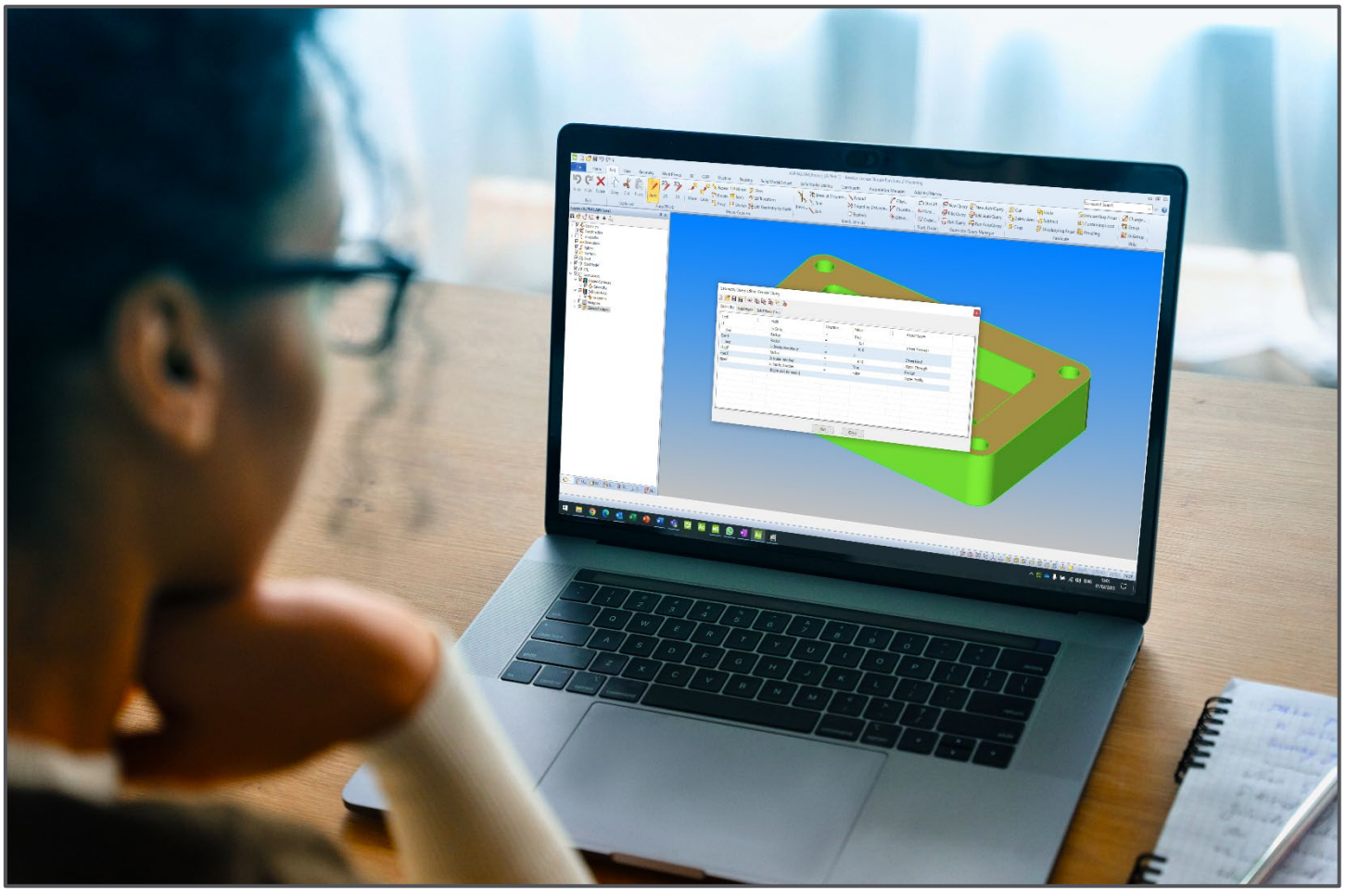
HEXAGON
MANUFACTURING INTELLIGENCE

ALPHACAM 2024.1

QUERY MANAGER



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Contents

Conventions used in this manual

To enable you to use the information in this guide effectively, you need to understand the conventions used in the guide to represent differing types of information.

- Buttons on the screen are represented as the button text in square brackets.
  For example: Click on **[OK].**
- Keys on the keyboard are represented as bold lettering in between **< >** characters.
  For example: Press **<Enter>.**
- Ribbon Tab options are represented as a path with the Ribbon Tab in **UPPER** case with sub menus Capitalised and separated with an arrow
  For example: Select **FILE > Open.**
- Field names are represented as bold text. And the value to be entered will be represented by Bold Text.
  For example: Enter the value **50** in the **Offset** field. or when prompted for the X & Y values type **100,50 <Enter>**


Denotes a **<LClick>** or Primary Mouse Button Click.


Denotes a **<RClick>** or Secondary Mouse Button Click.


This is a note. It contains useful or additional information.


This is a reference. It directs you to another part of the user guide.


This is a thought box. It is generally used in exercises and contains a question for you to consider.


This is a highlighted note to emphasise information.


This is a warning; it contains information that you must not ignore.


This is a tip. It is generally used in exercises and offers further advice.

1. This is the first line of a number list item
2. This is the second item of the numbered instructions, which you must
3. Follow in sequence.

- This is a list
- of items, in which
- The order is not important.

Recommended Operating Systems and Hardware for ALPHACAM

Supported Operating Systems

- **64bit** operating systems.
- Windows 10 and Windows 11 Professional and Enterprise.
- Nvidia or ATI Open GL Graphics Card with 1Gb dedicated memory


We recommend you keep up to date with the latest Software Updates for the supported operating systems and drivers for your hardware base.


Any Windows Operating system (OS) prior to and including Windows 8.1, are not a supported operating system.

ALPHACAM Minimum Specifications


The latest minimum specification can be found at:
hexagon.com/products/product-groups/computer-aided-manufacturing-cad-cam-software/alphacam/system-requirements

This minimum specification is to run any **ALPHACAM** basic system.

You are advised to increase the specification if you are:

- Wishing to produce files using the Automation Manager system.
- Working with solid models.
- Producing the NC code for 3D machining and 3, 4, or 5 axis simultaneous machining strategies.

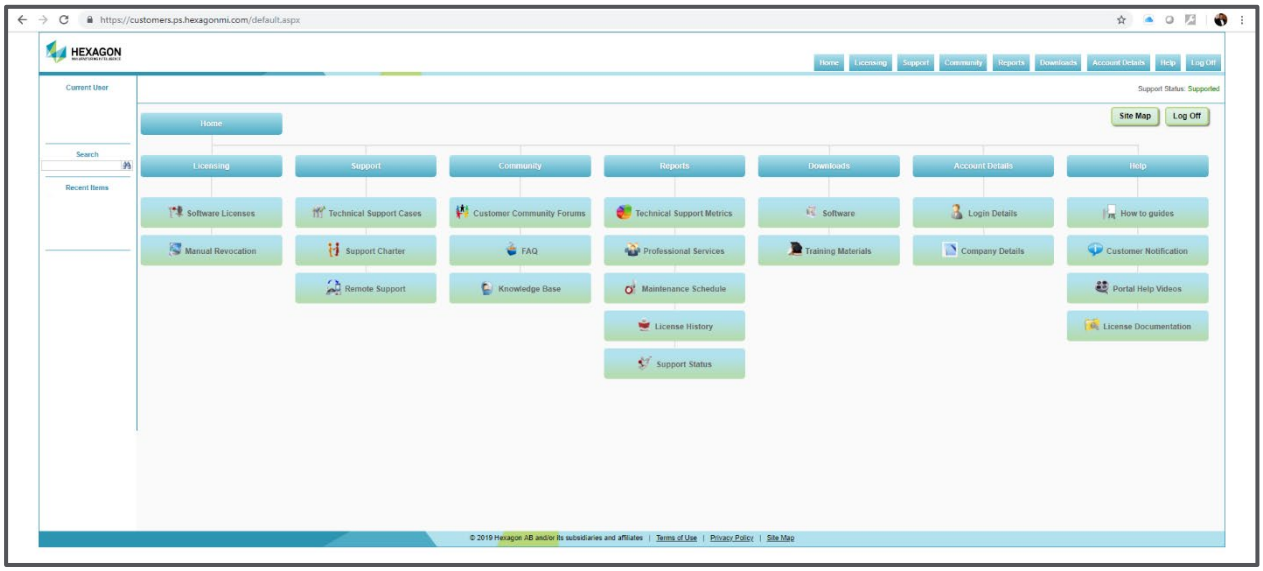
Your minimum specifications should be the fastest processor with the most memory and the highest specification video card that your budget will allow.


If using Autodesk Inventor Files, please check the current Inventor Apprentice Server requirements at Inventor Apprentice Server

Hexagon Customer Portal

At Hexagon, we strive to provide you and your business with first class technical support and services. The **Hexagon Customer Support Portal (HCP)** allows you the tools you need to receive the best from your software. In addition to generating new and updating existing support cases, the portal allows you:

- Unlimited user logins for your company.
- Access to all your licenses for easy reference.
- Get the latest releases and software update at the touch of a button.
- View what is available on your support and maintenance schedule.
- Reference to the Customer Support Charter at any time.
- View the status of your Technical Support cases.
- View all purchased Professional Services like Training and Consultancy.



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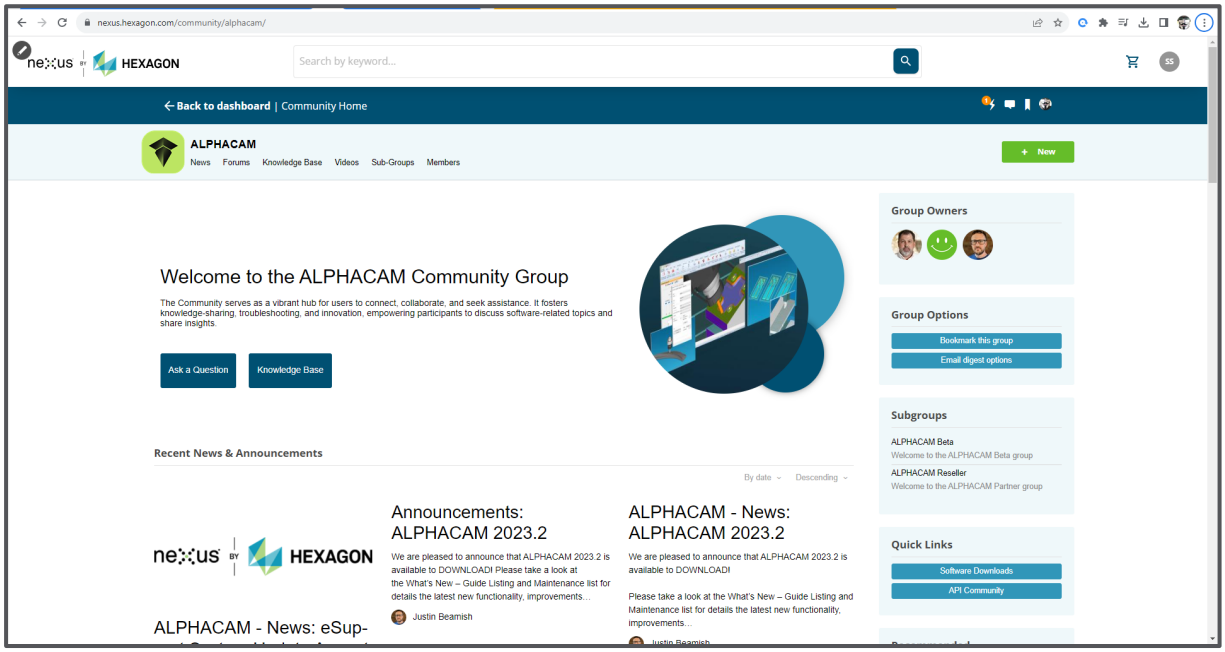
ALPHACAM esupport

Another location to gain valuable information about using the software or asking other experienced users for assistance are the esupport forums.

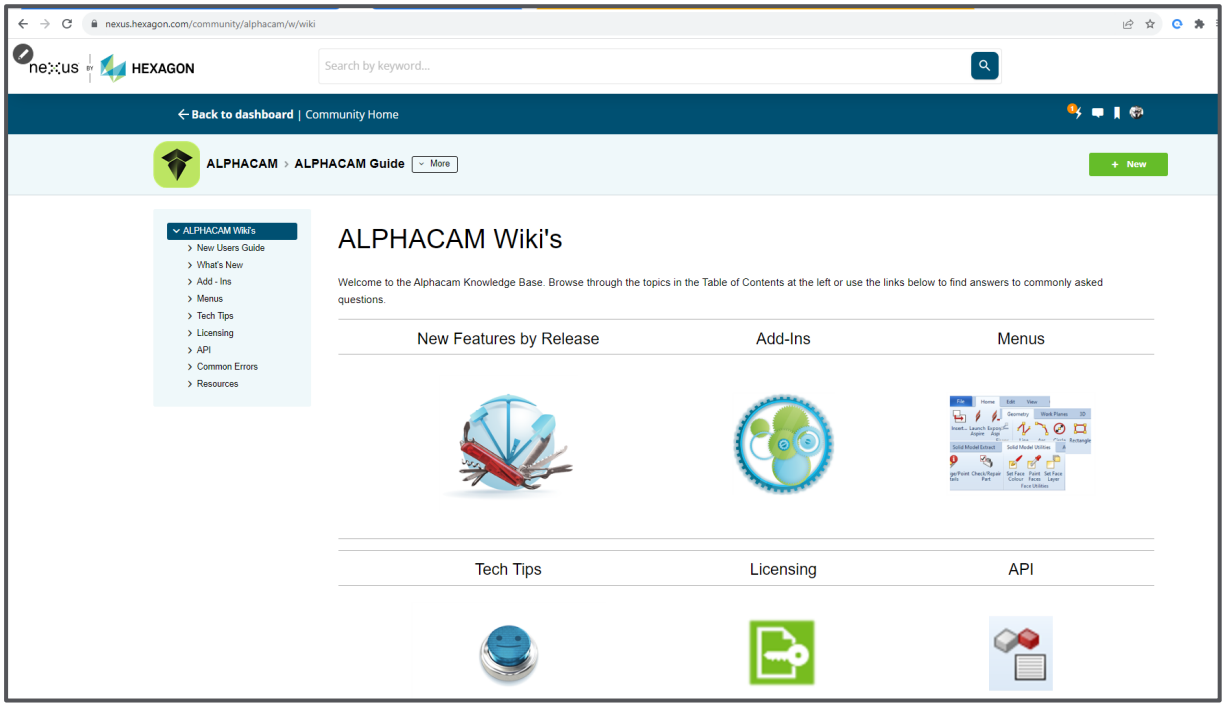


Asking a question of the community, using the knowledge base or other available information links could save you time if you have a problem that someone else may already have supplied a solution for.

For the Nexus Community pages please visit Nexus Community Home

ALPHACAM Wiki

Another location to gain valuable information about using the software or asking other experienced users for assistance is the ALPHACAM Wiki



The ALPHACAM Wiki is an ever expanding knowledge base where you will find all manner of information relating to many areas of the ALPHACAM software titles.

Including, but not limited to, specific information about the commands in ALPHACAM, tutorial videos to assist in your day to day use of the software.

Introduction to Automation

Once you have been using ALPHACAM for some time, you will start to realise that some of your processes have elements that are repeated on a daily, weekly or monthly basis.
At this point of your ALPHACAM life it is time to consider if there is an easier method to work with these repetitive items, this is where the **Automation** side of ALPHACAM starts to make its presence known.
There are four areas of Automation available within ALPHACAM before you start to look at more in depth customisation procedures.

- **Machining Styles** – The process of collecting all the machining data required for a single operation into a single button click operation. Machining Styles can then also be developed further into AutoStyles where the single Style items are collected together into a single process to allow the application of multiple machining operations to be applied in a single button click.

- **Nesting** – An automated process to allow multiple parts of the same thickness, to be aligned on to a single sheet of material. These parts can be selected via a predetermined list created by the user or via selection from parts in an already opened ALPHACAM drawing file.

- **Query Manager** – This is an automation element that can process the geometries or solid faces in an ALPHACAM created drawing or an imported drawing file, onto various differing layers created by the user or the query itself, so that the drawing file is then organised so that Styles and AutoStyles can be applied easier. As with Styles, the Query Manager has the facility to use single Queries or collect many single queries into AutoQueries.

- **Automation Manager** – This is a controlling dialogue process that allows the input of external file formats from design software titles, which can then be processed via ALPHACAM to create nested sheet output of the parts required. Automation Manager also can batch process assemblies of parts, either ALPHACAM drawing files or supplied solid model files of those currently accepted by ALPHACAM, and process these as nested based outputs for mass production.

The following multipliers will be required to use the aspects discussed in this pdf:

xNesting if you require nesting as part of your system.
xSolid if you are working with 3D solid models.
xAutomation if you wish to run the Automation Manager system.
xConstraints maybe applicable if you work with parametric drawings.

Depending on the support status of your ALPHACAM licence, there may be areas of the Automation Manager that have reduced functionality, this is detailed in the Automation Manager pdf.

Once you have had the time to identify the repeated sections of your process, it is time to proceed with the correct Automation options.

The scope of the Automation options in ALPHACAM are such that not all the options may need to be used, what suits a simple panel manufacturing process creating standard kitchen unit parts, could well be unsuitable for a complex Feature Extracted solid model part used in the aerospace industry.

It is down to you to identify those processes within this module that suit your own needs and adapt them as required.

Query Manager

The **Query Manager** provides an easier way to define procedures to automate manipulation of specific geometries or solid model faces onto specified user layers and is available in all ALPHACAM levels.

The command allows you to build a script that contains a set of rules that identify geometries or elements of a solid model, and automatically assigns them onto user layers.
The user layers will be created if they do not exist in the current drawing as the Query is run.

The layers used when creating the query can be imported from:

- The active Drawing.
- An existing Drawing.
- A template Drawing.
- Another query script.

Queries can be automatically run as part of the automatic **Feature Extraction** command, the **Auto Styles** command and the **Automation Manager** interface, where applicable in your level of ALPHACAM.

In a similar method to the use of Styles, Queries can also be set up as **AutoQueries** to allow running of multiple simple queries to fine tune a drawing prior to applying machining strategies either manually or using Styles or AutoStyles.

Query Field Options

Geometry tab

Field	Value	Value Options	Description
Area of Closed Path	Value		Calculated enclosed bounded area of the chosen geometry given in the current ALPHACAM units.
Billet	Boolean.	True or False	Used to distinguish between Material and Part.
Closed	Boolean	True or False	To select between a Closed or Open geometry.
ColourRGB	Value		Used to select a geometry by a specific RGB value setting.
Construction	Boolean	True or False	Used to check if an element is a Construction type.
CW	Boolean	True or False	Tool Direction set to Clockwise or Counter Clockwise.
Depth	Value		Checks the inclusive distance from a geometry **Top** to a geometry **Bottom** irrespective of location. Value is always positive.
Dimension	Boolean	True or False	Used to check if an element is a Dimension type.
Has Open Elements	Boolean	True or False	Checks the selected geometry for elements set to an Open option
Height	Value		Used to calculate a distance across elements, to find the height of Text or the Diameter of a circle for example. Works at 90° to the Width operator.
Hole Angle	Value		The drill point angle of a Feature Extracted Hole element.
Hole Cut Start	Value		The highest Z-level that the Drill side touches the Material of a Feature Extracted Hole element.
Hole Cut Stop	Value		The lowest Z-level that the Drill side touches the Material of a Feature Extracted Hole element.
Hole Diameter	Value		The Diameter of the Drill required to create the hole of a Feature Extracted Hole element.
Hole Drop	Value		The Z-level that the shoulder of the Drill Diameter would fall into the hole of a Feature Extracted Hole element.
Hole Shoulder	Value		The Z-level of the Drill Shoulder (where the Tip starts). Shoulder=Bottom if there is no conical tip of a Feature Extracted Hole element.
Hole Tip	Value		The point of the Conical Tip of a Feature Extracted Hole element. May differ from Bottom if the Hole is chamfered.

Field	Value	Value Options	Description
Hole Type	Value		Used to select Feature Extracted geometries based on the attributes of a hole feature, Through, Blind, Chamfer or Obstructed
Is 3D	Boolean	True or False	Used to check if an element is a 3D Polyline
Is Any Rectangle	Boolean	True or False	Checks for any Rectangular geometries
Is Arc	Boolean	True or False	Checks for Arc geometries
Is Circle	Boolean	True or False	Checks for Circular geometries
Is Deepest	Boolean	True or False	Checks geometries with depth attributes from Feature Extraction to ascertain the lowest Z value to select the deepest geometry elements.
Is Enclosing Another	Boolean	True or False	Used to check if a geometry encloses any number of others.
Is Highest	Boolean	True or False	Checks geometries with depth attributes from Feature Extraction to ascertain the uppermost Z value to select the highest geometry elements.
Is Inside Another	Boolean	True or False	Used to check if a geometry is enclosed by any number of others.
Is Inside How Many	Value		Used to check for a specific number of other geometries enclosing a specific one.
Is Intersecting Another	Boolean	True or False	Used to check for any crossing geometries.
Is Intersecting How Many	Value		Used to check to a specific number of geometries being crossed.
Is Line	Boolean	True or False	Checks for a Line type element.
Is Rectangle	Boolean	True or False	Checks for a specific Rectangle element.
Is Saw Edge	Boolean	True or False	Checks for edges created using the Saw Edge Feature Extraction process.
Is Work Volume	Boolean	True or False	Checks specifically for any Work Volume.
Layer Name	Value		Checks specifically for a dedicated User Layer.
Length	Value		Used to check for the lengths of elements irrespective of geometry creation methods.
Line Type	Value		Checks for elements of specific creation using the following options: 0= Continuous 1 = Dashed 2 = Dotted 3 = Dash Dot combination 4 = Centre Line type 5= Phantom Line type

Field	Value	Value Options	Description
Max Arc Length in Path	Value		Analyses the maximum arc lengths only on a selected geometry.
Max Line in Path	Value		Analyses the maximum line lengths only on a selected geometry.
Max Radius in Path	Value		Analyses the maximum radial values only on a selected geometry.
Max X	Value		Analyses the maximum X distance across the chosen geometry.
Max Y	Value		Analyses the maximum Y distance across a chosen geometry.
Min Arc Length in Path	Value		Analyses the minimum arc lengths only on a selected geometry.
Min Line Length in Path	Value		Analyses the minimum line lengths only on a selected geometry.
Min Radius in Path	Value		Analyses the minimum radial values only on a selected geometry.
Min X	Value		Analyses the minimum X distance across the chosen geometry.
Min Y	Value		Analyses the minimum Y distance across a chosen geometry.
Name	Text		The item name in project manager page, e.g GEO 1 This is not case sensitive
Radius	Value		Analyses the radial specific value.
Sheet	Boolean	True or False	Selects whether a surface is present in the drawing.
Tool In/Out			Checks against any pre-set Tool Direction settings.
Tool Side			Checks against any pre-set Tool Direction settings. Centre - Left - Right
WAA	Value		Angle about the global X to determine work plane rotation.
WAB	Value		Angle about the global Y to determine work plane rotation.
WAC	Value		Angle about the global Z to determine work plane rotation.
Width	Value		Used to calculate a distance across elements, to find the width of Text or the Diameter of a circle for example. Works at 90° to the Height operator.
WTA	Value		Angle to determine work plane tilt when using WAA.
WTB	Value		Angle to determine work plane tilt when using WAB.
WTC	Value		Angle to determine work plane tilt when using WAC.

Field	Value	Value Options	Description
WVF	Value	-Z (0), Y+ (1), X- (2), Y- (3), X+ (4), Z+ (5)	Used to determine which face of a Work Volume is being viewed when analysing geometries.
Z Bottom	Value		Used to analyse Feature Extracted Bottom geometry levels.
Z Top	Value		Used to analyse Feature Extracted Top geometry levels.

Conditional Operators	
=	Equal to
<>	Not Equal to
>	Greater than
>=	Greater Than or Equal to
<=	Less than or equal to
<	Less Than

Query Field Solid Options

Solid Model Tab

Field	Value	Value Options	Description
ColourRGB	Value		Used to select a solid model by a specific RGB value setting.
Extents X	Value		Used to select a solid model by a specific distance along the global X axis.
Extents Y	Value		Used to select a solid model by a specific distance along the global Y axis.
Extents Z	Value		Used to select a solid model by a specific distance along the global Z axis.
Layer Name	Value		Checks specifically for a dedicated User Layer.
Max X	Value		Analyses the maximum X distance across the chosen solid model.
Max Y	Value		Analyses the maximum Y distance across a chosen solid model.
Max Z	Value		Analyses the maximum Y distance across a chosen solid model.
Min X	Value		Analyses the minimum X distance across the chosen solid model.
Min Y	Value		Analyses the minimum Y distance across a chosen solid model.
Min Z	Value		Analyses the minimum Y distance across a chosen solid model.
Name	Value		Used to select a solid model by a specific name.

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Solid Model Faces Tab

Field	Value	Value Options	Description
A Angle	Value		Use to select a face by the angle of rotation of a face around the global X axis.
Area	Value		Selects a face based on a surface area value.
B Angle	Value		Use to select a face by the angle of rotation of a face around the global Y axis.
C Angle	Value		Use to select a face by the angle of rotation of a face around the global Z axis.
ColourRGB	Value		Used to select a solid model by a specific RGB value setting.
Conic Semi-Angle	Value		Used to select tapered faces by a dedicated angel value
Convex edges	Boolean	True or False	Used to select external radius faces on complex profiles.
Extents X	Value		Used to select a solid face by a specific distance along the global X axis.
Extents Y	Value		Used to select a solid face by a specific distance along the global Y axis.
Extents Z	Value		Used to select a solid face by a specific distance along the global Z axis.
Hollow Conic	Boolean	True or False	Used to select cylindrical and cone type faces.
Included Angle	Value		Used to define the extents of a cylindrical or conical face.
Layer Name	Value		Checks specifically for a dedicated User Layer.
Max X	Value		Analyses the maximum X distance across the chosen solid face.
Max Y	Value		Analyses the maximum Y distance across a chosen solid face.
Max Z	Value		Analyses the maximum Y distance across a chosen solid face.
Min X	Value		Analyses the minimum X distance across the chosen solid face.
Min Y	Value		Analyses the minimum Y distance across a chosen solid face.
Min Z	Value		Analyses the minimum Y distance across a chosen solid face.
Normal X	Value		Analyses the X angle of a face to select the perpendicular faces.
Normal Y	Value		Analyses the Y angle of a face to select the perpendicular faces.
Normal Z	Value		Analyses the Z angle of a face to select the perpendicular faces.

Field	Value	Value Options	Description
Radius 1	Value		Used to analyse cylindrical and conical faces. If the face is a cylinder, this is the entry used to identify.
Radius 2	Value		Used to analyse cylindrical and conical faces. If the face is a cone, this is the value of the minor describing circle.
Solid Layer Name	Value		Used to identify solid faces by already assigned User Layer Names
Solid Name	Value		Used to identify single solid models in a multi body part.
Tilt Angle	Value		Used to analyse faces based on the angle from the XY flat plane.
Twist Angle	Value		Used to analyse faces by an angel around the Z axis when a tilt angle has been identified.
Type	Value		Used to identify the specific type of face to analyse, Planar, Cylindrical, Conical or Complex.

Query Structuring

When creating Queries, the processing of each rule is carried out on each visible geometry or solid in the drawing in turn and only once.

Once each item has been acted upon and moved to a new layer it will be ignored for the rest of the processing rules within the current query.
In the most simplistic terms the phrase **If this, then that** covers all statements.
So ….
Geo 1 if test action Y/N, ElseIf test action Y/N, ElseIf test action Y/N, end of rules.
Geo 2 if test action Y/N, ElseIf test action Y/N, ElseIf test action Y/N, end of rules.
Geo 3 if test action Y/N, ElseIf test action Y/N, ElseIf test action Y/N, end of rules.

The Query runs until the entire drawing has been processed.
If you then need to sort the drawing further, you will need to create and run more Queries depending on the needs of the processing.

For the purpose of introducing new users to the Query Manager, this first example is based on 2D geometry elements only.

At the end of this query tutorial is a similar Query based on the use of Solid Face manipulation to show the differences.

Remember that an item can only be questioned once per query.

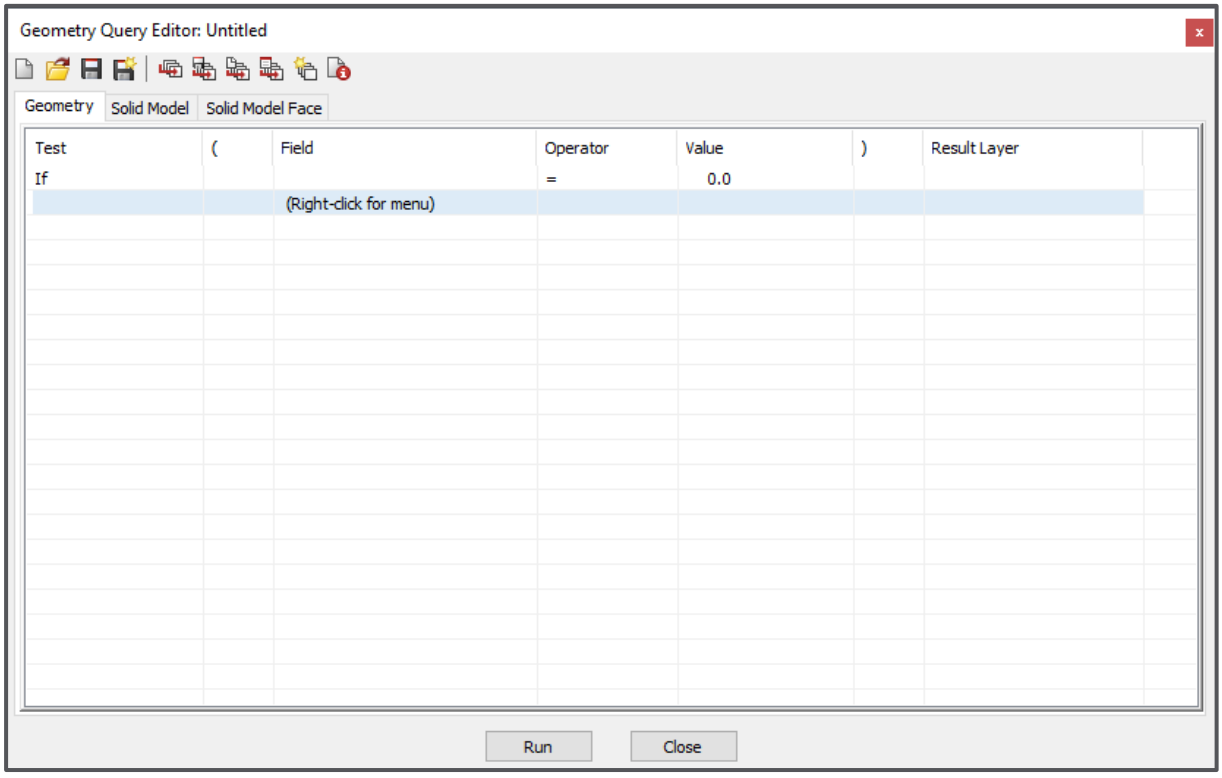
Query Creation

To successfully create a query, you need to be able to look at a drawing and analyse items into distinct categories which can then be manipulated onto separate layers. The primary requirement is therefore to have a set of layers either in the current drawing, or imported from another source; drawing, template or separate query.

Select **HOME > Open**  and navigate to "**….\ALP TRG 202 Automation 2024\Parts-Examples\Drawings\Query Drawings\"** folder and open **Simple Query Part.**
Make sure that the Layers page of the project manager is visible and create the following set of layers in the User Layer section.
Create the following set of layers in the **User Layer** section….

- 10mm Through
- 20mm Blind
- 20mm Through
- Pocket
- Outer Profile

Select **EDIT > Geometry Query Manager > New Query**



Along the top of the open dialogue is the tool bar for the Query creation dialogue box.

File Management				Import Layers.					
New Query	Open Query	Save	Save As	From Current Drawing	From Saved Drawing	From Template	From another Query	Add New Layer	Add/Edit Query Notes

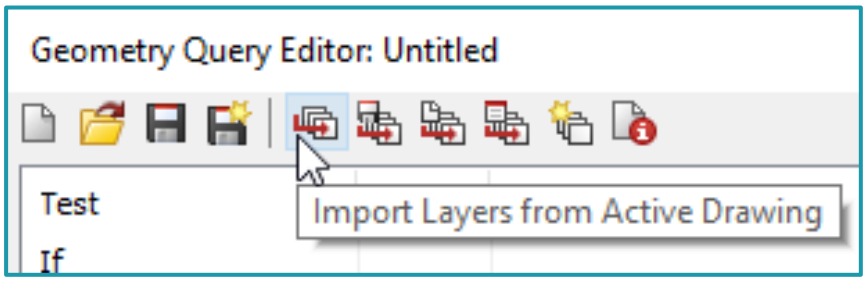
To allow the Query function to work there needs to be a layer structure in place.
The Layers can be set up from previous Drawings and imported using the appropriate option shown above.
Imported from another Query or created directly in the current open Query using the Add New Layer option.

Using any of the **From** options is a good method as if you have made any spelling mistakes, these will be imported and your processing will still run correctly.

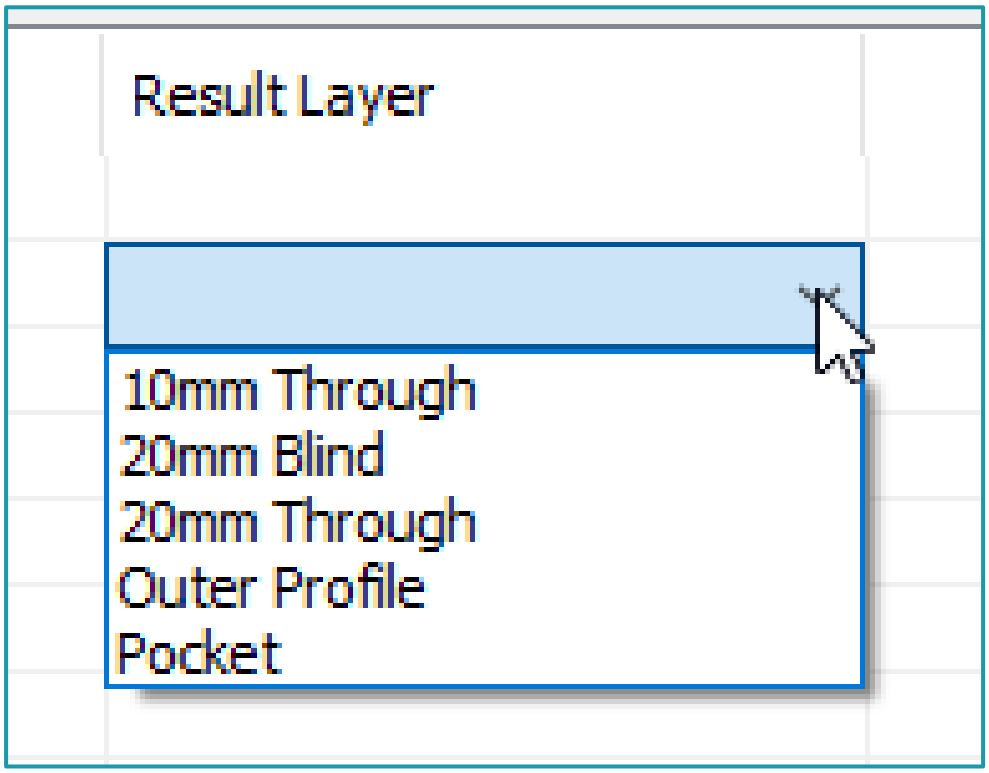
This can be crucial if you are then applying an AutoStyle as you need the Layer Names to match exactly.

In this example the layers are present in the Current Drawing.

<LClick> on the **Import Layers from Active Drawing** button on the Query Manager ribbon.



The layers are will now be available from the drop down menu under the **Result Layer** fields' area.



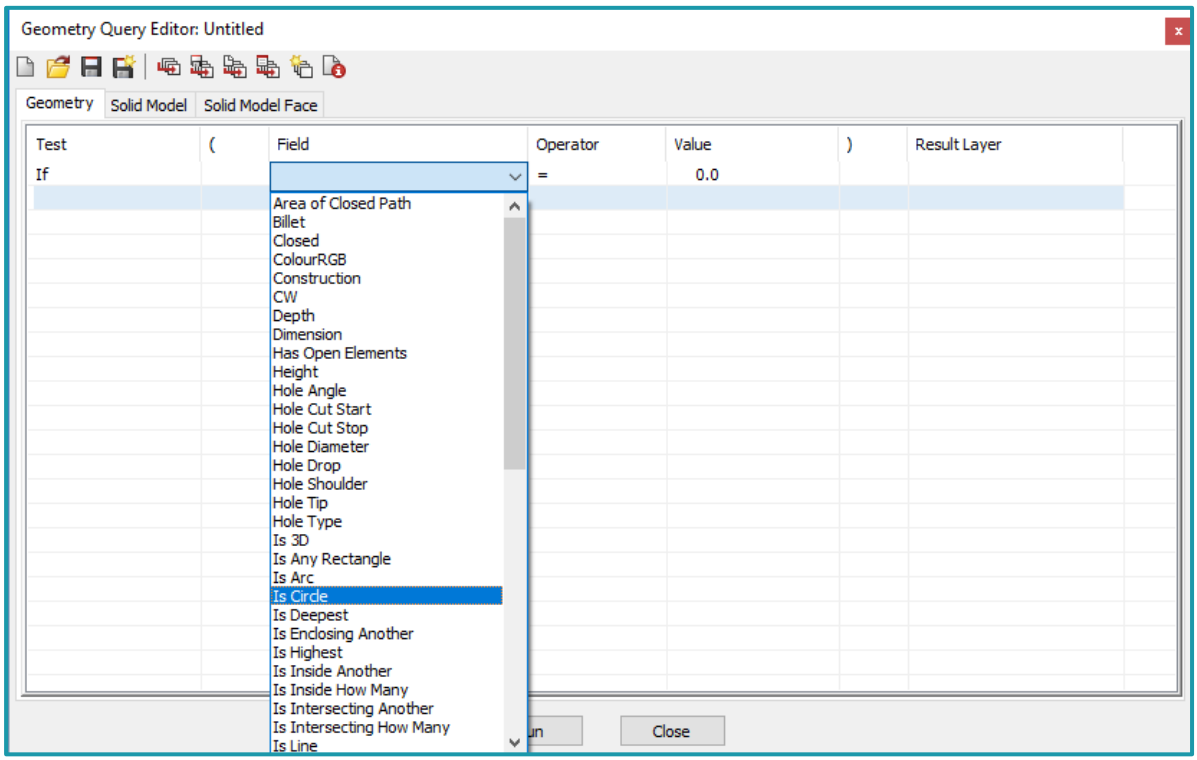
Note that this drop down is only available on the final row entry of a query question.

Create the sample Geometry based Query

Rule 1

<LClick> in the empty area under the heading **Field** and in line with the word **IF** on the very first line. Use the drop down selection box that becomes available.

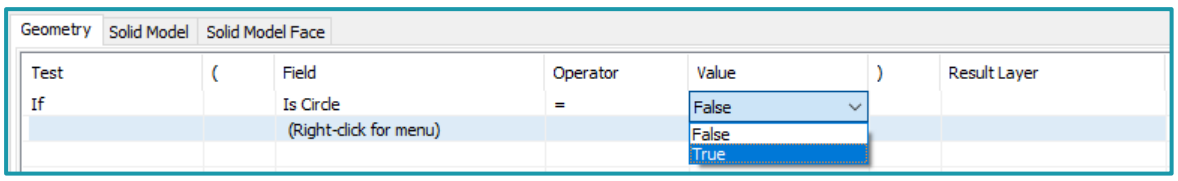
Chose the **Is Circle** option to place that as the first part of this rule.



The options underneath the **Operator** heading will automatically be set to **Equals [=]**, this is correct for this question.

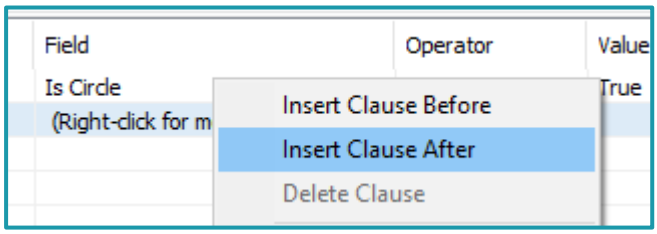
Depending on the question asked, the **Operator** drop down may be required to alter to suit the required answer.

<LClick> in the blank space on the same line under the **Value** heading and chose the option **True.**



This sets this question to only look for circles in the drawing.

<RClick> on the **Is Circle** statement, and from the resulting pop up menu, select **Insert Clause After** to add a secondary question to the current Rule utilising the **And** statement.



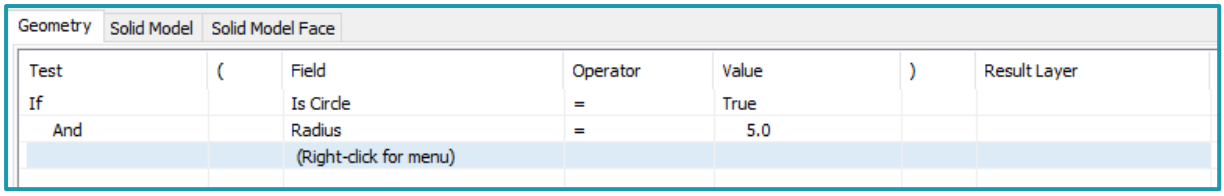
<LClick> in the blank **Field** area, next to the newly created **And** line to allow access to the drop down menu of **Field** options.

When creating a rule to search for circles, there is no diameter option so we must select the option **Radius**.

The options underneath the **Operator** heading will automatically be set to **Equals [=]**, this is correct for this question.

Depending on the question asked, the **Operator** drop down may be required to alter to suit the required answer.

<LClick> in the blank space on the same line under the **Value** heading and enter a value of 5**.**

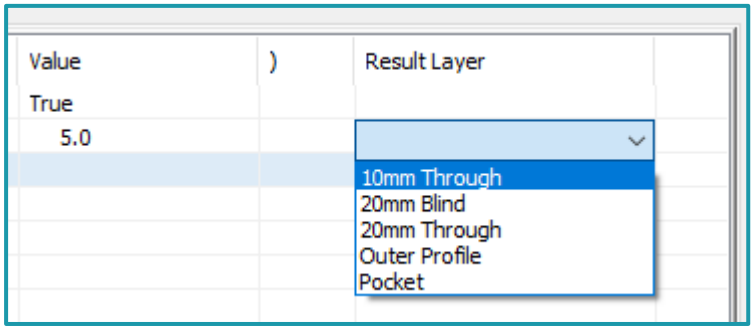


This rule now looks for any **Circle** geometry that is exactly **R5** in size.

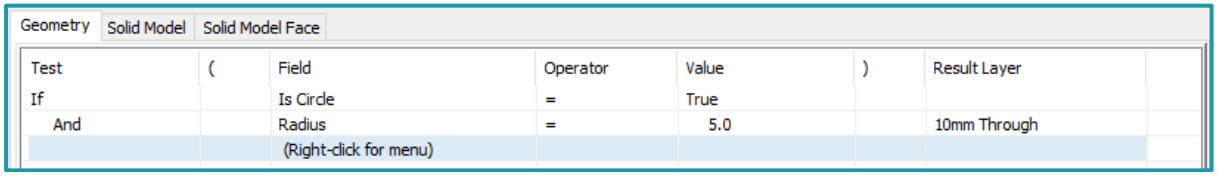
In our drawing, this qualifies all of the 10mm circles.

Finally, on the same line as the **Radius** statement, **<LClick>** in the blank box that is under the **Result Layer** heading to access the drop down menu for the layers in the query.

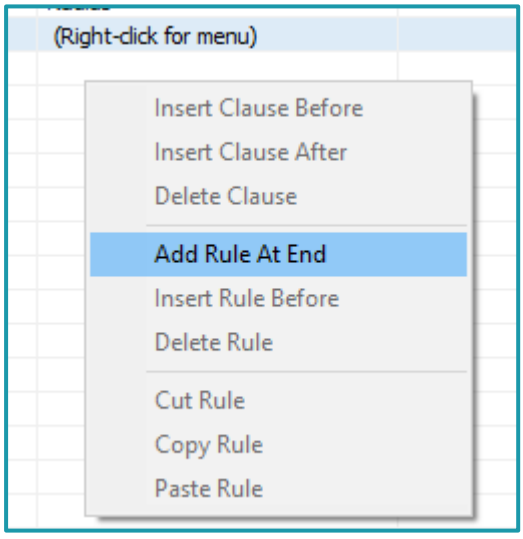
Set the layer to **10mm Through.**



So, this first rule does the following;
If the geometry is a circle **AND** if it is exactly Ø10, **move** it to the **10mmThrough** layer.



<RClick> anywhere under the **(Right click for menu)** statement and pick the option to **Add Rule at End** to the Query.



Using this method at this point only allows for a single choice from the drop down list. If you were to **<RClick>** anywhere above the **(Right click for menu)** statement, all of the menu options become live and allow for the flexibility to add or remove rules and clauses as you need to.

Continue to add **Rules** and **Clauses** to the Query as detailed below.

Rule 2

ElseIf	Is Circle	=	True		
And	Radius	=	10.0		
And	Is Inside How Many	=	2		20mm Through
	(Right-click for menu)				

So, this second rule does the following;

If the item is a circle **AND** if it is exactly Ø20, **AND** if it is located inside two other geometries, **Move** it to the **20mm Through** layer.

In our drawing, this qualifies the two 20mm circles inside the pocket detail as they have the Outer Profile and the rectangular pocket shape outside of their location.

Note that this question is written specifically for this design, if there were any more geometries representing recesses or chamfers around the part, then the **Is Inside How Many** would need altering to suit.

Rule 3

ElseIf	Is Circle	=	True		
And	Radius	=	10.0		20mm Blind

This third rule does the following;

If the geometry is a circle **AND** if it is exactly Ø20, **move** it to the **20mm Blind** layer.

As the other two Ø20 circles have already been analysed, they are not affected by this rule, and only the central circle is relocated.

> Remember that a geometry can only be questioned once per query.

<RClick> anywhere under the **(Right click for menu)** statement and pick the option to **Add Rule at End** to the Query.

Rule 4

ElseIf	Is Circle	=	True	
And	Is Inside Another	=	True	Pocket

This fourth rule does the following;

If the geometry is a circle **AND** if it is inside any other geometry, **move** it to the **Pocket** layer.
This tests for the island inside the pocket walls.

If the part design alters, then this query would also need to be adjusted.

 **<RClick>** anywhere under the **(Right click for menu)** statement and pick the option to **Add Rule at End** to the Query.

Rule 5

ElseIf	Is Inside Another	=	True	Pocket

This fifth rule does the following;

If the geometry is inside any other geometries, **move** it to the **Pocket** layer.

If the part design alters, then this query would also need to be adjusted.

 **<RClick>** anywhere under the **(Right click for menu)** statement and pick the option to **Add Rule at End** to the Query.

Rule 6

ElseIf	Is Inside Another	=	False	Outer Profile

This sixth rule does the following;

If the geometry is not contained within any other geometry, **move** it to the **Outer Profile**.

This tests for the outer geometry.

This very simple question can be set to True or False and can be a very simple method of sorting geometry.

Completed Query

Geometry | Solid Model | Solid Model Face

Test	(	Field	Operator	Value	)	Result Layer
If		Is Circle	=	True		
And		Radius	=	5.0		10mm Through
ElseIf		Is Circle	=	True		
And		Radius	=	10.0		
And		Is Inside How Many	=	2		20mm Through
ElseIf		Is Circle	=	True		
And		Radius	=	10.0		20mm Blind
ElseIf		Is Circle	=	True		
And		Is Inside Another	=	True		Pocket
ElseIf		Is Inside Another	=	True		Pocket
ElseIf		Is Inside Another	=	False		Outer Profile
		(Right-click for menu)				

Use the Save button to save the Query to the default **"……LICOMDIR/Queries"** folder and name it suitably.

Using questions in differing methods will allow you to create many options for your Geometry Queries.

Hints and Tips

Whilst building a query it is worth noting that if you **<LClick>** on the **[Run]** button to process the Query on the current drawing, if all the Rules and Clauses are created correctly, the Geometries will be moved to the differing layers on the drawing.
This is a good way to test as you work to see if you are asking the correct questions in the correct order.

Using **[Run]** when creating the Query can help you process the job Rule by Rule to make sure your Query is working, rather than waiting until the very end.

When setting up Rules to suit circle sizes, it is recommended that you start from the smallest size of circle and work up.

Creating Queries is not easy but can assist in the final stages of this course when you need to apply machining quickly and efficiently.

Tips for Queries

When writing a query, it is advisable to keep it manageable.

What this implies is to keep your queries simple to understand and short.

A long query may get all of your sorting done, but if there are any problems you may have trouble identifying which particular rule is causing the issue.

As a rule, you are advised to try and keep any scroll bar that appears at the side of the Query creation window as short as possible.

If your query creation widow is as large as your usual drawing area when using ALPHACAM, you should be able to see the entire query in that window.

If you must scroll down another one or two lines, then this is usually fine, scrolling down another full window distance is a very long and possibly complex query.

Managing very long single queries is better looked at from the point of view of many small length queries all listed inside a single AutoQuery.

Use of Queries

Once you have written your Query there are differing ways in which to implement them within ALPHACAM.

Basic Use

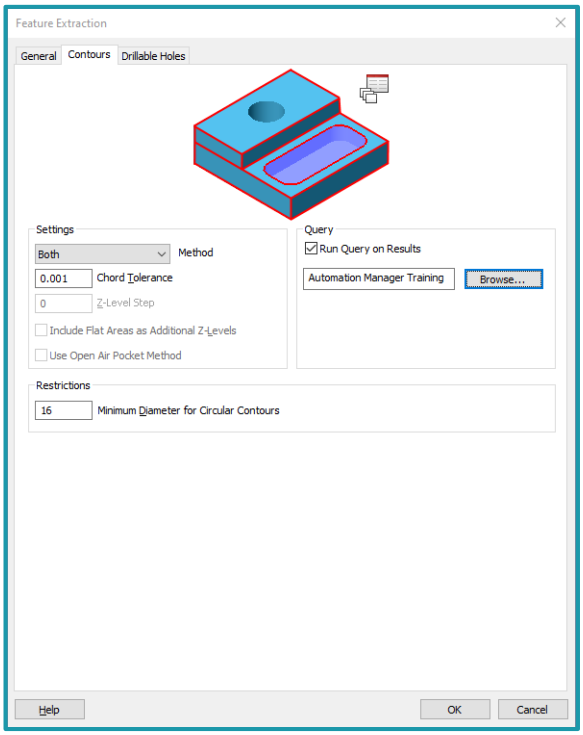
The first and easiest option is to run the Query on the current open drawing manually using

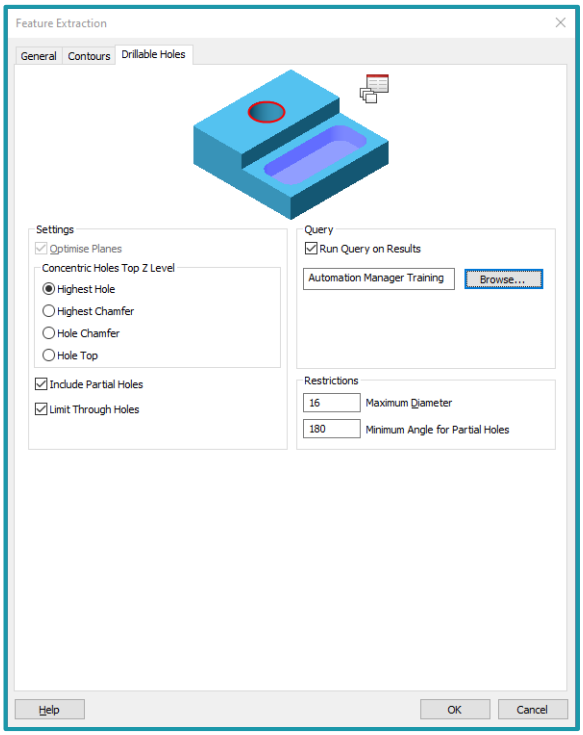
EDIT > Geometry Query Manager > Run Query 

This method is usually implemented on drawings that need further editing prior to the addition of any machining cycles or Styles.

Feature Extraction

The next method to use Queries is when taking advantage of the Feature Extraction processing in ALPHACAM available with the Solids multiplier.





Separate Queries can be run during the Feature Extraction process to sort Contours or Holes if you have created separate Query routines for these features, or it may be all in a single Query depending on the complexity of the part.

Once you have run a Query via Feature Extraction, there is nothing stopping you from running further individual Queries on the drawing to sort to a finer degree.

Queries and Solid Faces.
In this next section we demonstrate how the use of a Solid Face Query can obtain the same results as the previous Geometry based query.

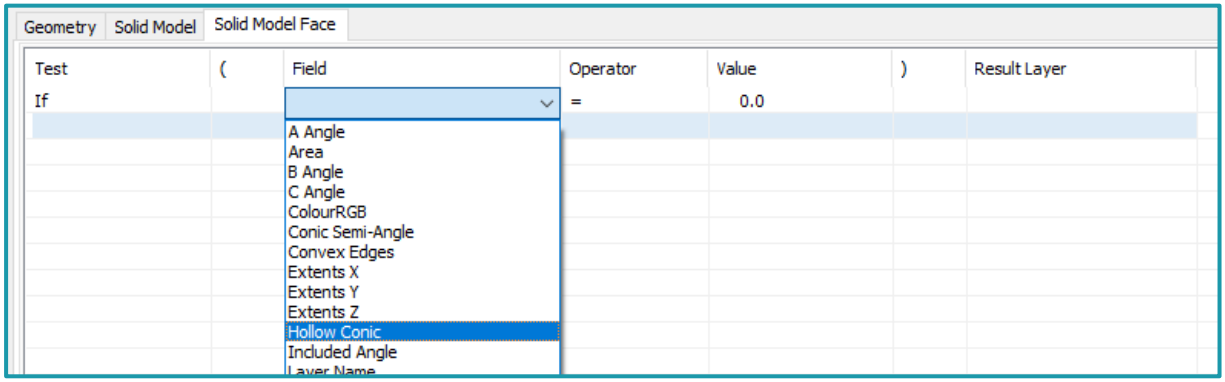
In fact, it is totally acceptable to run combinations of Geometry and Solid Face queries depending on the requirements of the part and machining application.

Note that the Solid Model and Solid Model Faces tabs will only be available if the **xSolids** multiplier is available on your ALPHACAM licence.

Rule 1

<LClick> in the empty area under the heading **Field** and in line with the word **IF** on the very first line. Use the drop down selection box that becomes available.

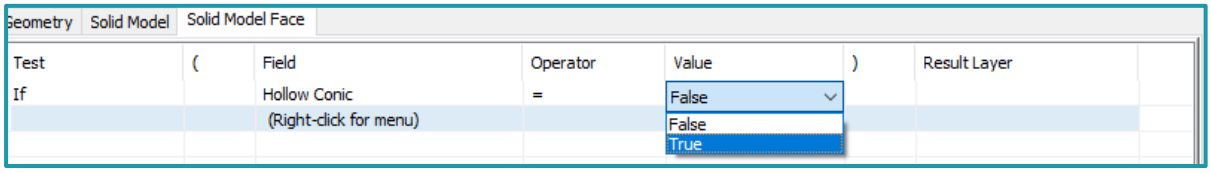
Chose the **Hollow Conic** option to place that as the first part of this rule.



The options underneath the **Operator** heading will automatically be set to **Equals [=]**, this is correct for this question.

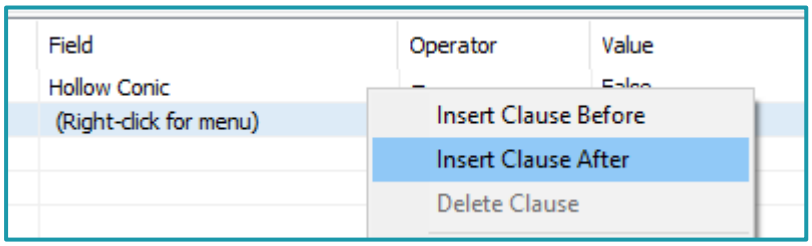
Depending on the question asked, the **Operator** drop down may be required to alter to suit the required answer.

<LClick> in the blank space on the same line under the **Value** heading and chose the option **True.**



This sets this question to look for cylindrical faces that either form part of a pocket detail or a hole.

<RClick> on the **Is Circle** statement, and from the resulting pop up menu, select **Insert Clause After** to add a secondary question to the current Rule utilising the **And** statement.



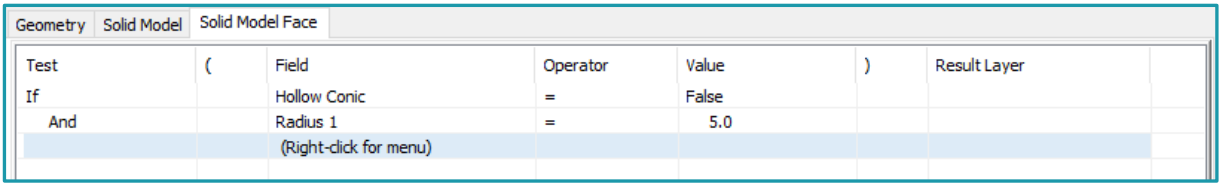
<LClick> in the blank **Field** area, next to the newly created **And** line to allow access to the drop down menu of **Field** options.

Select the option **Radius 1**.

The options underneath the **Operator** heading will automatically be set to **Equals [=]**, this is correct for this question.

Depending on the question asked, the **Operator** drop down may be required to alter to suit the required answer.

<LClick> in the blank space on the same line under the **Value** heading and enter a value of 5**.**



<RClick> on the **Radius 1** statement, and from the resulting pop up menu, select **Insert Clause After** to add a secondary question to the current Rule utilising the **And** statement.

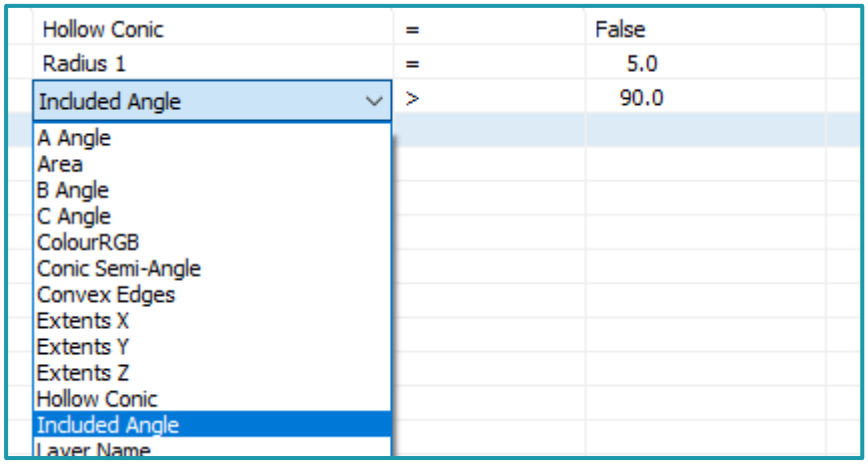
<LClick> in the blank **Field** area, next to the newly created **And** line to allow access to the drop down menu of **Field** options.

Select the option **Included Angle**.

The options underneath the **Operator** heading will automatically be set to **Equals [=]**, this is incorrect for this question. Change this option to **Greater Than [>]**

Depending on the question asked, the **Operator** drop down may be required to alter to suit the required answer.

<LClick> in the blank space on the same line under the **Value** heading and enter a value of 90**.**



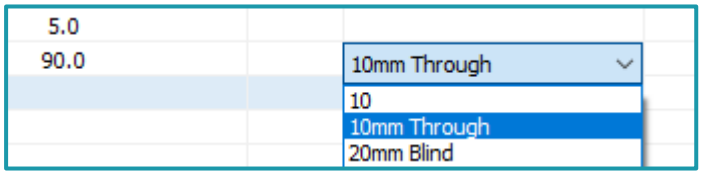
This rule now looks for any Cylindrical face that is exactly R5 in size but most importantly is not one of the radii in the corners of the profile faces.

In our drawing, this qualifies all of the 10mm holes.

If the design were slightly different with regards to the pocket profile, there may be a need to adjust the Included Angle statement.

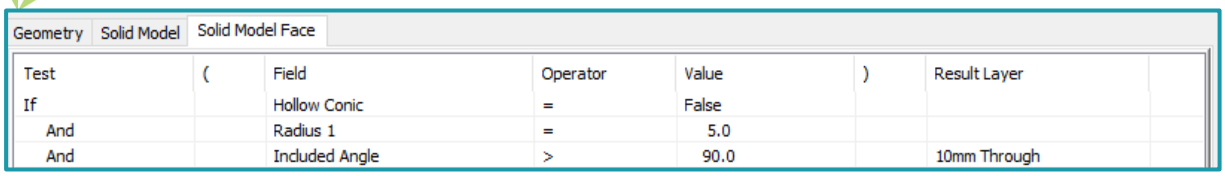
Finally, on the same line as the **Radius** statement, **<LClick>** in the blank box that is under the **Result Layer** heading to access the drop down menu for the layers in the query.

Set the layer to **10mm Through.**

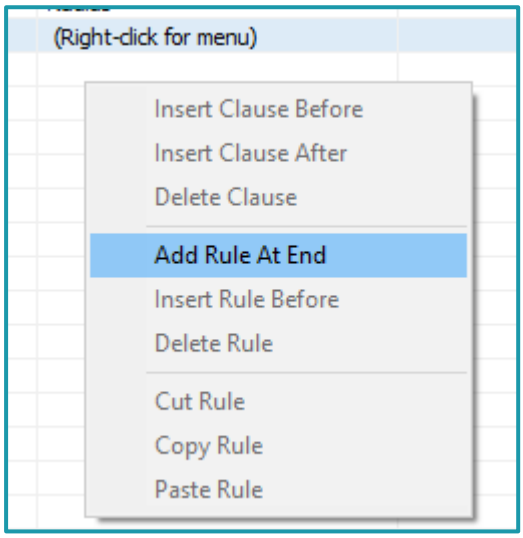


So, this first rule does the following;

If the face is a radial face **AND** if it is exactly R5 **AND** it sweeps more than a 90° arc, **assign** it to the **10mmThrough** layer.



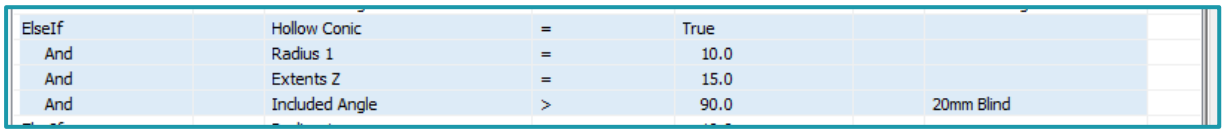
<RClick> anywhere under the **(Right click for menu)** statement and pick the option to **Add Rule at End** to the Query.



Using this method at this point only allows for a single choice from the drop down list. If you were to **<RClick>** anywhere above the **(Right click for menu)** statement, all of the menu options become live and allow for the flexibility to add or remove rules and clauses as you need to.

Continue to add **Rules** and **Clauses** to the Query as detailed below.

Rule 2



ElseIf	Hollow Conic	=	True		
And	Radius 1	=	10.0		
And	Extents Z	=	15.0		
And	Included Angle	>	90.0		20mm Blind

So, this second rule does the following;

If the face is a cylindrical **AND** if it is exactly R15, **AND** if it is exactly 15mm in the Z axis, **AND** it has a radial sweep of more than 90°, **assign** it to the **20mm Through** layer.

In our model, this qualifies the central blind feature.

Note that this question is written specifically for this design because of the stated Z value and exact radius, if the design alters from these specific values, this query will fail.

Rule 3

ElseIf	Radius 1	=	10.0		
And	Included Angle	>	90.0		20mm Through

This third rule does the following;

If the face is exactly R10, **AND** the radial sweep is greater than 90° **assign** it to the **20mm Blind** layer.

Notice the omission of the **Hollow Conic** statement, in some instances some fields are not required.

As the previous Ø20 hole has already been analysed, it is not affected by this rule, and only the two holes in the bottom of the pocket are affected.

Remember that an item can only be questioned once per query.

<RClick> anywhere under the **(Right click for menu)** statement and pick the option to **Add Rule at End** to the Query.

Rule 4

ElseIf		Radius 1	>	10.0	Pocket

This fourth rule does the following;

If the face has a radius larger than R10, **assign** it to the **Pocket** layer.

This tests for the island inside the pocket walls.

If the part design alters, then this query would also need to be adjusted.

 **<RClick>** anywhere under the **(Right click for menu)** statement and pick the option to **Add Rule at End** to the Query.

Rule 5

ElseIf		Hollow Conic	=	True	
Or		Tilt Angle	=	90.0	
And		Extents Z	=	15.0	Pocket

This fifth rule does the following;

If the faces are cylindrical **OR** it is at 90° to the global XY plane **AND** the Z axis distance is exactly 15, **assign** it to the **Pocket** layer.

What this is testing for is not only the vertical pocket walls but also the radii in the corners of the pocket, using the **OR** statement allows for differing combinations of tests to be applied in a single question.

If the part design alters, then this query would also need to be adjusted.

 **<RClick>** anywhere under the **(Right click for menu)** statement and pick the option to **Add Rule at End** to the Query.

Rule 6

ElseIf		Convex Edges	=	True	
Or		Tilt Angle	=	90.0	
And		Extents Z	>=	15.0	Outer Profile

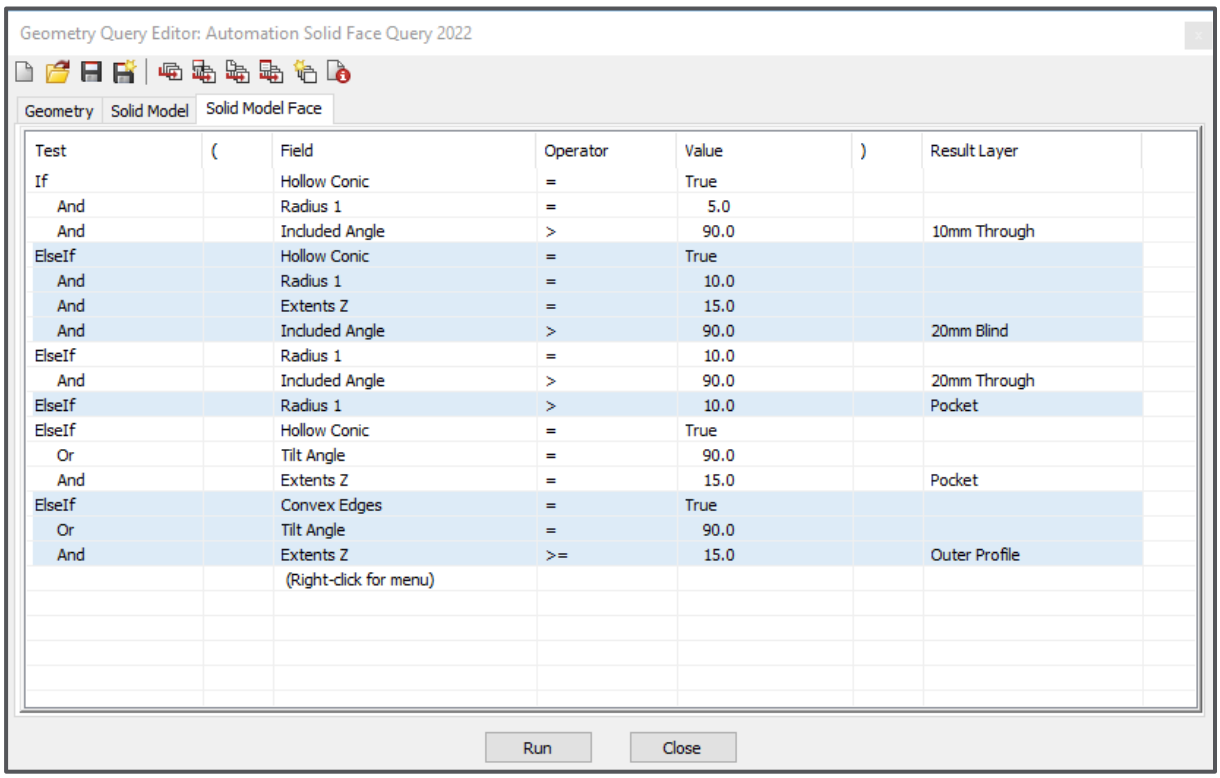
This sixth rule does the following;

If the faces are cylindrical but are external corners using the **Convex Edges** option **OR** it is a 90° to the global XY plane **AND** the Z axis distance is more than 15, **move** it to the **Outer Profile**.

This tests for the outer geometry.

Convex Edges is a very useful command to differentiate between internal and external radiused corners on profiles.

Completed Query



Use the Save button to save the Query to the default **"……LICOMDIR/Queries"** folder and name it suitably.

Using questions in differing methods will allow you to create many options for your Queries.

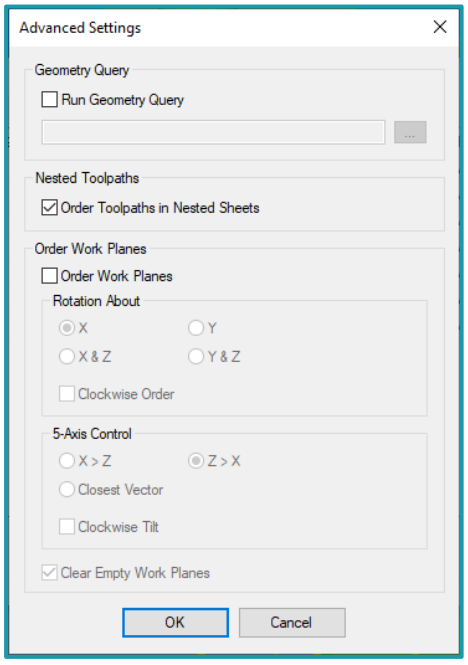
Queries and AutoStyles

The final and most beneficial use of a Query is to link it to an AutoStyle.
Doing this allows you to Import a drawing and then apply the AutoStyle directly to it, with a Query linked to the AutoStyle the drawing is then;

- Layer Sorted.
- Tool Sides set.
- Tool Directions applied.
- Machining Added.

To add a Query to an existing AutoStyle, use **MACHINE > Styles > Edit AutoStyle**  , in the dialogue box select the AutoStyle created earlier to edit.

At the bottom of the dialogue box,  **<LClick>** the **[Advanced Settings]** button to display the secondary options in AutoStyles.



Tick the option to ☑ **Run Geometry Query** then using the **[…]** button you will open a selection window that allows you browse to the location of your Queries, then to add a Query to the AutoStyle which will be run before the AutoStyle is added to the drawing.

Using the selection window, browse to the location of the query you created earlier,  **<LClick>** the file name and then click on the **[Open]** button at the bottom of the window.
This sets the location of the file into the location box on the Advanced Options dialogue box.

Order Toolpaths on nested sheet

Allows you to minimise tool changes if the AutoStyle is applied to a nest based drawing.

Order Work Planes

If your drawing is on multiple work planes then you can sort these to give a better motion to the machining with relation to which is the next Work Plane to move to, that is closest to the one already being worked on.
The options are all based on the type of machine that you have in use.
How the options work will be by testing them to see which suits your manufacturing methods best.

5 Axis Control

The options are all based on the type of machine that you have in use.
How the options work will be by testing them to see which suits your manufacturing methods best.

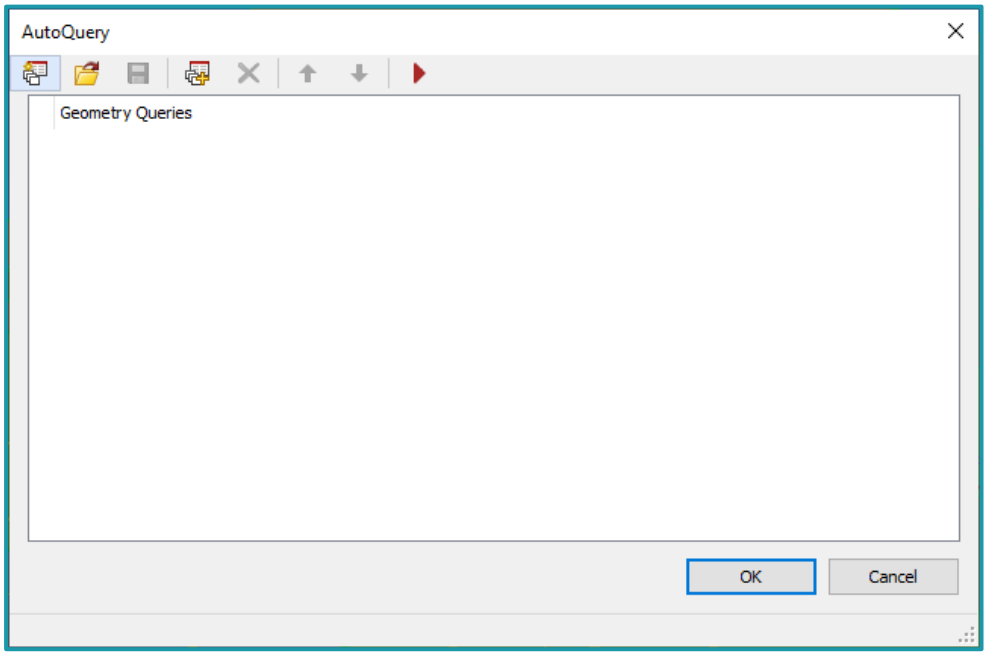
After selecting the Query  **<LClick>** on **[OK]** and then use the Save As option at the top of the AutoStyles dialogue to save this AutoStyle as a new item with a suitable name.

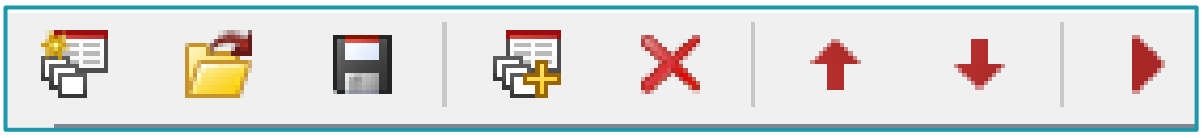
This now allows you to have an AutoStyle that you need to run a query manually first and an AutoStyle that will run a Query and then apply the machining as well.

AutoQueries

Whilst the use of Queries makes the sorting of a drawing a much more automated process than manually moving geometries between layers, the use of an **AutoQuery** can take the sorting process a stage further.

If you have reached the stage in the Automation process where you are running more than a single Query on each drawing it is more beneficial to set up an **AutoQuery**.
This is in a similar method that the use of **Machining Styles** leads on to using **AutoStyles**.
An **AutoQuery** is purely a list of your **Queries** in the order that you need them to be applied all in a single file.
As we looked at earlier you can run a Query on Feature Extraction and via an AutoStyle, the same options apply but you would be locating the AutoQuery and attaching that to the process instead of an individual Query.
Using AutoQueries is a suitable method of bringing together multiple simple queries into a single file if you find creating simple one or two rule Queries easier than a Query composed of multiple of rules.





New | Open | Save As | Add | Delete | Move Up | Move Down | Run

The options on the toolbar allow you to;

- Create a New AutoQuery.
- Open an existing AutoQuery.
- Save the AutoQuery with a different name.
- Add a Query to the list.
- Delete a Query from the list.
- Move a Query up the tree.
- Move a Query down the tree.
- Run the AutoQuery.

The order in which the individual Queries are placed in the tree structure is the order in which they will be processed so care should be taken to place items as they need to be operated on.

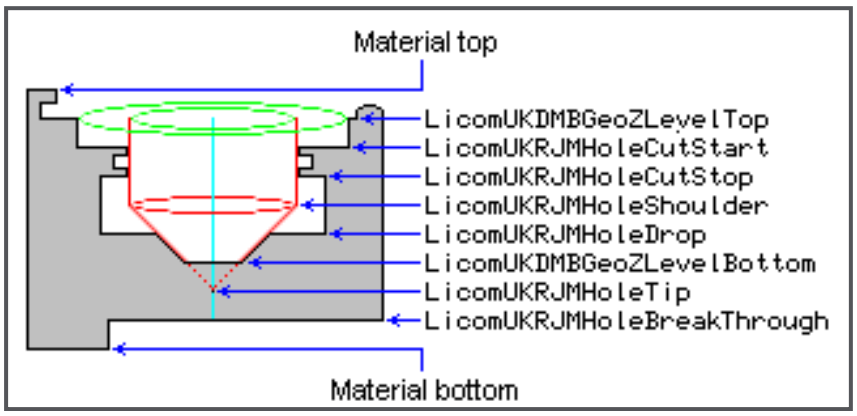
Additional Reference Information for Query Creation

Drillable Holes

The definition of Feature Extracted Drillable hole Geometry is:
A Hole is 'drillable' if no Solid Bodies obscure the Hole; i.e. a Drill which is longer than the model touches the sides or bottom of the Hole before the tip of the cylinder touches any other Solid Body.

Holes Extracted have the following Attributes:

Atribute NAme	Attribute criteria
LicomUKRJMHoleDrillNumber	A 1-based number allowing you to see which holes and groups may be drilled with the same tool. Drills are sorted in order of increasing Diameter and increasing Tip Angle. Drill Number 1 will be the smallest Drill with the sharpest Tip.
LicomUKRJMHoleType	An Integer representing the type of hole: Blind, Through etc.
LicomUKRJMHoleDiameter	The Diameter of the Drill required to create the hole.
LicomUKRJMHoleAngle	The angle of the conical tip of the Drill in Degrees. 180 is a flat-bottomed hole, 118 is the most common Drill Tip Angle.
LicomUKDMBGeoZLevelTop	The highest CutStart Z-level of all holes concentric to this one.
LicomUKRJMHoleCutStart	The highest Z-level that the Drill side touches the Material.
LicomUKRJMHoleCutStop	The lowest Z-level that the Drill side touches the Material.
LicomUKRJMHoleShoulder	The Z-level of the Drill Shoulder (where the Tip starts). Shoulder=Bottom if there is no conical tip.
LicomUKRJMHoleDrop	The Z-level that the bottom of a cylinder of the Drill Diameter would fall into the hole.
LicomUKDMBGeoZLevelBottom	The lowest Z-level that the Drill cuts the Material (may include the conical Tip).
LicomUKRJMHoleTip	The point of the Conical Tip. May differ from Bottom if the Hole is chamfered.
LicomUKRJMHoleBreakThrough	Not yet implemented. Will be implemented later if sufficient demand exists.



The above diagram illustrates all of the Attributes which may be used to describe a Drillable Hole.

With Flat-Bottomed Holes, the Shoulder, Drop, Bottom and Tip would all have the same value.

LicomUKRJMHoleType values are:

1 = Blind: Blind Hole
2 = Through: Through Hole without obstruction.
3 = Obstructed: Obstructed Through Hole.
4 = Chamfer: Hole drilled with the conical tip of the Drill, but not the sides.

Work Plane Array Variables, Work Plane Angles

(WAA and WTA, WAB and WTB, WAC and WTC)

These must be used in the pairs indicated above, and only one pair should be used. Which pair, depends on the machine configuration.

Think about how the work plane is to be rotated (using only two of the angles) so that the plane ends up with the tool normal to the plane. You may have to reverse the sign and/or add/subtract 90 degrees, depending on the machine.

WAA, WAB and WAC are the angles of rotation about the global X, Y or Z axes to make one edge of the work plane parallel to the plane which has the tool perpendicular to it.

WTA, WTB and WTC are the angles of tilt about the new position of the edge (the same edge) to make the tool perpendicular to the plane after it has been tilted.

For example, use WAC and WTC if you can make the work plane perpendicular to the tool by rotating the local X axis of the plane about the global Z axis, then tilting the plane about the new position of the local X axis.

To determine whether the angle is positive or negative, think of Xyz, Yzx, Zxy (the order of the letters is always the same - XYZ). If you look down the axis shown below as a capital letter (towards 0,0,0), the angle is positive in the direction given by the next letters. For example:

- XYZ - Look down X, angle from Y to Z is positive.
- ZXY - Look down Z, angle from X to Y is positive (conventional 2D view).
- WAA Angle about global X axis, i.e., looking down the X axis
  (think X yz rotation for +/).
- WAB Angle about global Y axis, i.e., looking down the Y axis
  (think Y zx rotation for +/).
- WAC Angle about global Z axis, i.e., looking down the Z axis
  (think Z xy rotation for +/).
- WTA, WTB and WTC are the angles of tilt required to achieve the correct direction for a sloping work plane after WAA or WAB or WAC have been applied.

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Version amendments

V	Amendment Description	A	Software Version	Amended Date
15	Updated to ne 2024 release.	0	2024.1	08/04/2024
14	Updated to new Nexus links	1	2023.3	20/09/2023
14	Updated to new Hexagon Template and software release	0	2023.1	13/03/2023
13	Adjustments to images.	2	2022.2	15/07/2022
13	Error on Reading postcode	1	2022.1	16/05/2022
13	Updated to new Hexagon Template and software release		2022.1	20/04/2022
12	Table of Figures removed. Wiki page links added. Course title altered. Solid Faces section added.	0	2022.0	16/06/2021
11	Updated to new Hexagon template. Moved to individual document.	0	2021.0	23/03/2020
10	Minor text formatting alterations	1	2020.1	10/10/2019
10	Template altered to Hexagon branding	0	2020.0	22/03/2019

HEXAGON
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Portal. customers.ps.hexagonmi.com