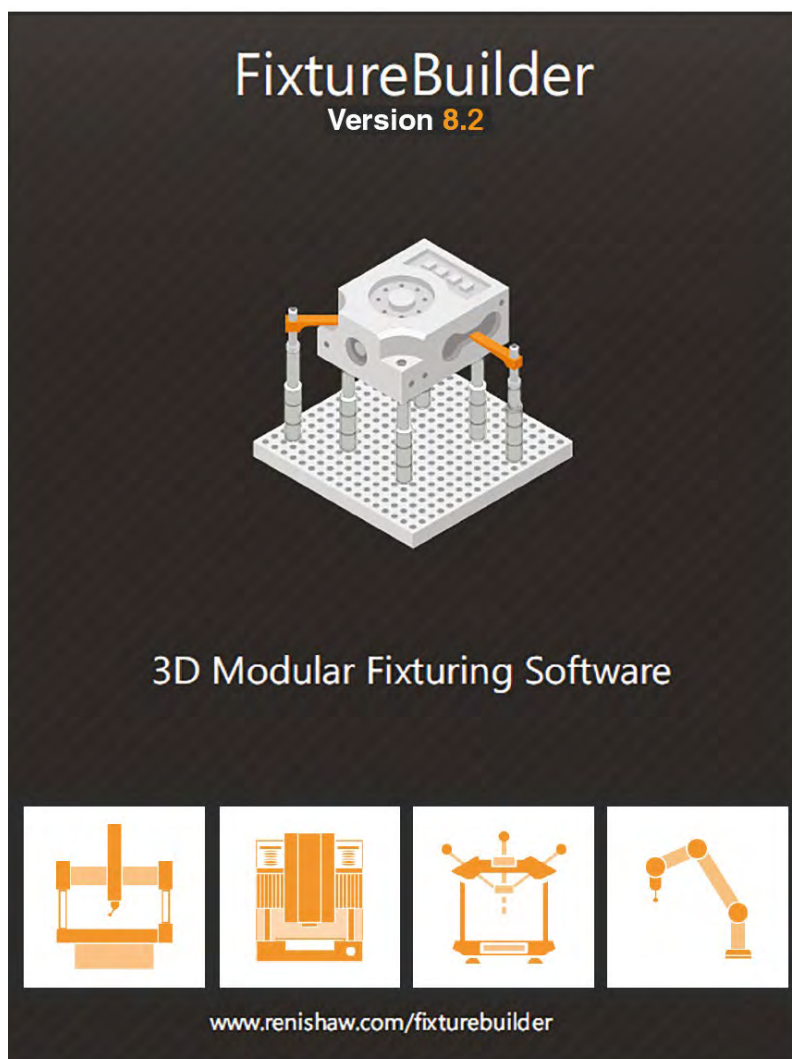


FixtureBuilder software



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FixtureBuilder introduction

FixtureBuilder is a 3D CAD package that helps you to create, edit, document, and export a metrology fixture set-up for use in offline programming. It has been created with software provider IronCAD. The software also automatically generates a “Build It” document, which includes:

- Comprehensive build instructions on how to assemble the fixture.
- Preview images of how the fixture should look.
- A bill of materials (BOM) to aid the user with components usage and ordering.

NOTE: The package requires a basic understanding of fixturing principles and also a basic knowledge of Renishaw’s fixturing component sets.

For support, contact **fixturebuildersupport@renishaw.com**.

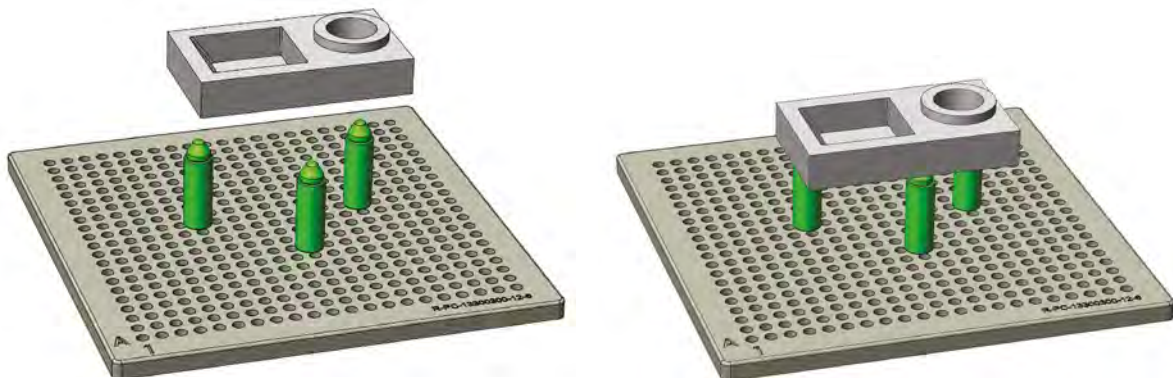
Fixturing principles

With any fixturing application, it is important to remember the key fixturing principles. These ensure that any fixture built will be correctly designed and stable enough and for repeatable measurements to be taken.

3-2-1 principle

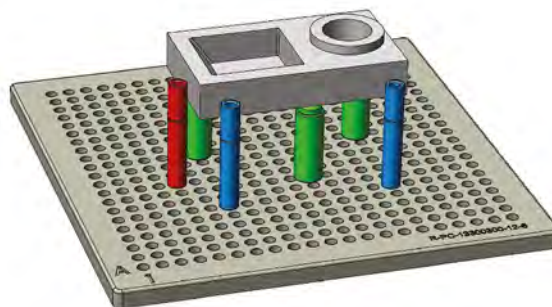
This principle outlines the core procedure for any fixture.

- Three points of support in Z axis (primary datum).
 - Two points to fix the X axis (secondary datum).
 - One point to fix the Y axis (tertiary datum).
1. The workpiece must be supported by three contact points (green standoffs). This fixes the Z movement of the workpiece while ensuring it has a stable base to rest on.



NOTE: More than three points can be used for large, heavy workpieces.

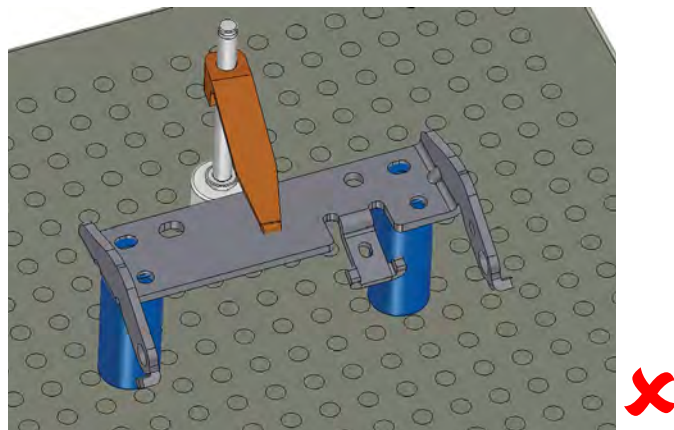
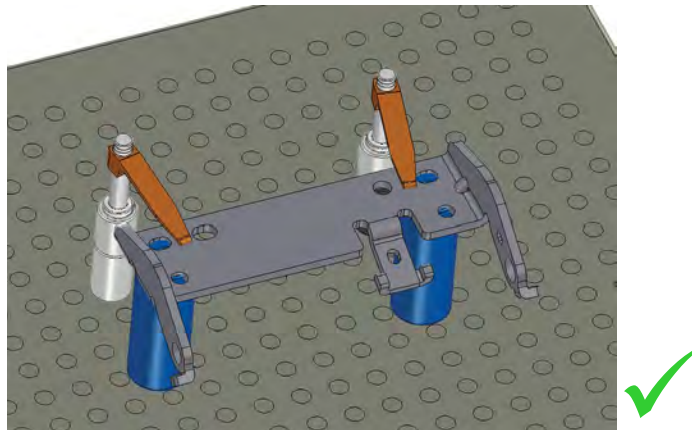
2. The workpiece must then be secured in the X and Y axes to stop translation and rotation. Two contact points are needed to fix the Y movement (blue standoffs), and finally one point is needed to fix the X movement (red standoff).



Clamping

Clamping makes sure that the workpiece does not move under inspection.

When clamping, the recommendation is to clamp above a supporting standoff. This ensures that the workpiece is not deformed by the clamping, and that the workpiece is rested on its datum features.



Adjustability

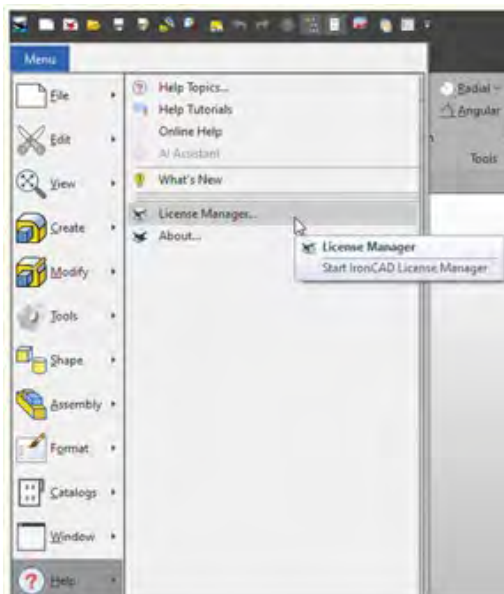
NOTE: Adjustable components should be reduced where possible as they can reduce the reproducibility of the fixture.

Using adjustable components is a great way of building a fixture that exactly fits the workpiece being inspected. If you are going to be breaking down and rebuilding the fixture frequently, it is advised that you keep these to a minimum as they are hard to reproduce in exactly the correct positions. However, adjustable height standoffs can be measured with a vernier calliper to check and record heights.

Update FixtureBuilder

To remove FixtureBuilder 8.1 and install FixtureBuilder 8.2:

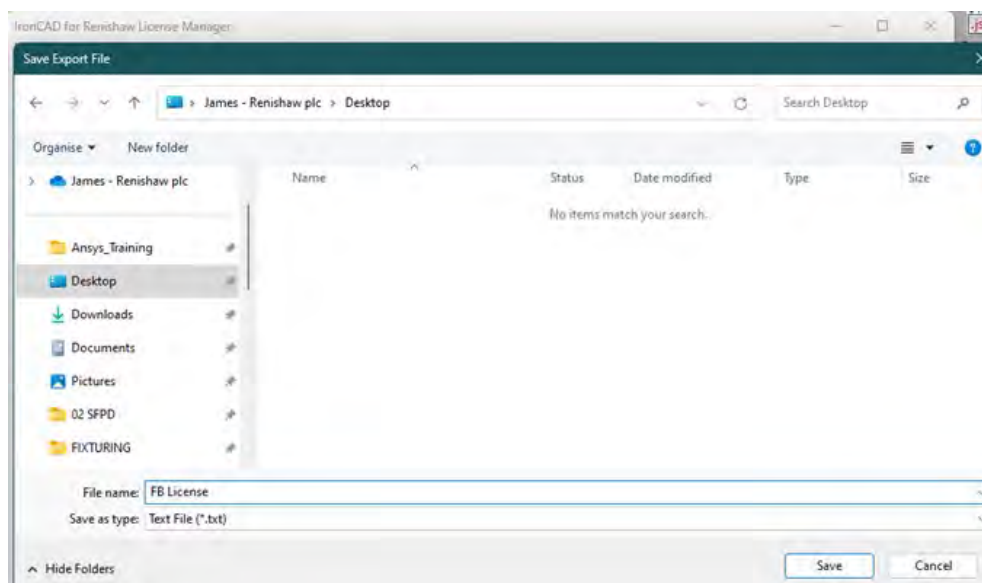
1. Open FixtureBuilder, and go to the **Menu**. Click **Help**, then click **License Manager**.



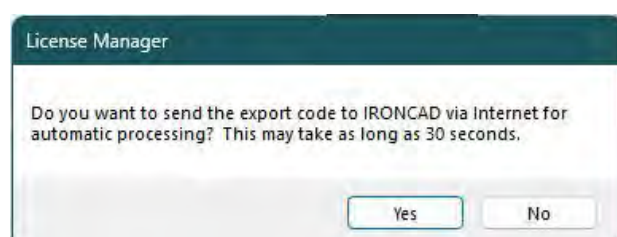
2. In the License Manager window, select **Remove Licenses** and click **Next**. Click **Yes** to confirm.



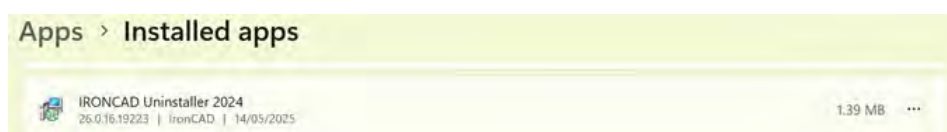
- When you are prompted to save your license code, save it in an accessible location, such as your desktop, for future reference.



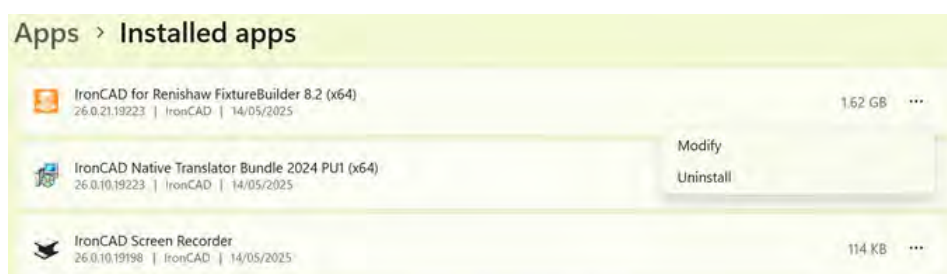
- If you are connected to the internet, click **Yes** to send the export code to IronCAD for automatic processing. If you are not connected to the internet, click **No**.



- Uninstall FixtureBuilder 8.1 from your system using the uninstaller application.



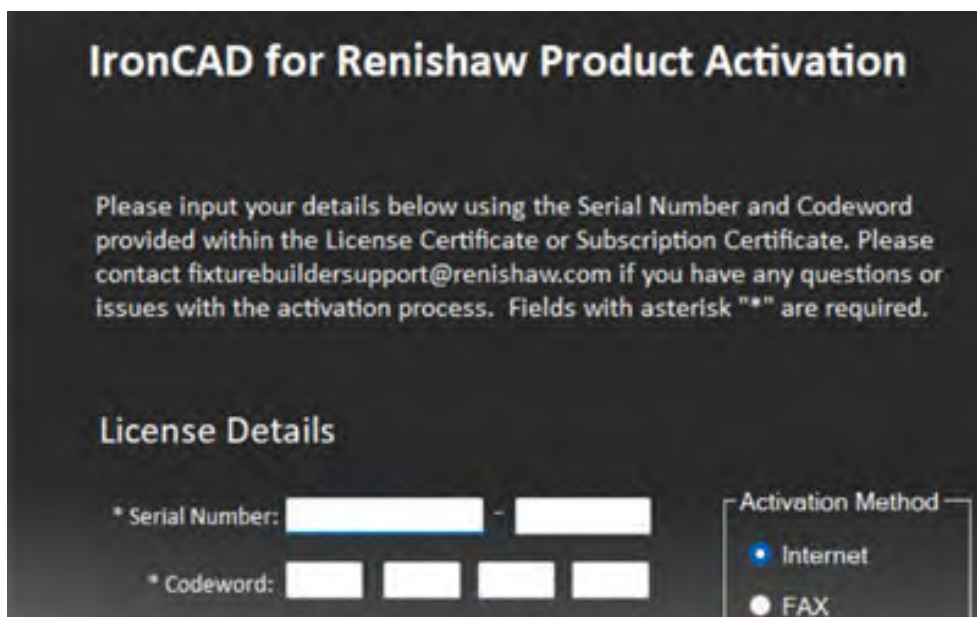
Alternatively, uninstall/delete the following applications manually.



- Check that FixtureBuilder 8.1 has been successfully uninstalled.

7. Download and install FixtureBuilder 8.2:
<https://www.renishaw.com/resourcecentre/en/--133543>.
8. Type in your activation code. If you have forgotten your code, contact us at **fixturebuildersupport@renishaw.com**.

You can also find this information in your original purchase email and on your FixtureBuilder flyer.



The screenshot shows a dark-themed window titled "IronCAD for Renishaw Product Activation". Below the title, there is a paragraph of instructions: "Please input your details below using the Serial Number and Codeword provided within the License Certificate or Subscription Certificate. Please contact fixturebuildersupport@renishaw.com if you have any questions or issues with the activation process. Fields with asterisk "*" are required." Below this, the "License Details" section contains two input fields: "* Serial Number:" followed by two text boxes separated by a hyphen, and "* Codeword:" followed by four text boxes. To the right of these fields is the "Activation Method" section, which has two radio buttons: "Internet" (selected) and "FAX".

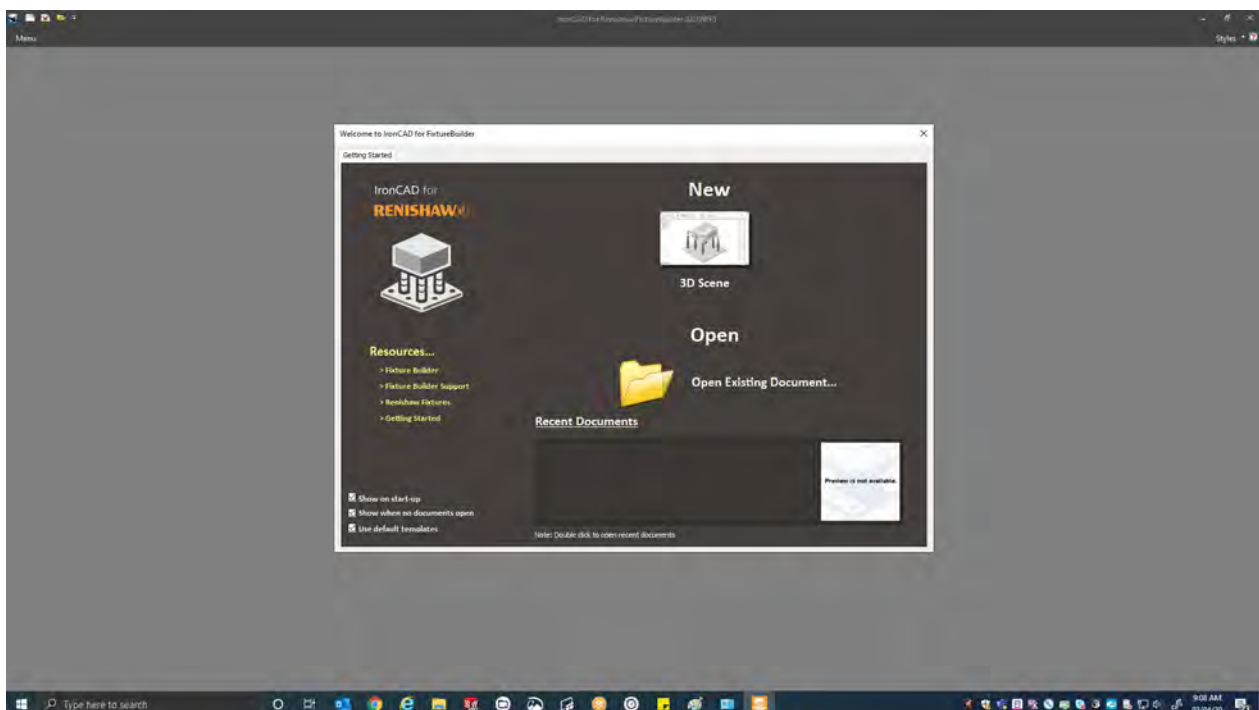
9. FixtureBuilder 8.2 is ready to use.

Getting started

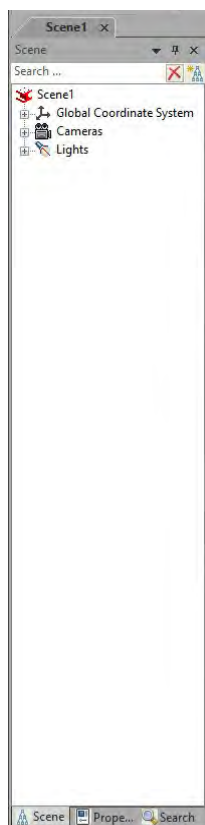
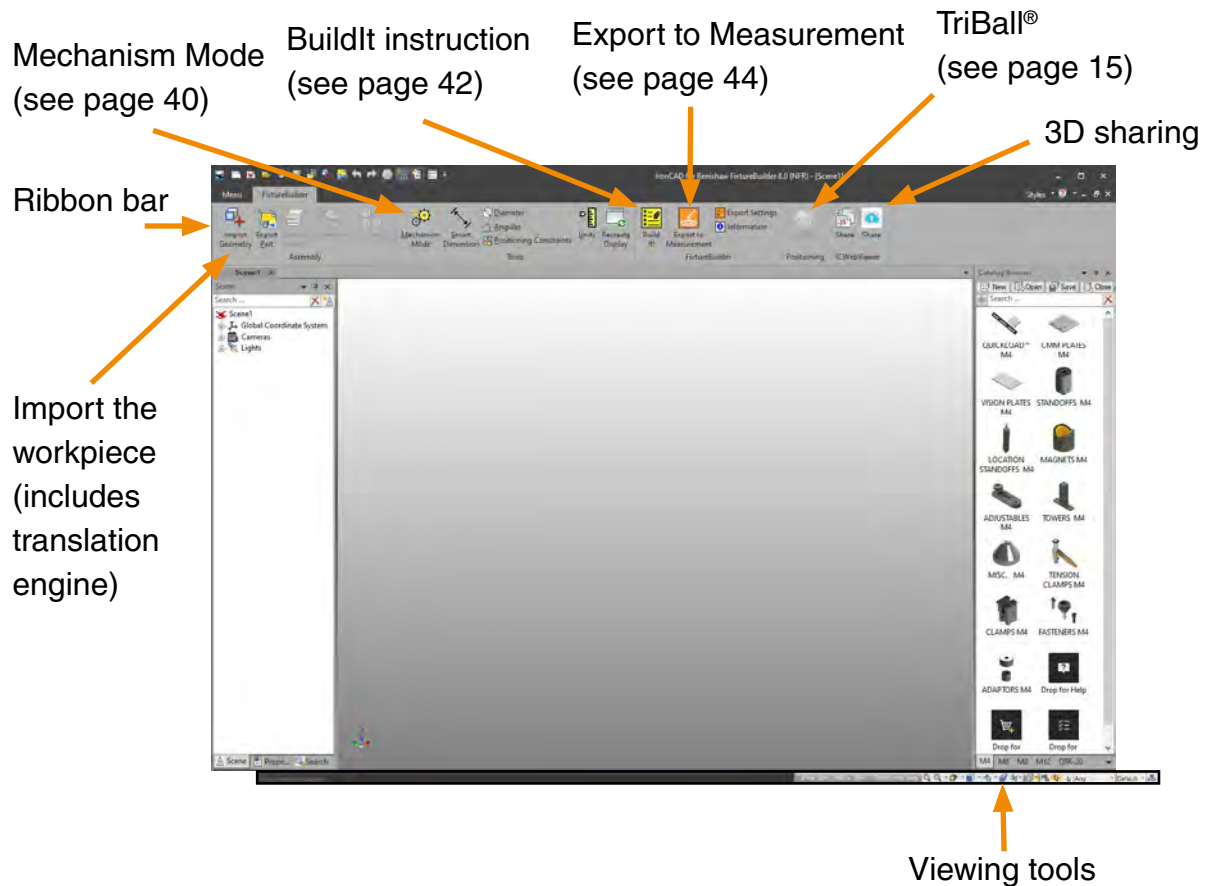
Open FixtureBuilder by clicking the desktop icon.



- Click **New** to launch a new blank scene. Then select the scene style.
- Click **Open** to search for a previously configured FixtureBuilder file.

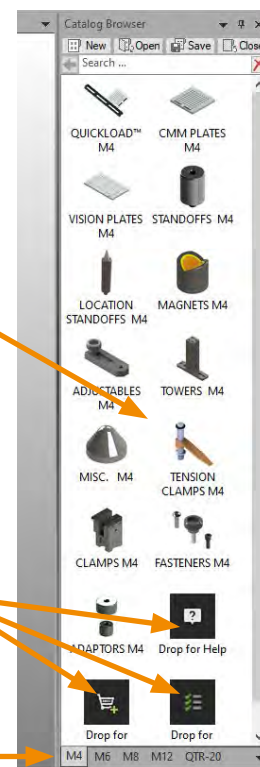


FixtureBuilder scene navigation



Scene Browser

Catalogue Browser (see page 11)



Catalogue group

Drag and drop web links (see page 46)

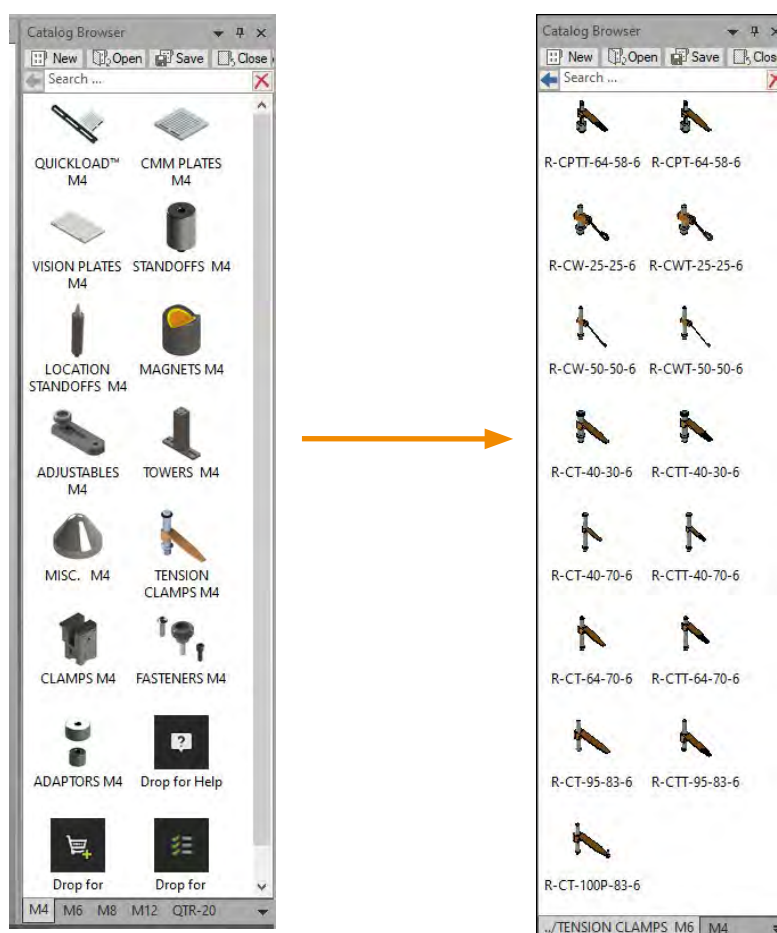
Available catalogues (see page 11)

Catalogue Browser

The Catalogue Browser contains the full range of modular fixturing components across M4, M6, M8 and ¼-20 (QTR-20) thread sizes. View the different catalogues by clicking the tabs at the bottom of the Catalogue Browser.

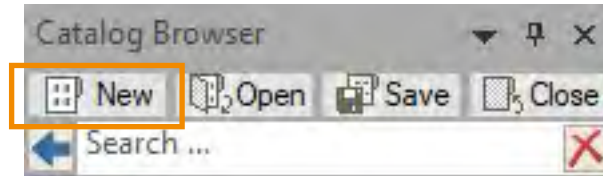
NOTE: Always use the correct threaded components with the base plate, otherwise the auto-snap function will not work (for example, use M4 components with M4 plates).

1. To enter into a specific catalogue (clamps, adjustables, standoffs), double-click the catalogue icon to open that catalogue set.
2. Click  at the top of the Catalogue Browser to go back.

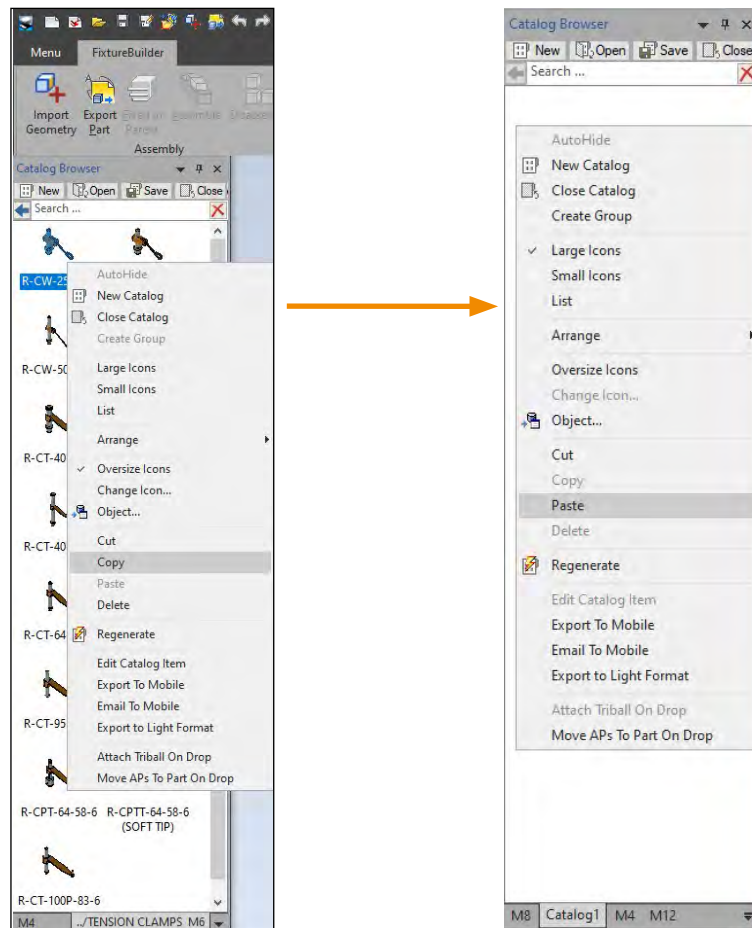


The Catalogue Browser can be customised with specific components (for example, to suit a customer's purchased parts).

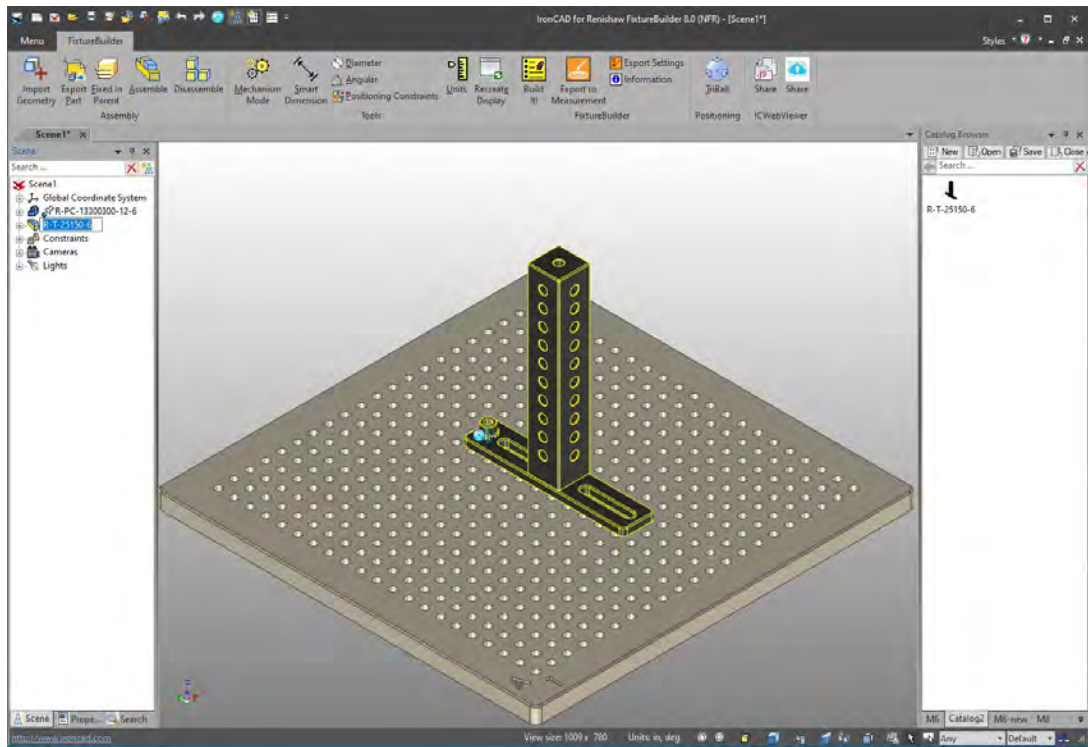
To create a new catalogue, click **New** in the Catalogue Browser. A new catalogue opens on the left-hand side of the window.



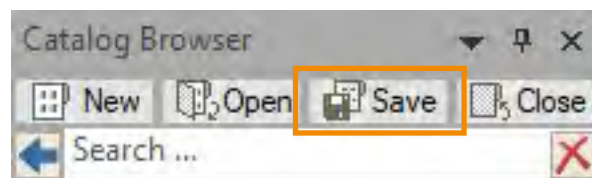
3. To populate the new catalogue, right-click on the component you want in the default FixtureBuilder catalogues. **Copy** and **Paste** into the new catalogue.



4. Alternatively, drag and drop any component or part from the Scene Browser to the Catalogue Browser.

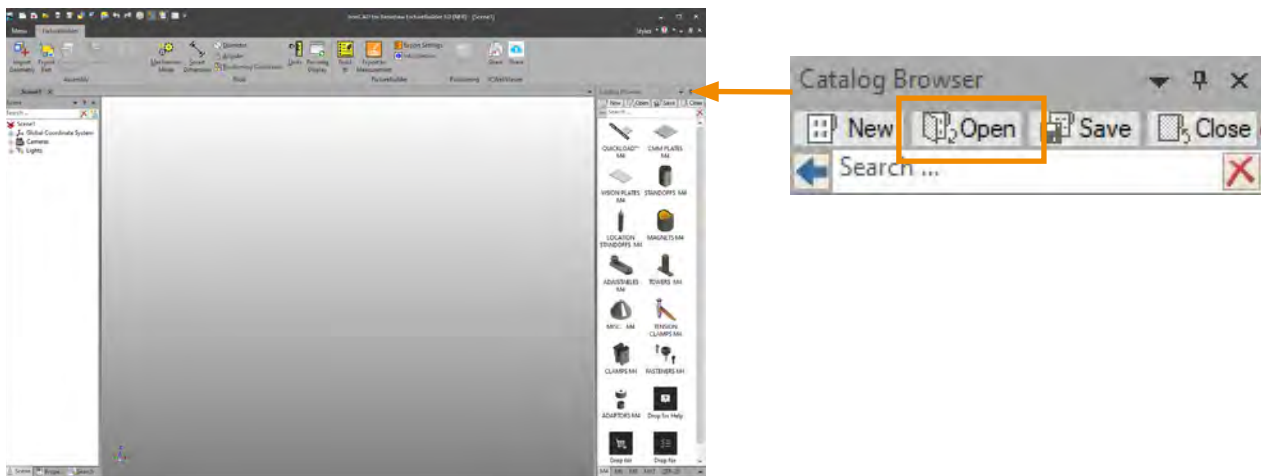


5. Click **Save** to rename and save the new catalogue.

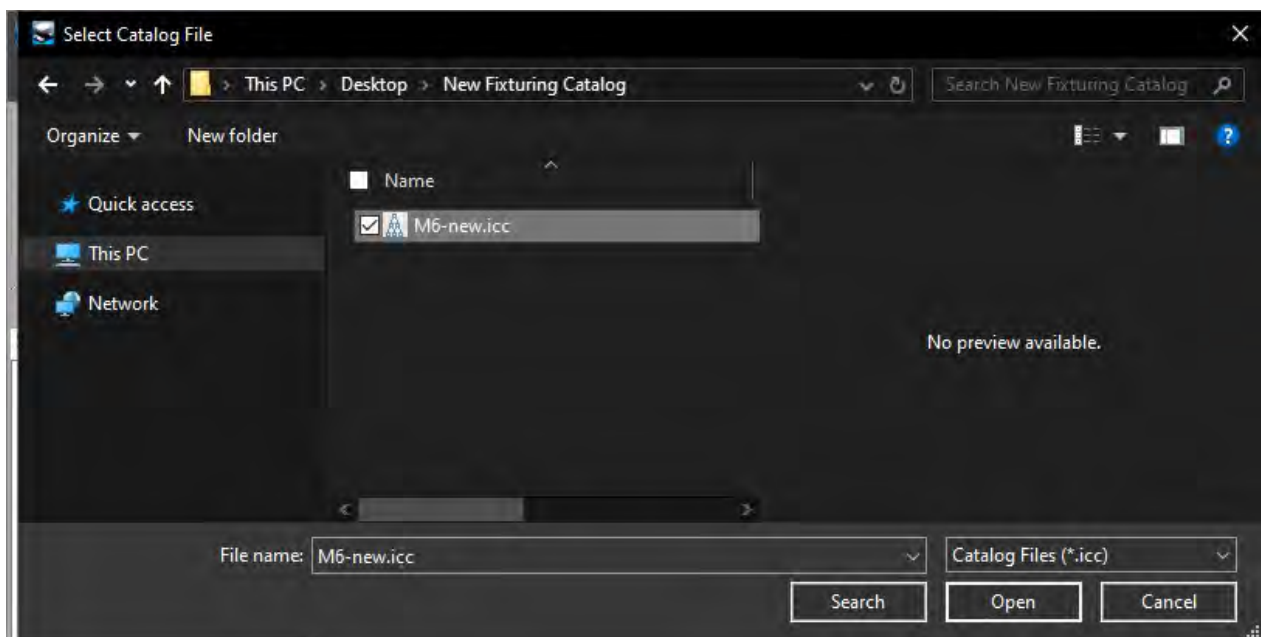


Opening new catalogues

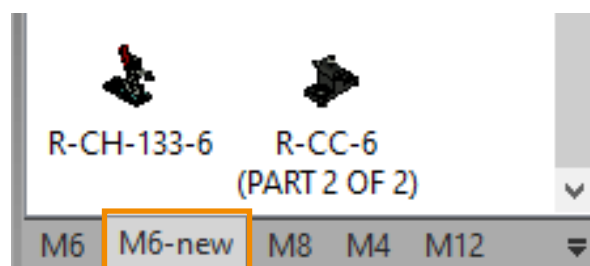
1. In the Catalogue Browser, click **Open**.



2. Select the catalogue file you want to open, and click **Open**.



3. The catalogue appears in your Catalogue Browser.

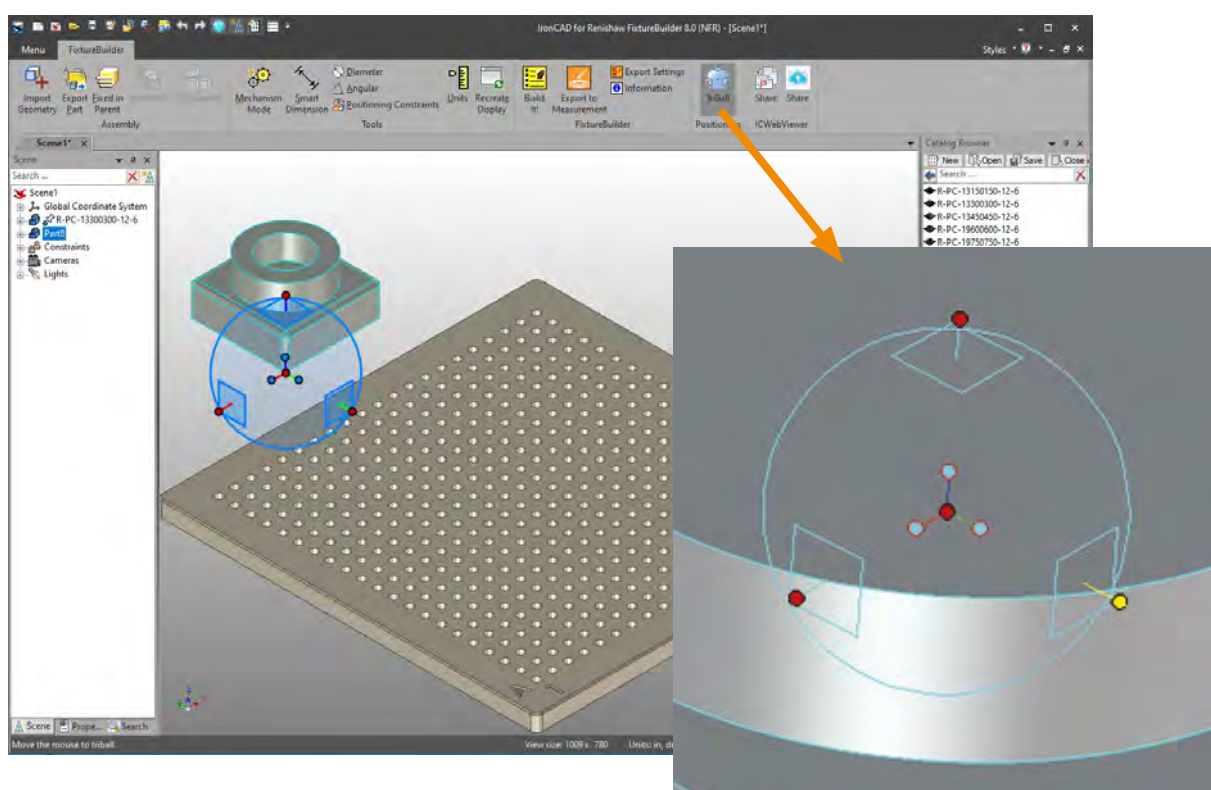


Using the TriBall®

The TriBall® is a feature of FixtureBuilder that helps you quickly manipulate workpieces within the working environment. Workpieces can be moved and rotated about the X, Y and Z axes with the left mouse button.

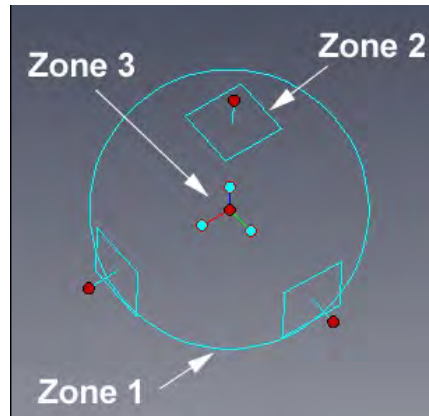
Most FixtureBuilder set-ups will require some limited TriBall use. Follow this guide to learn all about the TriBall and increase your efficiency in fixture set-up.

To activate the TriBall, select a workpiece – or multiple workpieces – to move. Click **TriBall** on the ribbon bar (or press the **F10** key).

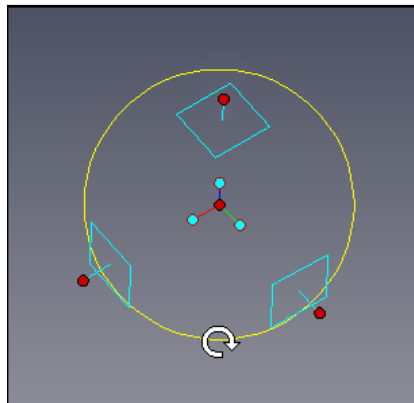


Anatomy of the TriBall

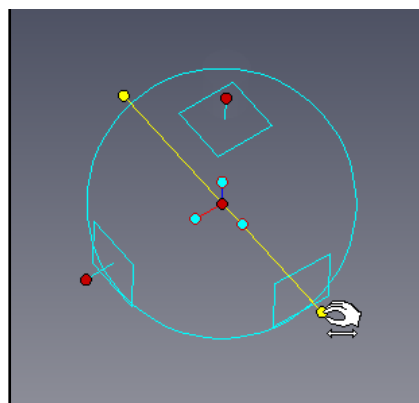
The TriBall provides tools to freely move an object about the plane of the screen (Zone 1), along defined axes, or in planes (Zone 2) using left-click for visual positioning or right-click for controlled precise movements. In addition, the TriBall provides control of position and orientation of the item being manipulated (Zone 3). The Zone 3 tools are also used to alter and control the position of the TriBall.



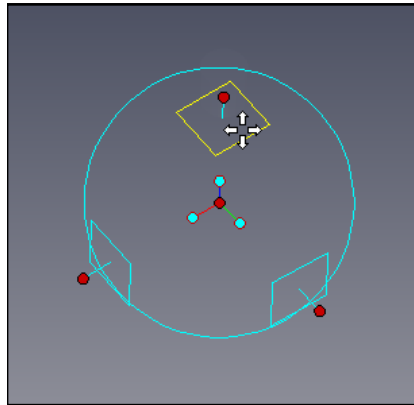
FixtureBuilder provides visual feedback via the symbol by the cursor:



Rotate/copy in the plane of the screen.



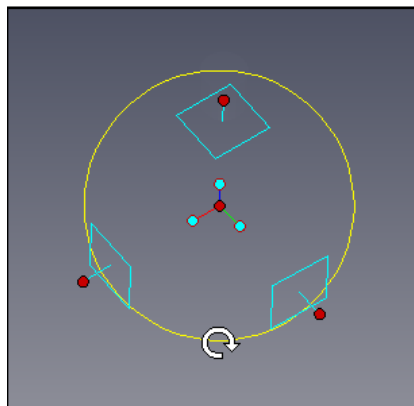
Rotate/copy about a defined axis.



Move/copy in plane.

TriBall Zone 1

Zone 1 is the circle drawn on screen used to define the outer boundary of the TriBall. Place the cursor over the boundary circle. The mouse cursor changes to a clockwise rotating arrow and the boundary circle changes from cyan to yellow.



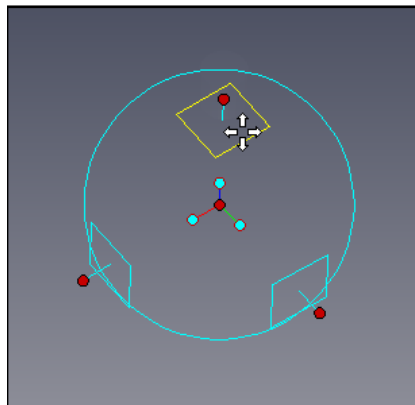
Click and drag the left mouse button while over the boundary circle to rotate the item about the current TriBall centre position in the plane of the screen.

TriBall Zone 2

Zone 2 controls movement along defined axes or planes.



On the outside of the boundary circle are three squares that represent individual planes and, as such, are at 90° to each other. Originating from the centre of each plane is the axis handle. The planes and axis handles are orientated with respect to the anchor of the item being manipulated. Position the cursor over one of the plane symbols to change the cursor graphic to four arrows which are perpendicular to each other.

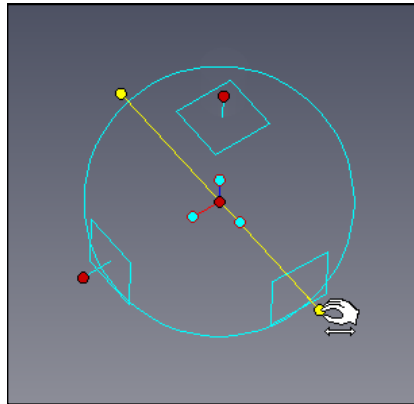


Left-click and drag with the plane highlighted in yellow to visually move the item in that plane. Right-click to display a dialog box which gives precise control. As an aid, FixtureBuilder displays a pair of dimensions to give feedback of the movement.

The axes handles are used for three primary actions:

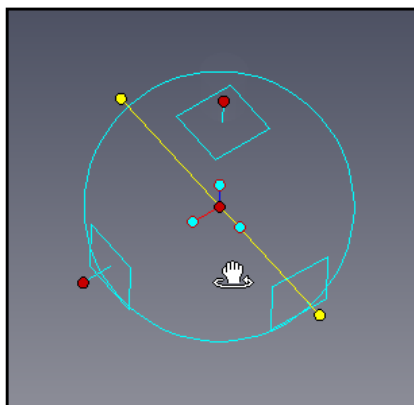
- Moving in a defined direction.
- Rotating about an axis.
- Adding extra control of the direction of movement when positioning using the Zone 3 functions.

Click on one of the handles to highlight the handle passing through the TriBall. This declares an axis for movement or control even when clicking on the handle and dragging in one movement.



FixtureBuilder gives feedback of any positional changes and changes the cursor shape. With the axis 'declared', moving the mouse pointer inside of the outer boundary circle will cause FixtureBuilder to change the cursor shape one more time.

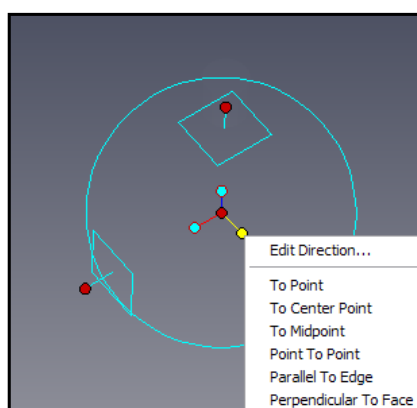
Click and move the cursor (keeping it inside the boundary circle) to rotate the item about the declared axis.



TriBall Zone 3

Zone 3 refers to the inner three orientation handles with cyan ends and the centre red point. The controls provided by Zone 3 impact the orientation of the item being manipulated (such as parallel to an edge) or the TriBall.

To view the full range of options, right-click on one of the cyan handles.

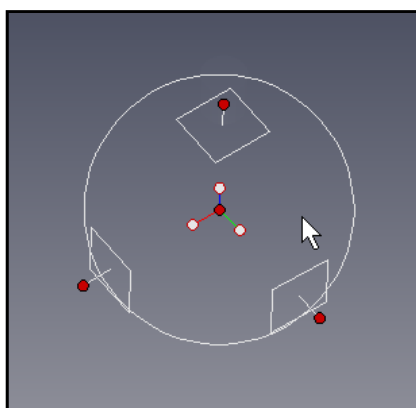


The centre red point (the centre handle) provides a quick way to freely drag the item to an existing point on any model in the scene. Click on the centre handle and, with the mouse button pressed, drag to the desired point on any model in the scene.

FixtureBuilder provides SmartSnap feedback to position the item. If an axis handle is selected, FixtureBuilder aligns the item being manipulated along the axis but aligned to the selected point.

Repositioning the TriBall

The TriBall is powerful because its position is not fixed within an item or space. Pressing the space bar when the TriBall is active changes the TriBall base colour from cyan to white. Any resulting manipulations affect the TriBall itself and not the item.



Tutorial

Fixtures are easily created using the drag and drop functionality. However, your fixture may require positioning/movement/orientation without snapping to a smart attachment point.

Practical example using the TriBall

This example introduces the fundamentals of Zones 2 and 3. During installation, FixtureBuilder installs a scene file under the Tutorials folder. By default (for version 8.2), this is:

Program Files\FixtureBuilder\2024\Tutorials\en-us

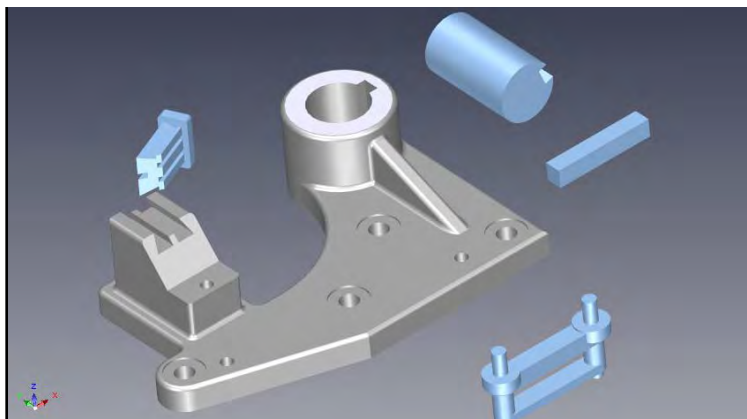
The scene file is **triball1.ics**. The example will show the power provided by the TriBall by:

- Using the centre handle of the TriBall.
- Using the inner “orientation handles” of the TriBall.
- Using the space bar to detach and reposition the TriBall.
- Temporarily constraining (declaring) an axis of the TriBall.
- Increment snapping with the TriBall.
- Using the TriBall to copy radial/linear array patterns.
- To Point command.
- Point to Point command.
- Parallel to Edge command.
- Perpendicular to Face command.
- To Centre Point command.
- Parallel to Axis command.
- Reverse command.
- Creating ‘Patterns’.

FixtureBuilder has three keyboard commands for the TriBall:

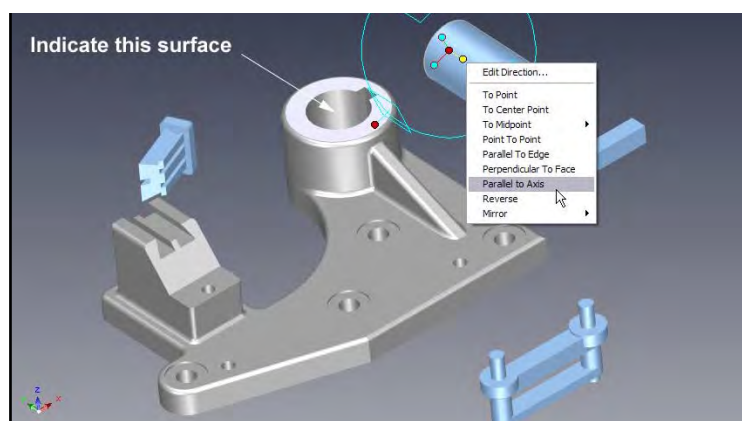
- F10: Turn the TriBall on/off.
- SPACE: Detach/attach the TriBall with selected object.
- CTRL: Activate incremental snapping for translation/rotation.

Open the **triball1.ics** file.



Using the TriBall's orientation handles to position parts

1. Select the shaft shown and turn on the TriBall.
2. Right-click on the orientation handle (Zone 3) running parallel to the axis of the shaft (as shown) and choose Parallel to Axis.

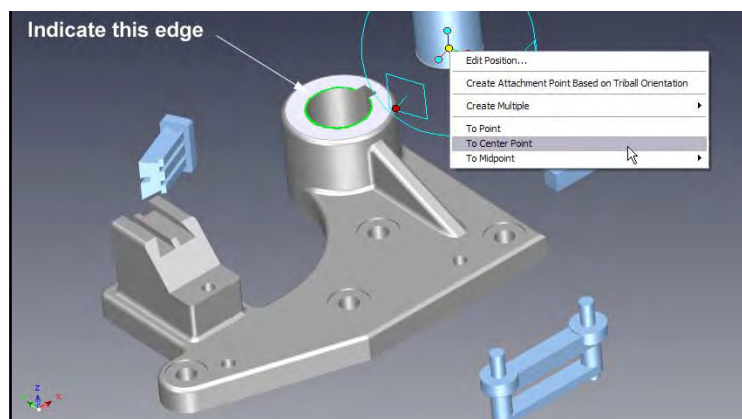


3. Click on the cylindrical surface of the main grey part shown in the image. This aligns the shaft's selected axis to the axis of the hole.

NOTE: In this case, you could select the outer surface of the hole instead of the inner surface and achieved an identical result.

Using the TriBall's centre point to position parts

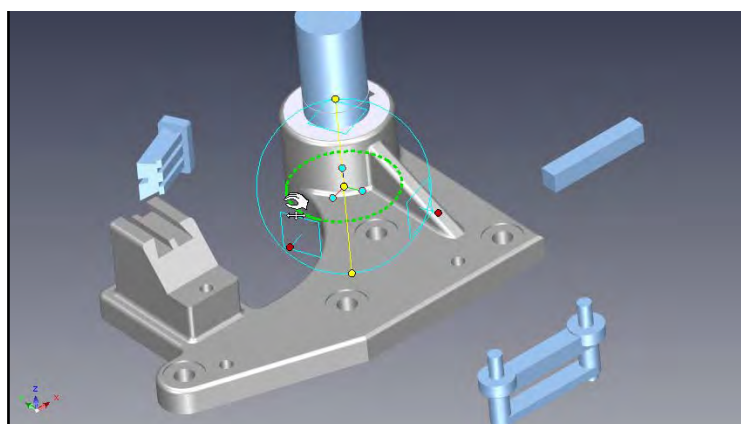
1. To move the shaft over to the hole's centre, right-click the centre of the TriBall and choose **To Centre-point**.



2. Click on the circular edge shown. The TriBall centre (and the shaft) moves to the centre point of the target selection.

Temporarily constraining (declaring) an axis of the TriBall

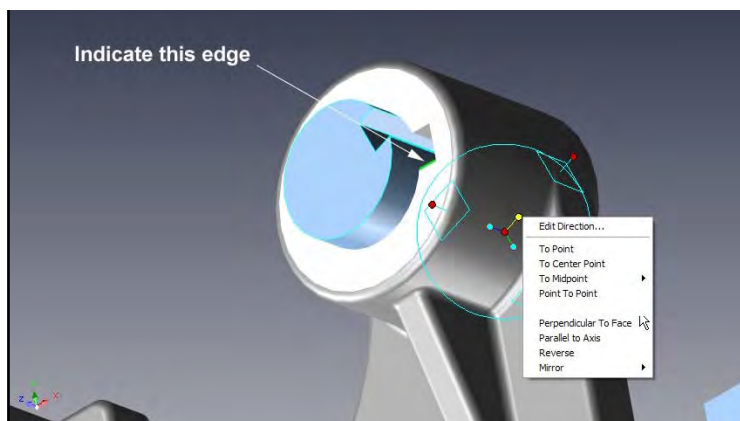
1. Click on the top outer (Zone 2) TriBall handle shown to slide the shaft down to the base of the hole. The vertical axis of the TriBall is highlighted in yellow, which means the TriBall is now temporarily constrained to move/rotate only along/about that axis.



2. Left-click and hold the mouse button on the TriBall centre red dot to drag the centre of the TriBall to the lower circular edge as shown. By declaring the axis, the cursor is effectively free to move outside the TriBall to enable other features or parts to be selected. The shaft 'slides' down the constrained vertical axis and snaps into alignment with the bottom of the hole.

Parallel to Edge command

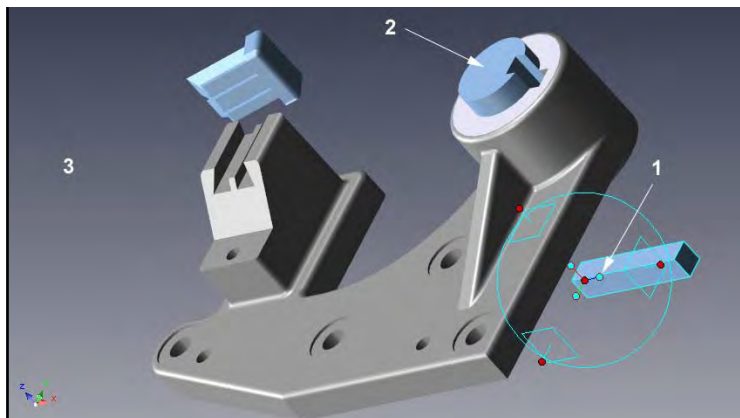
1. Manipulate the viewing position to get a clearer view of the keyway in the shaft and housing. To align the keyway, right-click on the centre orientation handle (Zone 3) shown and choose **Parallel to Edge**.



2. Click on the edge shown on the keyway. The selected axis of the TriBall aligns with the target edge by rotating about the TriBall centre point.
3. Turn off the TriBall either by pressing **F10** or by clicking on its icon.

Perpendicular to Face command

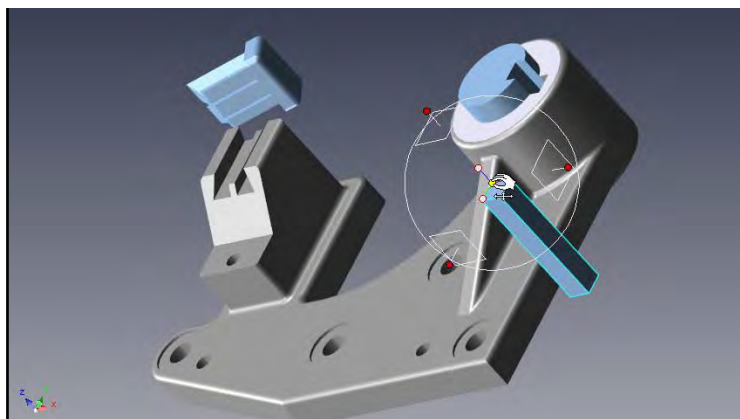
1. To insert the key into the keyway, select the key and turn on the TriBall.



2. Align the key with the keyway by right-clicking on the centre orientation handle shown (1) and choose **Perpendicular to Face**.
3. Click the top surface of the shaft you positioned previously (2). The selected axis of the TriBall aligns perpendicularly with the target face. Click in a blank area (3) of the scene to deselect the selected axis.

Drag-and-drop method of repositioning the TriBall

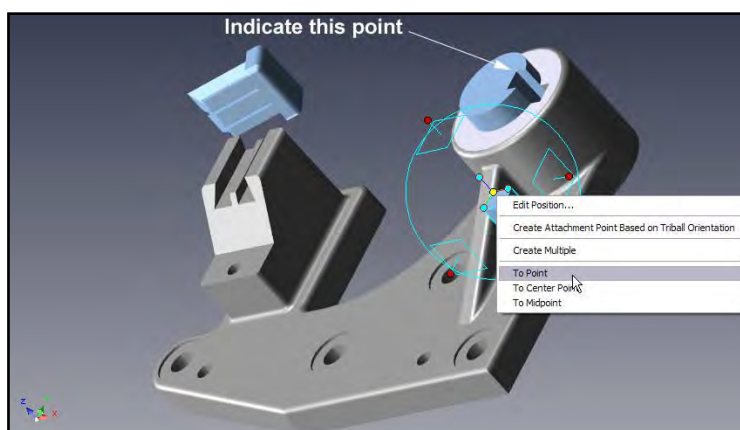
1. Press the space bar to relocate the TriBall on the part. The TriBall colour changes to white, indicating that it is 'detached' and can be moved independently of the part. Drag the centre of the TriBall to the corner of the key as shown.



2. Press the space bar again to re-attach the TriBall to the part (colour returns to blue).

To Point command

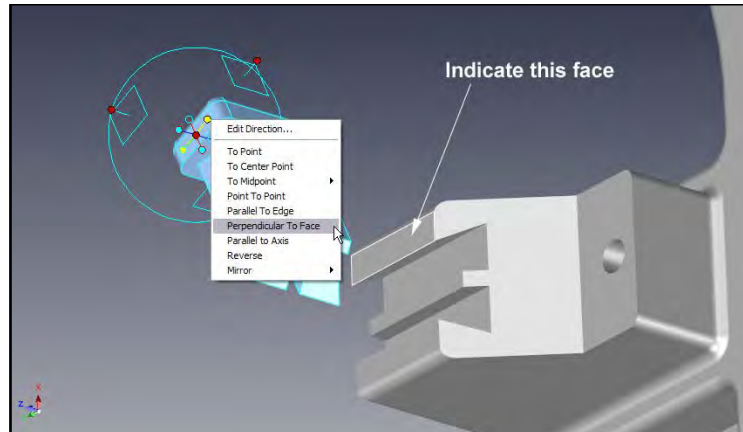
1. Position the key into the keyway by right-clicking the centre of the TriBall and choose **To Point**. Next, select the corner point of the shaft. Alternatively, drag the centre of the TriBall to the corner point of the shaft.



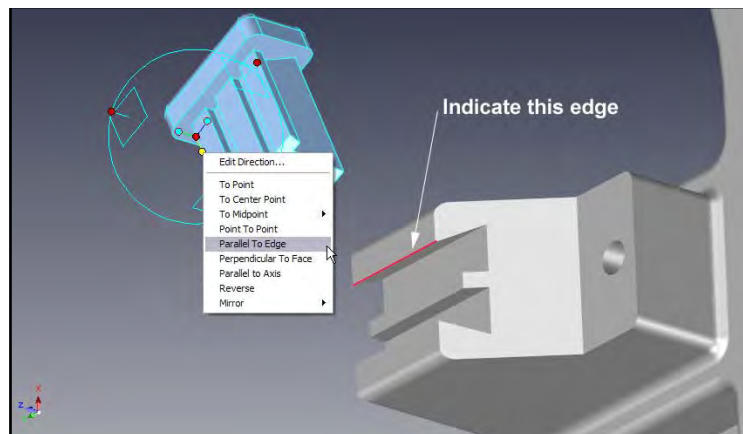
2. The key is now assembled into the keyway. Turn off the TriBall either by pressing **F10** or by clicking on its icon.

Aligning the Dovetail component

1. Select the dovetail part and turn on the TriBall. Right-click on the orientation handle shown and choose **Perpendicular to Face**.

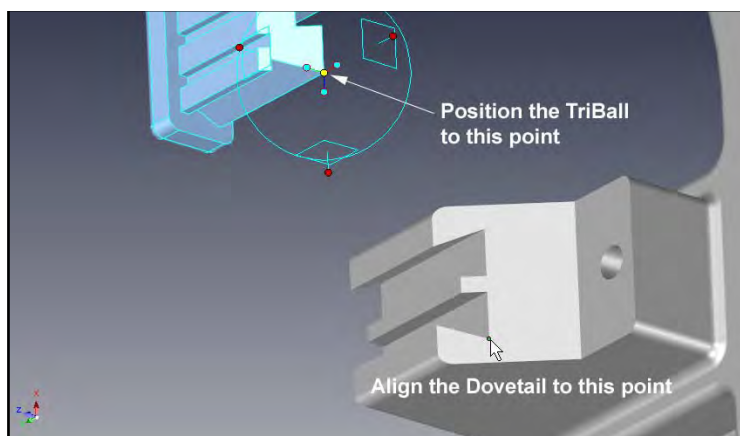


2. Click the face shown in the image and left-click the scene background to deselect the handle.
3. To align the dovetail component to the dovetail grooves, right-click on the orientation handle parallel to the grooves and choose **Parallel to Edge**. Indicate the edge shown in the image below.



4. Click in a blank area of the scene to deselect the axis.
5. Press the space bar to relocate the TriBall on the workpiece. The TriBall colour changes to white, indicating that it is 'detached' and can be moved independently of the workpiece.

6. Drag the centre of the TriBall to the corner shown. Press the space bar again to re-attach the TriBall to the workpiece (colour returns to blue). Once the TriBall has been locked in place, left-click on the centre point of the TriBall. Drag the dovetail component into position by indicating the point shown. SmartSnap feedback enables accurate positioning.

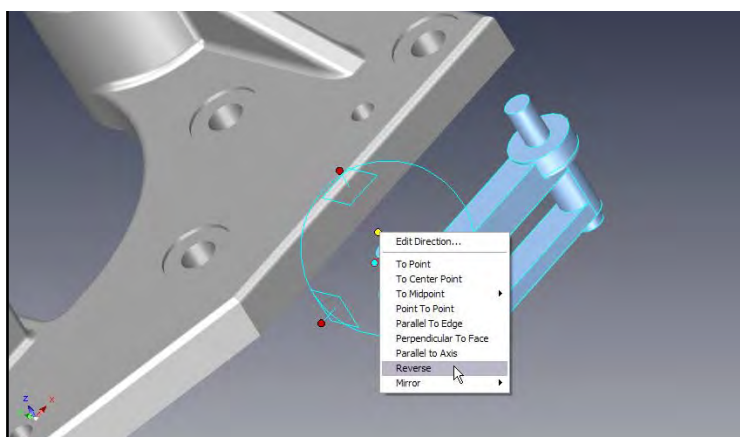


7. Alternately, right-click the centre of the TriBall, choose **To Point**, and select the same point.

The part is now assembled correctly.

The TriBall Reverse command

1. If the TriBall is still active on the dovetail component, turn it off. Select the workpiece shown and turn the TriBall back on.



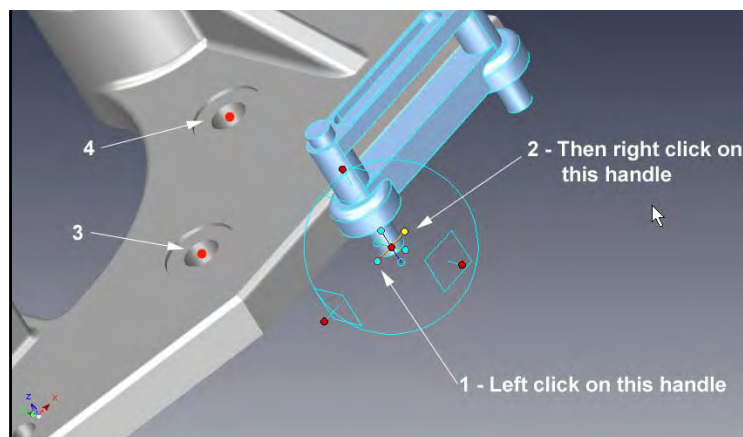
2. Right-click on the top orientation handle shown and choose **Reverse**. This 'flips' the part 180° in the direction of the selected axis.

NOTE: Reverse is different to mirroring the workpiece.

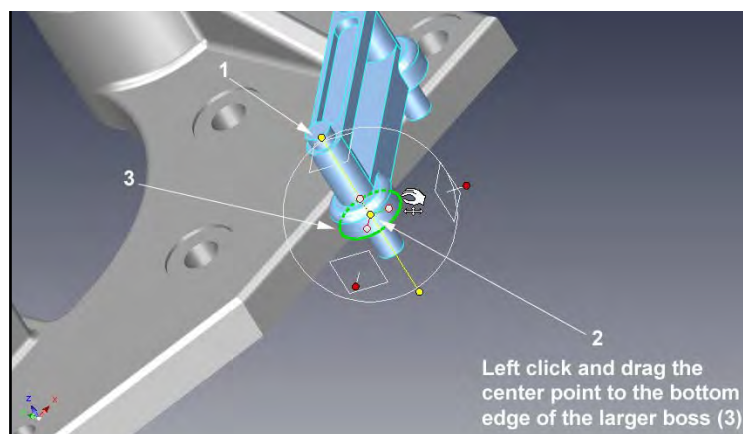
Point to Point command

The TriBall is displayed with the minimum of handles to help maintain a clean working environment. However, when a handle is selected, FixtureBuilder displays the opposite handle.

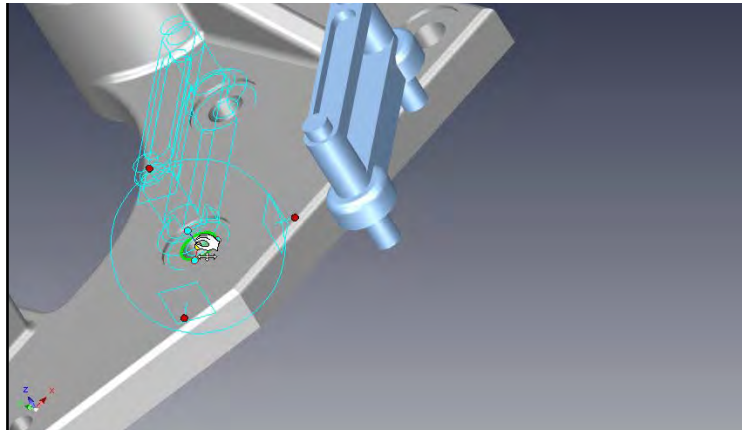
1. To align the pegs with the holes, left-click to select the orientation handle in the next image (1). FixtureBuilder displays the opposite handle (2) first. Right-click on the newly displayed orientation handle to indicate the direction of manipulation to FixtureBuilder.
2. Select **Point to Point** and select the target hole centre points (3) and (4). The selected axis of the TriBall will align parallel to a virtual line between the two target points. Undo the command, and indicate the hole centre points in the opposite sense.



3. Press the space bar to relocate the TriBall on a feature of the workpiece reflecting how it would be assembled. FixtureBuilder changes the TriBall colour to white.
4. Click on the top outer TriBall handle (1). The vertical axis of the TriBall is highlighted in yellow, which indicates that the TriBall is now temporarily constrained to move/rotate only on that axis.

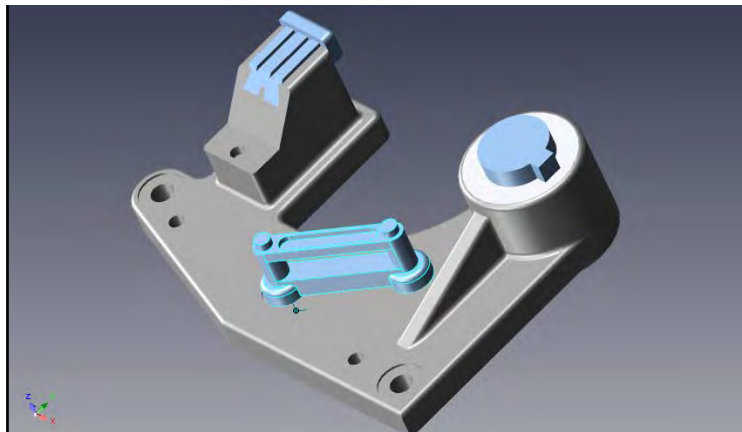


5. With the axis constrained and the TriBall highlighted in white, drag the centre of the TriBall (2) to the lower circular edge (3). The TriBall 'slides' up the constrained vertical axis and snaps into alignment with the base of the peg. Press the space bar to lock the TriBall to the new position. The TriBall will turn back to cyan.
6. Click in a blank area of the scene to deselect the selected axis.
7. To place the pegs in the holes, drag the centre of the TriBall to the centre of the hole.



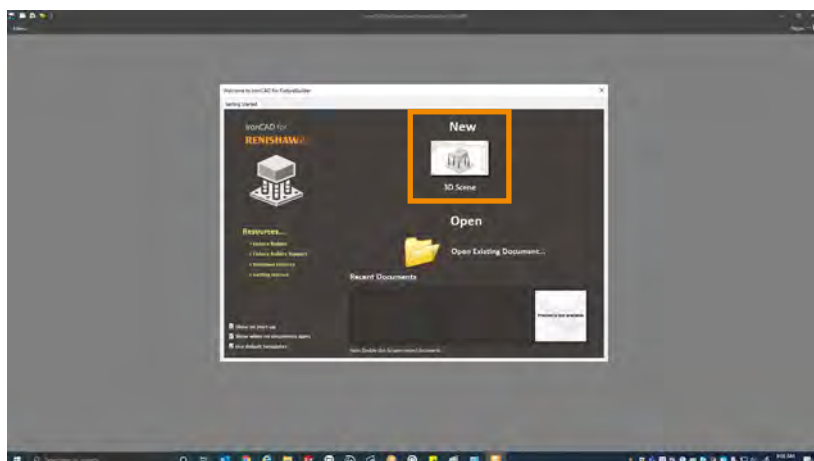
8. Alternatively, right-click on the centre of the TriBall, select **To Centre Point**, then click the circular edge of the hole.

The assembly is now complete and should look like the following image.



Creating a fixture

1. Create a new scene by clicking **New** in the welcome window or **New Scene** in the top of the ribbon bar.



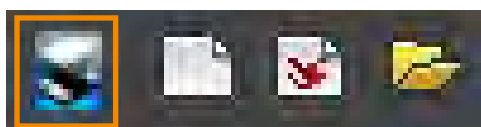
Useful keys

F7 – Positions the viewpoint to a face/feature by clicking on the item you want to look at.

F8 – Fits the fixture to the scene.

F9 – Turns on/off perspective mode.

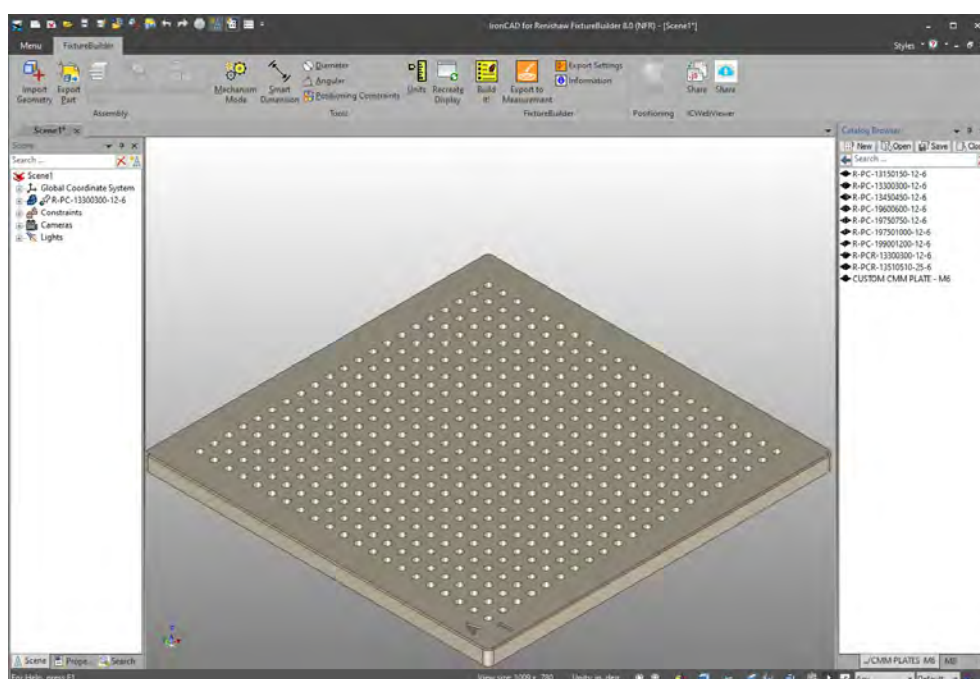
F10 – Activates/de-activates the TriBall.



The first step of fixture creation is the base plate. This must be selected based on the part size or machine you are using.

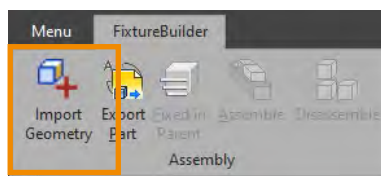
2. To position a plate in the scene, select a suitable plate from the Plates catalogue. To position the plate, drag it out of the catalogue and drop it into the scene.

NOTE: After dropping the plate, press **F8** to fit the plate to the scene window.



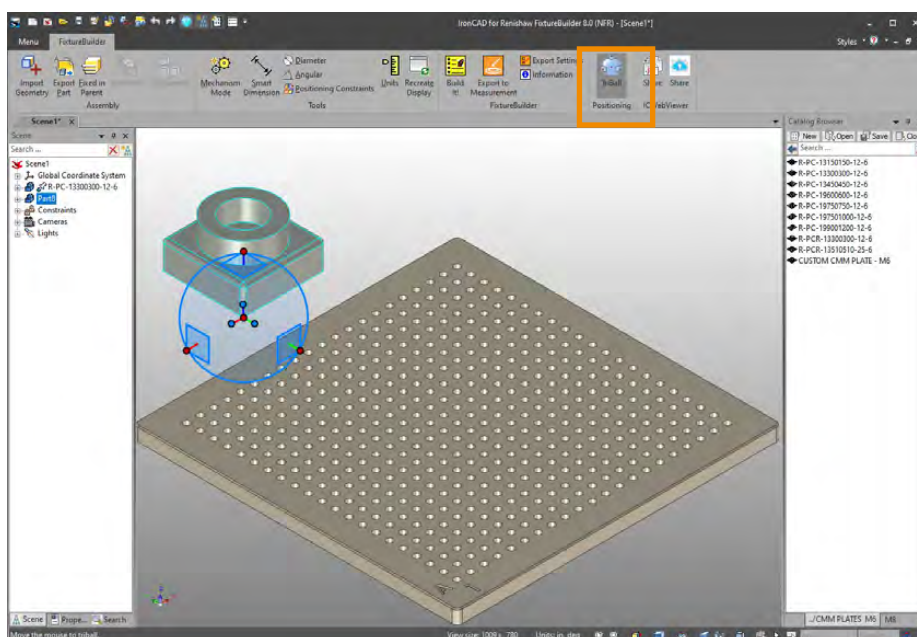
After the plate has been placed, you can import a workpiece.

- Click **Import Geometry** on the ribbon bar, select a suitable file and click **Open**.
FixtureBuilder supports all major CAD formats:
visit www.renishaw.com/fixturebuilder for full details.

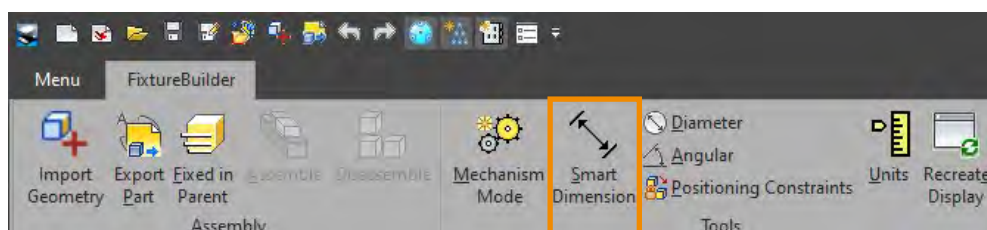


The workpiece must be approximately positioned within the scene. Typically, the workpiece is centralised on the plate; however, this can change when multiple parts are added to one plate.

- Select the workpiece and press **TriBall** or **F10**, then move the workpiece. For more information, see “Using the TriBall®” on page 15. More accurate positioning is enabled once the fixture has been built.

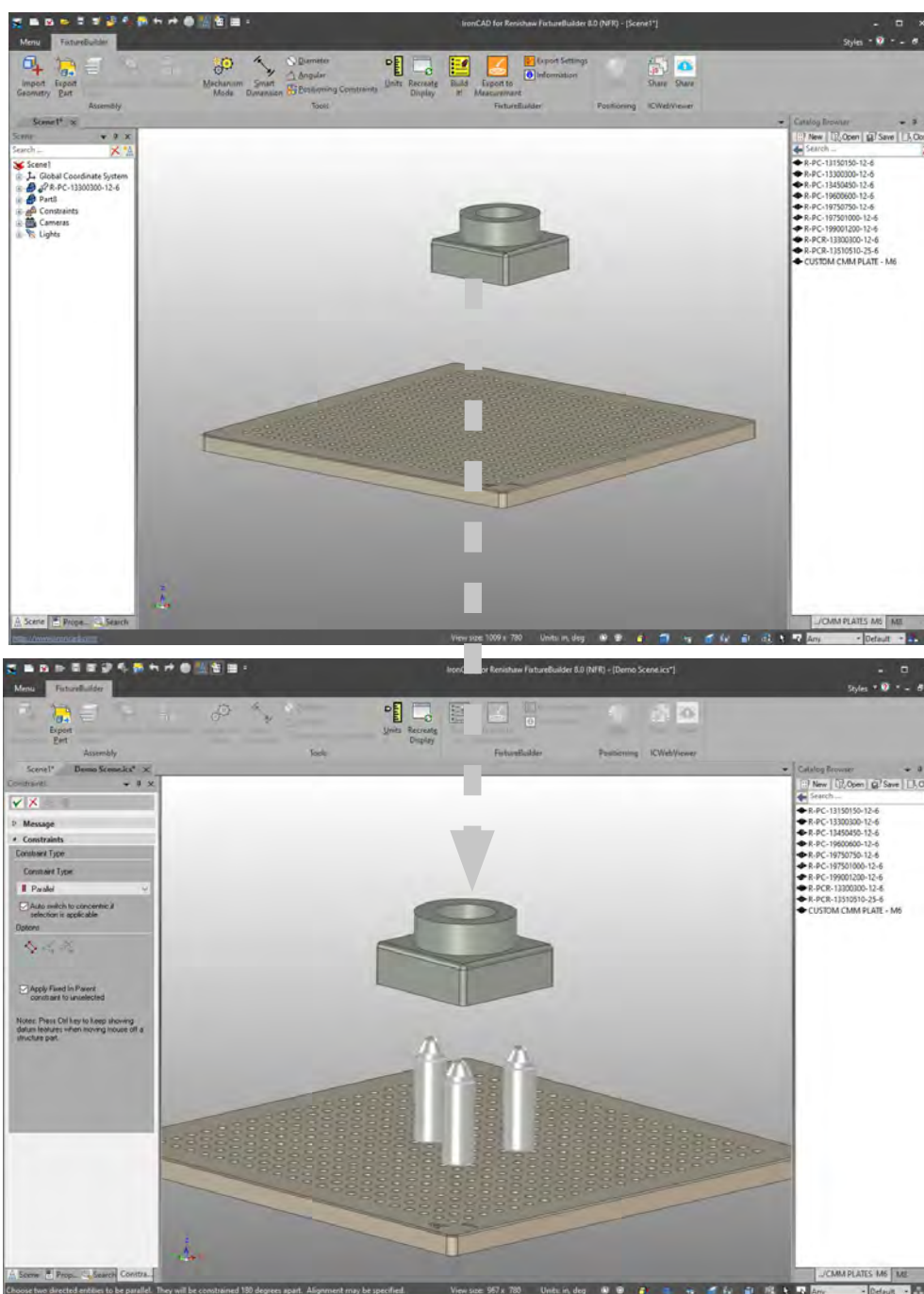


NOTE: You can check how high the part is positioned above the plate using the Smart Dimension tool. This is useful for machines with restricted measuring ranges.



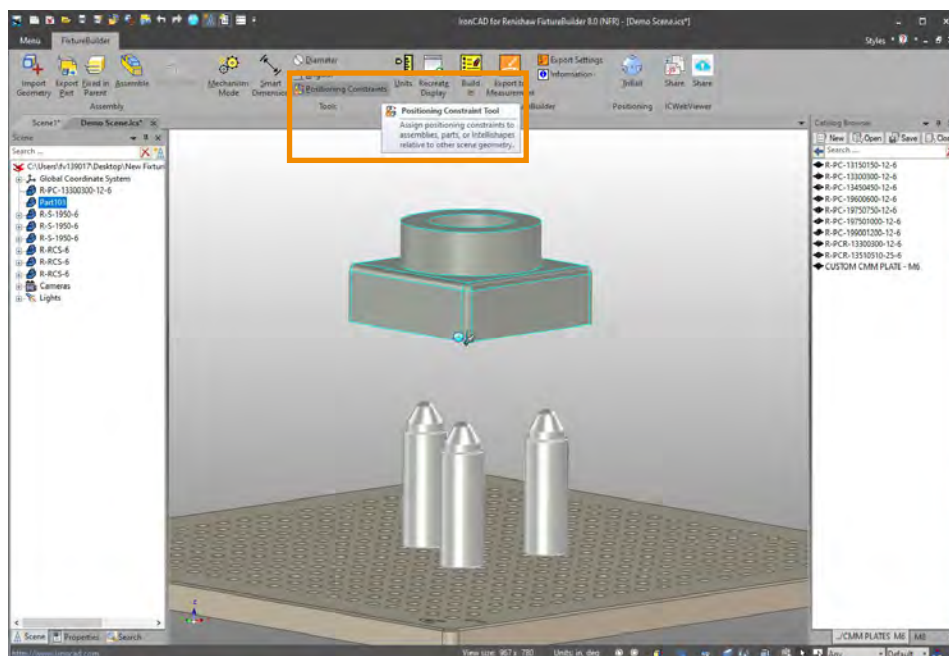
- Once the workpiece is positioned on the plate, you can add the fixturing components. Drag and drop the components from their relevant catalogues. As you drag the component over the plate, the software informs you which hole position you are about to drop the component into. To stack components, drag the next component over the top of the previous one. It automatically snaps into position.

NOTE: Always remember to build fixtures using the “3-2-1” principle to ensure the fixture is stable and repeatable. See “Fixturing principles” on page 4.

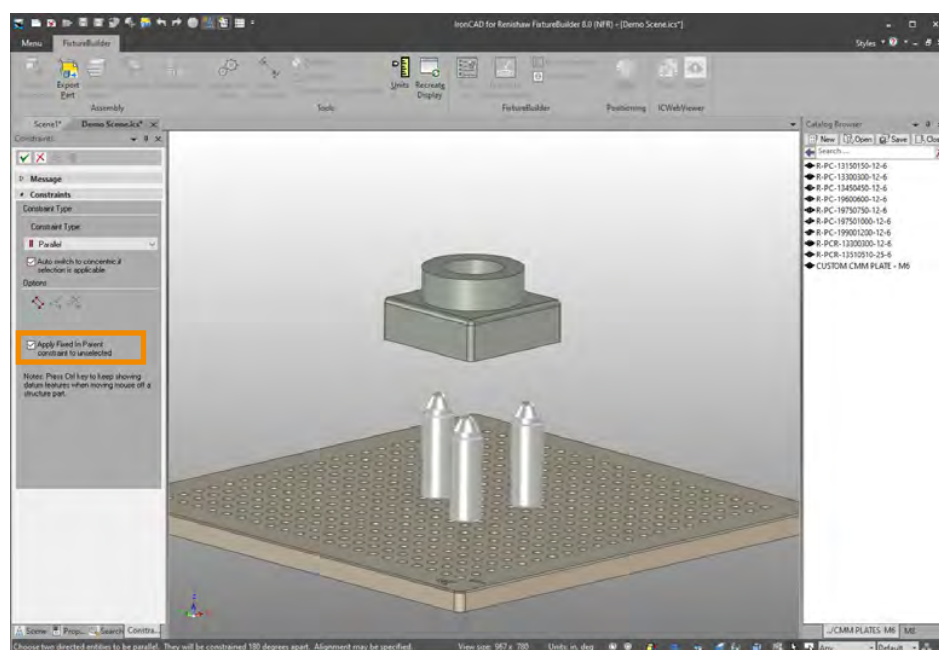


Use the **Positioning Constraints** tool to position the part on the fixture. You can assign relationships between the part and the fixture to ensure the part is correctly positioned.

6. Select the workpiece you wish to constrain: it is outlined either in blue (if it is a single part), or yellow (if it is an assembly). Click **Positioning Constraints** on the ribbon bar. The Positioning Constraints tool opens on the left-hand side.

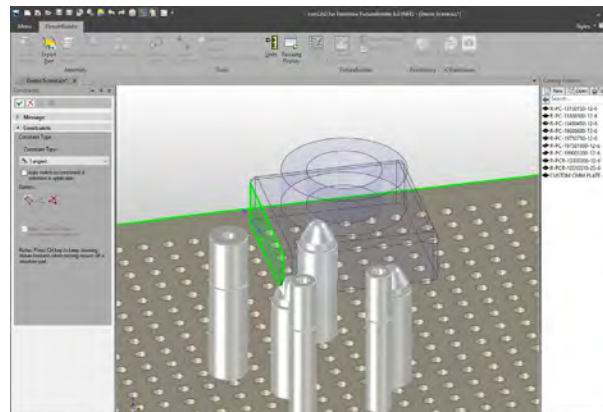


NOTE: Ensure the highlighted box below is ticked before assigning constraints. This allows the software to understand which workpieces to move when constraints are applied.

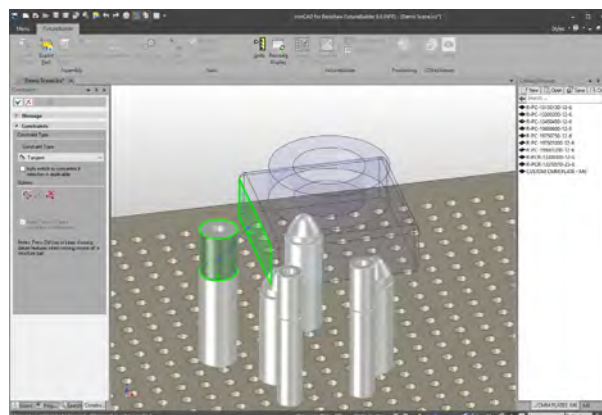


Various constraint options are available for aligning the workpiece to the fixture. The most common are “mate” and “tangent”. Mate constraints align two faces together, and tangent constraints are used to align a flat surface with a cylinder. In the example below, tangent constraints have been used to assign the workpiece to the XZ axes supports of the fixture.

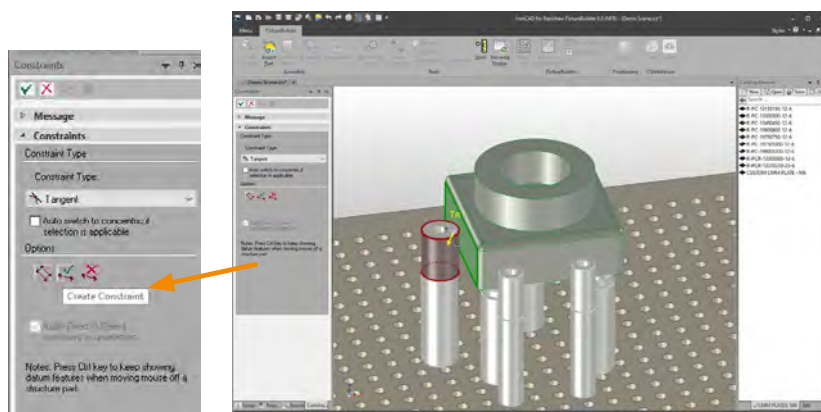
1. Select the workpiece you want to constrain (see page 23), then select the face of the workpiece you want to move.



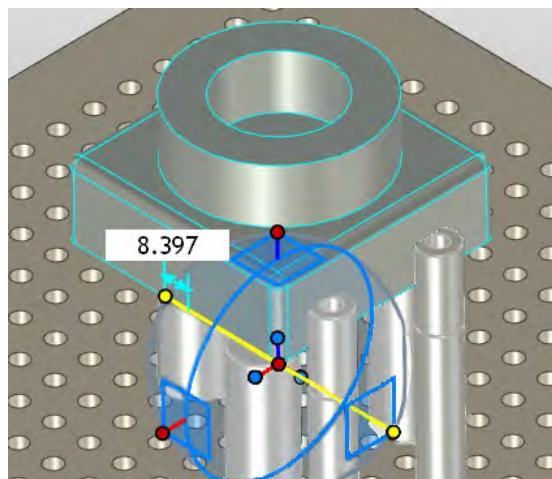
2. Select the face of the fixture component.



3. Click **Create Constraint** to stay in the positioning constraints mode.

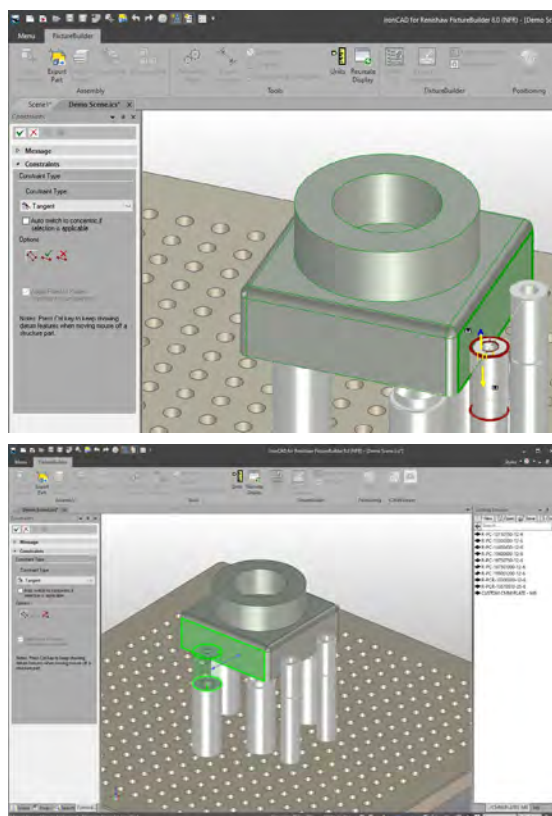


NOTE: Sometimes, when applying constraints, the workpiece will overlap fixturing components. If this happens, reposition the part using the TriBall away from the fixturing components to ensure the constraints solver uses the correct face.



Further constraints can be added to align the workpiece with the X and Y axes fixture positions.

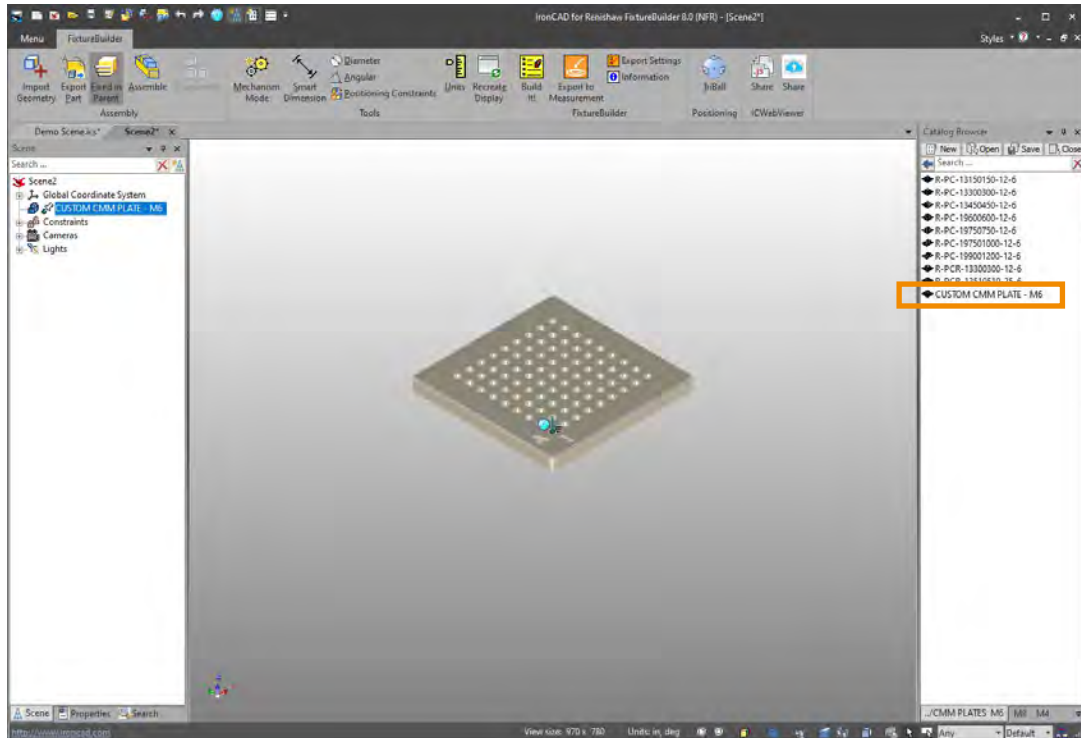
NOTE: Always select the part before clicking **Positioning Constraints** and ensure that the tick box is checked in the constraints box (see page 23).



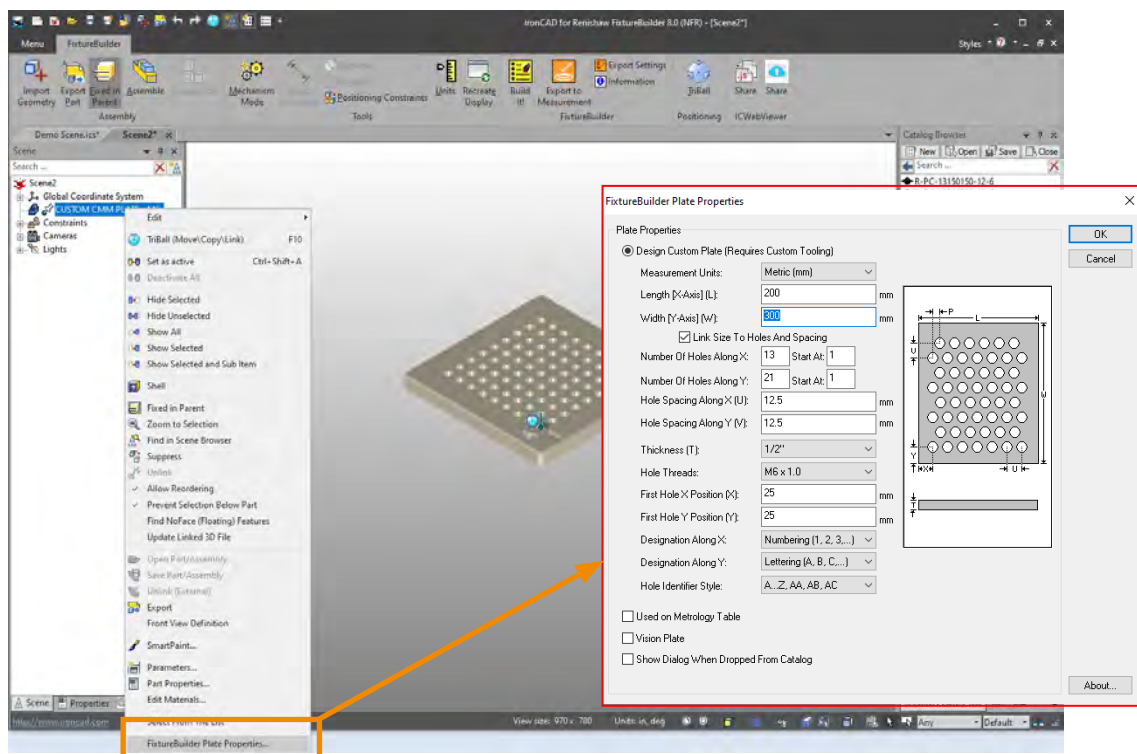
How to create a custom plate: FixtureBuilder plate properties

In each plate catalogue there is a custom plate component that can be customised.

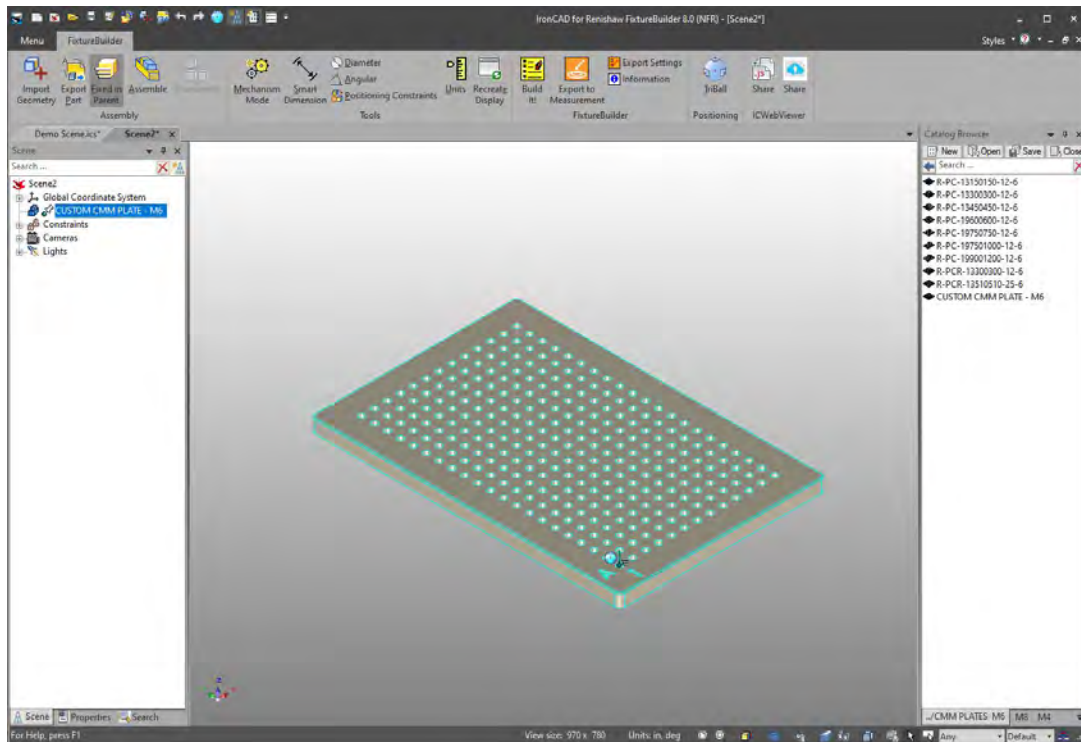
1. Drag and drop a plate in the scene.



2. Right-click on the plate and click **FixtureBuilder Plate Properties**.



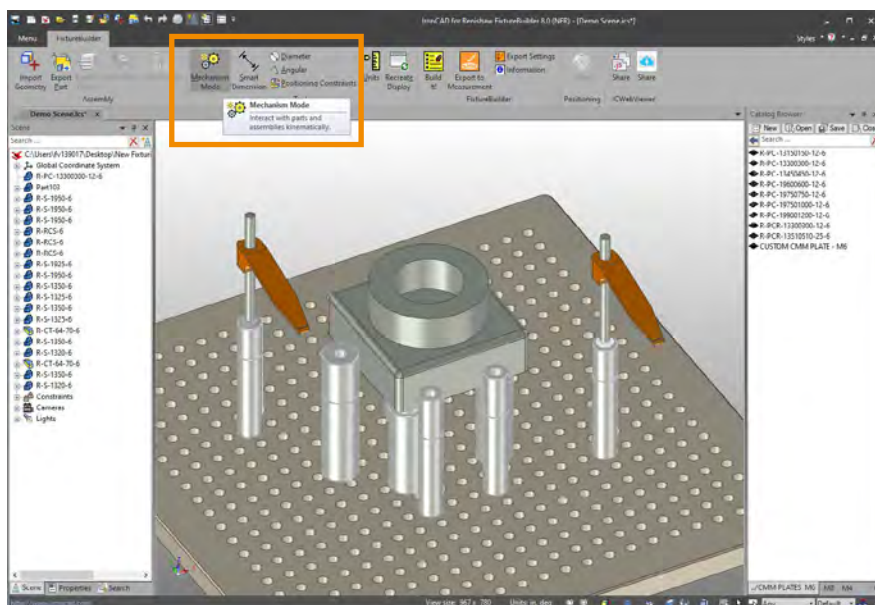
3. Update the applicable properties and click **OK**.



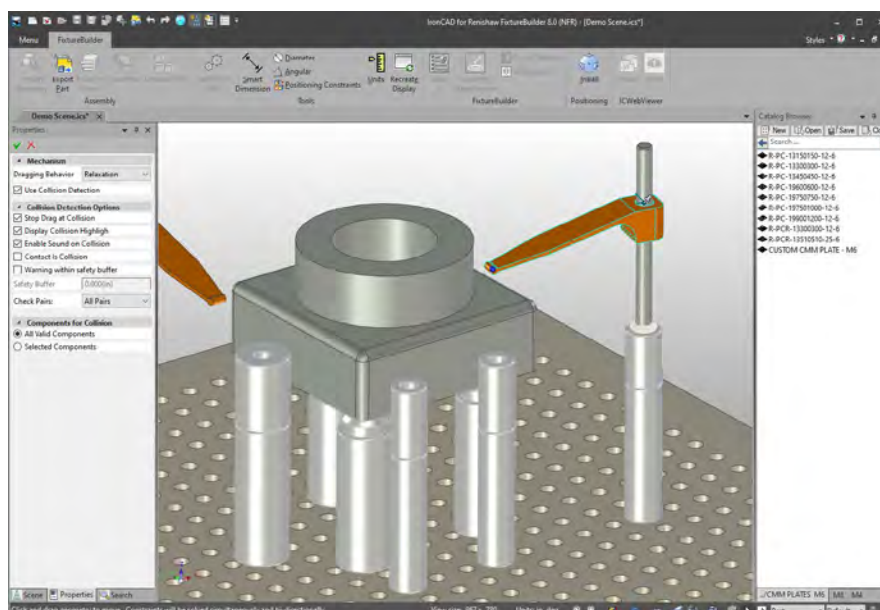
Mechanism Mode

Mechanism Mode allows you to manipulate fixturing components to move as they would in real life. Click and drag the adjustable part of any fixturing component with a degree of freedom. Collision detection is used to stop the components moving any further when they come into contact with a workpiece. Mechanism Mode is used for assigning clamps to a workpiece and pushing adjustable slide bases into position.

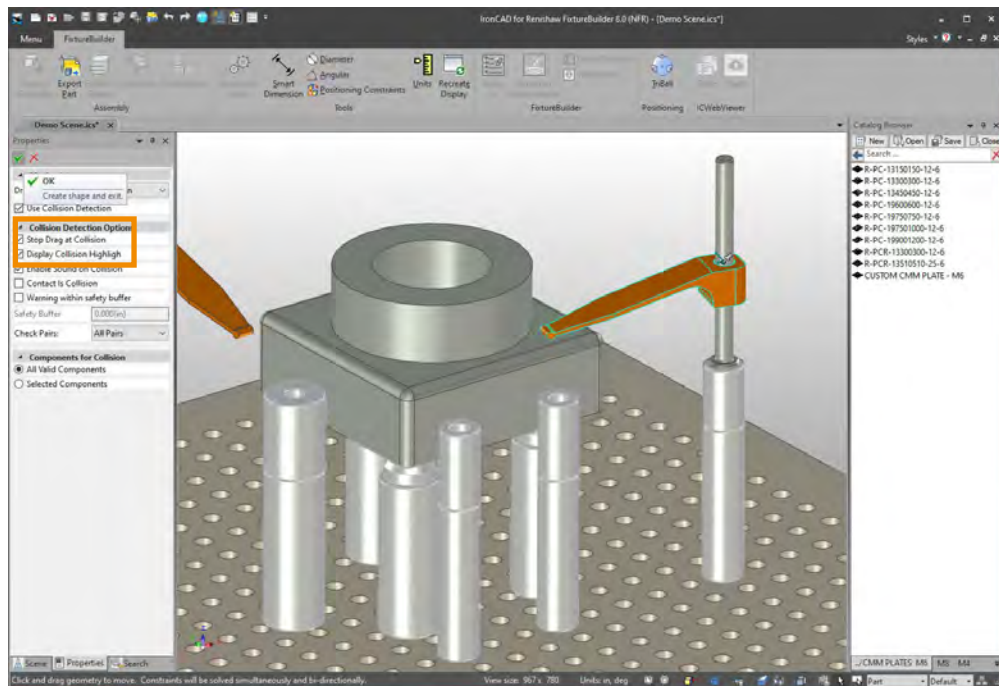
1. Click **Mechanism Mode**.



2. Drag the fixture component into place on the workpiece. Collision detection stops the part moving.



3. Click **OK**.



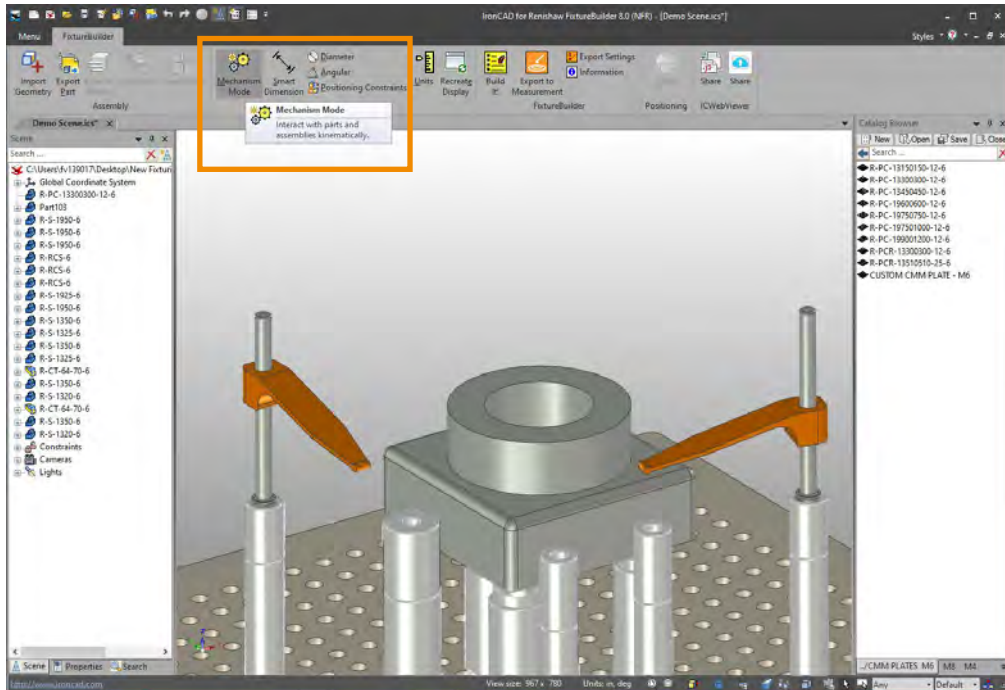
Mechanism Mode can also be used to move adjustable height stands, slide bases, and so on.

NOTE: Ensure the adjustable section of the fixturing component is dragged (for instance, the tension clamp arm) and that standoffs are repositioned outside of Mechanism Mode.

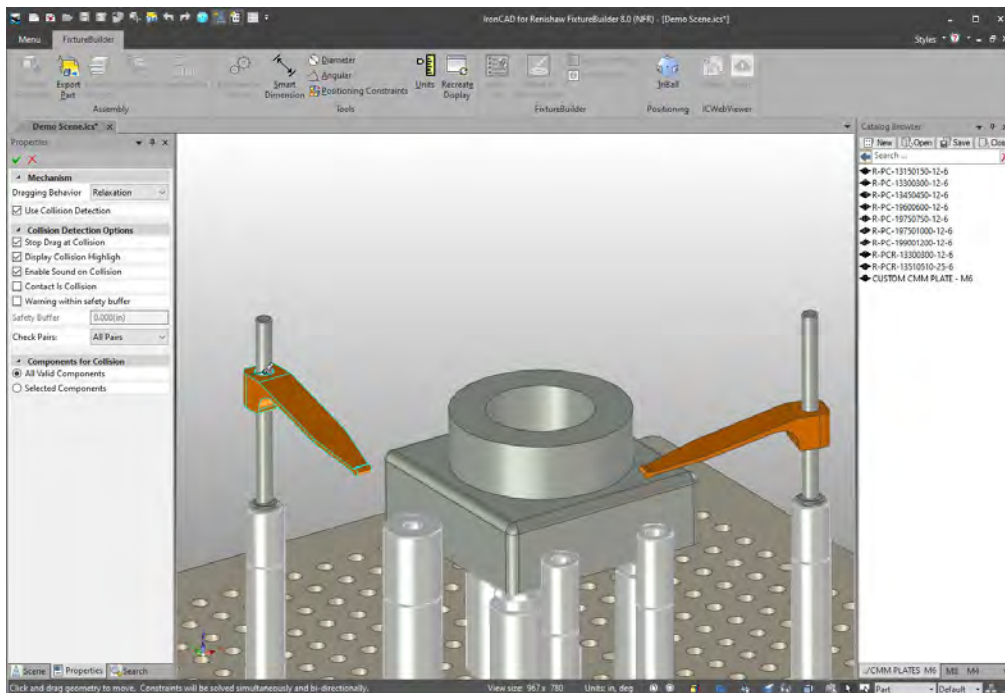
Mechanism Mode with TriBall

Mechanism Mode can also be used with the Triball for more precise movement:

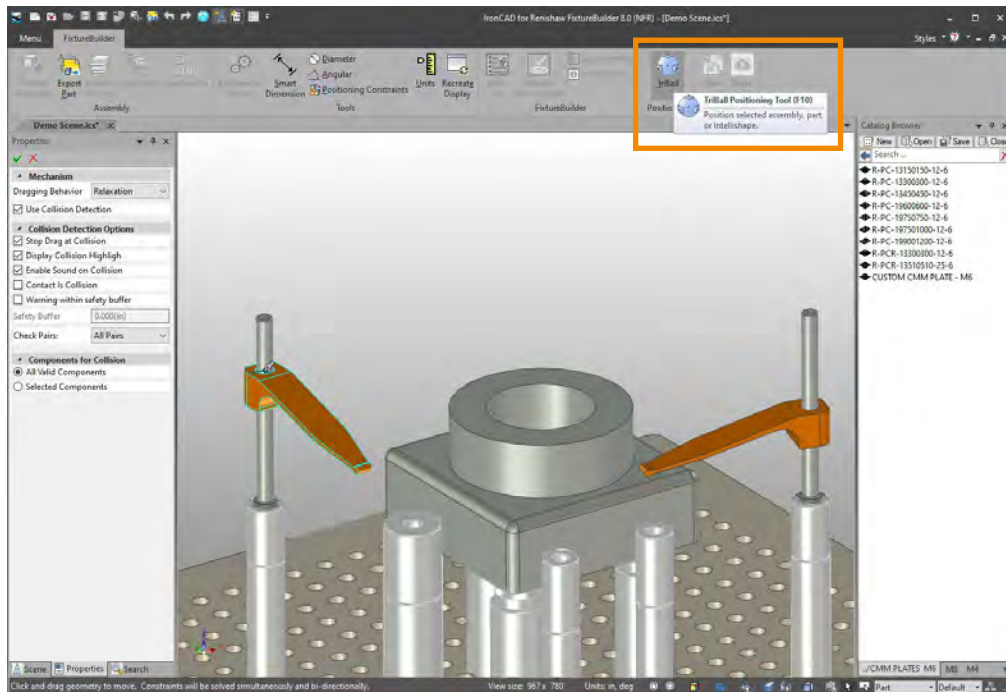
1. Click **Mechanism Mode**.



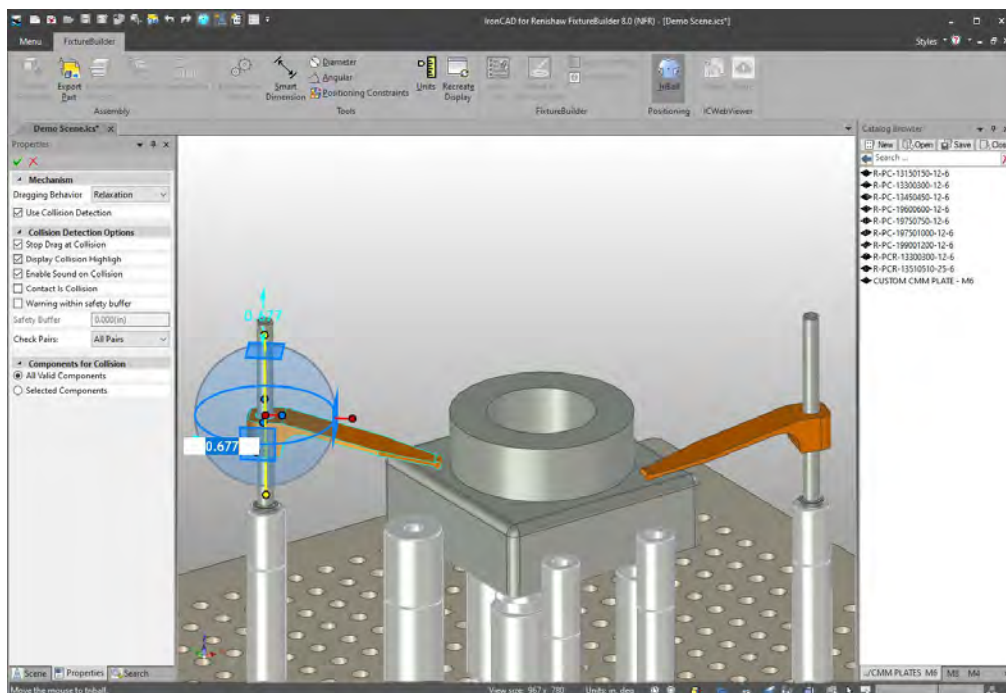
2. Click on the part you want to move. It is outlined in blue.



3. Click **Triball** (or press **F10**):



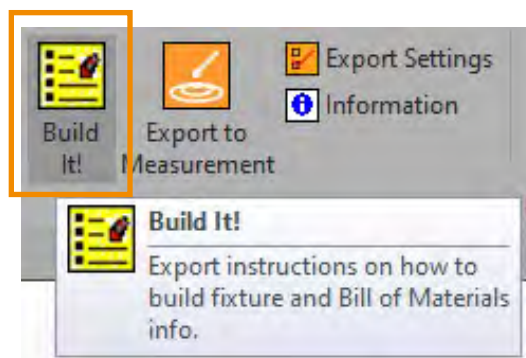
4. Move the workpiece using the Triball as explained in section 6, “Using the TriBall”.



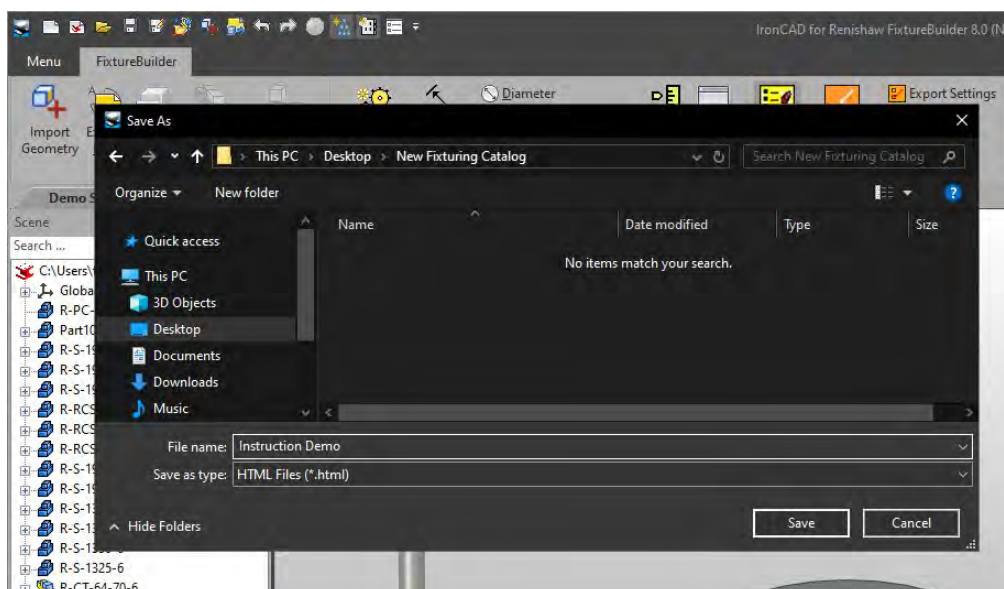
NOTE: Using the Triball with Mechanism mode lets you use the Collision Detection mode at the same time as using accurate movements from the Triball.

Creating the Build It document

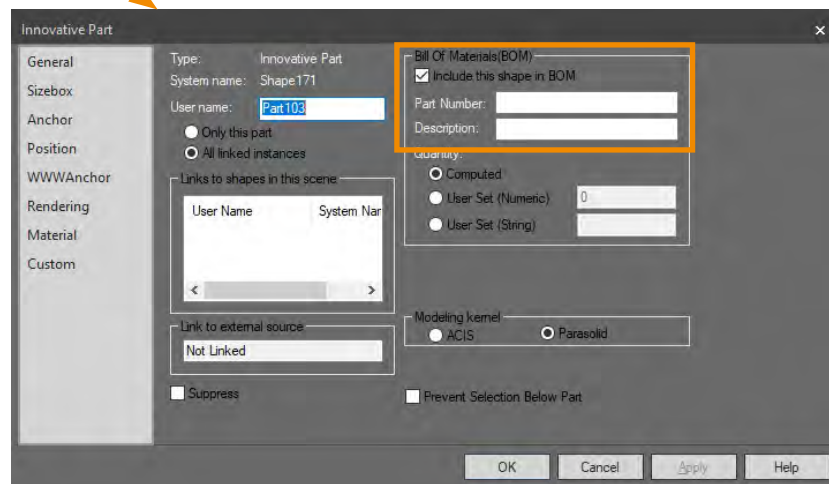
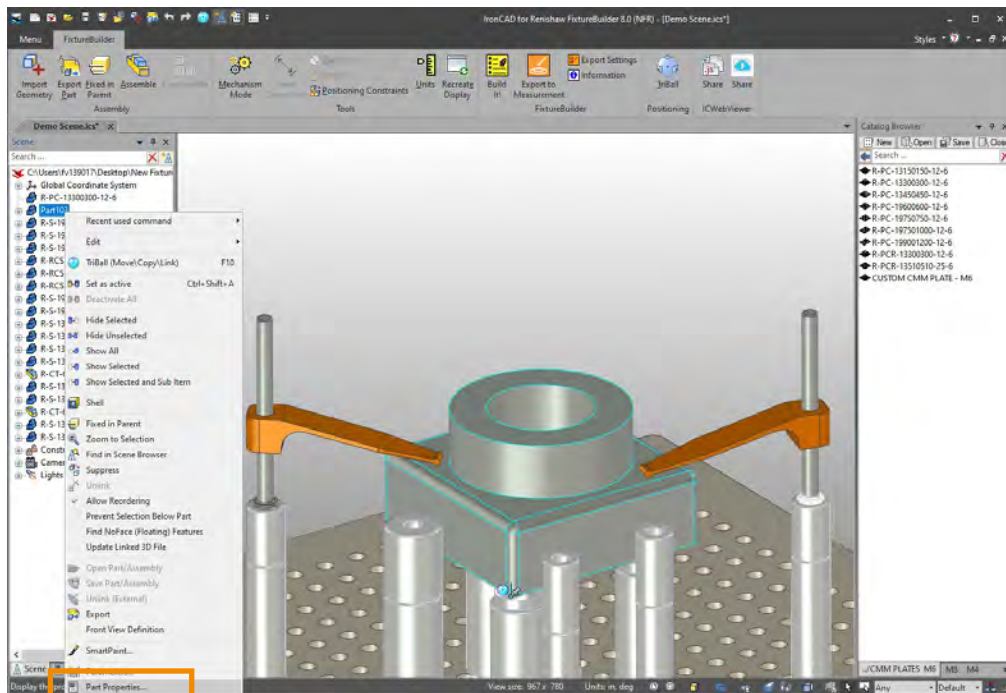
1. When the fixture is complete, click **Build It**.



2. Select a file location and name for the document and click **Save**. This opens an HTML document with build instructions, images of the fixture, and a bill of materials. The HTML document can be printed or saved as a PDF.



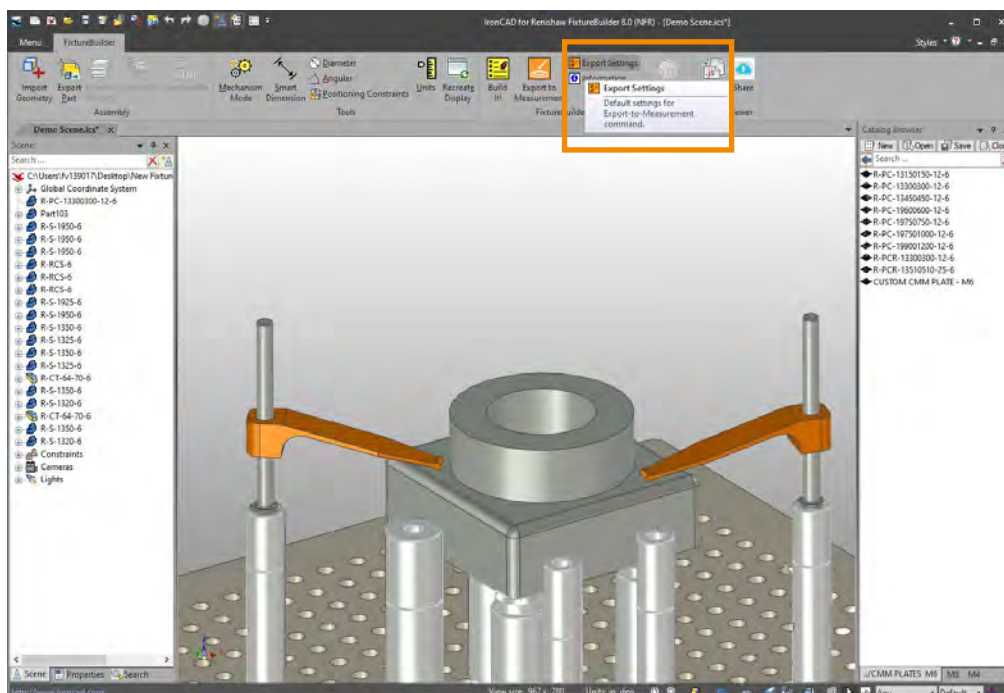
3. The bill of materials (BOM) in the Build It document also makes reference to your workpiece. To edit the name of this, select the workpiece, right-click and select **Part Properties**.
4. Rename your workpiece with a specific part number and description. Alternatively, untick the **Include this shape in BOM** check box to remove from the Build It document.



Exporting to measurement

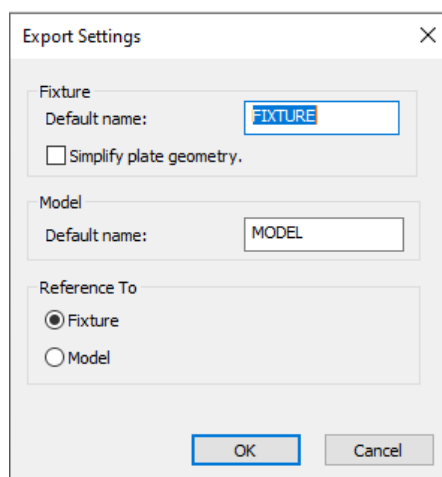
The fixture can be exported in a number of different formats for offline programming. The fixture and the model are exported in two separate files.

1. To configure your fixture and workpiece for export, click **Export Settings**.

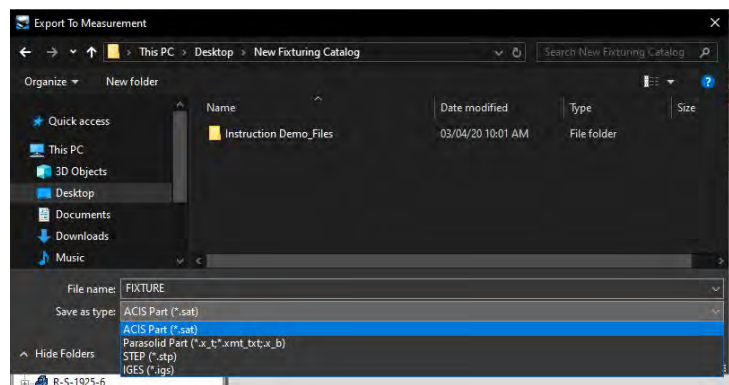
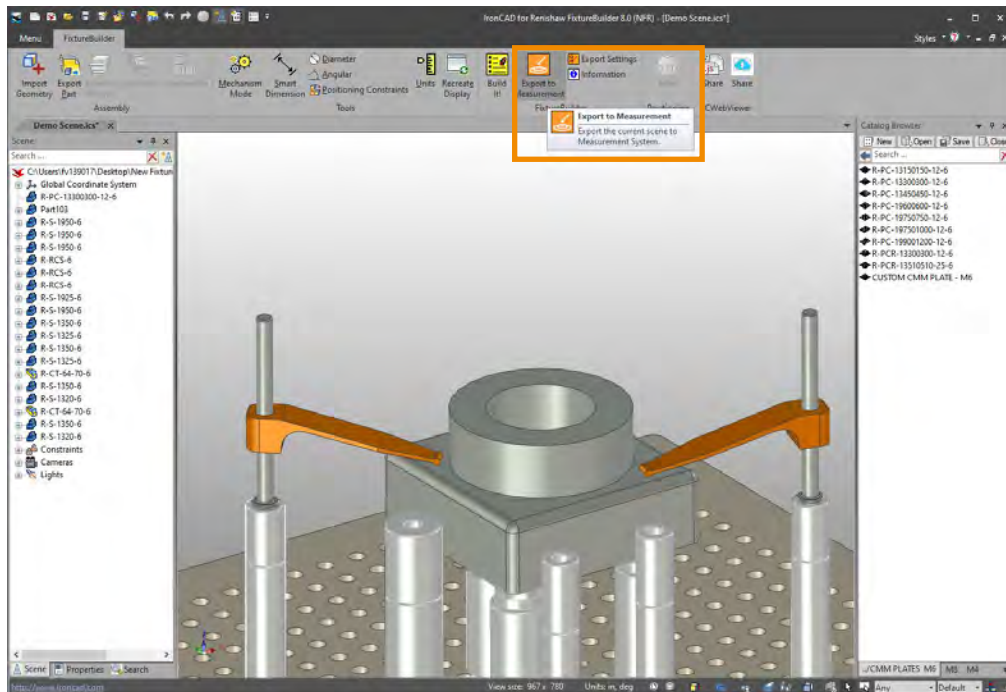


NOTE: The co-ordinate system of the fixture or the model will match the co-ordinate system of the Measurement Machine software.

TIP: Adjust or orient the fixture or model co-ordinate system in FixtureBuilder before exporting.



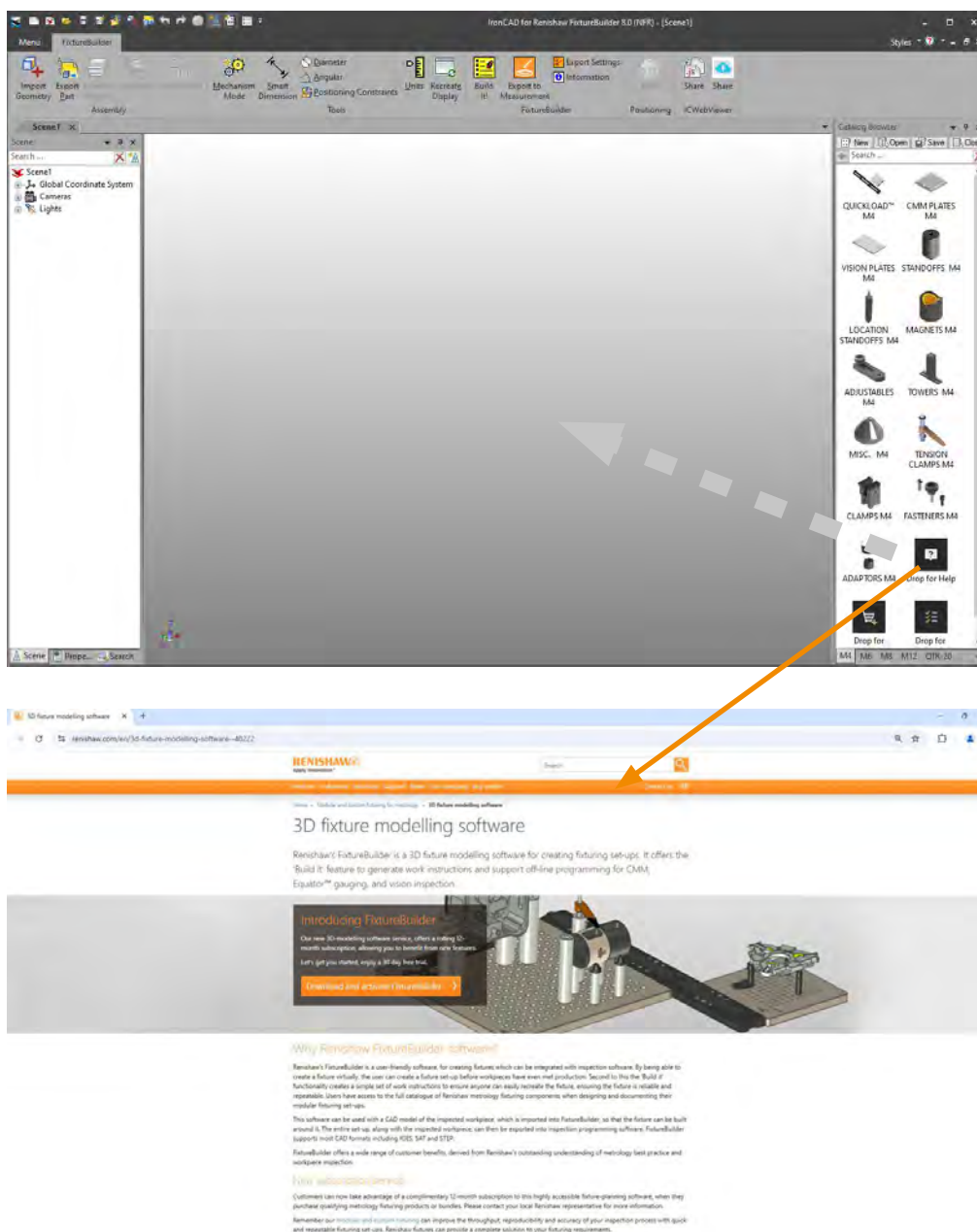
- To export the fixture and the workpiece, click **Export to Measurement**.



Drag and dropping web links within catalogues

You can drag and drop the web link logos into the scene to open the webpage for additional information.

Example 1



www.renishaw.com/contact



#renishaw



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