

# Inside the TriBall

Hailed by some as “the most useful tool in the history of CAD”, the TriBall is a powerful and flexible tool for performing 3D spatial transformations in IronCAD. Most of the examples here show how to position individual parts, however it is important to know that the TriBall is used in many other places in IronCAD. Therefore, mastery of the TriBall provides tremendous productivity boosts throughout IronCAD in areas such as:

- Assembly positioning
- Part positioning
- Feature positioning
- Direct Face Modeling
- Profile Plane Positioning
- Key Frame Animation Path Manipulation
- Loft and Sweep Path Manipulation
- Texture Mapping Placement
- Camera Positioning
- Point and Spot Light Positioning
- Anchor Positioning
- Attachment Point Positioning

Purpose of this document is to demonstrate, via examples, some of the more advanced capabilities of the TriBall. It assumes that the reader is somewhat familiar with the basic capabilities of the TriBall covered in Chapter 9 of the IronCAD User Guide. Two files: **triball1.ics** and **triball2.ics** are required for these examples. Topics covered here include

- Using the center handle of the TriBall
- Using the inner “orientation handles” of the TriBall
- Using the space bar to detach and reposition the TriBall
- Temporarily constraining 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 Center-Point” command
- “Parallel to Axis” command
- “Reverse” command
- Direct Face Modeling with the TriBall

## Anatomy of the TriBall

*The outer handles* - these are used mainly for simple linear translations along an axis, or for specifying an axis of rotation. They can also be used to apply a temporary axis constraint before using one of the other TriBall features.

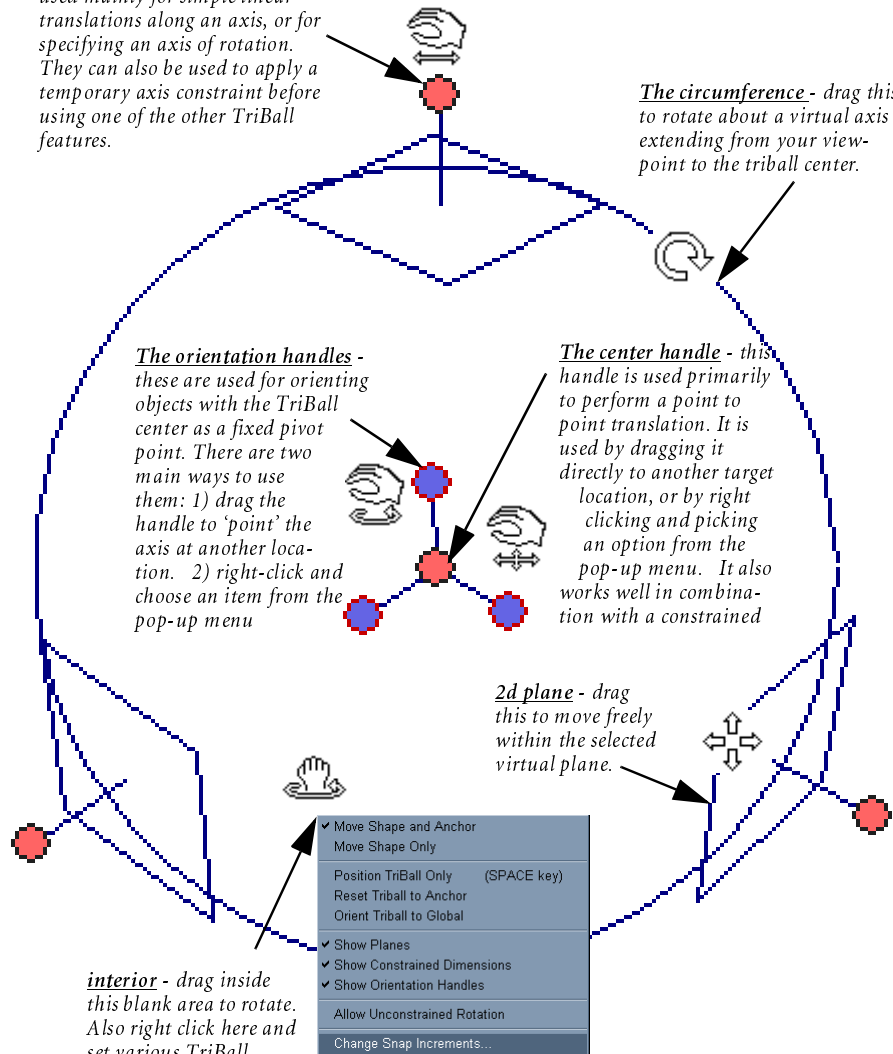
*The circumference* - drag this to rotate about a virtual axis extending from your view-point to the triball center.

*The orientation handles* - these are used for orienting objects with the TriBall center as a fixed pivot point. There are two main ways to use them: 1) drag the handle to 'point' the axis at another location. 2) right-click and choose an item from the pop-up menu

*The center handle* - this handle is used primarily to perform a point to point translation. It is used by dragging it directly to another target location, or by right clicking and picking an option from the pop-up menu. It also works well in combination with a constrained

*2d plane* - drag this to move freely within the selected virtual plane.

*interior* - drag inside this blank area to rotate. Also right click here and set various TriBall options, such as snap settings



### Keyboard commands for the TriBall

F10 - turn the TriBall on/off

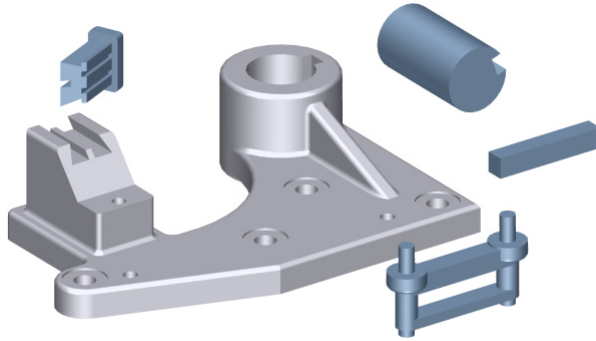
SPACE - detach/attach the TriBall on selected object

CTRL - activate incremental snapping for translation / rotation

### Toolbar button for the TriBall



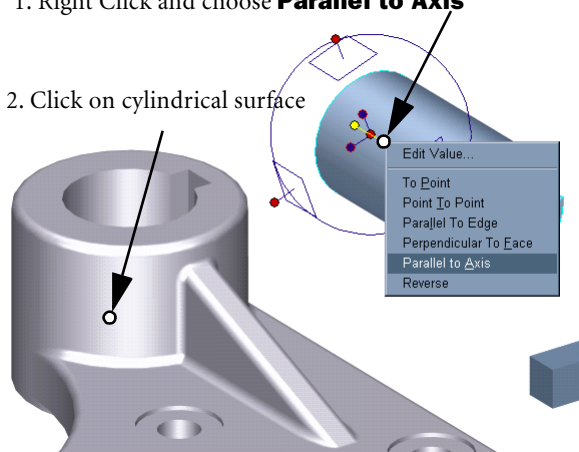
Open the file **triball1.ics**.



Select the shaft shown, then turn on the TriBall. Right-click on the orientation handle shown and choose **Parallel to Axis** from the resulting pop-up menu. Then click on the cylindrical surface as shown. This will cause the shaft's selected axis to be aligned with the axis of the hole. Note that in this case, the inner surface of the hole could have been chosen instead of the outer surface, and the result would be identical.

1. Right Click and choose **Parallel to Axis**

2. Click on cylindrical surface



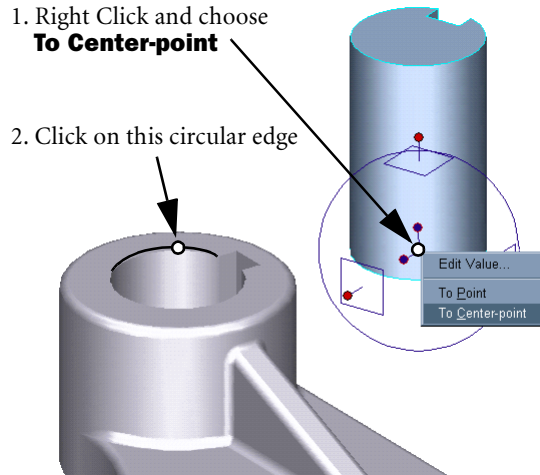
### Note

*When using the "Parallel to Axis" function, the target must be either a true cylindrical, elliptical, or conical surface.*

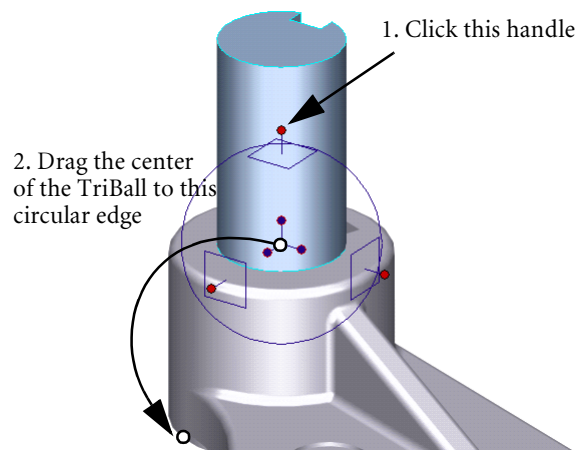
## Note

When using “To Center-point”, any of the following can be used for the target selection: circular edge, elliptical edge, cylindrical surface, elliptical surface, or spherical surface. In the case of a cylindrical or elliptical surface, the TriBall center will move to the nearest point on the target surface's axis.

To move the shaft over to the hole's center, right click the center of the TriBall and choose **To Center-point** from the resulting pop-up menu. Then click on the circular edge shown. This will move the Triball center (and the shaft) to the 'virtual' centerpoint of the target selection.

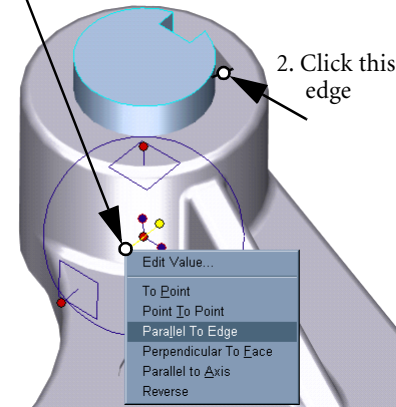


Now slide the shaft down to the base of the hole by first clicking on the top outer TriBall handle shown. This action will cause the vertical axis of the TriBall to become highlighted in yellow, which means the TriBall is now temporarily constrained to move/rotate only on that axis. Now drag the center of the TriBall to the lower circular edge shown. The shaft should 'slide' down the constrained vertical axis and snap perfectly into alignment with the bottom of the hole.



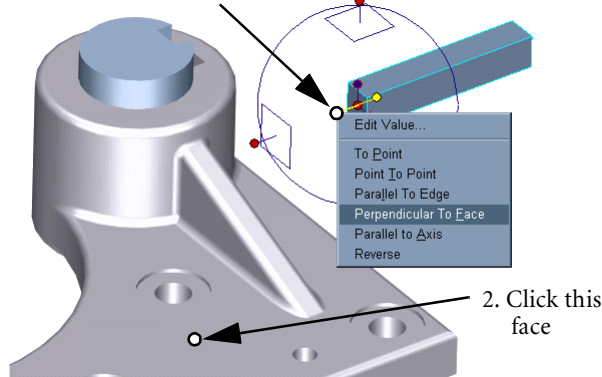
Next, align the keyways by right-clicking on the orientation handle shown and choosing **Parallel to Edge** from the resulting pop-up menu. Then click the edge shown on the hole's keyway. This will cause the selected axis of the TriBall to become aligned with the target edge by rotating about the TriBall center point.

1. Right click and choose **Parallel to Edge**



Select the key and turn on the TriBall. Align the key with the keyway by right-clicking on the orientation handle shown and choosing **Perpendicular to Face** from the resulting pop-up menu. Then click the top surface of base as shown. This will cause the selected axis of the TriBall to become perpendicular the target face.

1. Right Click and choose **Perpendicular to Face**



### Note

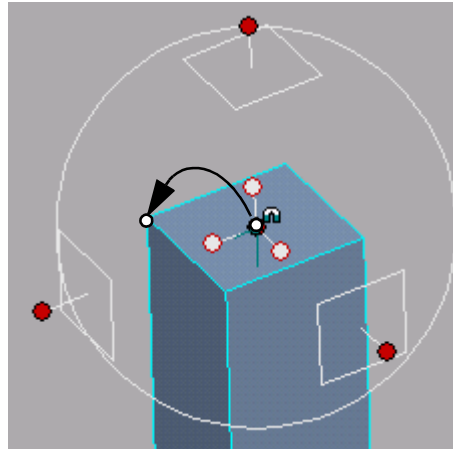
*The TriBall must be turned off before another object can be selected.*

Relocate the TriBall on the part by pressing the SPACE BAR. The TriBall color will now become white, indicating that it is 'detached' from the part, and can be moved independently of the part. Now drag the center of the TriBall to the corner of the key as shown (zoom in if necessary). Then press the SPACE BAR again to re-attach the TriBall to the part (color should turn blue again).

**Note**

*Relocating the TriBall with the space bar is an extremely important technique, and a key part of using the full power of the TriBall. Note that when using this feature, objects will 'remember' the position (but not the orientation) of the TriBall if/when it is activated again later.*

1. Press the SPACE BAR (TriBall color turns white)
2. Drag the center of the TriBall to the corner of the key



3. Press the SPACE BAR (TriBall color turns blue)

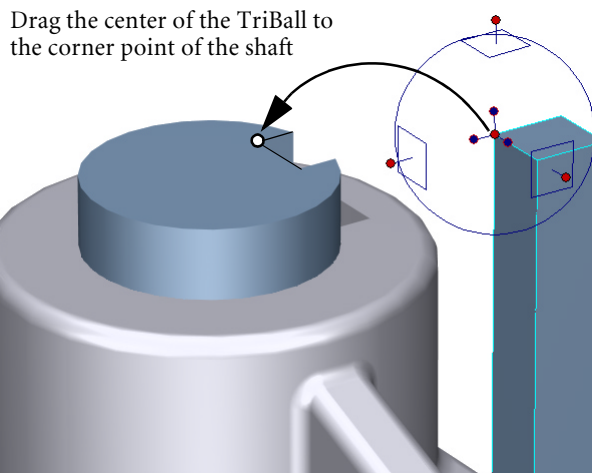
Position the key into the keyway by dragging the center of the TriBall to the corner point of the shaft as shown. Alternatively, right-click the center of the TriBall and choose **To Point** from the resulting pop-up menu, then select the corner point of the shaft. Either approach will have the same result.

**Note**

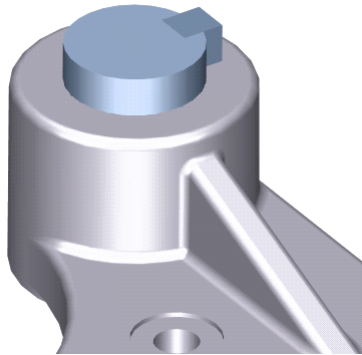
*An alternative to using the space bar is to right click inside the TriBall (not on a handle) and choose "Position TriBall Only" from the pop-up menu.*

**Note**

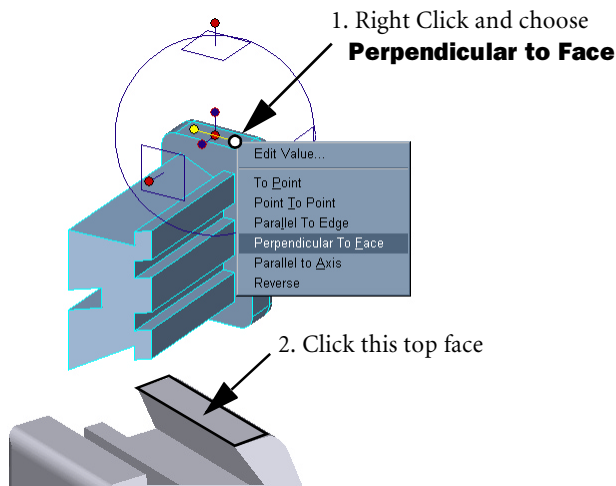
*When dragging the center of the TriBall, it will not move until the cursor is over another valid target object.*



The shaft and key should now appear as shown below.



Select the part shown and turn on the TriBall. Now right-click on the orientation handle shown and choose **Perpendicular to Face** from the resulting pop-up menu. Then click the face shown.

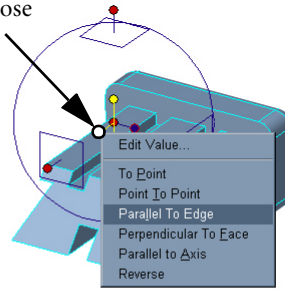


## Note

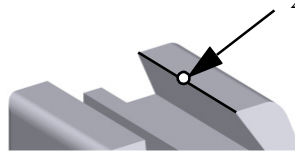
*Because only 3 orientation and 3 outer handles are shown at a time, sometimes the desired handle is not visible. Each of these handles has a counterpart on the opposite side of its axis. To show other handles, rotate the view and note how they turn on/off automatically to match the current view.*

Next right-click on the orientation handle shown and choose **Parallel to Edge** from the resulting pop-up menu. Then click the edge shown.

1. Right Click and choose **Parallel to Edge**

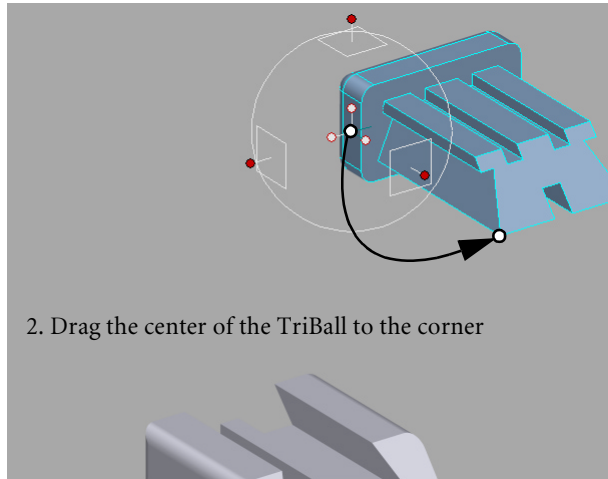


2. Click this edge



Relocate the TriBall on the part by pressing the SPACE BAR. The TriBall color will now become white, indicating that it is 'detached' from the part, and can be moved independently of the part. Now drag the center of the TriBall to the corner shown. Then press the SPACE BAR again to re-attach the TriBall to the part (color should turn blue again).

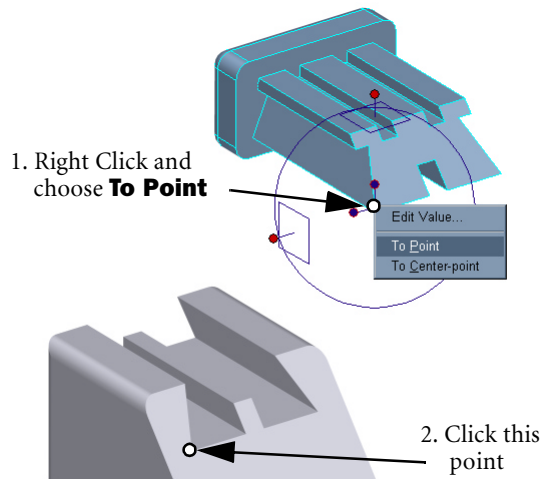
1. Press the SPACE BAR (TriBall color turns white)



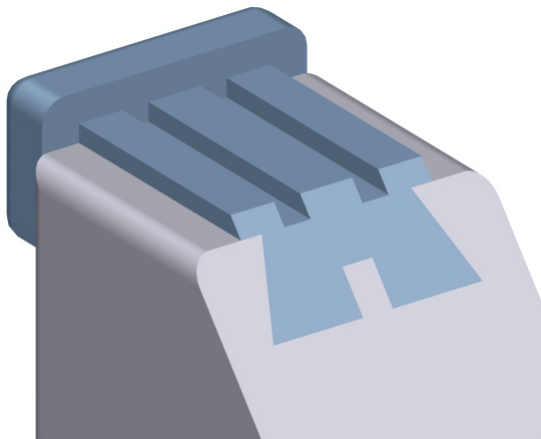
3. Press the SPACE BAR (TriBall color turns back to blue)



Position the key into the keyway by dragging the center of the TriBall to the corner point of the shaft as shown. Alternatively, right-click the center of the TriBall and choose **To Point** from the resulting pop-up menu, then select the corner point of the shaft. Either approach will have the same result.



The part should now appear as shown



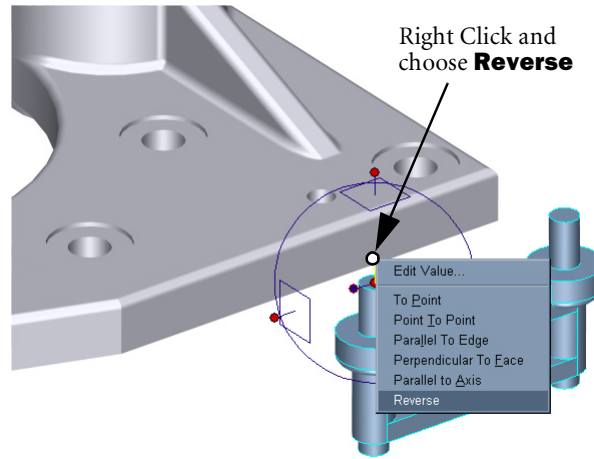
## Note

*Dragging the orientation or center handles automatically activates SmartSnap, which gives green highlighting feedback when snapping to edges, vertices, faces, and centers of circular and elliptical faces, polygons, and mid-points of edges. Using the right mouse options on the orientation or center handles (e.g. 'to point') will also automatically enable SmartSnap for the target selection.*

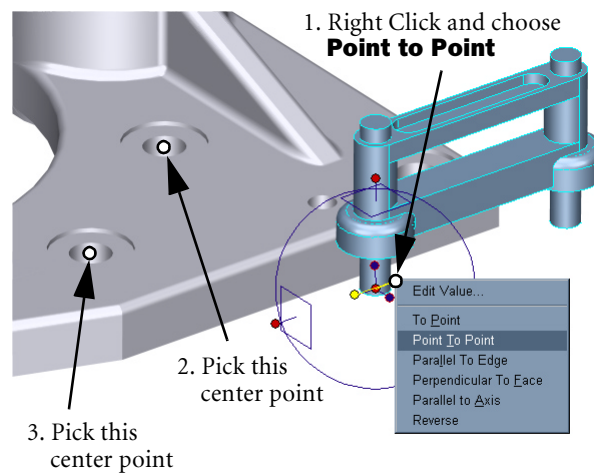
## Note

By default, the TriBall appears on the object's anchor, unless it has been repositioned manually. The TriBall can easily be reset to the anchor by right clicking in TriBall interior (not on a handle) and choosing 'reset to anchor' from the resulting pop-up menu

Select the part shown and turn on the TriBall. First, right-click on the top orientation handle shown and choose **Reverse** from the resulting pop-up menu. This will 'flip' the part 180 degrees in the direction of the selected axis

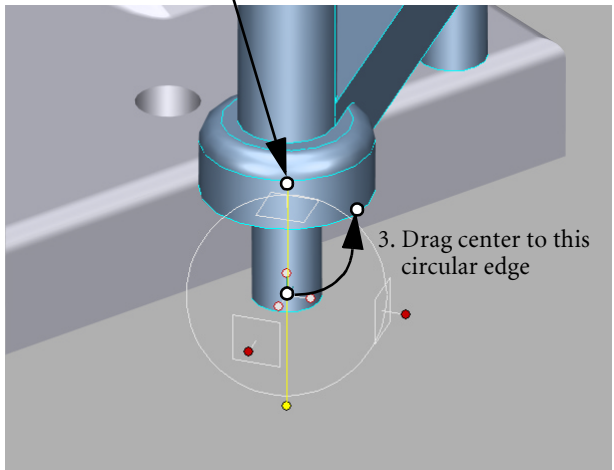


To align the pegs with the holes, first right-click on the orientation handle shown and choose **Point to Point** from the resulting pop-up menu. Then, in the order indicated, click the two center points of the holes shown. This will cause the selected axis of the TriBall to become parallel to a virtual line between the two target points.



Relocate the TriBall on the part by pressing the SPACE BAR. The TriBall color will now become white, indicating that it is 'detached' from the part, and can be moved independently of the part. Next click on the top outer TriBall handle shown. This action will cause the vertical axis of the TriBall to become highlighted in yellow, which means the TriBall is now temporarily constrained to move/rotate only on that axis. Now drag the center of the TriBall to the lower circular edge shown. The TriBall should 'slide' up the constrained vertical axis and snap perfectly into alignment with the base of the peg. Now press the SPACE BAR again to re-attach the TriBall to the part (color should turn blue again).

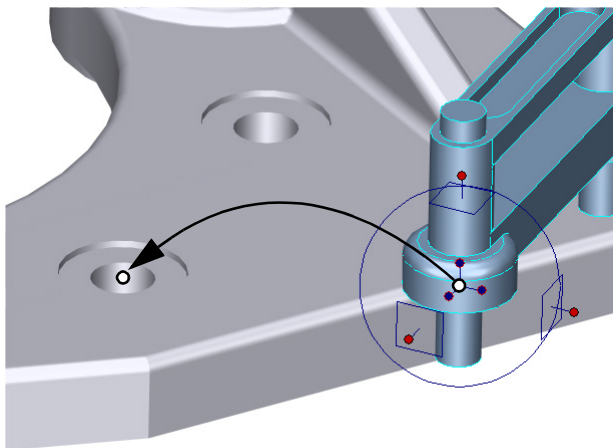
1. Press the SPACE BAR (TriBall color turns white)
2. Click this handle



3. Drag center to this circular edge

4. Press the SPACE BAR (TriBall color turns back to blue)

To place the pegs in the holes, simply drag the center of the TriBall to the center of the hole. Again, an alternate method is to right-click the center of the TriBall and choose **To Point** from the resulting pop-up menu, then click the center of the hole.

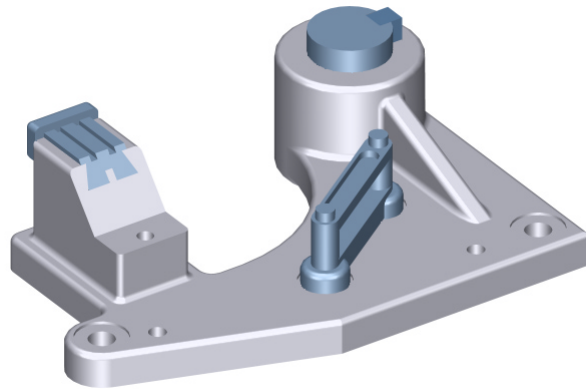


Drag center of Triball to center of hole

**Note**

*To 'de-select' an axis constraint, just click anywhere outside the TriBall.*

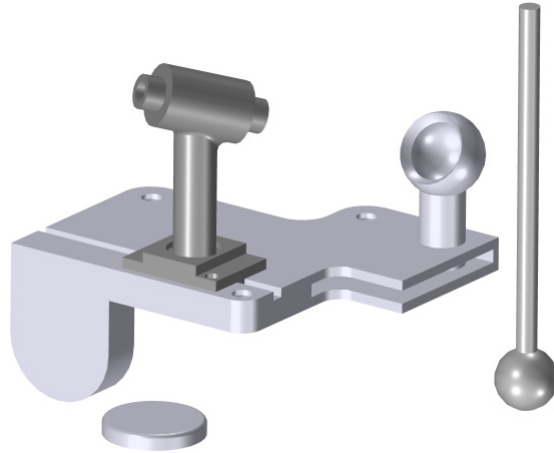
The parts should now appear as shown.



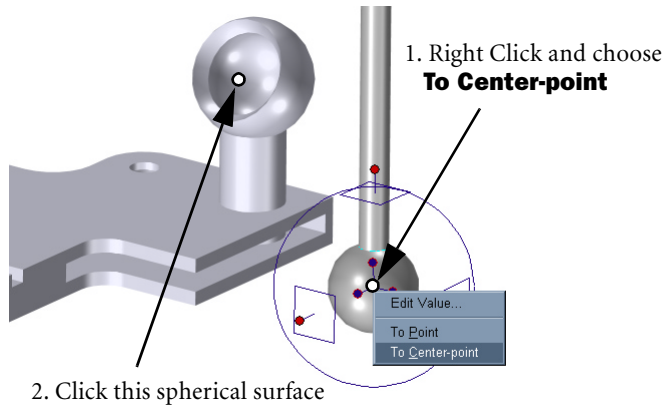
## Note

*Although not demonstrated here, the TriBall can be used to position the Anchor of an object independently. To do this, just select the anchor and turn on the TriBall. This can be especially useful for 'slide along surfaces' behavior, which is controlled by the anchor.*

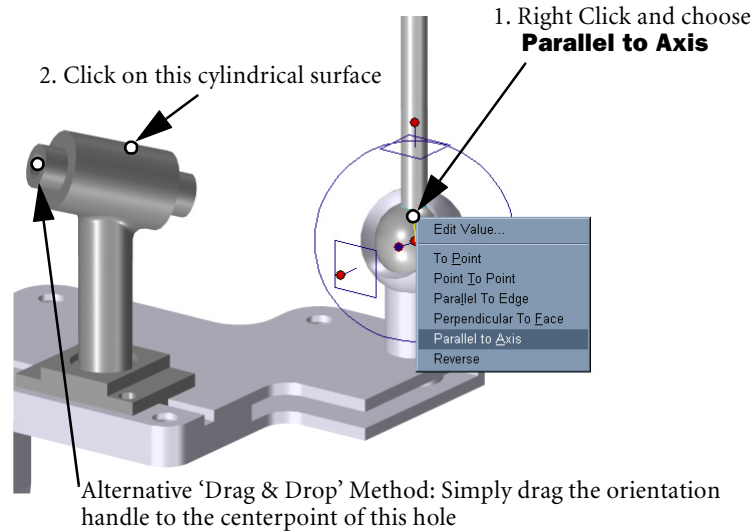
Open the file **triball2.ics** (shown below)



Select the shaft and turn on the TriBall. Move the shaft to the center of the socket by first right-clicking on the center of the TriBall and selecting **To Center-point** from the resulting pop-up menu. Then click the inner spherical surface as shown. In this case, the outer spherical surface could be chosen as the target as well, which would give the same result because the inner and outer spherical surfaces are concentric.



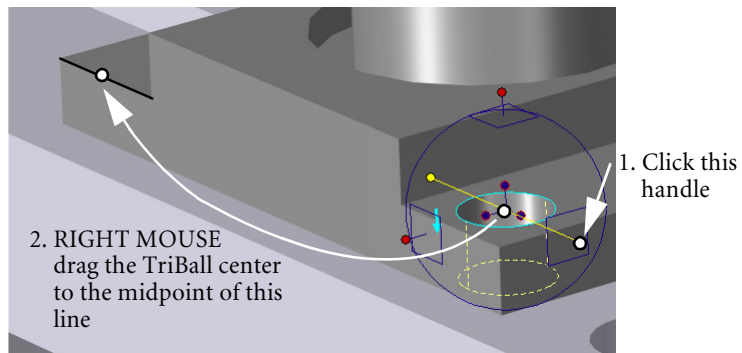
To align the shaft, right-click on the top orientation handle shown and choose **Parallel to Axis** from the resulting pop-up menu. Then click on the cylindrical surface shown. This will cause the shaft's selected axis to be aligned with the axis of the hole. Note there are several other co-axial cylindrical surfaces that could be used for the target selection which would give the same result.



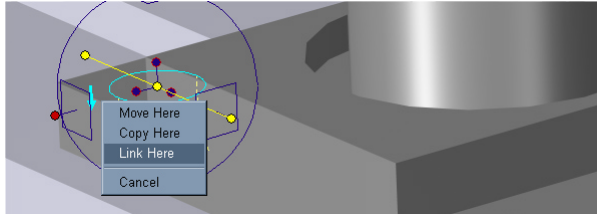
Now use the TriBall to make a linked copy of an IntelliShape. First select the IntelliShape hole shown and turn on the TriBall. Then click the outer TriBall handle as shown. As in the previous examples, this action will cause that axis of the TriBall to become highlighted in yellow, which means that it is now temporarily constrained to move/rotate only on that axis. Now, holding the RIGHT mouse button, drag the center of the TriBall to the midpoint of the edge shown. The TriBall should 'slide' along the constrained axis and snap into alignment with midpoint of the target edge and a pop-up menu will appear. Choose **Link Here**. Then click **OK** in the resulting dialog box.

## Note

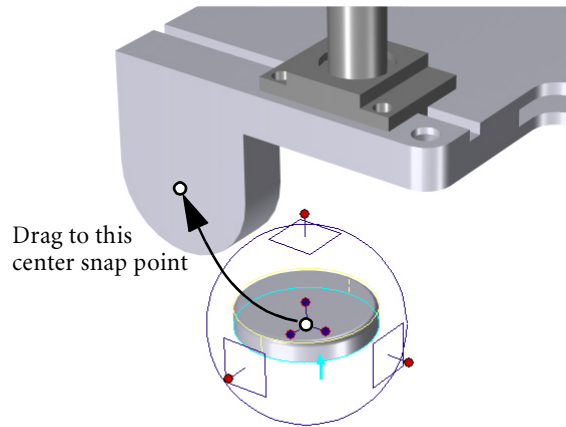
*Using the right mouse button to drag is a general concept used widely in IronCAD to make copies or links.*



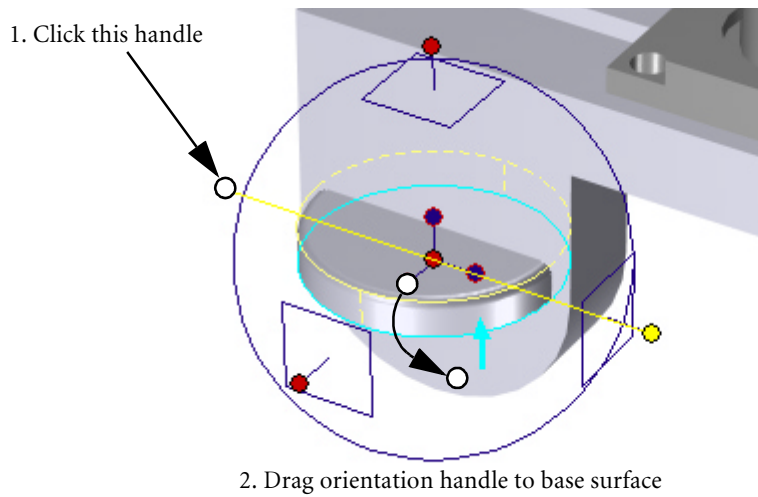
Choose **Link Here** then click **OK**



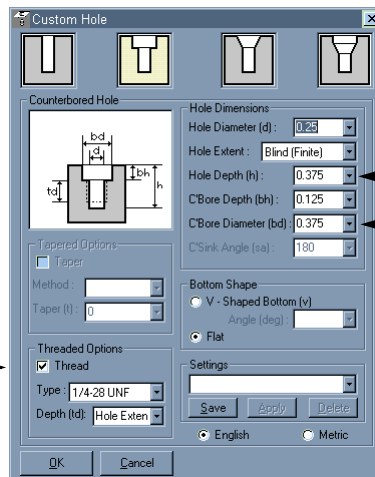
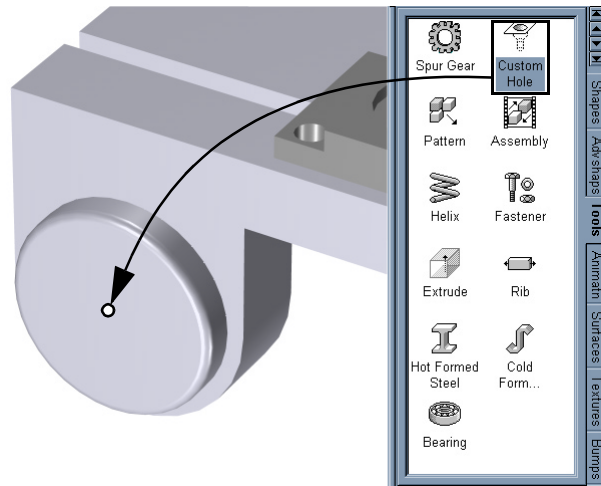
Select the disk shown and turn on the TriBall. Drag the center of the TriBall to the centerpoint on the base as shown.



Click the outer TriBall handle as shown to constrain the axis. Now drag the indicated orientation handle to the base surface shown. This is an example of using the drag and drop capabilities of the orientation handles (as opposed to the 'right-click / select' methods).



Add a threaded counterbored hole by dropping the **Custom Hole** from the **Tools** catalog and dropping it onto the center of the disk, as shown. In the resulting **Custom Hole** dialog box, change the values as shown, then click OK.

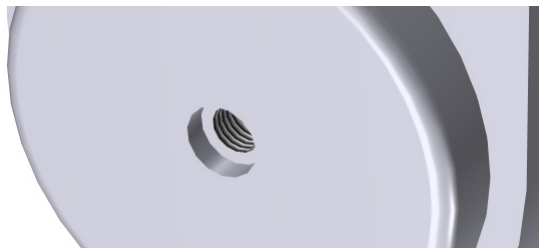


Threads On →

Hole Depth (h): 0.375

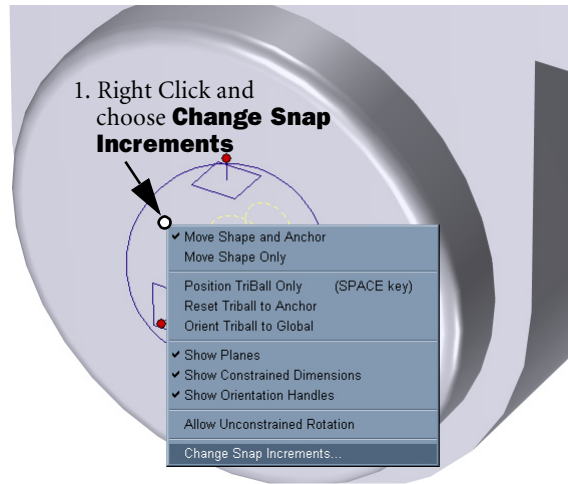
C'bore Diameter (bd): 0.375

The hole should appear as shown.





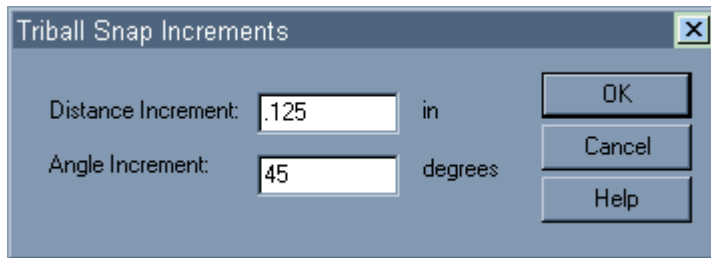
Select the Custom Hole and turn on the TriBall. Then right-click inside the TriBall in a blank area (i.e. not on a handle) and choose **Change Snap Increments...** from the resulting pop-up menu.



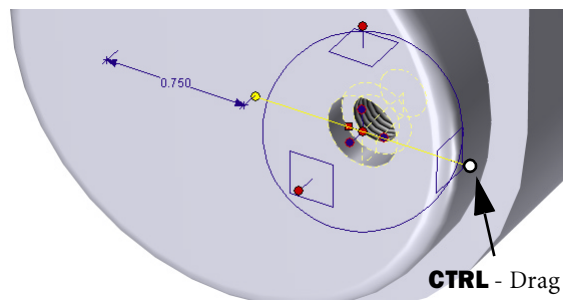
### Note

Right mouse clicking inside the TriBall (not on a handle) activates a pop-up menu with a variety of settings. For instance, the Orient to Global setting is useful for re-setting the orientation of a “skewed” object with respect to the global scene coordinates

Enter **Distance** value of **0.125** in the TriBall Snap Increments dialog then click OK.



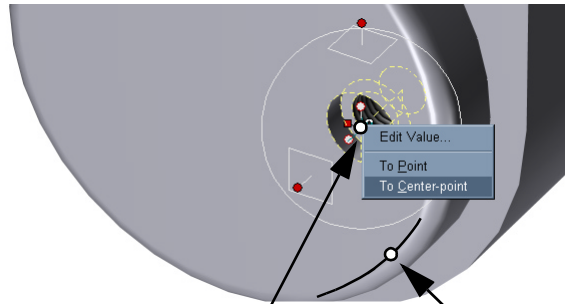
Hold down the **CTRL** key to activate the TriBall increment snapping, and drag the outside TriBall handle to the right a distance of **0.75**, as shown.



### Note

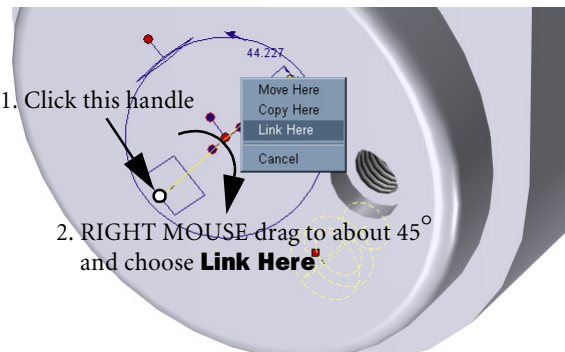
The dimension value which appears during a translation or rotation can be edited precisely by right-clicking the value and choosing “Edit Value” from the resulting pop-up menu.

To make a radial array of hole around the center of the disk, the TriBall must first be relocated to the center of the disk. To do this, first press the SPACE BAR (the TriBall color will now become white, indicating that it can be moved independently). Now right-click the center of the TriBall and choose **To Center-point**, then click the circular edge shown. The TriBall will move to the center of the disk. Press the SPACE BAR again to re-attach the TriBall to the part (color should turn blue again).



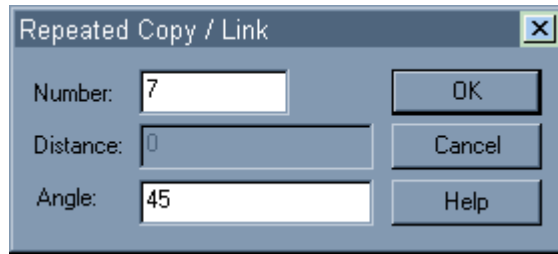
1. Press the SPACE BAR
2. Right Click and choose **To Center-point**
3. Click this circular edge
4. Press the SPACE BAR

Now make a radial array of holes about the center. To accomplish this, click the outer TriBall handle shown to specify the axis of rotation. Next, RIGHT mouse drag inside the blank area of the TriBall (not on a handle). Release the right mouse button and choose **Link Here** from the resulting pop-up menu.



1. Click this handle
2. RIGHT MOUSE drag to about 45° and choose **Link Here**

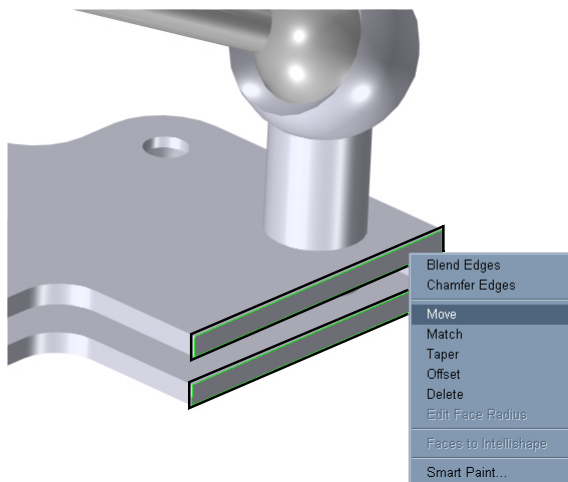
Enter the following values in the **Copy / Link** dialog then click OK.



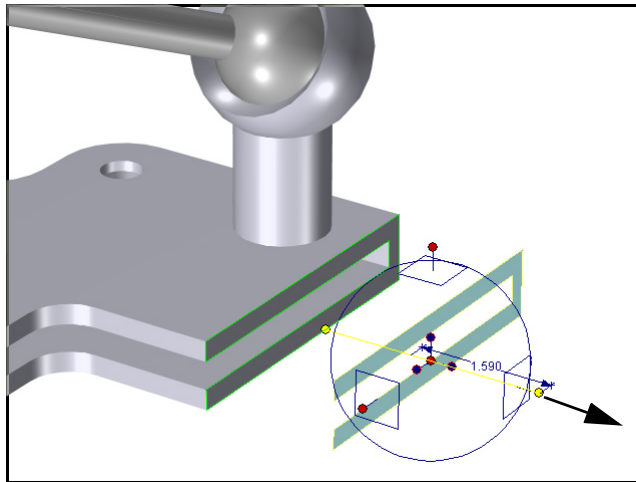
The part should appear as shown (to show the threads on the copied holes, just open and close the Add-On Properties by right-clicking on each IntelliShape.)



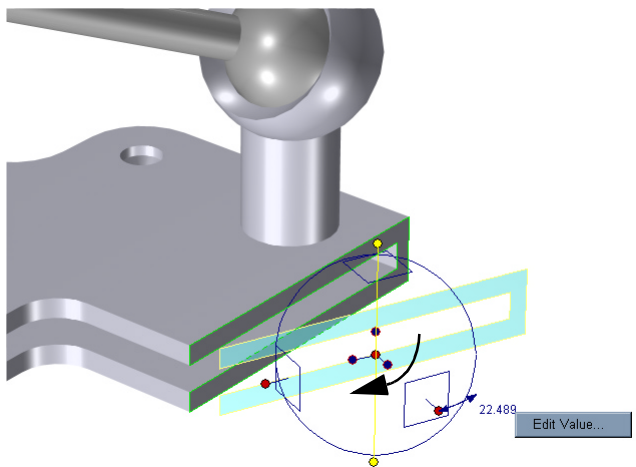
Select the face shown (highlight should be green) then right click and choose **Move** from the resulting pop-up menu.



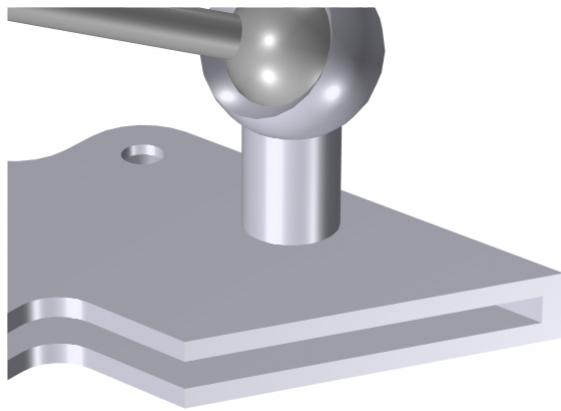
Turn on the TriBall and drag the right-most outer TriBall handle to the right a distance of approximately 1.5 as shown. Then right click on the distance value and choose **Edit Value** from the pop-up menu. Enter a value of 1 and choose OK.



Next click the top outer handle of the TriBall as shown. As in the previous examples, this action will cause that axis of the TriBall to become highlighted in yellow, which means that it is now temporarily constrained to move/rotate only on that axis. Now click and drag inside the TriBall (not on a handle) to rotate the face approximately as shown. Then right click on the angle value and choose **Edit Value** from the pop-up menu. Enter a value of 30 and choose OK.



Now click the **Apply and Exit Command** button. The part should now appear as shown.



These examples have demonstrated only a small fraction of the potential uses for the TriBall. The TriBall can be used almost everywhere within IronCAD, wherever spatial transformations are needed. Experiment for yourself and discover the many other ways the TriBall can boost your productivity.

