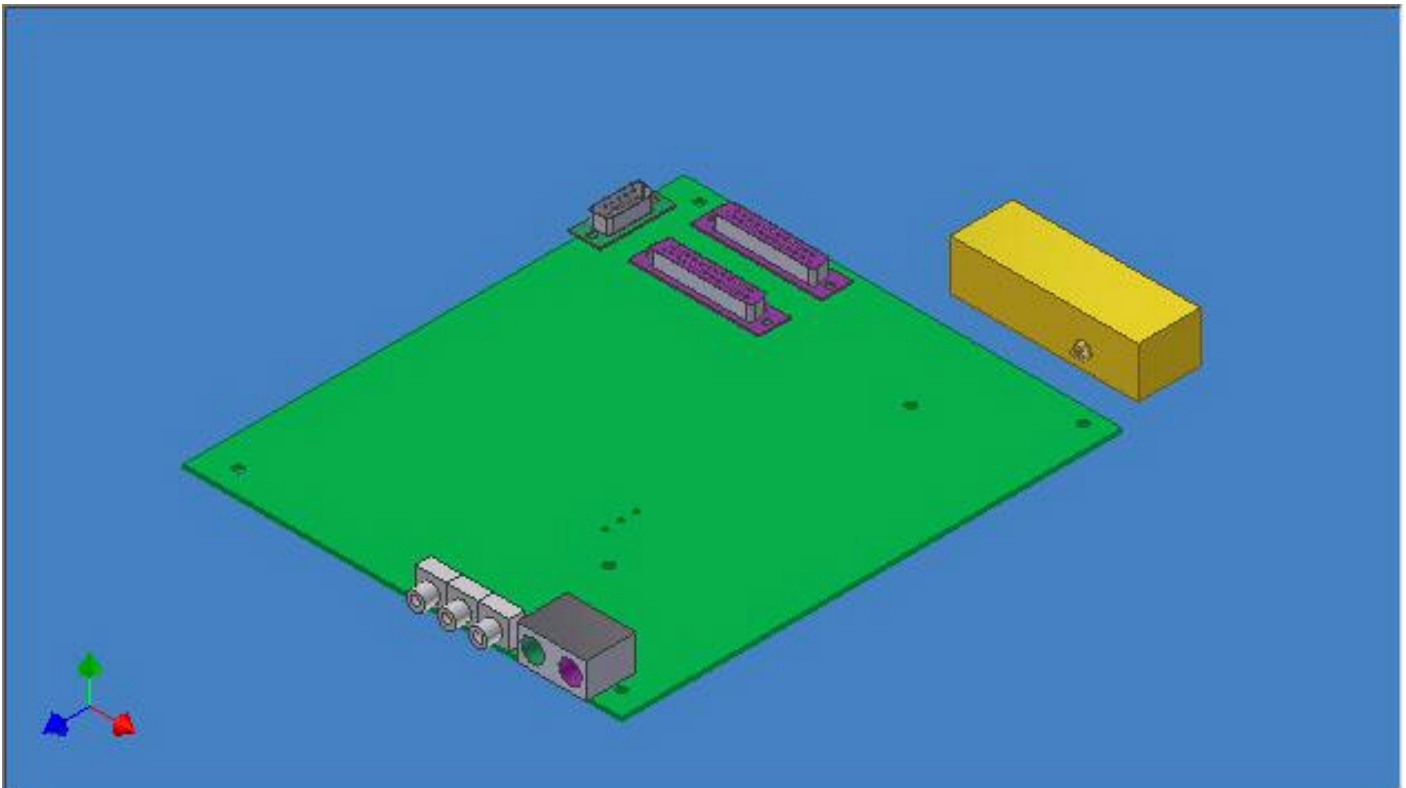


Purchased Parts Master Sketch Approach

The Purchased Parts File

The first thing to do is to make a Purchased Parts Assembly. In this assembly insert all of the major components that will define the size, shape and location of the top assembly that you are trying to build. In my example I am placing a PC Board and a small power-supply.

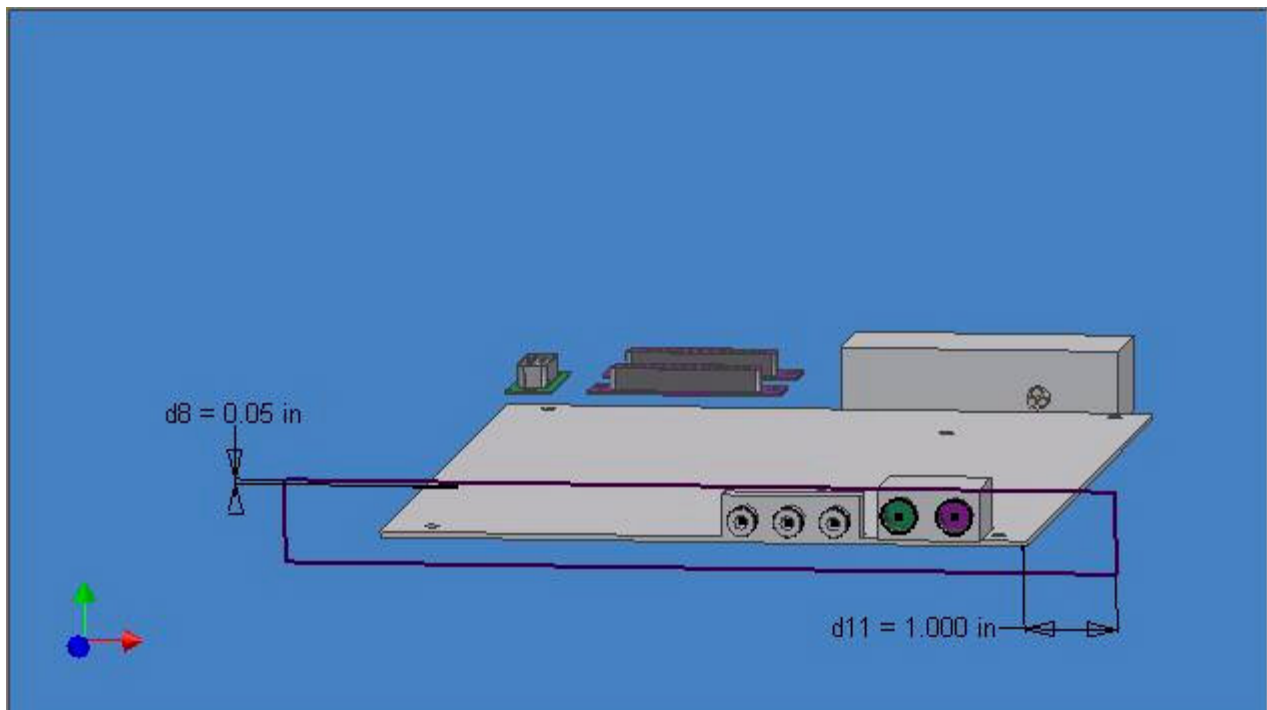


These parts are placed with standard 3d constraints to the Origin planes, and between themselves. If you open the Purchased Parts.iam file you will be able to see how I have placed them. I have done this example with only parts but if it were a real project I probably would have made the PC Board an assembly on its own, and it could have sub assemblies nested as deep as you need.

In this approach the part locations drive most of the shape of the enclosure.

The Master Sketch File

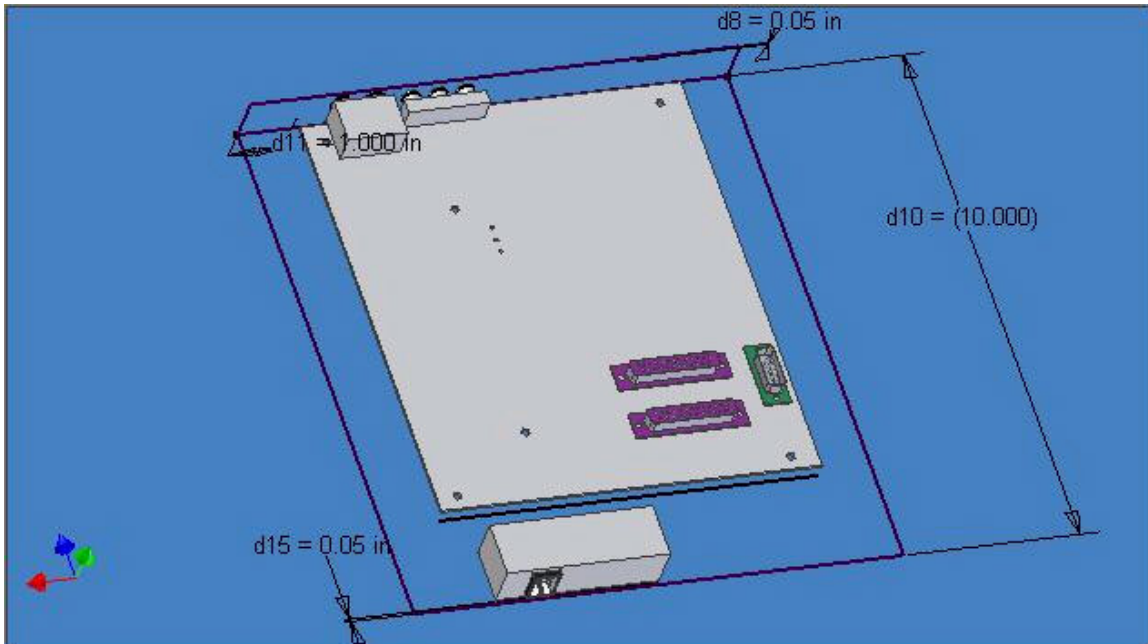
Next I start a new ipt file called *Master.ipt*. The first thing to do is to derive in the *Purchased Parts.iam* file. Here we can use the origin planes, the faces of the purchased parts and of course user planes to make sketches on. I tend to base the first sketch on the origin planes, but you could certainly base them off a face on the derived file if you like.



Lets start with the First Sketch called "Front Face" Here you can see I projected the origin and started a rectangle coincident to the projection. Next I simply dimmed the width to be 1" to the right of the PC Board and .05 (our sheetmetal material thickness) above the face of the DB connectors. I then projected the 5 circular connectors.

The Master Sketch File Continued

I then made a new sketch on the XZ plane and Project the bottom corner points of the Front sketch. On this sketch we make the corners coincident to the projected Front sketch points and .05 (material thickness) back from the Power Supply. I also added a Reference Dimension to the side of the sketch to keep track of my overall depth and use in locating some sketches yet to come.



Next we project all 6 mounting holes from the PC Board onto the sketch.

From here you go on making sketches as needed by projecting points and lines. A couple of things to notice are how the tabs in Left Side Bottom sketch reference the Depth of the box (d10) to locate them.

Also I made the top and the bottom half of the left side as different sketches. They could be done on the same sketch, but sometimes it is nice to be able to turn off other sketches to remove some of the clutter when editing so I tend to make different sketches if it is a different part.

A workplane was made by selecting the top line of the front sketch and the top line of the Left Side Top sketch. This workplane was used to sketch the top panel. Again we just projected points and the holes from the dB connectors. I also projected the corners of the DB connectors.

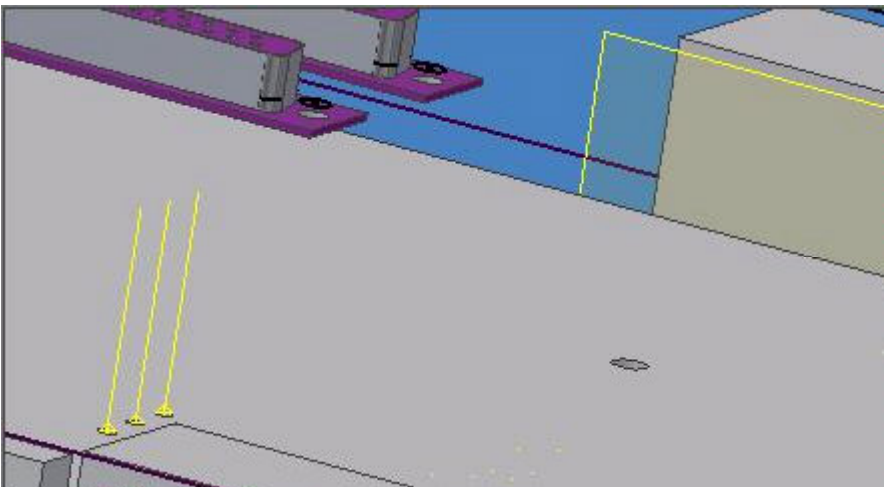
The Back sketch only has the AC plug inlet projected.

The Master Sketch Wires

This is an area that I am trying to learn myself, so my methods may not be the best. Many of my Axes could have been created inside the Point command. I decided to go ahead and add this anyhow just to round out the Master sketch approach and give you an idea of what all can be done.

I started by using the axis command on the 3 holes in the PC Board making Axis one through Axis 3, Then with the Work Point command I select the Axis and then the PC Board Face on each Axis. I follow the same procedure on the face inside the Power Supply where the 3 holes are.

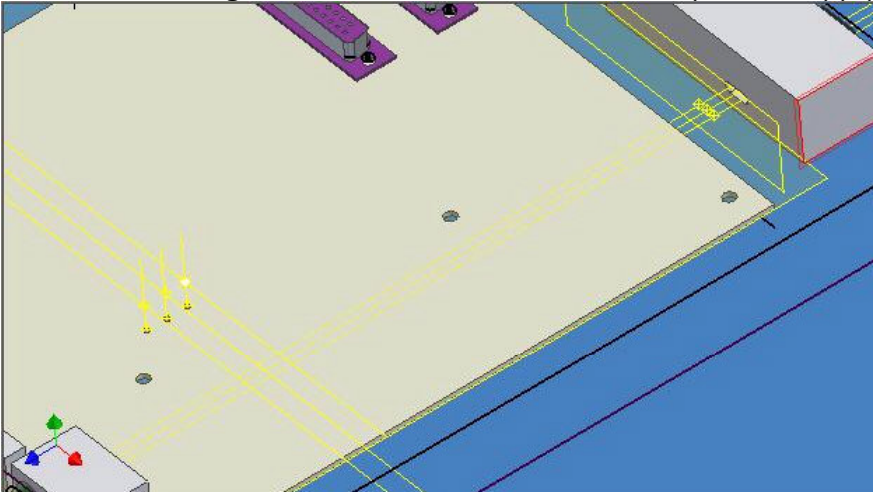
Next make a workplane offset from the Power Supply approximately half the distance between the Power Supply and the PC Board. Using this Plane and Axes in the Powersupply add three more Work Points. We now have 6 Axis and 9 points.



Next I made a offset Work Plane off the top face of the PC Board. Now create 3 more Work Points using this Plane, and the three Axes in the PC Board.

The Master Sketch Wires Continued

Next is 3 more Work Axis created by selecting the Work Points you just made (Work Points 10 through 12) and the end face on the power supply so they end up like this.



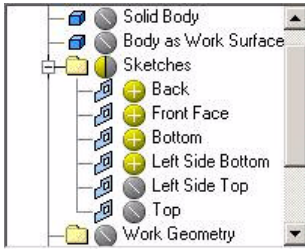
Now Start the Work Point Command and right click select Axis. First Pick the Work Point just outside of the Power Supply, (Work Points 7 through 9) then the top face of the Power supply. You should see an Axis coming up from the Work Point. Now click on the Face that is offset from the PC Board. Again do this for all three locations.

Final set. Start the Work Point command again, and right click select Axis. Pick one of the three last created points, then the face on the Power Supply that is closest to the PC Board. When you see the Axis, select Axis 13 through 15 for each of the three points.

Start a new sketch on the face inside the Power Supply where the three holes are. Project the three holes. Save the Master File.

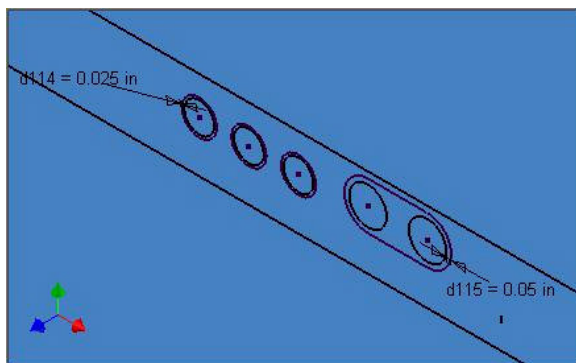
The Bottom Part

Make sure all sketches are visible in the Master.ipt Start a new Sheetmetal file. Exit the sketch and switch to the Feature Panel Bar. Select the Derived toolbutton, and derive in the Master.ipt file. Turn off the Solid Body, and turn off Left Side Top, and Top Sketches. Unless there is some specific need for it, I usually turn off all Work Geometry when making the parts. Select OK to the Derive dialog.



It is a good idea at this point to sync the names of the sketches between the Master file and this file. It makes it easier when you come back to edit this 6 months later. I have heard rumors that this is going to get easier in a future release.

Ok, so now we have a bunch of sketches, but before we start making a part, let's make some tweaks. Edit the Front Face sketch. Draw 5 circles basing the center points on the existing circles. On the smaller 3 holes give them a clearance of .025, and on the larger two holes we want a slot, so first give them a clearance of .05 and draw the necessary lines and trim to make a slot.



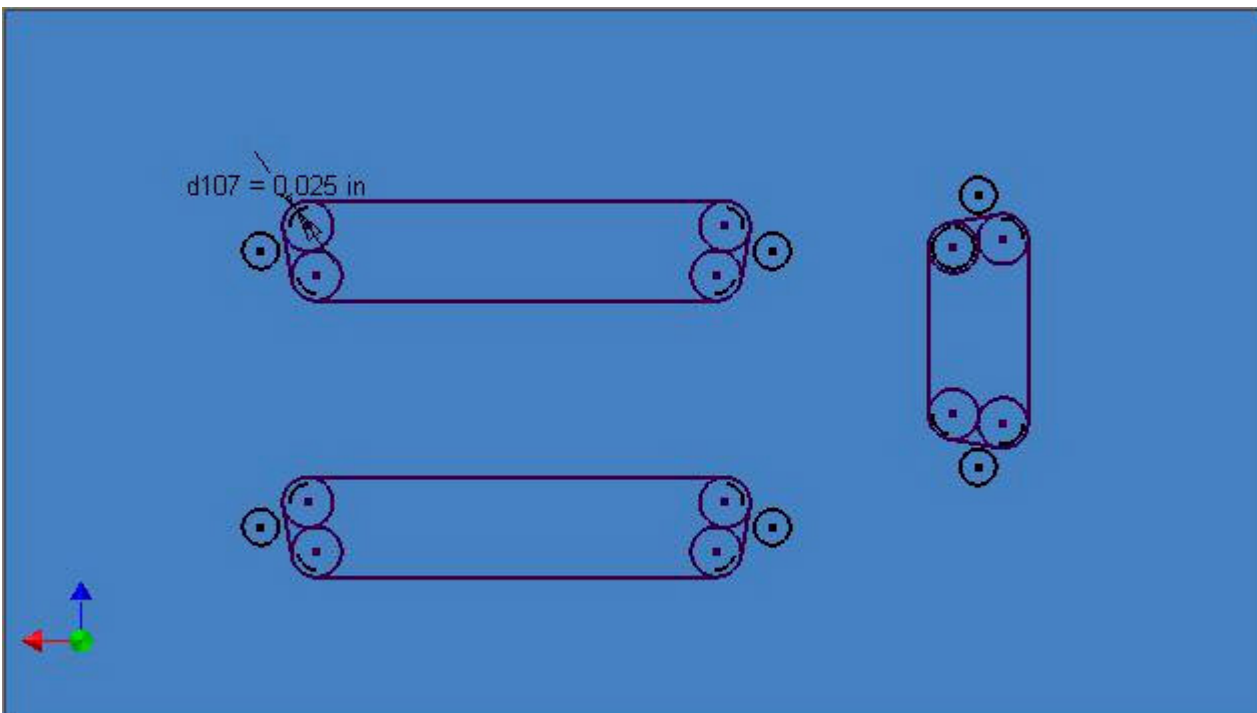
Now just start making the faces. Be particularly careful of extrusion directions.

To make the Right Side and the Back I simply made a sketch on the appropriate edge of the sheetmetal and projected the shape from the Left side and the Front Face. Extrude those, then add the cut for the AC Inlet. We can add any other features we may want here, such as the chamfers. Save this file as Bottom.

The Master Sketch File Top Part

Follow the same basic procedure to make the Top as you did to make the Bottom. Derive in the Master.ipt, and exclude the unnecessary Sketches and Work Geometry and turn off solids. Remember to rename the sketches.

Here is how I did the DB connectors. Another method would have been to project all the edges from the connector in the Master file and then just offset those projects the proper amount. .



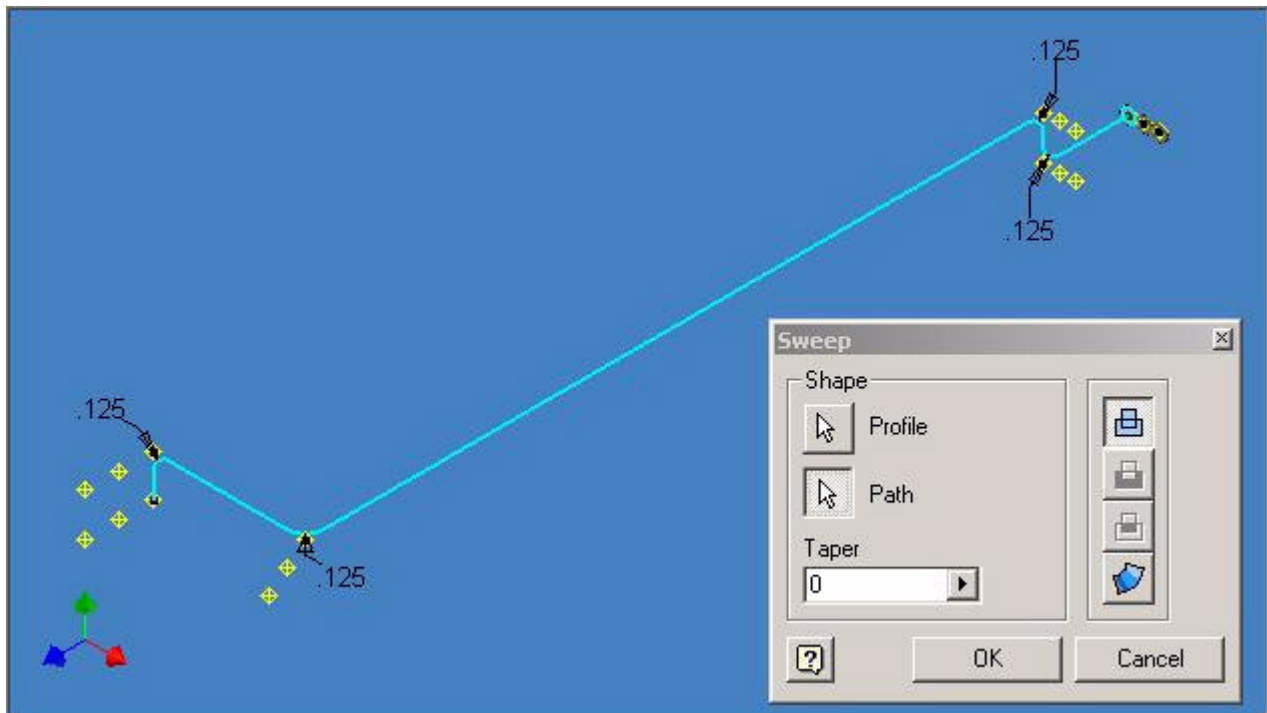
One tricky thing with master sketches is a lot of times you don't end up with things on the right side of the face. The three side hole points are on the inside face, but we want to add a countersunk hole to the outside face. Since you can't project derived sketches, you first have to edit the Left Side Top sketch and add points on top of the existing points. Now start a new sketch on the outside of the Left face. Project the newly created points, and exit the sketch. Turn off Left Side Top sketch so we don't inadvertently select them with the hole tool, and finally add the holes. These holes can of course be projected to a sketch on the outside of the right side to make the countersunk holes on that side.

Save the File as Top.ipt.

The Wires

Start a new part file and derive in the Master. We only want to derive in the last sketch (Named Wires), and all the Work Points, so turn everything else off. Edit the Document settings and make sure the 3d Sketch radius is set to .125.

Start a new 3d sketch and use the line command to join the Work Points for the first wire. Then simply Sweep the first projected circle down the path.



Save as 12V and close. Repeat the procedure for the other two wires, naming them Ground and VDD.

The Final Assembly

Start a new assembly file. Insert Top.ipt, Bottom.ipt, and Purchased Parts.iam. You could then constrain each ones origin planes to the assembly origin, or you could have used my Multi Insert and Fix macro to insert all the files at once and Ground them so no constraints are needed. (A cheap plug) You can get it on the iCode page of my site.

<http://www.mymcad.com/kwik/mcad.htm> I also find the replacement UCRES.DLL on the iMisc page of my site to be a big help when working in Master files. It makes it much easier to tell what sketches are on and which are off in the browser.

Ok, seemed like a lot of work and what did it get us? Why is this any better than doing it in the assembly? To answer that lets try an experiment. Suppose the PC Board designer just changed a bunch of locations of parts on you. Open both the Assembly file and the Purchased Parts file.

In the Purchased parts file edit the PC Board and swap its overall dimensions.

D0 becomes 8 and d1 becomes 7

Then constraint DB25 to Side changes from 1.25 to 2.5

Constraint DB25 to Back changes from 1 to 2.25

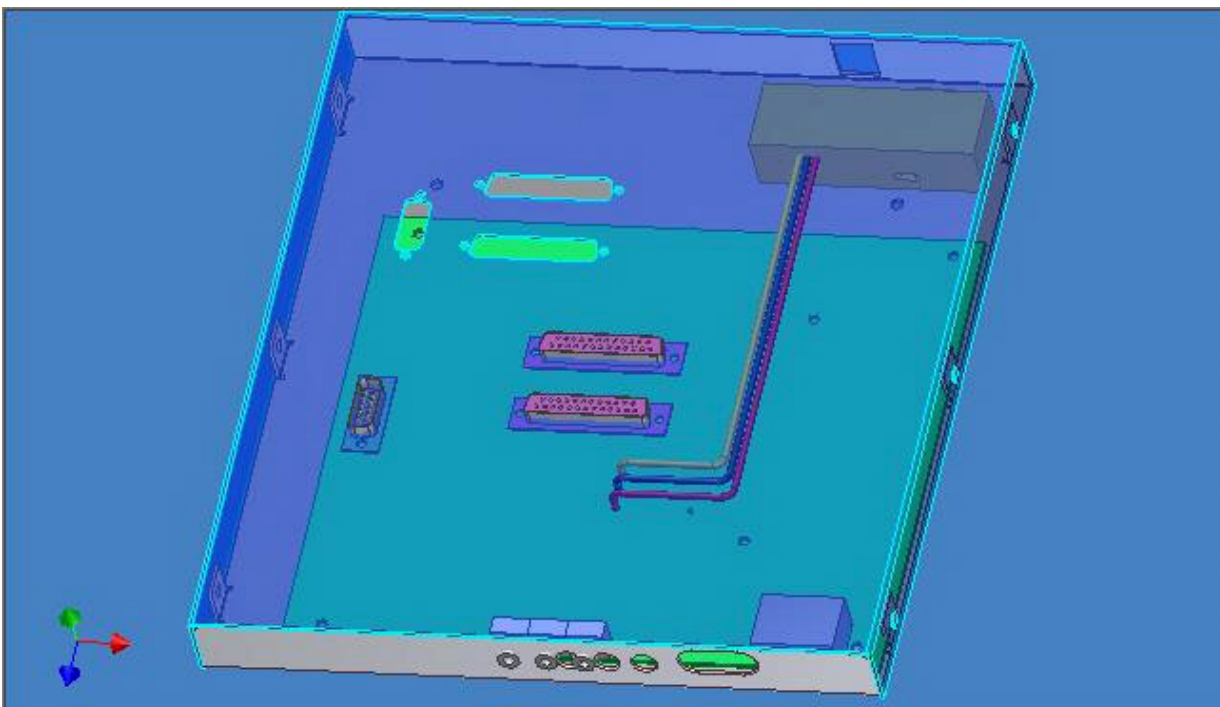
Constraint DB9 to Back changes from 1 to 3

Constraint Power Supply Space changes from .75 to 1

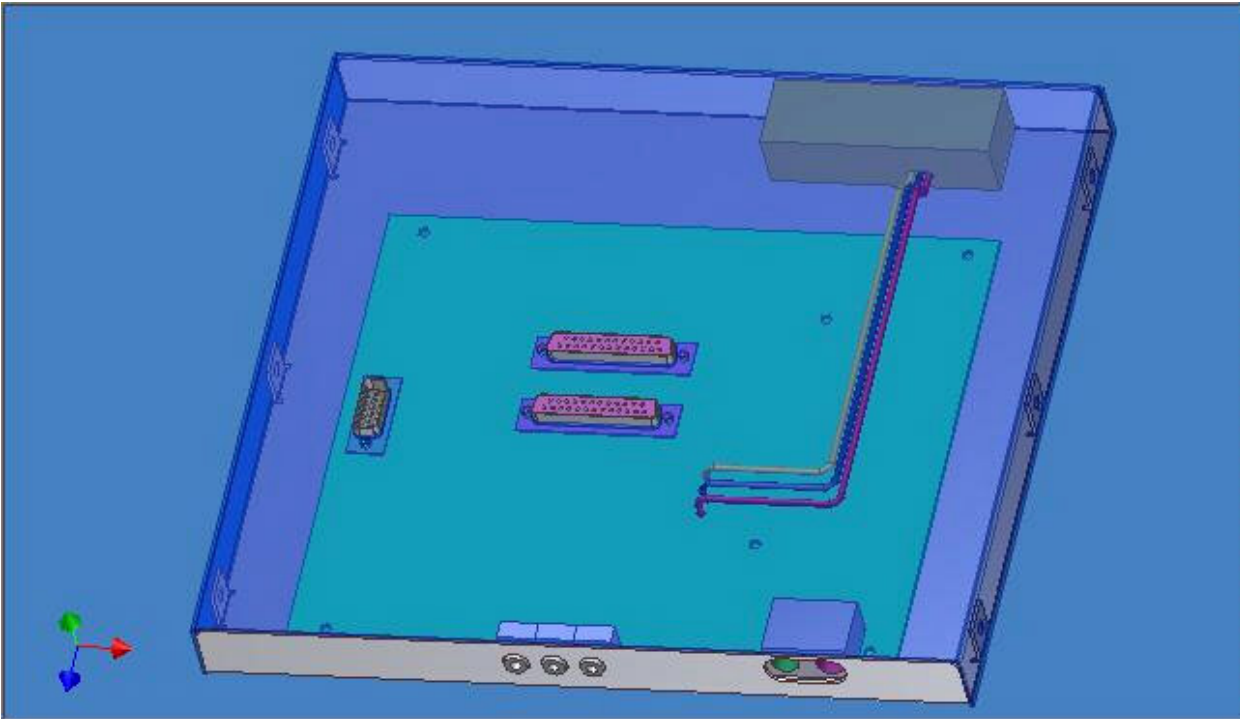
Constraint Power Supply to Side changes from .5 to .25

Constraint Triple to Double changes from .2 to 2

Now switch back the assembly ... and notice how nothing lines up any more.



Hit the Update button and with a little luck it should all fall back into place.



There are things that will cause failures, such as moving parts to make them come out a different face. Also in this file if the holes in the PC Board are moved to the right causing the wires to turn right instead of left they will end up cutting through each other.

The Master Sketch approach takes a little while to get used to and sometimes can be slower during initial design, but updates generally go so much smoother it is worth it in the long run.

Some people that have helped me start to understand this method are Drew Fulford, Walt Jaquith, Quinn Zander, and Udaya Gunasena who I believe had a lot to do with making so this method works.

Some other info on the Basic Skeleton Approach can be found at these sites

www.mymcad.com

www.sdotson.com

<http://pointa.autodesk.com/local/enu/portal/inventor/tips/>

And some examples can be found here.

www.inventorparts.com/

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