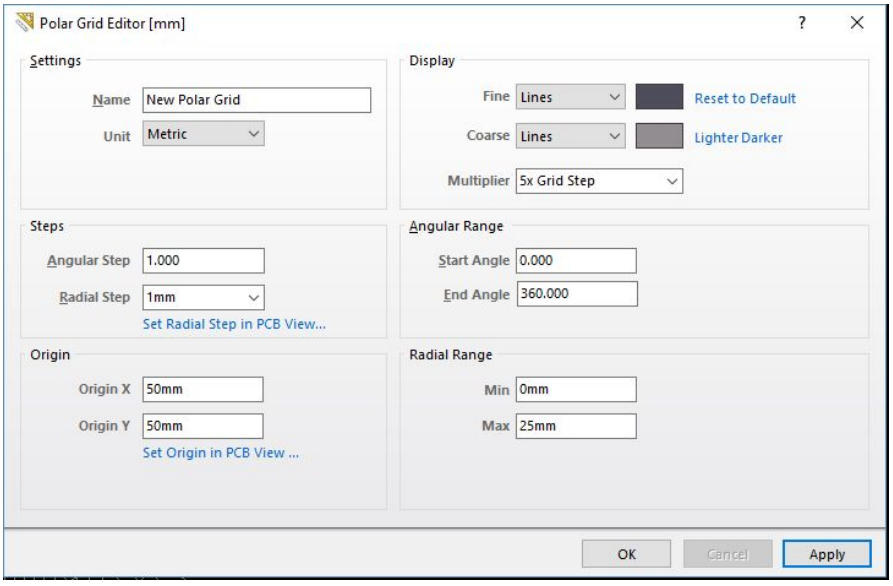
Altium Encoder Demo

Note: In this tutorial I have used metric units. Altium defaults to Imperial units, you can change to metric once you have started a new PCB by selecting **DESIGN>BOARD OPTIONS** and then changing the measurement unit box from Imperial to Metric

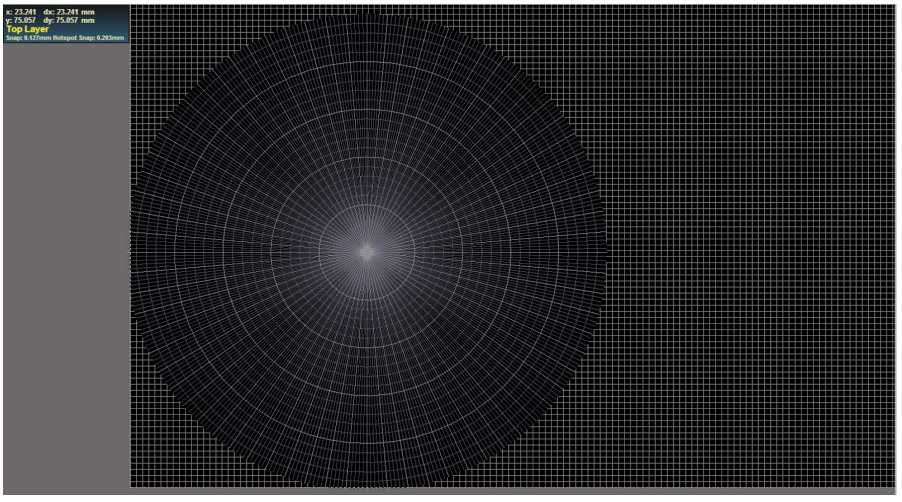
Step 1 - Create a Polar Grid

1-Since the encoder is a circle we must first implement a polar grid. Select **TOOLS>GRID MANAGER** then right click and select **ADD POLAR GRID.**

2-Double click on the New Polar Grid and modify the polar grid with following values



You should then see the following in your workspace

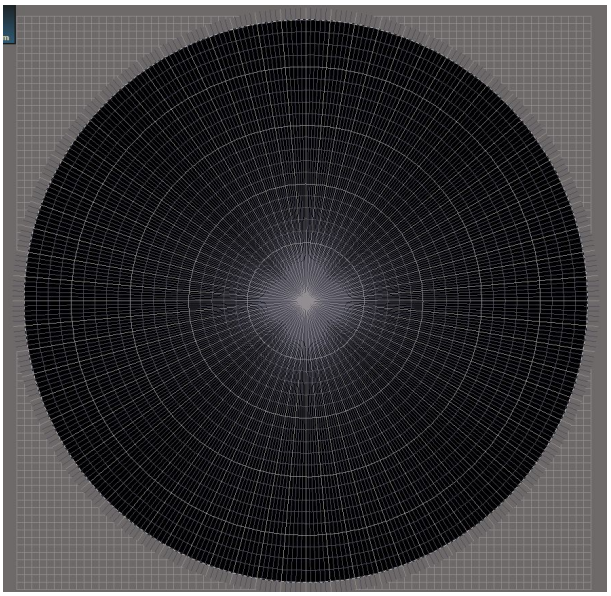


Step 2 - Define your Board

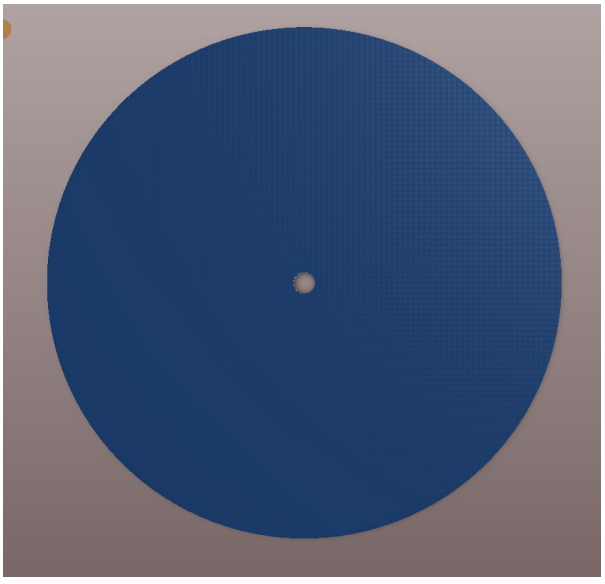
Now we will define the shape of the encoder PCB

1-Select **PLACE>FULL CIRCLE** and place a circle with diameter 48mm (radius 24mm) centered around the center of the polar grid we established in Step 1

2-With circle highlighted select **DESIGN>BOARD SHAPE>DEFINE FROM SELECTED OBJECTS.** Then delete the circle. You should see the following



3-Place another small circle in the center of the board for a pilot hole. With the circle highlighted select **TOOLS>CONVERT>CREATE BOARD CUTOUT FROM SELECTED PRIMITIVES** then delete the circle. If you select **VIEW>3D LAYOUT MODE** you should see the following



Step 3 - Create Copper Rings

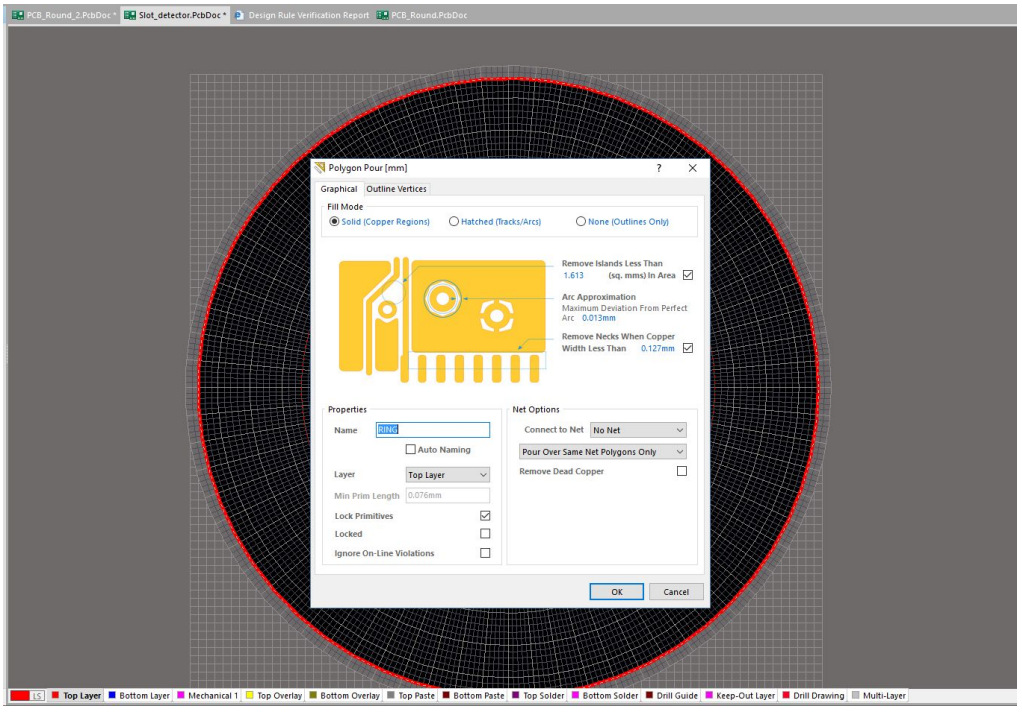
Change back to **2D LAYOUT MODE** and ensure you have top layer of board selected from the bottom toolbar.

1-Place a circle centered at the center of the board with a diameter of 46mm (radius 23mm). With the circle highlighted select **TOOLS>CONVERT>CREATE POLYGON FROM SELECTED PRIMITIVES.** Then delete the circle.

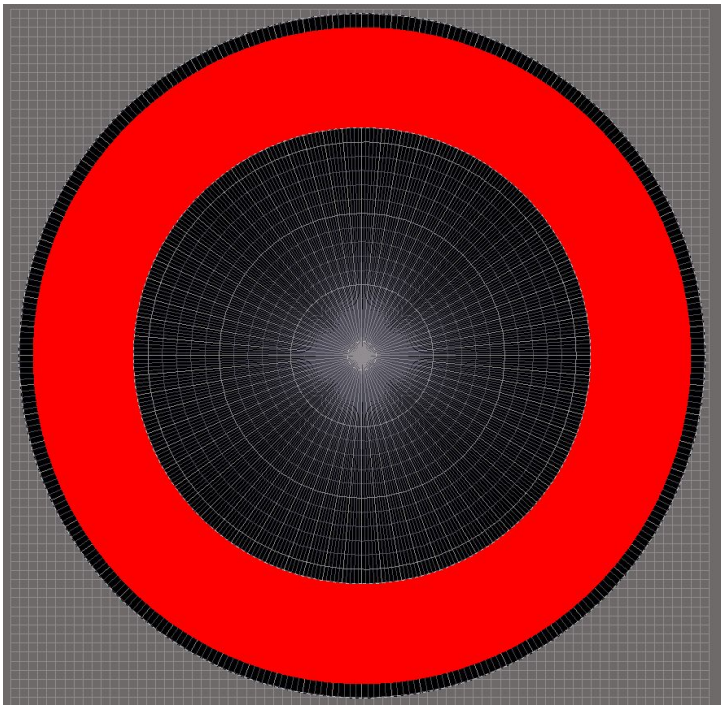
2-Place a second circle with diameter 32mm (radius 16mm) **TOOLS>CONVERT>CREATE CUTOUT FROM SELECTED PRIMITIVES**. Then delete the second circle.

3-Double click on the cutout region that you just created and from the region menu change the layer from ‘Top’ to ‘Multi-Layer’.

4-Double click on the polygon to bring up the polygon menu and select **Solid** from the Fill Mode Options at the top of the menu.



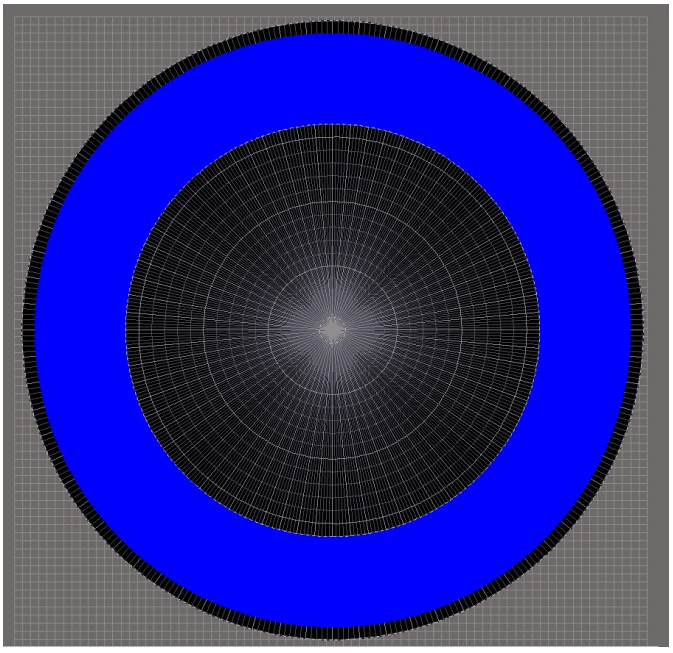
5-Close the menu, ensure polygon is selected, and right click on the polygon then select **POLYGON ACTIONS>REPOUR SELECTED** should see the following



6-Now we need to copy the copper ring from the top layer to the bottom layer. Highlight the polygon and press **CTRL+C** to copy. Select a reference point then press **CTRL+V** and select that same reference point in order to place the copy. We now have two polygons in the top layer.

7-In order to move the copied polygon to the bottom layer double click over the polygons and then select one of them from the menu. When the polygon menu comes up change the ‘Layer’ option from ‘Top Layer’ to ‘Bottom Layer’.

8-Finally right click over the polygon and select **POLYGON ACTIONS>REPOUR ALL**. From the layer toolbar select ‘Bottom Layer’ and you should see the following

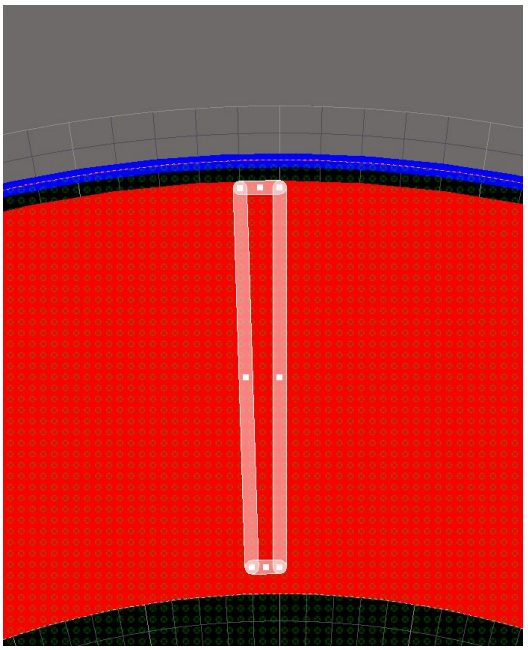


We have now placed a copper ring in both the top and bottom layers of the encoder PCB

Step 4 - Add encoder Slots to Copper Rings

Now we will add slots to the copper rings. Given our radius is 24mm if we do 1.8° for the slits we end up with ~ 0.75mm at the radius of the encoder and ~ 0.52mm near the inner radius of the copper rings laid out. Additionally this value brings us to a round number 100 slots around the outside of the encoder.

1-In order to create the slots first change the angular step to 1.8° in the grid manager, then use **PLACE>LINE** to draw 4 lines in the shape of a slot at the outer edge of the encoder as per the following. (to draw lines following any angle cycle through the possible drawing corner styles by pressing <Shift + space bar>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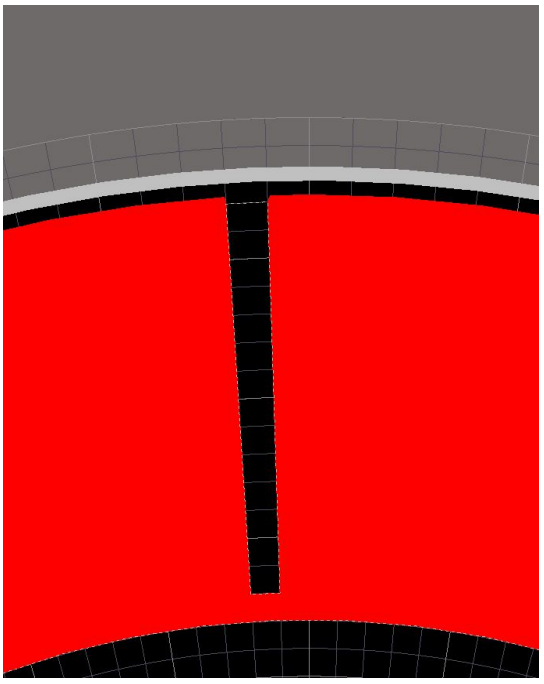
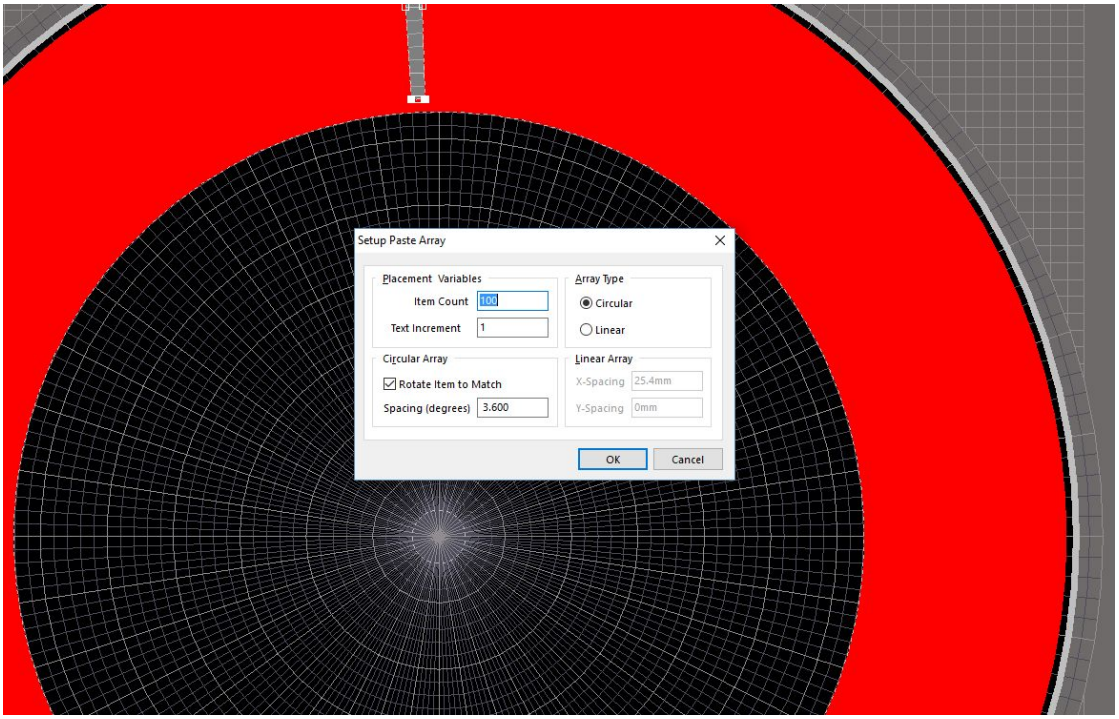
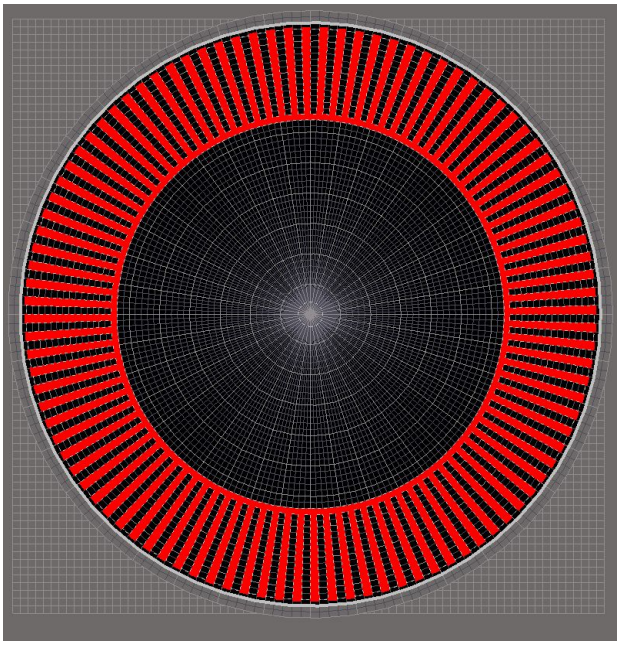
2-Select all four lines and create a multilayer cutout as per Step 3-2 and 3-3. Then delete the four lines but keep the cutout. If you now repour the copper polygon on both the top and bottom layers should see



3- Next select the cutout and press **CTRL+C** to copy. Select one corner to act as the reference point. Now select **EDIT>PASTE SPECIAL>PASTE ARRAY** to bring up the paste array menu fill in as pictured and hit ok.



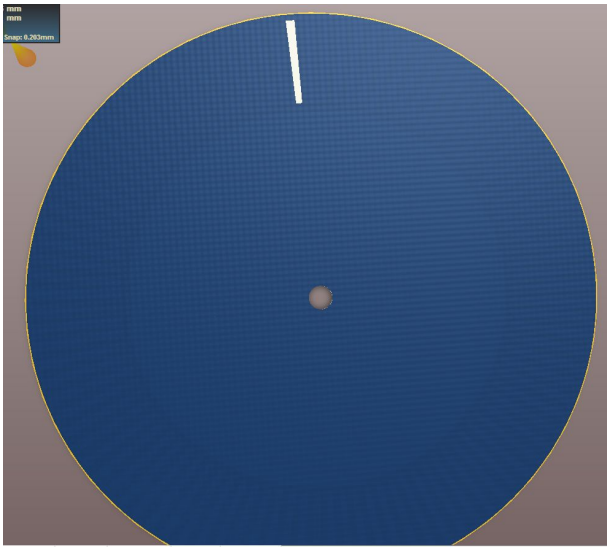
4- Click on center of the board then on the same corner of the cutout you used as the reference point in step 4-3. The cutout should be copied around the ring. If you repour the polygons you should see the following



Step 5 - Add encoder Slots to Solder Mask Layers

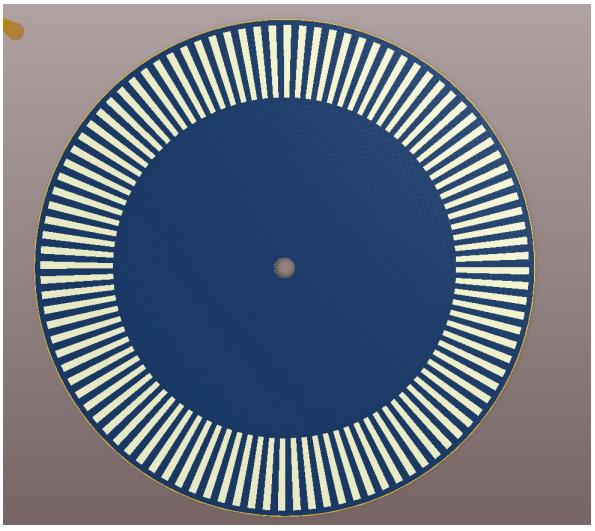
The slots added step 4 exist in the top and bottom copper layers, but not the solder mask layers. We need to add the slots there as well.

1-Double click on the original slot you created, there should be an additional copy created there by step 4-4. In the menu for this additional cutout change the kind from ‘cutout’ to ‘copper’ and the layer from ‘multi-layer’ to ‘top solder’. If you change the view to **3D LAYOUT MODE** you should see the following.



2- On bottom toolbar select top solder layer and repeat step 4-3 and 4-4 to copy the slit around the board in the top solder layer.

3- Now on the bottom toolbar selecto bottom solder layer and repeat the procedure to create the solder layer slots in the bottom solder layer. If you switch to **3D LAYOUT MODE** you should see the following on both sides of the board.



There you have it, that is the process to create your own encoder. You can modify the above steps to change the diameter of your encoder or the size of the slots in your encoder.