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# Probing



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# Introduction to Probing

GibbsCAM Probing was introduced as a new product option in 2020, with GibbsCAM 14.

**Please Note:** This feature requires a post upgrade. To request a post upgrade, contact your Reseller or the Gibbs Post Department.

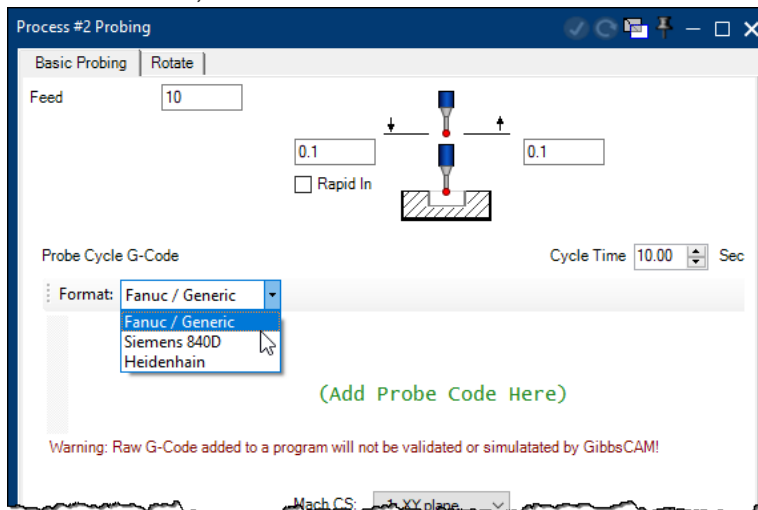
## Basic Probing

Basic Probing includes all the following:

- Probing tools: ball, disk, cylinder, 2D Form, and 3D Form

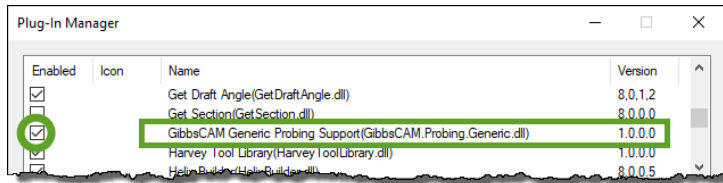


- User interface for setting basic probing parameters, including G-code format: Fanuc/generic, Siemens 840D, or Heidenhain



- Framework for generating probing operations
- Machine simulation of probing operations
- API library for third-party vendors to create plug-ins and macros

# GibbsCAM Generic Probing Cycles



GibbsCAM Generic Probing is available by using Plug-In Manager to enable a plug-in named **GibbsCAM.Probing.Generic.dll**. This plug-in provides Basic as well as several generic probing cycle types, including: Single Surface, Rectangle Pocket, Circular Pocket, Rectangle Boss, and Circular Boss.

## Probing User Guide

This document provides a guide to Basic Probing, the generic probing cycles, and using macros to create a custom probing cycle. It does not cover additional cycles or options that may have been provided by your vendor. If you have these additional capabilities, please consult the third-party documentation.

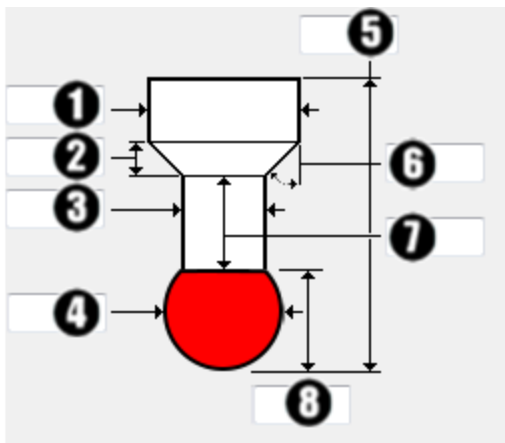
# Tool Types for Probing

GibbsCAM supplies five tool types for Probing:

- **Ball:** See [Ball Tool for Probing](#) below  
A ball probe is the simplest type of probe and the one most often used. It is suitable for most probing applications.
- **Disc:** See [“Disc Tool for Probing” on page 8](#)  
Disc probes are used to probe undercuts and grooves within bores. When the disc's edges are spherical, the results are equivalent to probing with a ball probe, but a disc provides more clearance above and below the probed point.
- **Cylinder:** See [“Cylinder Tool for Probing” on page 8](#)  
Cylinder probes are used for probing holes in thin parts and for probing threaded holes and similar features. The cylinder assures a uniformity of measurement where a ball probe might provide different measurements for different Z depths.
- **Forms :** See [“2D and 3D Form Tools for Probing” on page 8](#)



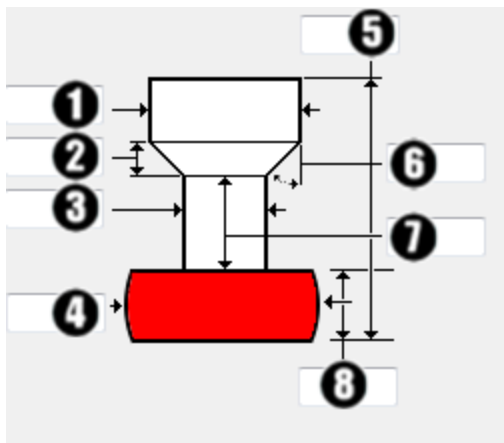
## Ball Tool for Probing



1. Shank diameter
2. Shank taper length
3. Shank neck diameter
4. Probe tip diameter
5. Overall tool length
6. Shank taper angle
7. Shank neck length
8. Probe tip length



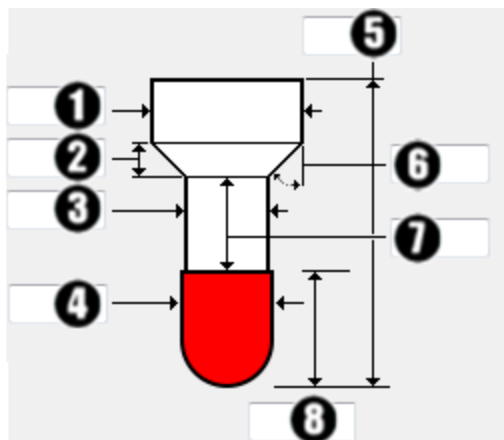
## Disc Tool for Probing



1. Shank diameter
2. Shank taper length
3. Shank neck diameter
4. Probe tip diameter
5. Overall tool length
6. Shank taper angle
7. Shank neck length
8. Probe tip length



## Cylinder Tool for Probing



1. Shank diameter
2. Shank taper length
3. Shank neck diameter
4. Probe tip diameter
5. Overall tool length
6. Shank taper angle
7. Shank neck length
8. Probe tip length



## 2D and 3D Form Tools for Probing



As with other 2D and 3D form tools, you create the tool by:

- (2D Form Tool): Selecting a 2D shape that forms a body of revolution when spun about a central axis.
- (3D Form Tool): Selecting a 3D body.

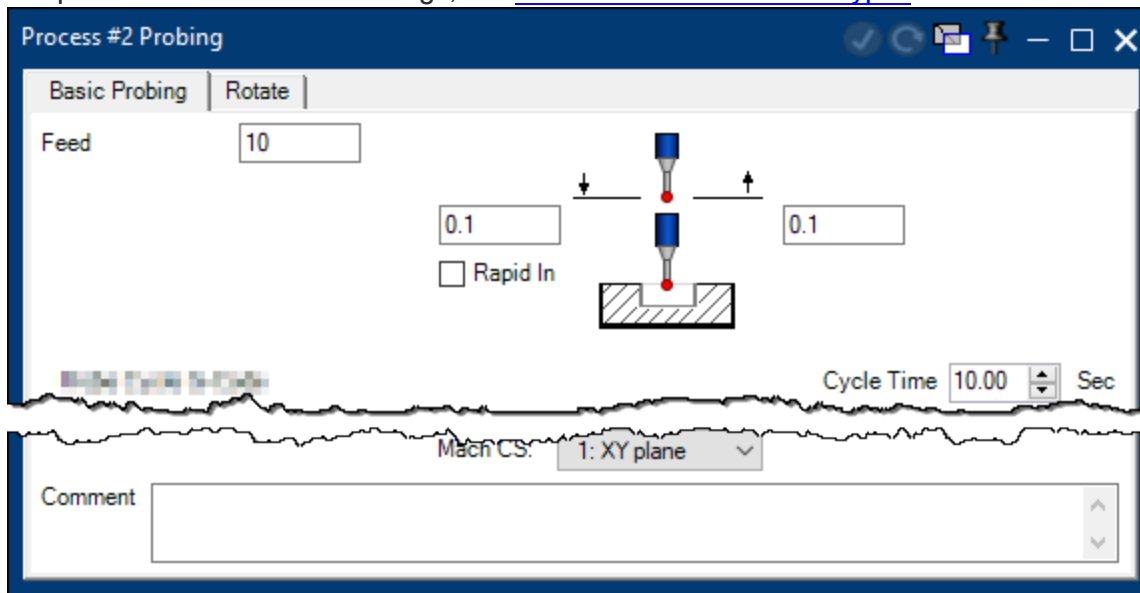


# Interface

**Tools.** User interface controls for Probing tools use a standard tool diagram. For complete information, see “[Tool Types for Probing](#)” on page 7.

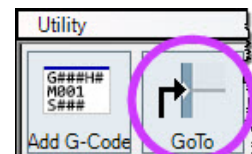
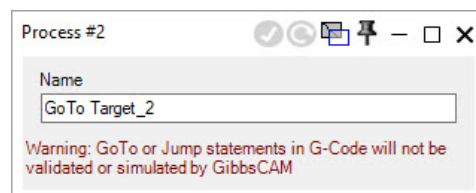
**Processes.** The Probing process dialog presents one or two tabs: the main probing tab – either Basic Probing or Probe Shape (Generic) – and, optionally, **Rotate**.

- The **Basic Probing** page presents a depths diagram for the tool, and also a few other parameters you can specify, such as Cycle Time, Machining CS, and Comments. For parameters and their meanings, see [Parameters for All Probe Types](#).



- If your license includes cycles beyond Basic Probing, further parameters are presented.
- If you are licensed for **Generic Probing** and if `GibbsCAM.Probing.Generic.dll` is enabled, the Basic Probing page is replaced by the **Probe Shape (Generic)** page. See [Parameters for Generic Probe Types](#).
- The **Rotate** page appears if your DCD supports at least one programmable rotary axes suitable for machining. The page presents choices for CS's and/or spindles. For complete information, see [Rotate tab for Probing](#).

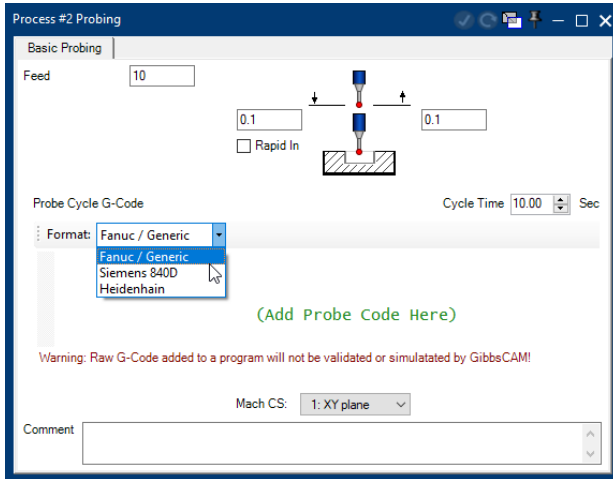
**Utility Operation.** Use the GoTo utility operation if you want to use `Result > Measurement > Undersize or Oversize > GoTo`.



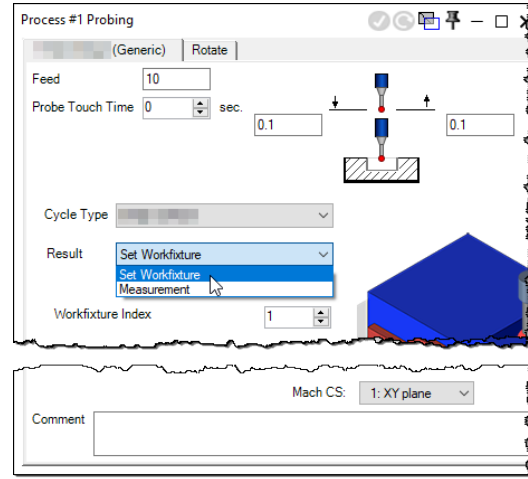
## Probe Tab

Most controls presented in the main page of the Probing process dialog depend on the product (Basic or Generic) and, for Generic, the choice of **Probe Type** (Probe Shape or Corners).

Several basic parameters are shared across all probe types.



Process: Basic Probing



Process: Generic Probing

## Parameters for All Probe Types

### Feedrate

Specifies the speed (in either ipm=inches per minute or mmpm=millimeters per minute) for the move between the clearance plane and the workpiece or material.

### Rapid In

When this checkbox is available and selected, the probing tool will use a rapid move, rather than a feed move, to go between the transition plane and the selected point.

### Cycle Time (Basic)

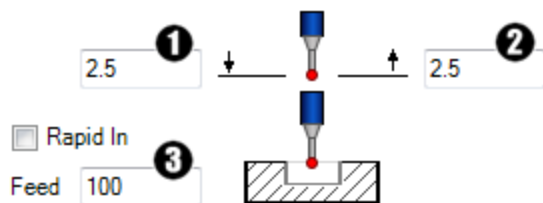
Cycle Time is the length of time, in seconds, for the entire G-Code block to execute.

### Probe Touch Time

Probe Touch Time is the length of time, in seconds, that must elapse for a probe encounter to be considered a touch. A value of 0 is acceptable, and means that no further time for probe travel is added to the time computed for the moves.

## Depths diagram

The items in this section of the Probing process dialog define the clearances and depths for the toolpath of the probe tool.



1. Entry Clearance Plane
2. Exit Clearance Plane
3. Feedrate (unavailable if Rapid In is selected)

### Entry Clearance Plane

Also called CP2, the Entry Clearance Plane specifies the plane (normally Z height) where the probe tool will rapid to before feeding to the start point of the toolpath.

### Exit Clearance Plane

Also called CP3, the Exit Clearance Plane specifies the plane (normally Z height) where the probe tool will rapid to after completing the toolpath.

## Other basic parameters

### Machining CS

Select the correct CS from the list.

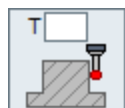
### Comment

You can enter text that can record your choices or remind you or others of helpful information. When the operation is generated, this text is stored in operation data **Op Comment** field.

## Parameters for Generic Probe Types

Additional parameters are available if you are licensed for **Generic Probing** and if `GibbsCAM.Probing.Generic.dll` is enabled:

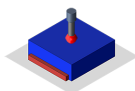
- For Probe Shapes (Generic), see [Probe Shape \(Generic\)](#), below.
- For Corners (Generic), see [“Corners \(Generic\)”](#) on page 13.



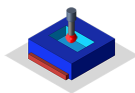
### Probe Shape (Generic)

#### Cycle Types for Probe Shape (Generic)

Choose a cycle type from the pull-down list from among the following. The graphic changes to match to the cycle type you select.

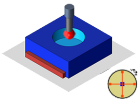


**Single Surface** – Use this cycle to probe a single surface cut. In addition to the standard parameters, this cycle type offers controls for **Clearance** and **Axis**.

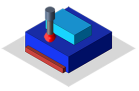


**Rectangle Pocket** – Use this cycle to probe a cut that has made a rectangular pocket. In addition to the standard parameters, this cycle type offers controls for **Axes**.

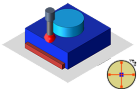




**Circular Pocket** – Use this cycle to probe a cut that has made a circular pocket. In addition to the standard parameters, this cycle type offers controls for **Points**: either **Four Point** or **Three Point**.



**Rectangle Boss** – Use this cycle to probe a cut that has formed a rectangular boss. In addition to the standard parameters, this cycle type offers control for **Boss Clearance** and **Axes**.



**Circular Boss** – Use this cycle to probe a cut that has formed a circular boss. In addition to the standard parameters, this cycle type offers controls for **Boss Clearance** and **Points**.

## Parameters for all cycle types for Probe Shape (Generic)


### Result

Choose what to do upon a probe touch:

- **Set Workfixture** – Designate the result as a workfixture whose index you specify.
- **Measurement** – Register the result as a measurement.

### Undersize / Oversize

To the right of the pull-down list, you can choose a system action to take if the probe determines that the cut was **Undersize** (insufficient to meet the tolerance specified) or **Oversize** (went farther than the tolerance specified):

- **Continue** – Instructs the system to continue without interruption.
- **Alarm** – Instructs the CNC machine to stop and to throw an alarm that alerts the operator to the out-of-spec condition.
- **GoTo** – Instructs the system to jump to a GoTo utility operation that you specify and to execute subsequent operations. The  GoTo utility process is available in the **Select Process Type** flyout, **Utility** section.

*Note:* In a probe operation that specifies a GoTo, ensure that no MTM sync intervenes between that probe operation and its GoTo target.

### Two Touch

Enabling this checkbox specifies that the probing tool must touch twice for a hit to register.

### Probe Depth

The Z depth where you want the probe to touch the part. For example, you might select geometry of a top surface that may have burrs and use a negative value for **Probe Depth** to touch the probe farther down a cut wall.

## Parameters for specific cycle types for Probe Shape (Generic)

### Clearance (for cycle type **Single Surface**)

Specify a minimum distance for the probe to keep away from the surface.

**Axis (for cycle type Single Surface)**

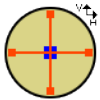
You can specify any of the three axes (normally X, Y, or Z, but possibly H, V, or D) and the direction: From Positive Side or From Negative Side.

**Axes (for both Rectangle cycle types)**

Designate which axis or axes should be used – for example, X and Y, X Only, or Y Only.

**Boss Clearance (for both Boss cycle types)**

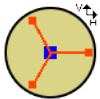
Specify a minimum distance for the probe to keep away from a shape you are probing from the outside.

**Points (for cycle types Circular Pocketing or Circular Boss)****Four Point**

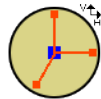
Choose Four Point to probe at the extreme maximum and minimum values of the V (vertical, often Y) direction and H (horizontal, often X) direction.

**Four Point****Three Point Bore/Boss**

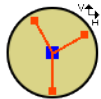
Choose Three Point to designate three points. Angles are measured counterclockwise from the positive H+ direction (often X+). For example:



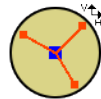
0, 120, -120



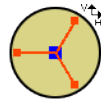
0, 90, -120



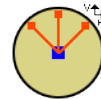
30, 120, -90



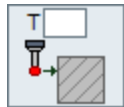
45, 150, -60



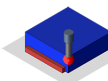
60, 180, -60



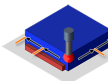
45, 90, 135

**Corners (Generic)****Cycle Types for Corners (Generic)**

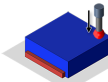
Choose a cycle type from the pull-down list from among the following. The graphic changes to match the cycle type you select.



Outside Corner – Use this cycle to probe %%%. In addition to the standard parameters, this cycle type offers controls for X, Y, and Z Distance.



Outside Corner with Angle – Use this cycle to probe %%%. In addition to the standard parameters, this cycle type offers controls for X, Y, and Z Distance.



Single Surface from Corner (Z) – Use this cycle to probe %%%. In addition to the standard parameters, this cycle type offers controls for Probe Depth and Axis.

## Parameters for all cycle types for Corners (Generic)

### Set

Choose what to do upon a probe touch:

- **Workfixture** – Designate the result as a workfixture whose index you specify.
- **Workplane** – .

### XY Clearance

Specify a minimum distance for the probe to keep away from workfixture in the XY plane.

### Z Clearance

Specify a minimum distance for the probe to keep away from workfixture the Z direction.

### Two Touch

Enabling this checkbox specifies that the probing tool must touch twice for a hit to register.

## Parameters for specific cycle types for Corners (Generic)

### XY Clearance (for cycle types **Outside Corner** and **Outside Corner with Angle**)

Enter the minimum distance in the XY plane for the probe to keep away from the workpiece.

### Z Clearance (for cycle types **Outside Corner** and **Outside Corner with Angle**)

Enter the minimum distance in the Z direction for the probe to keep away from the workpiece.

### Probe Depth (for cycle type **Single Surface from Corner (Z)**)

Enter the Z depth where you want the probe to touch the part. For example, you might select geometry of a top surface that may have burs and use a negative value for **Probe Depth** to touch the probe farther down a cut wall.

### Axis (for cycle type **Single Surface from Corner (Z)**)

You can specify any of the three axes (normally X, Y, or Z, but possibly H, V, or D) and the direction: From Positive Side or From Negative Side.

---

## Rotate Tab for Probing

The controls presented in the **Rotate** page of the Probing process dialog ...

# Using Macros to Create a Custom Probe Cycle

Probing processes support the use of macros to create a custom probe cycle. You can use macros to customize the probe process dialog and to create your own probing toolpath.

## Macro Paths, Folders, and Files

Each macro that defines a custom probe cycle resides in its own separate folder. Each macro folder is stored within the `ProbeProcesses\` folder in the global data folder. By default, this is:

```
C:\ProgramData\CAMBRI0\GibbsCAM\<version> \Macros\ProbeProcesses\
```

For example, if you want to create a probe cycle called `MyProbeCycle` to be used in GibbsCAM version 14.0.48, you would put the files in this folder:

```
C:\ProgramData\...\14.0.48\Macros\ProbeProcesses\MyProbeCycle\
```

## Files Used by Macros for Probing

For custom probe cycles, each macro folder contains the following files:

- “Macro Filename: `Visible.txt`” on page 17 – *Optional*. Specifies the MDDs that are supported by this macro. If the file is not present, all MDDs are supported.
- “Macro Filename: `ProcessData.txt`” on page 17 – Specifies process parameters used by this macro.
- “Macro Filename: `ProcessVars.txt`” on page 18 – Lists all variables and default values used by the process dialog that is defined by the macro.
- “Macro Filename: `Process.mac`” on page 19 – *Optional*. Specifies one or more macros to be called before the process dialog is displayed to the user.
- “Macro Filename: `Process.dlg`” on page 19 – Defines the controls to be displayed to the user in the process dialog, and also specifies the field's width and height.
- “Macro Filename: `AllowDoIt.mac`” on page 20 – *Optional*. Specifies the circumstances in which the `DoIt` and `ReDo` buttons are available to the user.
- “Macro Filename: `Toolpath.mac`” on page 20 – Creates the operation toolpath. Can call other macros.



## Macro Filename: **Visible.txt**

The **Visible.txt** file specifies the MDDs that are supported by this macro. It contains one line per MDD. Each line contains the actual name of the MDD, such as **VMill15a.mdd**. It can also specify any or all of these categories (one per line):

```
ANY_MILL
ANY_LATHE
ANY_MTM
```

If the MDD used by the current part file is not on this list, then the macro for this probe process is unavailable to the current part.

The file **Visible.txt** is optional. If it does not exist, then the probe process will be available to any MDD.

## Macro Filename: **ProcessData.txt**

The **ProcessData.txt** file specifies process parameters used by this macro. Each line in the file must be in the following format:

```
<data> = <value>
```

The acceptable values for *<data>* are listed in the left column of the following table.

<i>data</i>	<i>note</i>	<i>value</i>
PROCESS_NAME	1	Name of the probe process.
DISPLAY_NAME	1	Used when displaying the process name.
SHORT_PROCESS_NAME	1	Used when GUI displays a short process name.
LONG_PROCESS_NAME	1	Used when GUI displays a long process name.
PROCESS_ICON	1	Name of *.ico file used for the process.
NEED_FEEDRATE	2	<b>YES</b>   <b>NO</b> : Does this process dialog show the <b>Feedrate</b> textbox?
USE_RAPID_IN	2	<b>YES</b>   <b>NO</b> : Does this process dialog show the <b>Rapid In</b> checkbox?
NEED_TOUCH_TIME	2	<b>YES</b>   <b>NO</b> : Does this process dialog show the controls for <b>Touch Time</b> ?
CS_USE_TYPE	3	Must be one of the following values:  <b>NONE</b> <b>NORMAL</b> <b>PART_STATION_ALIGNED</b>

<i>data</i>	<i>note</i>	<i>value</i>
PATH TYPE	3	Must be one of the following values:  FULL_PATH_NO_GEO FULL_PATH_WITH_GEO POINT_EXPANSION
<i>Notes:</i>		
1 – Value must be enclosed between doublequotes.		
2 – Value must be either YES or NO.		
3 – Value must be one of items in supplied list.		

## Sample Code for **ProcessData.txt**

A sample **ProcessData.txt** file might consist of these *<data>=<value>* pairs:

```

PROCESS_NAME = "MYPROBEPROCESS"
DISPLAY_NAME = "MYPROBEPROCESS"
SHORT_PROCESS_NAME = "MYRPROC"
LONG_PROCESS_NAME = "MY PROBE PROCESS "
PROCESS_ICON = "MYPROBEPROCESS "
NEED_FEEDRATE = YES
USE_RAPID_IN = NO
NEED_TOUCH_TIME = YES
CS_USE_TYPE = NORMAL
PATH_TYPE = FULL_PATH_WITH_GEO

```

## Macro Filename: **ProcessVars.txt**

The **ProcessVars.txt** file lists all variables and default values used by the process dialog that is defined by the macro.

Each line contains the variable name and the default value. These variables are saved with the operation that is created, and they will be available to the toolpath macro and to the post processor.

## Sample Code for **ProcessVars.txt**

A sample **ProcessVars.txt** file might consist of these *<data>=<value>* pairs:

```

VERSION = 1
OPT1 = 2 ! DEFINES WHICH RADIO BUTTON IS SELECTED
Z_CLEAR = 3.5 ! CLEARANCE ABOVE SELECTED GEOMETRY
Z_DEPTH = -2.2 ! DEPTH BELOW SELECTED GEOMETRY TO PROBE

```

## Macro Filename: **Process .mac**

The **Process .mac** file (optional) specifies one or more macros to be called before the process dialog is displayed to the user.

You might want to use this macro to check the values of each variable used by this probe cycle. For example, you could check if a probe Z plane height is below a clearance plane height.

## Macro Filename: **Process .dlg**

The **Process .dlg** file defines the controls to be displayed to the user in the process dialog, and also specifies the field's width and height. You use this as you use other macro dialog file, except that it addresses the controls and text field of the Probing dialog.

The **Process .dlg** file uses the following subset of dialog commands:

```
LABEL
INPUT
CHECK
RADIO
```

You can define up to ten of each control type. All radio buttons must be in the same group.

You must include the **DIALOG** command to define the size of the free field (red area in the illustration). The format for this command is not the same as for regular macro dialogs. Instead, it simply defines the width and height of the area. For example:

```
WIDTH 300, 200
```

## Tab Label, Feedrate, Probe Touch Time, and Rapid In

Four special fields and controls are as follows:

- The value for **LABEL** is the text to display for the tab name.
- The **Feedrate** textbox is displayed only if the **ProcessData.txt** file has this line:  

```
NEED_FEEDRATE = YES
```
- The **Probe Touch Time** control is displayed only if the **ProcessData.txt** file has this line:  

```
NEED_TOUCH_TIME = YES
```
- The **Rapid In** checkbox is displayed only if the **ProcessData.txt** file has this line:  

```
USE_RAPID_IN = YES
```

## Macro Filename: **AllowDoIt.mac**

The **AllowDoIt.mac** file (optional) specifies the circumstances in which the DoIt and ReDo buttons are available to the user. If this file is not present, then the buttons will always be enabled for the process. Like all \*.mac files, the **AllowDoIt.mac** file can call other macros.

As with other macros, setting the variable to 1 enables it. For example:

```
PROBE_ALLOW_DO_IT = 1
```

## Sample Code for **AllowDoIt.mac**

As an example of when and how you would use this, imagine a situation where you want to check if the user has one geometry feature selected and the selected feature is a circle, but in all other cases, you want to disable the DoIt and ReDo buttons.

A sample **AllowDoIt.mac** file might include the following snippet of code:

```
PROBE_ALLOW_DO_IT = 0

GET_NUM_FEAT_SELECTED INUMFEAT
IF INUMFEAT<>1 THEN GOTO END

GET_SELECTED_GEO_REF 1, IREF
GET_FEAT_TYPE IREF, IFEATTYPE
IF IFEATTYPE<>FEAT_TYPE_CIRCLE THEN GOTO END

PROBE_ALLOW_DO_IT = 1

:END
```

## Macro Filename: **Toolpath.mac**

The **Toolpath.mac** file creates the operation toolpath. Like all \*.mac files, it can call other macros.

## Toolpath Commands

You can use any regular macro commands in this file, but to create the toolpath, you must use commands from the following list.

Command <parameters>	Meaning
START <xs> <ys> <zs>	Toolpath start position
RAPID <xe> <ye> <ze>	Rapid in x, y, z
RAPID_X <xe>	Rapid in x

Command <parameters>	Meaning
RAPID_Y <ye>	Rapid in y
RAPID_Z <ze>	Rapid in z
FEED <xe> <ye> <ze>	Feed in x, y, z
FEED_X <xe>	Feed in x
FEED_Y <ye>	Feed in y
FEED_Z <ze>	Feed in z
ARC <xe> <ye> <ze> <xc> <yc> <dir>	Arc

## Commands and Variables Specifically for Probing

Command
CYCLE_START
CYCLE_END
MOVE_ENABLE
MOVE_DISABLE
TOUCH_MARKER

None of the probe commands have any parameters, but the `CYCLE_START` command will add extra data to the toolpath for use by the post processor. This data comprises 17 different variables with values that are set using the `SET_PROBE_PROCESS_CYCLE_START_DATA` command.

Probing-specific variables are as follows:

`H`, `V`, `D`, `Radius`, `Distance`, `Over_Tol`, `Under_Tol`,  
`Val1`, `Val2`, `Val3`, `Val4`, `Val5`, `Val6`, `Val7`, `Val8`, `Val9`, `Val10`

Any value that is not defined is set to zero.

## Sample Code for `Toolpath.mac`

If you want to tell the post processor the values for `H`, `V`, `Radius`, and `Over tolerance`, you might use these commands:

```
SET_PROBE_PROCESS_CYCLE_START_DATA H, 20
SET_PROBE_PROCESS_CYCLE_START_DATA V, 16.75
SET_PROBE_PROCESS_CYCLE_START_DATA RADIUS, 3.5
```

SET\_PROBE\_PROCESS\_CYCLE\_START\_DATA OVER\_TOL, 0.002

# Conventions

GibbsCAM documentation uses two special fonts to represent screen text and **keystrokes or mouse actions**. Other conventions in text and graphics are used to allow quick skimming, to suppress irrelevancy, or to indicate links.

## Text

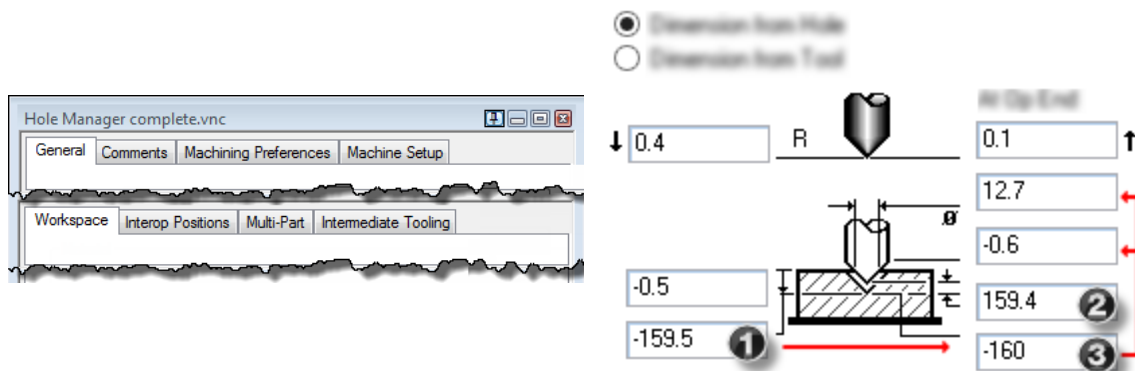
**Screen text.** Text with this appearance indicates text that appears in GibbsCAM or on your monitor. Typically this is a button or text for a dialog.

**Keystroke/Mouse.** Text with this appearance indicates a keystroke or mouse action, such as **Ctrl+C** or **right-click**.

**Code.** Text with this appearance indicates computer code, such as lines in a macro or a block of G-code.

## Graphics

Some graphics are altered so as to de-emphasize irrelevant information. A “torn” edge signifies an intentional omission. Portions of a graphic might be blurred or dimmed to highlight the item being discussed. For example:



Annotations on a graphic are usually numbered callouts (as seen above), and sometimes include green circles, arrows, or tie-lines to focus attention on a particular portion of the graphic.

Faint green borders that outline areas within a graphic usually signify an image map. In online help or a PDF viewer, you can click a green-bordered area to follow the link.

## Links to Online Resources

Link	URL	Action / Description
<a href="#">Go</a>	<a href="http://www.GibbsCAM.com">http://www.GibbsCAM.com</a>	Opens the main website for GibbsCAM.
<a href="#">Go</a>	<a href="https://online.gibbscam.com">https://online.gibbscam.com</a>	Opens a restricted website containing materials available for download. Requires a GibbsCAM Online Services account; to set up an account, contact GibbsCAM Support.
<a href="#">Go</a>	<a href="https://store.GibbsCAM.com">https://store.GibbsCAM.com</a>	Opens the website for the GibbsCAM Student Store.
<a href="#">Go</a>	<a href="https://macros.gibbscam.com">https://macros.gibbscam.com</a>	Opens a wiki containing documentation and examples of GibbsCAM macros. Requires a GibbsCAM account.
<a href="#">Go</a>	<a href="http://kb01.GibbsCAM.com">http://kb01.GibbsCAM.com</a>	Opens a Knowledge Base article, <b>Contour Operations Using Thread Mill Tools</b> , that explains in detail the correct way to program Contour processes using Thread Mill tools.
<a href="#">Go</a>	<a href="mailto:Support@gibbscam.com">mailto:Support@gibbscam.com</a>	Runs your email client to create a new message addressed to the CAMBRIO Technical Support department for GibbsCAM.
<a href="#">Go</a>	<a href="mailto:Registration@gibbscam.com">mailto:Registration@gibbscam.com</a>	Runs your email client to create a new message addressed to the CAMBRIO Registration department for GibbsCAM.
<a href="#">Go</a>	<a href="mailto:Sales@gibbscam.com">mailto:Sales@gibbscam.com</a>	Runs your email client to create a new message addressed to the CAMBRIO Sales department for GibbsCAM.
<a href="#">Go</a>	<a href="http://www.autodesk.com/inventor">http://www.autodesk.com/inventor</a>	Opens an external website that provides more information on Autodesk Inventor products.
<a href="#">Go</a>	<a href="http://www.celeritive.com">http://www.celeritive.com</a>	Opens an external website that provides more information on VoluMill Ultra High-Performance Toolpath (UHPT) from Celeritive Technologies.
<a href="#">Go</a>	<a href="http://www.predator-software.com">http://www.predator-software.com</a>	Opens an external website that provides more information on a CNC editor and a virtual CNC viewer from Predator Software, Inc.



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