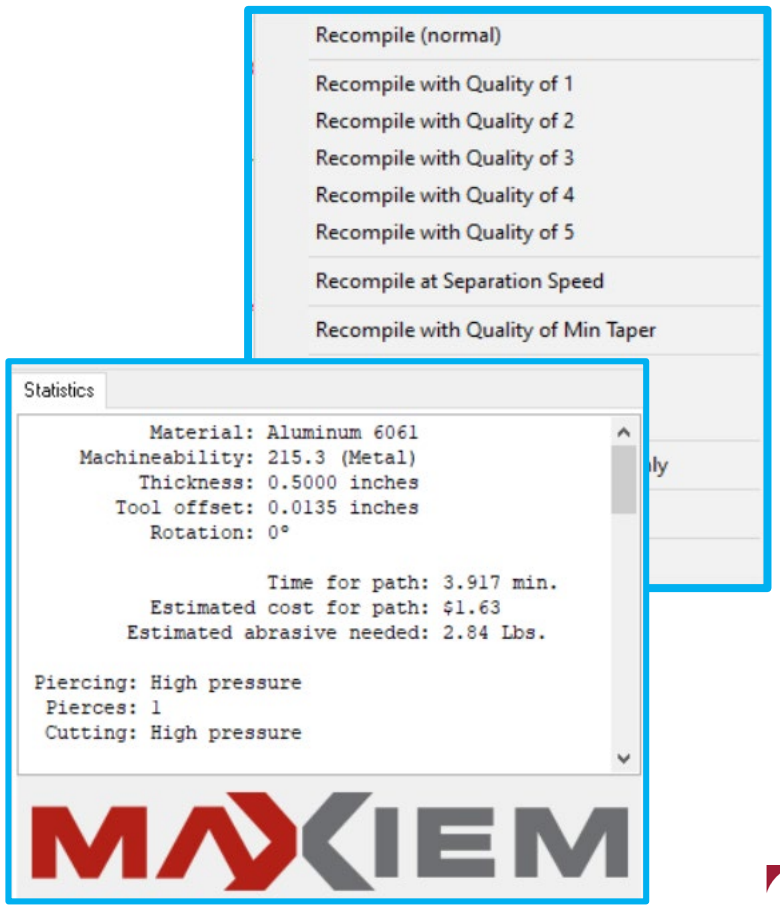


Step 8: Configure the ORD/OMX File

Activity

- Open an ORD file in **MAKE**
- Review the data in the **Statistics** window for the part
- **Recompile** the part using a different machining quality
- Review the data in the **Statistics** window for the part – what changed?

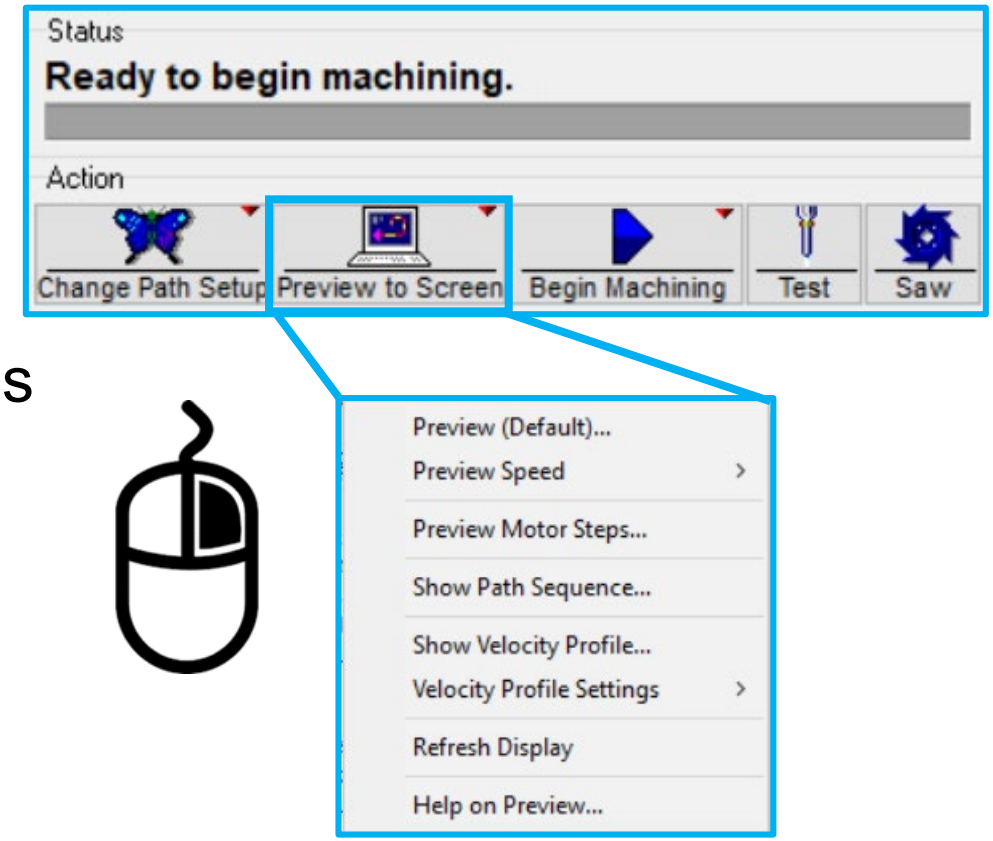




Step 8: Configure the ORD/OMX File

Preview to Screen

- Preview (Default)
- Preview Speed
- Preview Motor Steps
- Show Path Sequence
- Velocity Profile Settings
- Help on Preview



Step 8: Configure the ORD/OMX File

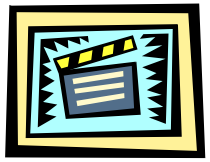
Preview Options

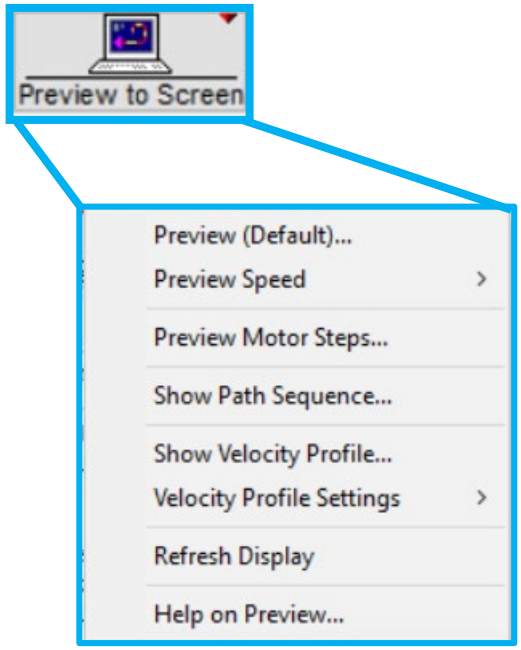
- **Preview Speed** - adjusts the speed of the default preview option
- **Preview Motor Steps** - displays each motor step (approximately 0.005 in.) – zoom to 5,000% to view
- **Show Path Sequence** – adds numbers to each section of the tool path following a traverse
- **Show Velocity Profile** – shows the speed of the nozzle in color and height as a 3D model

Step 8: Open and Configure the File

Activities

- Open an ORD file in **MAKE**
- Preview using the following
  - **Preview** (Default)
  - **Preview Motor Steps**
  - **Show Path Sequence**





Step 8: Open and Configure the File

ORD File Configuration Review

1. Which of the following controls or actions do we use to open and configure an ORD file?
   a. Setup
   b. Homes
   c. Change Path Setup
   d. Preview to Screen
2. What is one of the ways to get to **Material Setup** in **MAKE**?

Step 8: Open and Configure the File

ORD File Configuration Review

3. Which control or activity would you choose if you wanted to see the motor step view of a part?
   a. Change Path Setup
   b. Preview to Screen
   c. Setup
   d. Homes
4. Which area of the **MAKE** window do you find information on about how much time it will take to make a part?

Steps in Making Parts

- Intelli-MAX **LAYOUT**
  - **Step 1:** Obtain/create a Drawing File (DXF file).
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- Intelli-MAX **MAKE**
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  - **Step 7:** Configure Machine Settings.
  - **Step 8:** Open and configure the ORD/OMX file.
  - **Step 9:** Load and clamp the material.
  - **Step 10:** Begin machining and cut the part.

Step 9: Load and Clamp Material

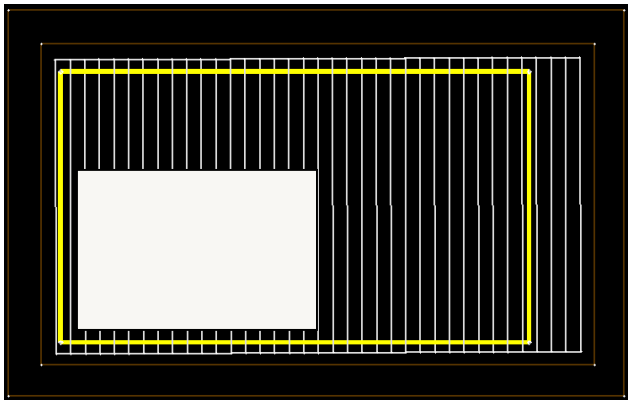
Loading and Clamping Material Tasks

- Task 1: Place the material in the machine
- Task 2: Clamp the material in the machine
- Task 3: Position the nozzle for machining

Step 9: Load and Clamp Material

Task 1: Place material in the tank

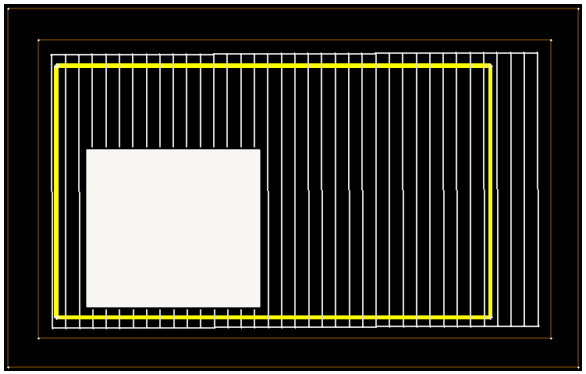
- Move the nozzle out of the way before loading material in the tank
- Place material “logically” on the slats in the tank for cutting



Warning! Slats may be sharp

Step 9: Load and Clamp Material

What Is Logical Placement of the Material?



- Within the cutting area
- Accessible to the operator
- Can be clamped for stability
- Lays flat
- No obstructions for the cutting head
- On sacrificial material (such as waterjet brick) if applicable

help *Keywords "materials tips"*

Step 9: Load and Clamp Material

Task 2: Clamp the material in the tank

- Securely fasten the material for cutting to keep it from moving, vibrating, floating, tipping, or falling into the tank

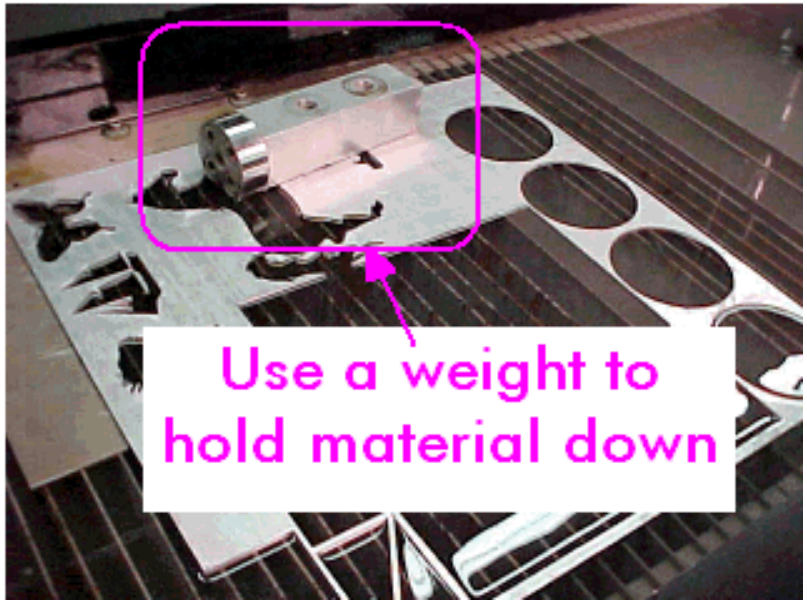
NOTICE! Insufficient clamping may result in inaccuracies in finished parts

Keywords "fixturing"

Step 9: Load and Clamp Material

Securely Fasten Materials in the Tank

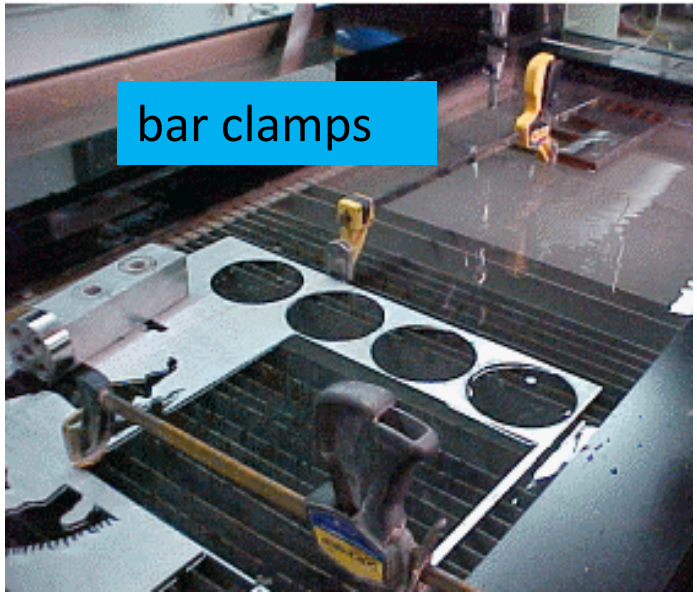
- Place a heavy weight on top of the material to keep it from floating



Step 9: Load and Clamp Material

Securely Fasten Materials in the Tank

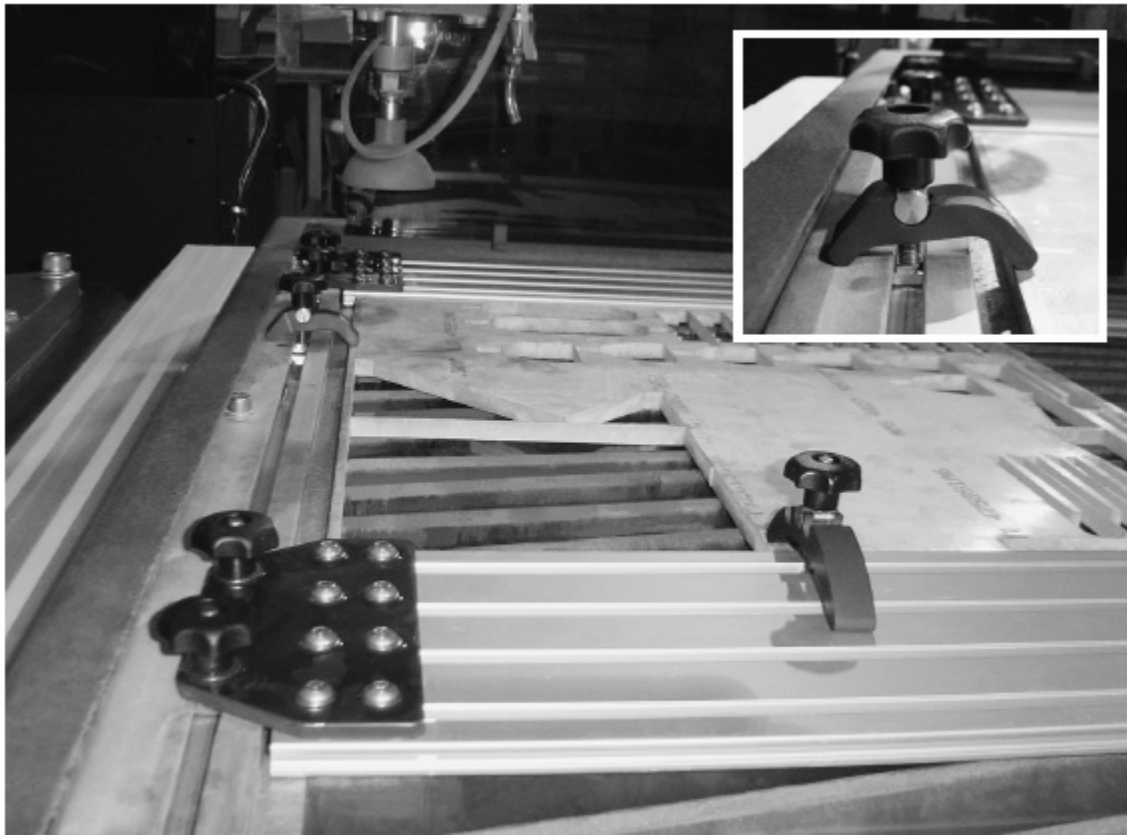
- Secure the material against the side of the tank



NOTICE! Do not secure materials against the slats

Step 9: Load and Clamp Material

Material Holding Systems



Step 9: Load and Clamp Material

Securely Fasten Materials in the Tank

- Flat plates
- Quick grips
- C-clamps
- Custom fixtures
- ?

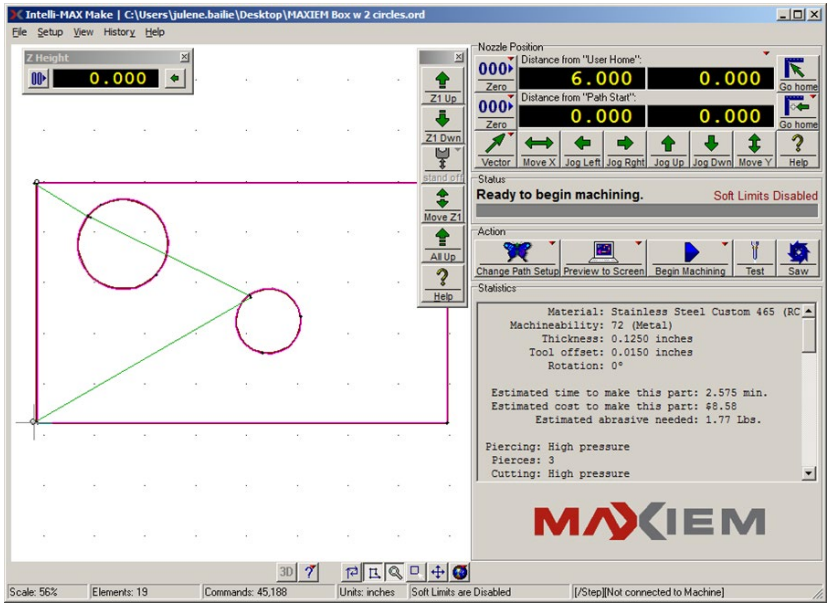
What else might work for securing materials in the tank?

See Dr. Olsen's article: *Fixturing for abrasive jet machining*
http://www.thefabricator.com/WaterjetCutting/WaterjetCutting_Article.cfm?ID=1238

Step 9: Load and Clamp Material

Task 3: position the nozzle for cutting

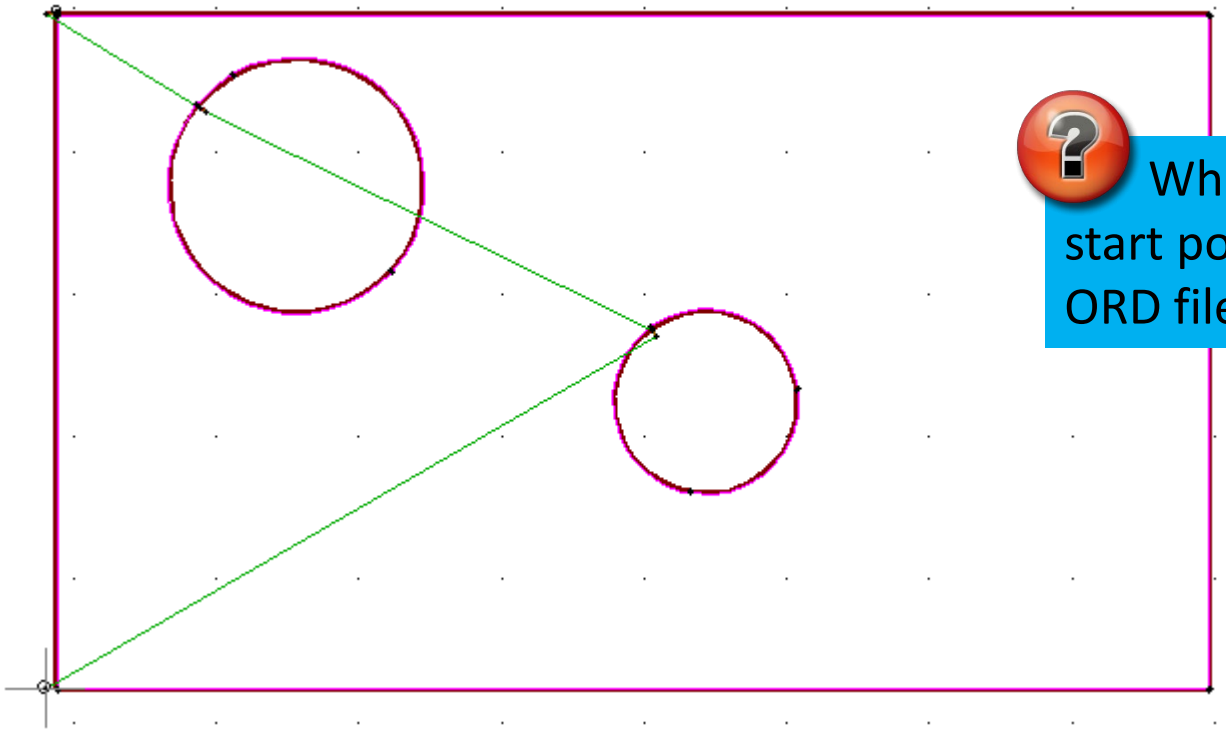
- Move the nozzle to the nozzle travel path start location
- The machine will move along the path beginning from the start point (white cross) in your ORD/OMX file



Step 9: Load and Clamp Material

Example

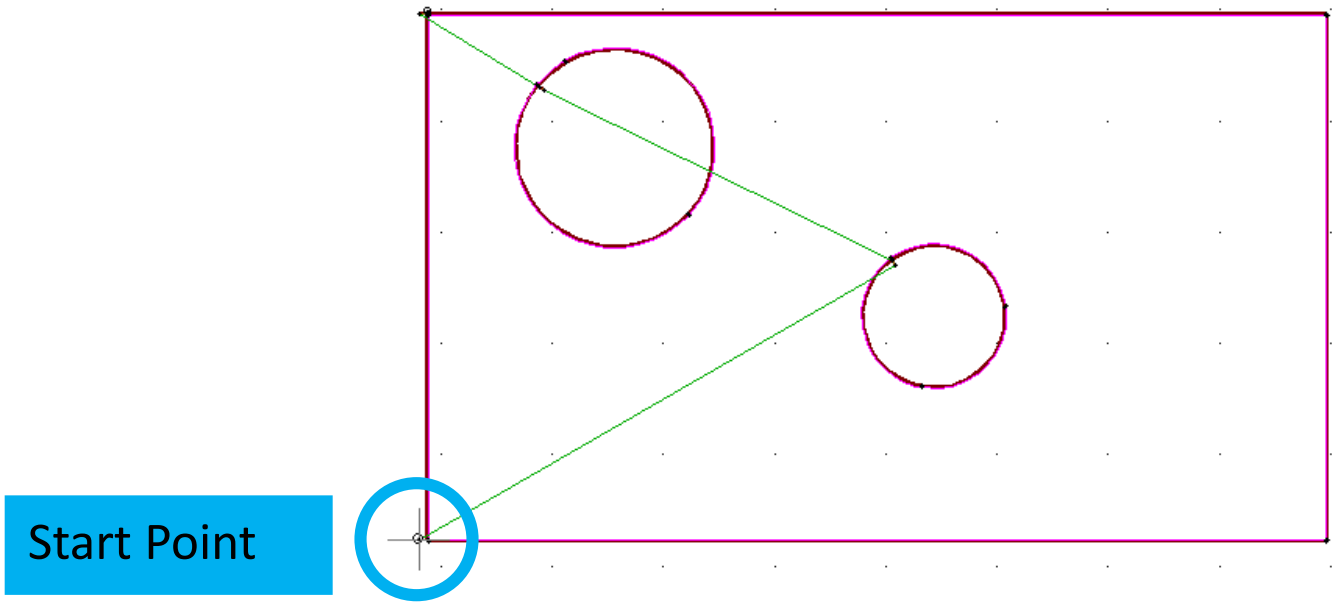
ORD file and machine path



Where is the start point in this ORD file preview?

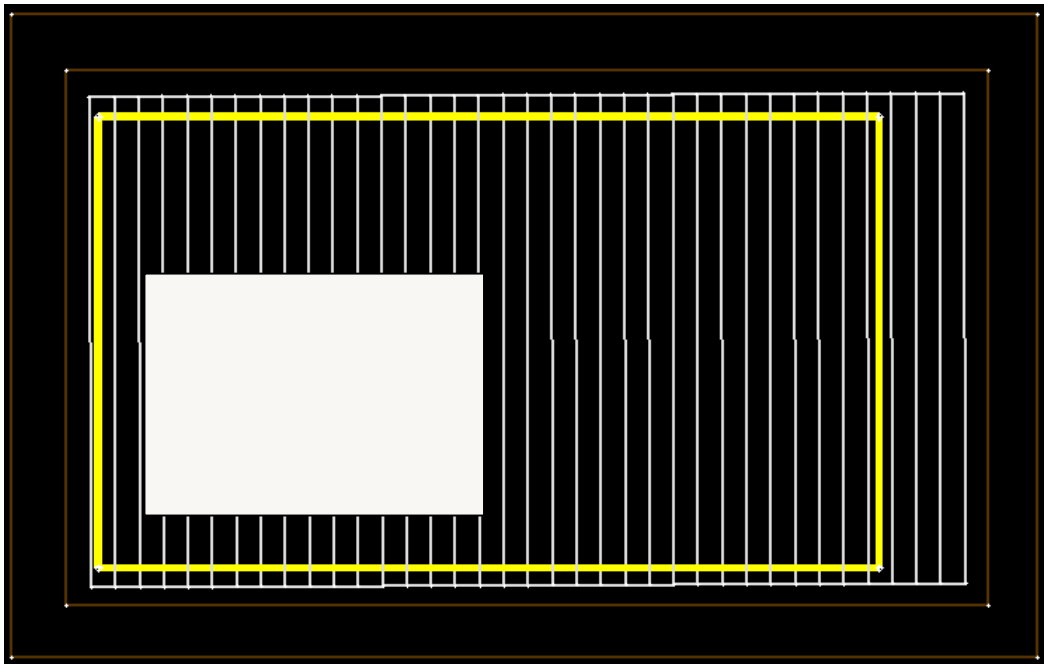
Step 9: Load and Clamp Material

ORD file of the part we are going to cut



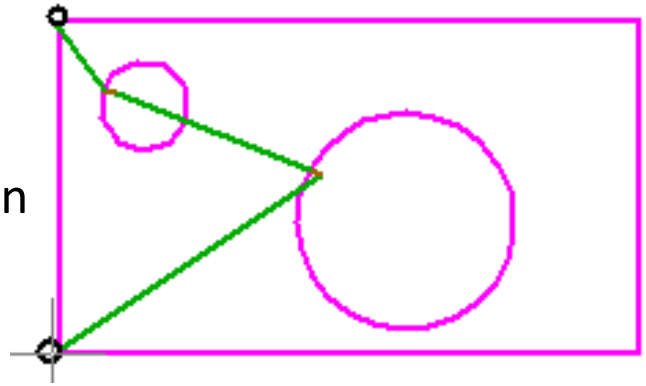
Step 9: Load and Clamp Material

Material loaded and clamped in the tank



Step 9: Load and Clamp Material

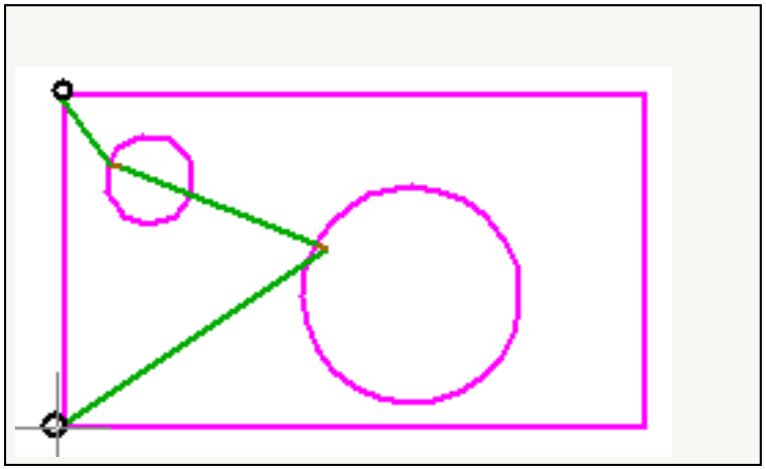
Given the following part and material dimensions, where would you place the nozzle on the material to begin machining?



Step 9: Load and Clamp Material

Nozzle start position

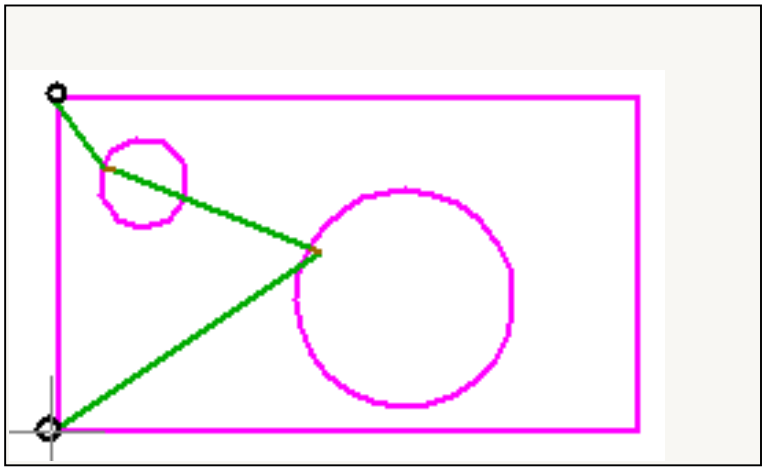
You would place the nozzle so the whole part could be cut out of the material and so you would minimize your scrap



Step 9: Load and Clamp Material

Best Practices for Nozzle Positioning

- Position for best material utilization and part quality
  - Reduce material scrap
  - Reduce risk of damaging the part



Step 9: Load and Clamp Material

Loading and Clamping Material Review

1. Give one example of placing the material logically in the tank.
2. What are the three tasks involved in Step 9 of the Loading and Clamping Material process?
   1. _____
   2. _____
   3. _____

Step 9: Load and Clamp Material

Loading and Clamping Material Review

3. Why do we need to make sure our material is securely clamped in the machine before we cut it?
4. What is one consideration for positioning the nozzle for cutting a part?

Steps in Making Parts

- Intelli-MAX **LAYOUT**
  - **Step 1:** Obtain/create a Drawing File (DXF file).
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  - **Step 10:** Begin machining and cut the part.

Step 10: Begin Machining & Cut the Part

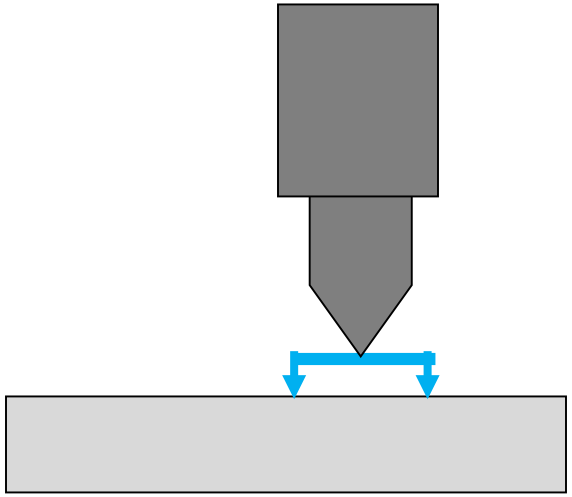
Machining Tasks

- Task 1: Set the nozzle stand-off
- Task 2: Do a dry run of the tool path
- Task 3: Put the splash guard on the nozzle
- Task 4: Start the cutting process
- Task 5: Remove the cut part(s) from the machine

Step 10: Begin Machining & Cut the Part

Task 1: Set the nozzle stand-off

- Stand-off is the distance between the material surface and the tip of the mixing tube in the nozzle
- Set using a feeler gauge
  - .040 in. for standard Z-axis
  - .080 in. when using the A-Jet

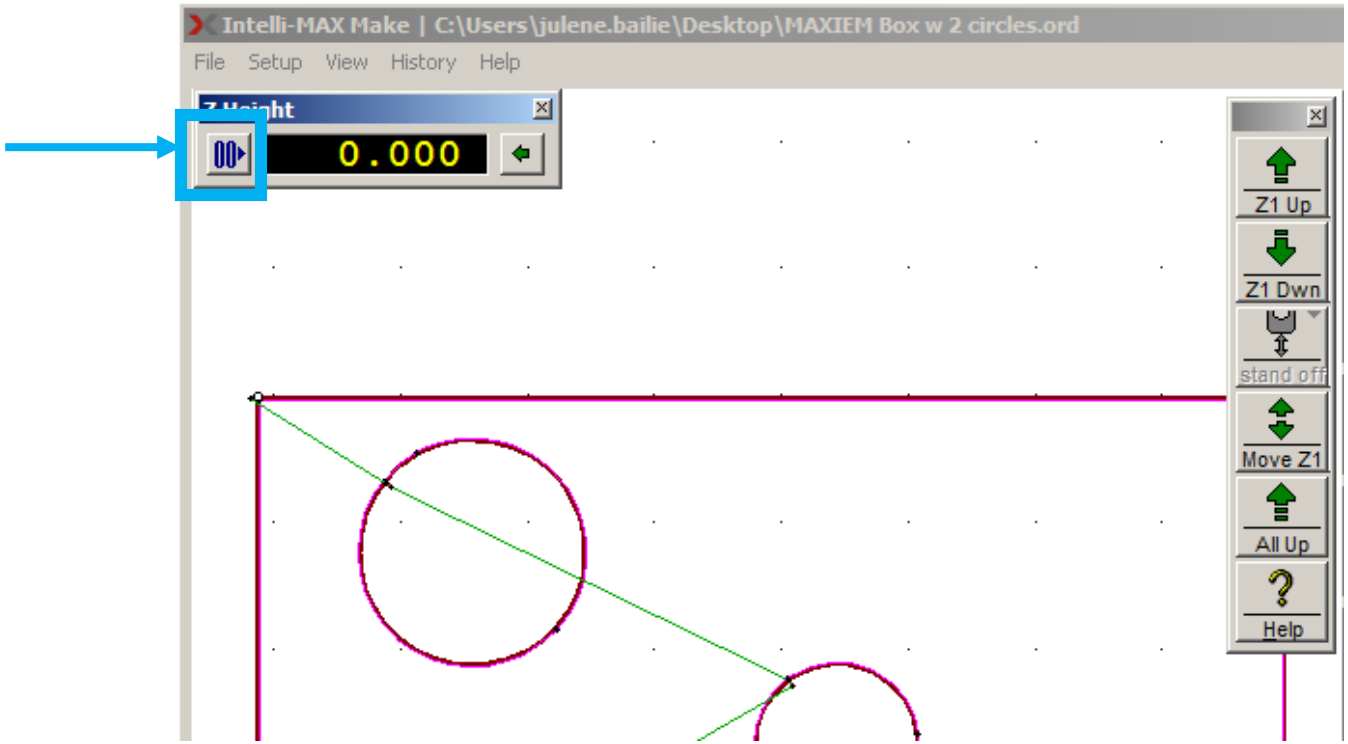


help *Keywords "stand-off"*

Step 10: Begin Machining & Cut the Part

Task 1: Set the nozzle stand-off

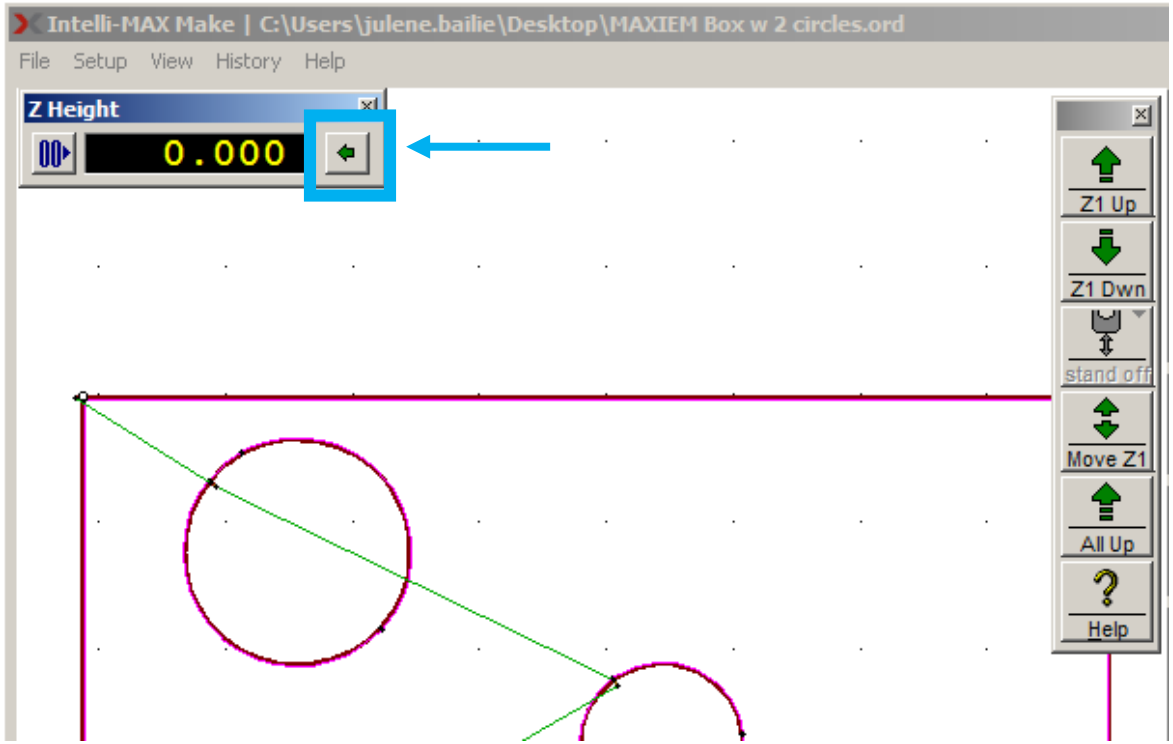
- Click to zero the **Z Height** counter in **MAKE**



Step 10: Begin Machining & Cut the Part

Task 1: Set the nozzle stand-off

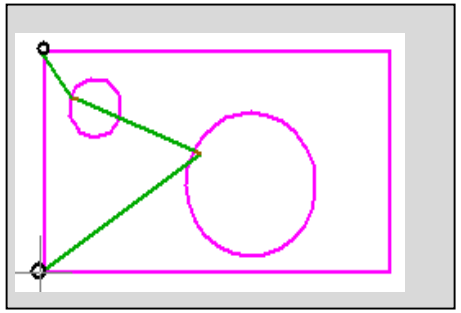
- Click to move the nozzle back to Z = zero in **MAKE**



Step 10: Begin Machining & Cut the Part

Task 2: Do a dry run of the tool path

- Goes through all the cutting motions without turning on the water or abrasive
- Quality check prior to cutting the part
  - Verifies the part will fit on the material
  - Verifies the start point
  - Verifies the nozzle will not hit any fixturing
  - Verifies the nozzle stand-off is sufficient so the nozzle won't run into the material (if an uneven surface)

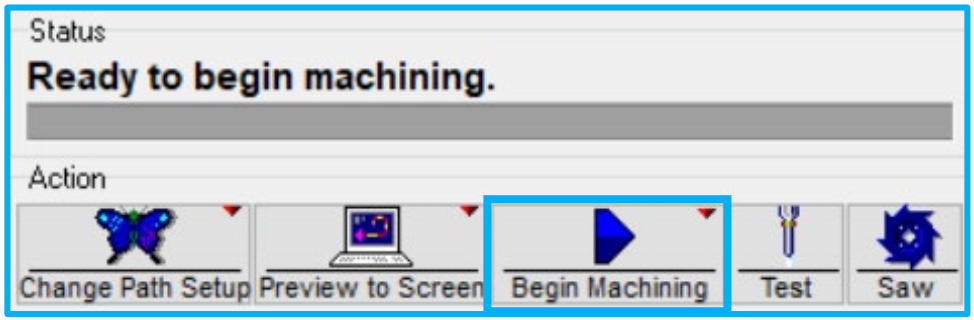


help *Keywords "dry run"*

Step 10: Begin Machining & Cut the Part

Task 2: Do a dry run of the tool path

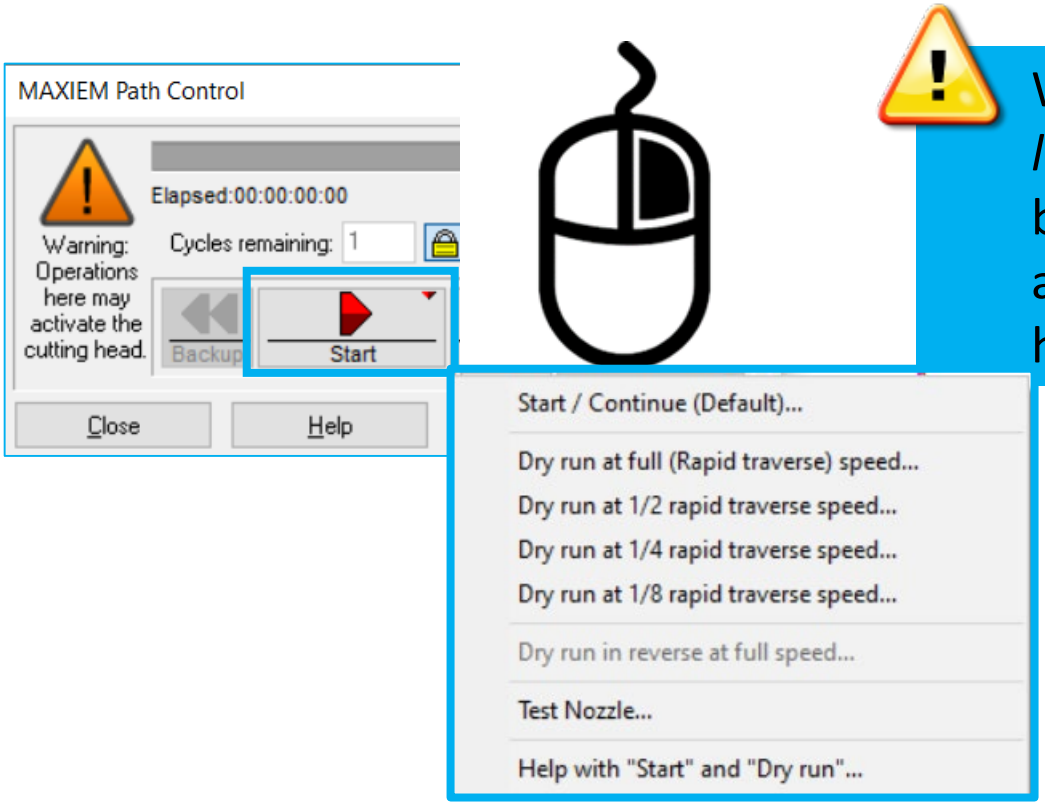
- To access the dry run option in **MAKE**, click **Begin Machining**
- This displays **OMAX Path Control**



Step 10: Begin Machining & Cut the Part

Task 2: Do a dry run of the tool path

- In **OMAX Path Control**, right-click **Start**

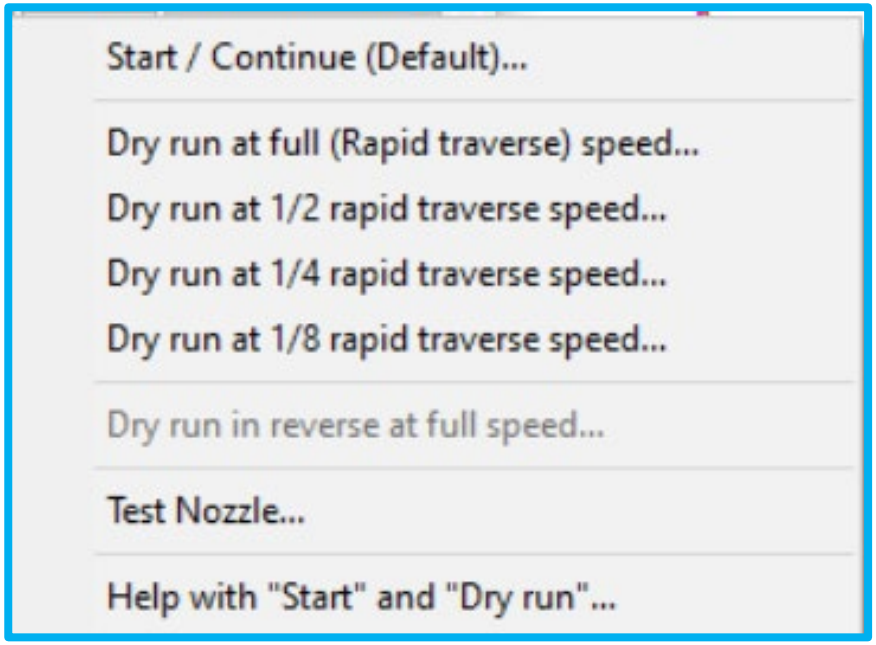


Warning! Do not *left*-click the Start button as this will activate the cutting head

Step 10: Begin Machining & Cut the Part

Task 2: Do a dry run of the tool path

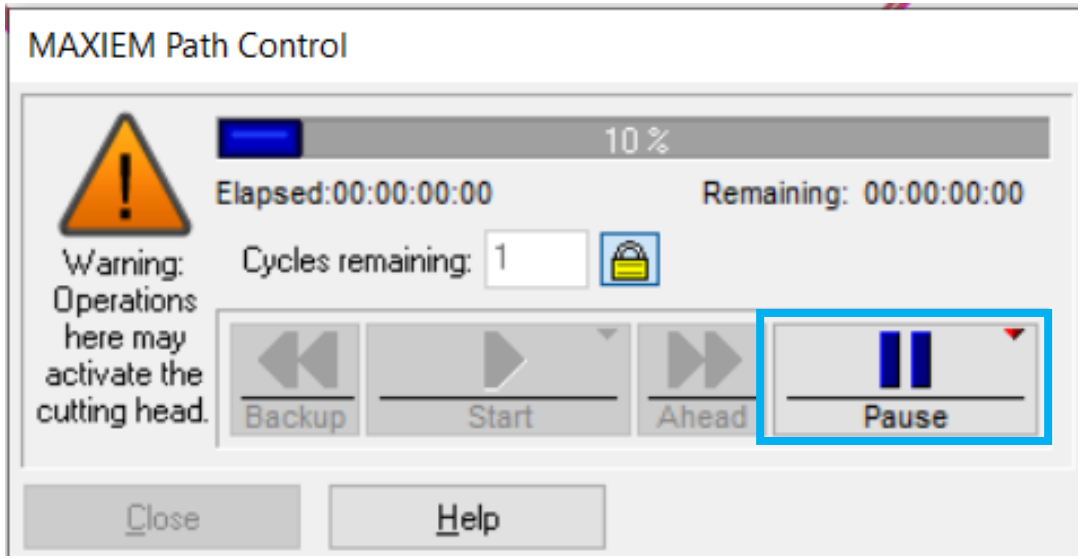
- Right-click **Start** to display the list of dry run options



Step 10: Begin Machining & Cut the Part

Task 2: Do a dry run of the tool path

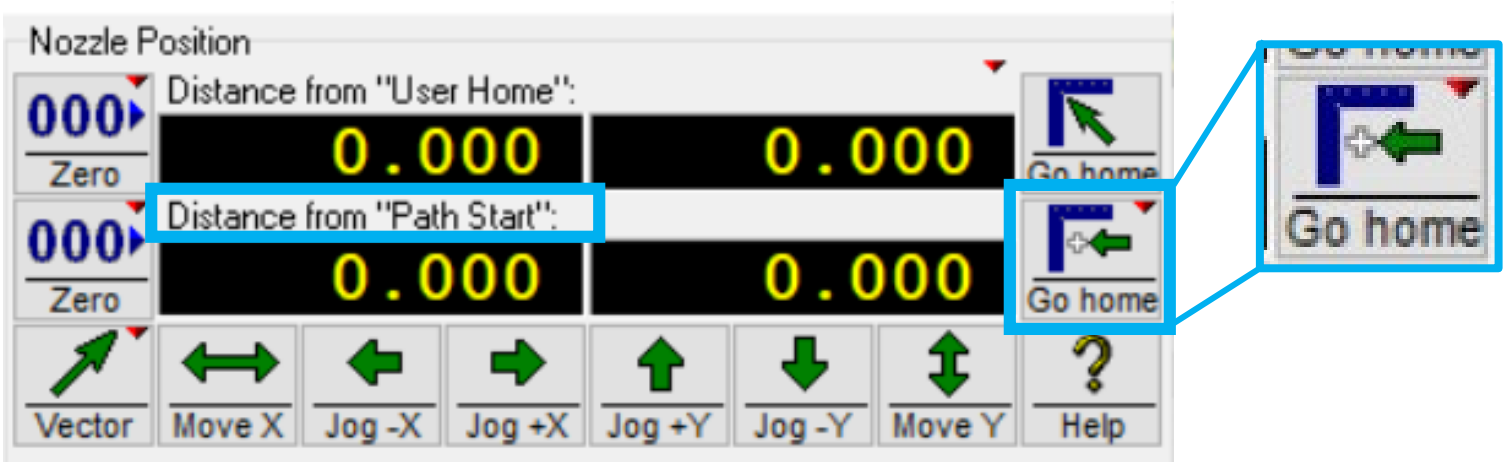
- Click **Pause** if you see potential problems during the dry run process – this will stop the nozzle



Step 10: Begin Machining & Cut the Part

Task 2: Do a dry run of the tool path

- Click **Go home** to move the nozzle back to the **Path Start Home** position when you are finished with the dry run



Task 3: Put splash guard on cutting head

- Putting a splash guard on the cutting head prevents splash back that can damage the machine
- Always use a splash guard

Step 10: Begin Machining & Cut the Part

- To put the splash guard on the cutting head
  - Close machining functions in **MAKE**
  - Raise the nozzle Z-height about three inches
  - Slide the splash guard up onto the nozzle body so the bottom of the guard is about even with the tip of the mixing tube on the nozzle

Task 4: Begin machining the part

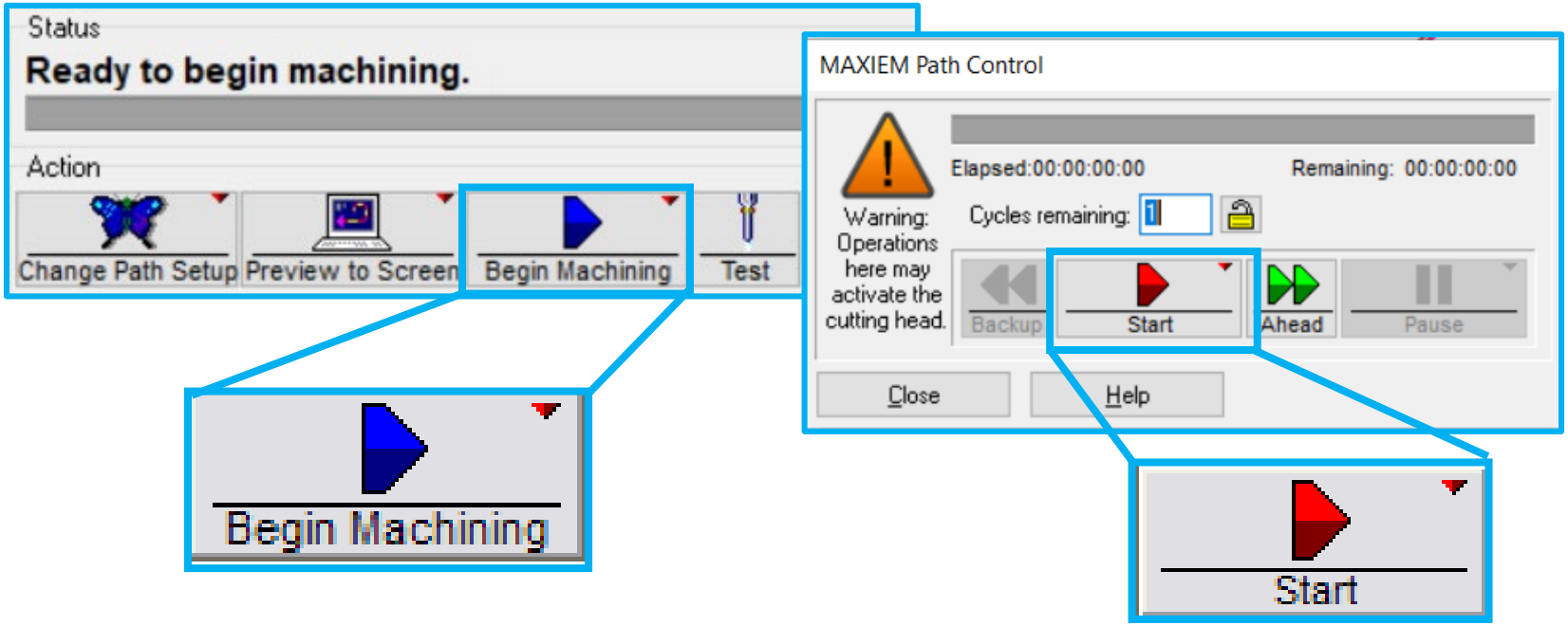
- Pre-machining checklist

  - ✓ Ear protection on?
  - ✓ Eye protection on?
  - ✓ Anyone or anything near the nozzle that could be hit when the nozzle moves?
  - ✓ Is there enough abrasive to make the part?
  - ✓ Is the nozzle positioned at the start of the path?
  - ✓ Is the charge pump turned on?

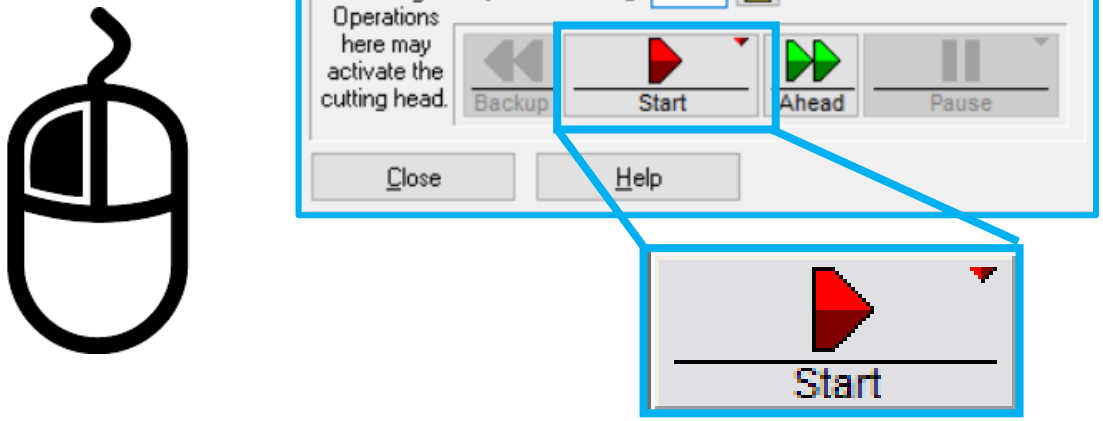
Step 10: Begin Machining & Cut the Part

Task 4: Begin machining the part

- To begin the machining process, click **Begin Machining**, and then click **Start**

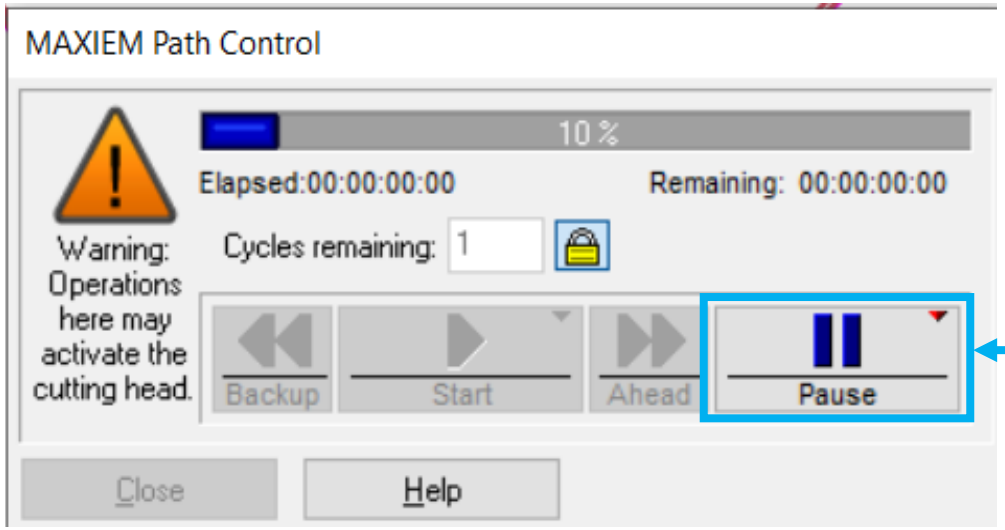


Task 4: Begin machining the part

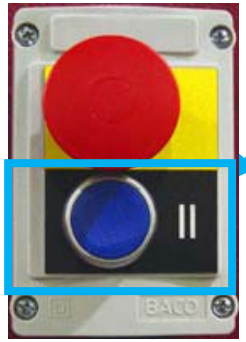


Warning! *Left*-clicking the Start button will activate the cutting head and start the machining process

Task 4: Begin machining the part



Both of these **Pause** controls will stop the cutting head and turn off the water and abrasive



Task 4: Begin machining the part

- Watch the part being machined
  - Stay in the area
  - If the machine must be paused for any reason, press **Pause**
  - The white cross on the **MAKE** preview window will move to reflect the current position of the nozzle on the part

Task 4: Begin machining the part

- Watch the part being machined
  - Adjust water level if necessary
  - Monitor the abrasive level. Add as needed.
  - Listen to the MAXIEM. It makes a distinct sound when cutting.
  - Check the part periodically

Step 10: Begin Machining & Cut the Part

Task 5: Remove the cut part from the machine

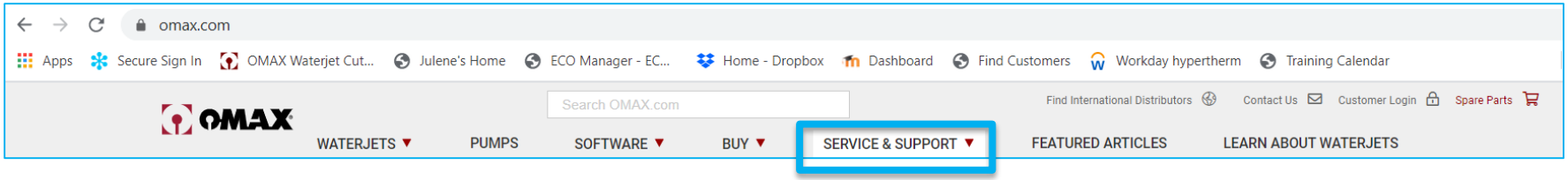
- Close any machining function windows in **MAKE**
- Raise the nozzle Z-height
- Move the nozzle out of the way
- Rinse excess abrasive off the material (if needed)
- Remove and inspect the part

Steps in Making Parts

- Intelli-MAX **LAYOUT**
  - **Step 1:** Obtain/create a Drawing File (DXF file).
  - **Step 2:** Assign machining Qualities (edge finish).
  - **Step 3:** Clean and save the drawing.
  - **Step 4:** Add Path Elements to the drawing and save it.
  - **Step 5:** Create the Machine Tool Path file (ORD/OMX file).
- Intelli-MAX **MAKE**
  - **Step 6:** Start up the machine.
  - **Step 7:** Configure Machine Settings.
  - **Step 8:** Open and configure the ORD/OMX file.
  - **Step 9:** Load and clamp the material.
  - **Step 10:** Begin machining and cut the part.

Technical Support

- Review the Customer Service section of the OMAX website for the following:
  - Hours of operation
  - Contact information
  - How to order/return parts
  - Warranty information



https://www.omax.com/service-support