Introduction

CATIA Version 5 Electrical Design

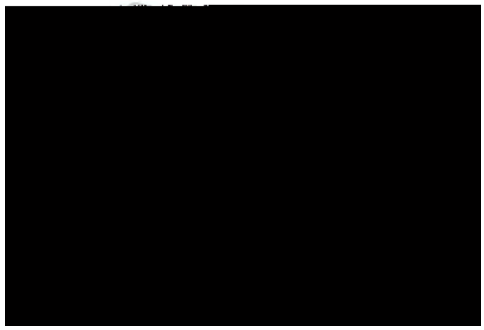
Upon completion of this course the student should have a full understanding of the following topics:

- Defining electrical parts and assemblies
- Defining electrical connection points
- Defining support parts
- Storing electrical parts into catalogs
- Assembling electrical parts

Electrical Design

Electrical Design is the first phase of defining an electrical harness. Before you can begin defining the wire segments and bundles, you need to build the electrical parts. The actual building of the parts is done utilizing part design, generative shape design, and other part related workbenches. Once the model is developed, you are ready to begin defining the electrical properties for that model. Any part that is to be used with the electrical harness should have all necessary electrical properties defined prior to trying to build a harness.

There are three stages to defining an electrical part. You must first always build the part. This can generally be the most difficult aspect since you will need to determine the level of complexity for the part. The more complex you make the part, the more detailed it will become, and the more information you can put into and take out of the part. Take, for example, a simple electrical cord plug.



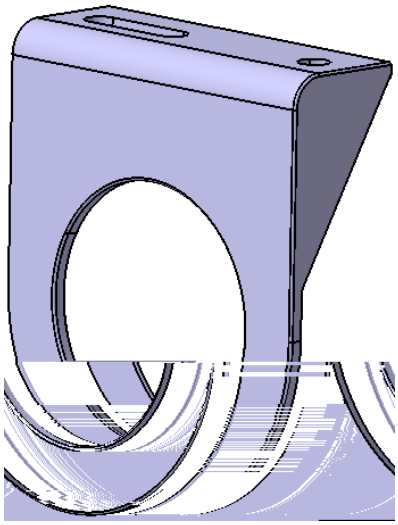
This type of plug can be modeled and electrified in a number of different degrees of complexity. You could model the plug as a single cylinder where only the wire connection point is identified.

This type of model is easily created and can rapidly be used when defining electrical properties, but it lacks a lot of information. In this case, you would indicate that the wire bundle would connect to the connector via one termination point. You would then need adequate documentation to indicate which wire was to connect to which terminal, as well as the number of terminals, terminal arrangement, etc. This type of plug is used more for space reservation and rapid proof of concept rather than a final design.

Mounting Equipment with Cavity

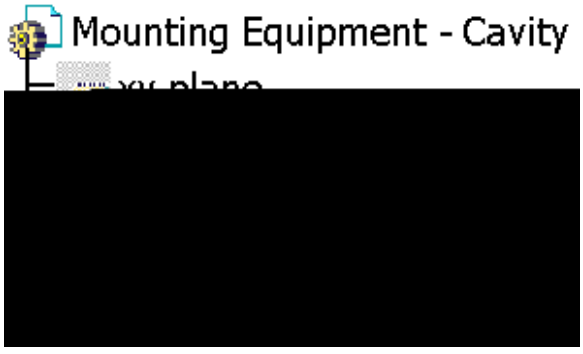
Mounting equipment with a cavity will generally be a mount that has a hole or pocket it in to allow another part to connect. If you refer to the earlier chart, you will find that you can mount other mounting equipment, equipment, shells, etc into the cavity.

Open the Mounting Equipment - Cavity document. This is a simple gage mount bracket that you will define electrical properties and a cavity in the large hole.



If not already there, switch to the Electrical Part Design workbench. The Electrical Part Design workbench will allow you to define all the necessary electrical properties for a detail part.

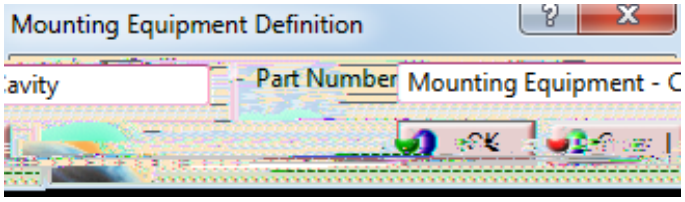
Before going too much further, notice this is a standard part design part.



Select the Define Mounting Equipment icon.  This icon will change the selected part to mounting equipment.

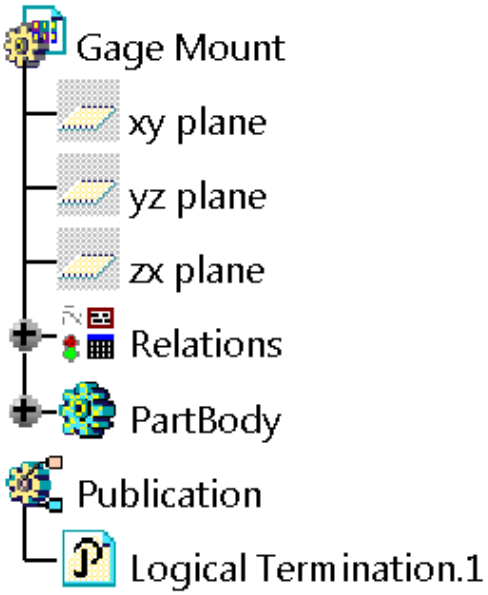
Select the part either from the graphical workspace or from the specification tree. Equipment properties are always applied to the entire part. Therefore, it does not matter if you select the part from the graphical workspace or from the specification tree.

Notice a *Mounting Equipment Definition* window displays.



This will allow you to change the part number for the mounting equipment as you define it.

Change the *Part Number* to Gage Mount and select *OK*. Notice the name of the part changes. You should also notice that the icon for the part document changes slightly, and a publication is created.



The publication does not necessarily point to a specific element, but instead defines electrical termination properties for the device.

At this point, you have defined the part as an electrical device. Now you need to define the electrical connection point.

Defining a Cavity

Cavities are essentially cutouts or holes in a part that will allow another part to connect via a cavity connection point. Cavities can only be defined in the following type of equipment:

Mounting Equipment	Stud
Equipment	Terminal Strip
Shell	Terminal Block
Single Insert Connector	Back Shell

Now to create the cavity for the mounting equipment.

Select the Define Cavity icon. This icon will allow you to define a cavity on the

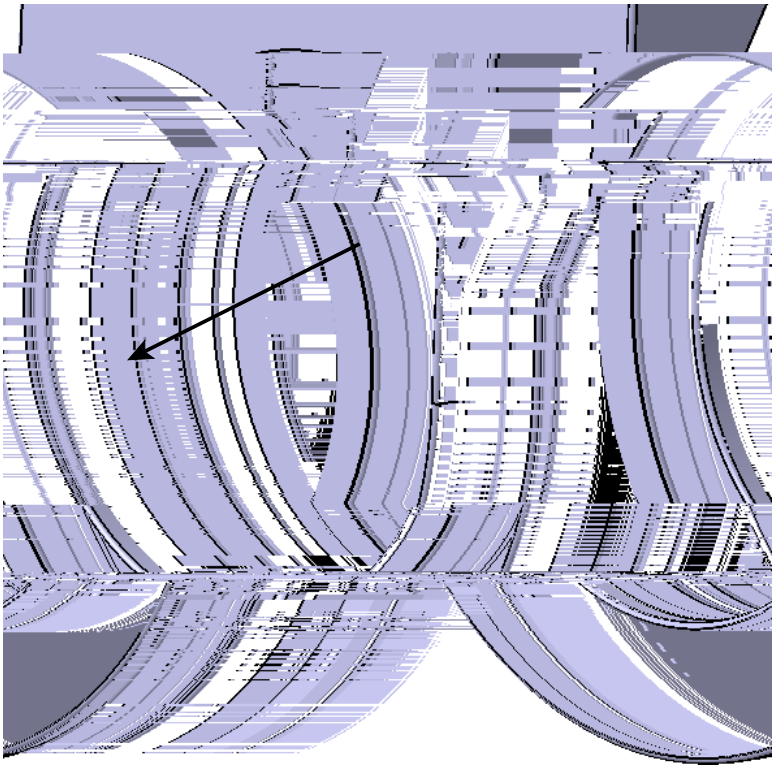
Placement Constraints

Contact	This defines the surface that will be contacted against the cavity connection point contact surface. When a planar face is selected, a contact constraint will be generated. Generally, this will be the mating face for the equipment
Coincidence	This defines an element that will get a coincidence constraint with the coincidence element from the cavity connection point. In many cases, this will generally be a centerline for the connection
Orientation	This defines an orientation element that will coincidence with the orientation element on the mating part. A coincidence constraint will be generated between the two elements

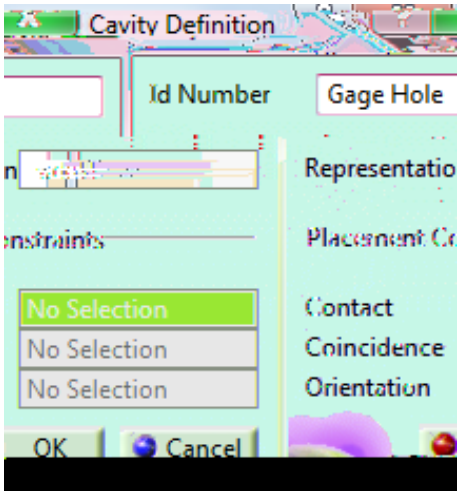
The placement constraints are optional fields. Many times you may not have an orientation or coincidence definition. Without these definitions, you will want to be sure to switch back to the Assembly Design workbench and define any additional constraints necessary to fully constrain the electrical assembly.

Change the *Id Number* to Gage Hole. This will better identify the cavity within the part.

Select the inner surface of the large hole (*Hole.2*) as the *Representation*. You can also select *Hole.2* from the specification tree. This defines the surfaces that will highlight when the cavity is selected.



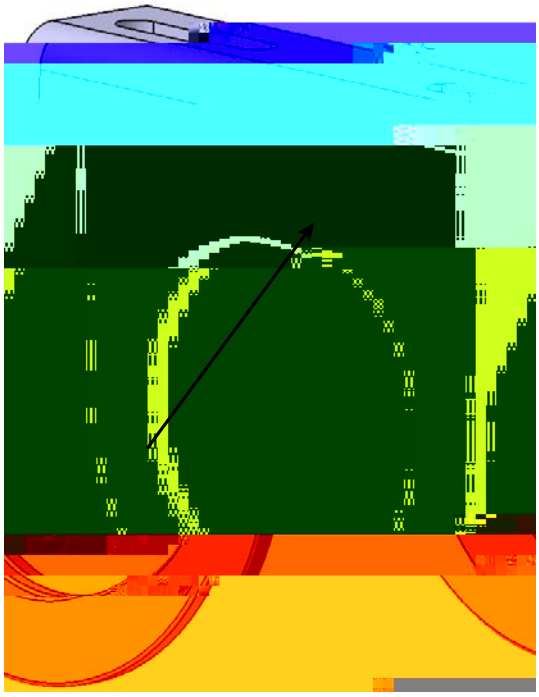
At this point, you should notice that you can now select *OK* to the *Cavity Definition* window.



Without any placement constraints defined, no constraints will be established when the two parts are electrically assembled. The two parts will be related electrically, but you will still need to manually assemble them.

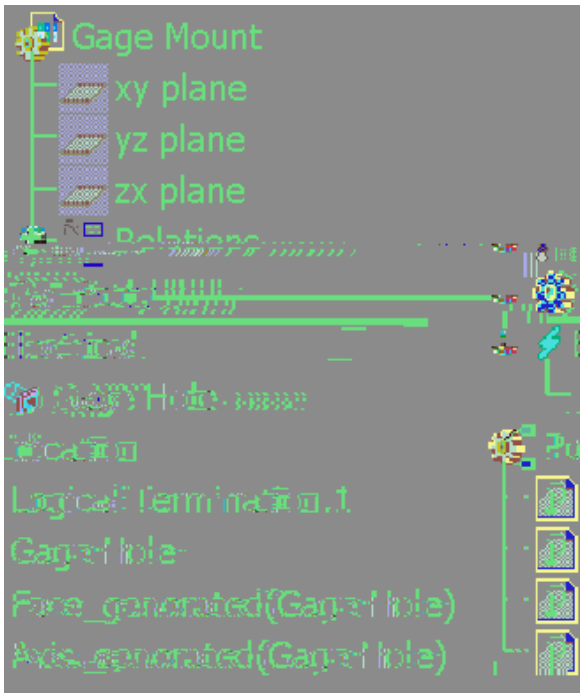
In this case, you will go ahead and define a few of the placement constraints.

Select the front face for the *Contact* placement constraint. This will define the face for the contact constraint.



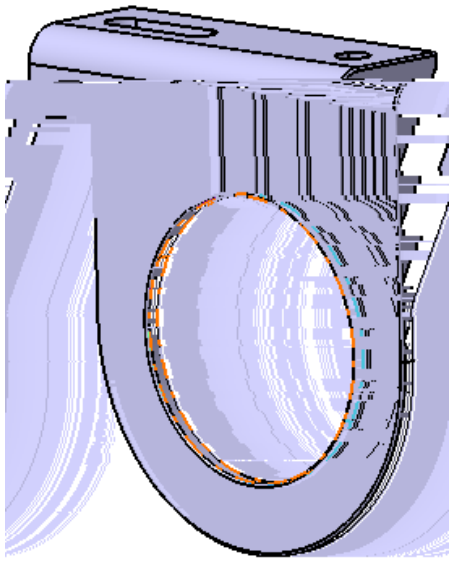
Select the hole centerline for the *Coincidence* placement constraint. It can be selected by clicking on the cylindrical surface of the hole.

Select *OK* to the *Cavity Definition* window. There are a few additions to the specification tree.



Notice the new *Electrical* branch. This branch will hold all connection point information. With the existence of the *Electrical* branch, this part has become electrified and can now be used in an electrical harness.

Point the cursor at the *Gage Hole* cavity in the *Electrical* branch. The geometry that was defined as a representation should highlight in the workspace.



Multi Insert Connectors

Multi insert connectors only allow for connections to single insert connectors and mounting equipment. Generally, multi insert connectors work well for "Y" adapters or splitters where you will have multiple single insert connectors connecting. Multi insert connectors can also be used in the place of an external splice when several connectors are connecting together, rather than the bundle segments themselves.

Multi Insert Connector Connection Type	Can Connect to this Connection Type	On this type of Device
Connector Connection Point	Connector Connection Point	Single Insert Connector
Cavity Connection Point	Cavity	Mounting Equipment

Open the Multi Insert Connector document. This is a mockup of a coax cable splitter.

Using the Define Connector icon, define this part as a *Multi Insert Connector*. 

Change the *Part Number* to <u>Cable TV Splitter</u> and leave the *Number of Terminations* at zero, then select *OK*. Even though you are going to end up defining eight terminations for this model (two per connector), you will be learning to define them after the fact for this connector.

Now that the device is defined as a multi insert connector, you are now ready to define the cavity connection point Į M ᶠ ᴀ ᵠ U ȷ ᴀ þ Q U nnector, uct%

&KDQJH WKH WR &RQQHFWLRQ)DFH WKH ERWWRP IDFH RI
VKRZQ EHORZ WR Representation WKH G Contact SODFHPHQW FRQWZLUDQW
GHILQH WKH FDYLW\ FRQQHFWLRQ SRLQW

6HOHFWKFZKHQ G1RQZH\RX DUH UHDG\ WR VWDUW GHILQLQJ WK
SRLQWV

6HOHFWWILWQH &RQQHFWRU &RQQHFWLRQ 3RLQW WKH FRQ
7KLV ZLOO VWDUW WKH FRQQHFWRU SRLQW GHILQLWLRQ SURFHVV
ZLOO EH WKH LQSXW FRQQHFWLRQ SRLQW

&KDQJH WR , QDSXW VHOHFW WKH Representation FKLOG XW KDFH
LV VKRZQ EHORZ

Select the front face of the connector as the *Contact* placement constraint. Again, this surface is shown.

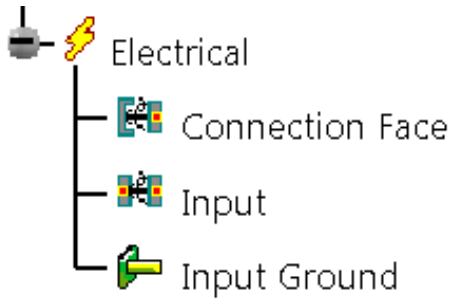
Defining Terminations

Terminations can be defined on any type of connector. Keep in mind, the terminations are just simply the termination of a wire at the connector. Terminations can only be defined in the following type of equipment:

Equipment	Shell
Single Insert Connector	Multi Insert Connector
Stud (only one)	External Splice
Internal Splice	Terminal Strip
Contact (Only One)	

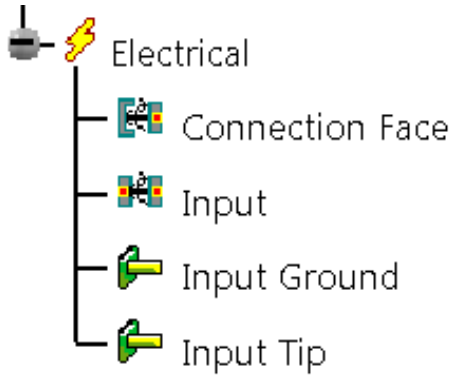
Select the Define Termination icon and select the connector. This will display

Select *OK* when done. This will define your first termination.



Using the Define Termination icon, define another termination for the tip.  **Set the *Id Number* to Input Tip and select the inner cylindrical surface as the *Representation*.** This is shown below.

Select *OK* when done. This will have the two terminations defined for the input.



Create the necessary connector connection points and terminations for the three output connectors. This will leave the part with all necessary connections and terminations defined.

Note: Publications not shown for clarity.

Save and close your document.

Assembling Electrical Devices

The best use of the Electrical Assembly Design workbench is the ability to electrically assemble devices together. All of the various connection points you have been defining allow you to electrically assemble these devices together to ensure the proper connections and relations between them. Keep in mind though, unless all electrical placement constraints have been defined, the assemblies might not fully come together. You may also have parts in your electrical assemblies that actually do not have nor do they need electrical properties associated. Any parts that do not fully assemble together will simply need assembly constraints to tie them together. The main goal you are after is the ability to electrically relate the parts that you assemble.

Create a new product in the Electrical Assembly Design workbench called <u>Electrical</u>

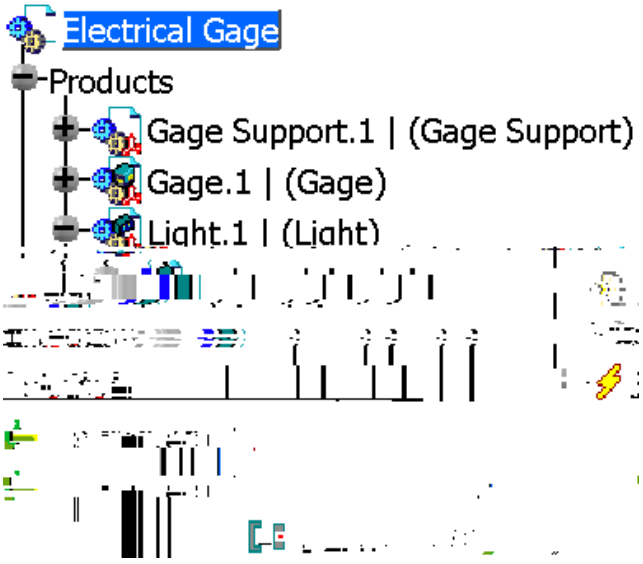
With the third mouse button, select on the *Light.1* instance from the specification tree and select *Properties*. This will display the properties for the light bulb.

Select *More...* Be patient, this can sometimes take a few moments to load.

You should now notice several new tabs, including the *Electrical* tab.

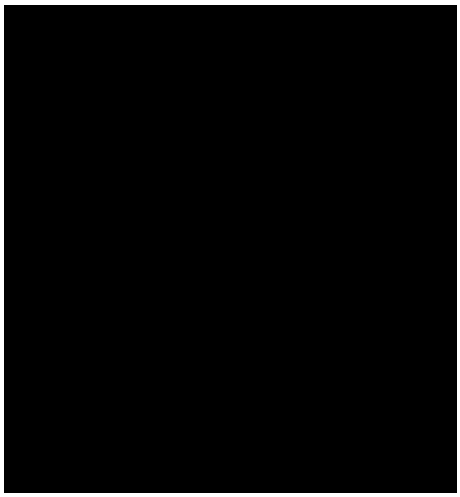
This shows the electrical properties for the light. In this case, the light was defined as a *Single Insert Connector*.

Select *OK* to the *Properties* window and expand the specification tree for *Light.1* until you can see the electrical connections for the light.

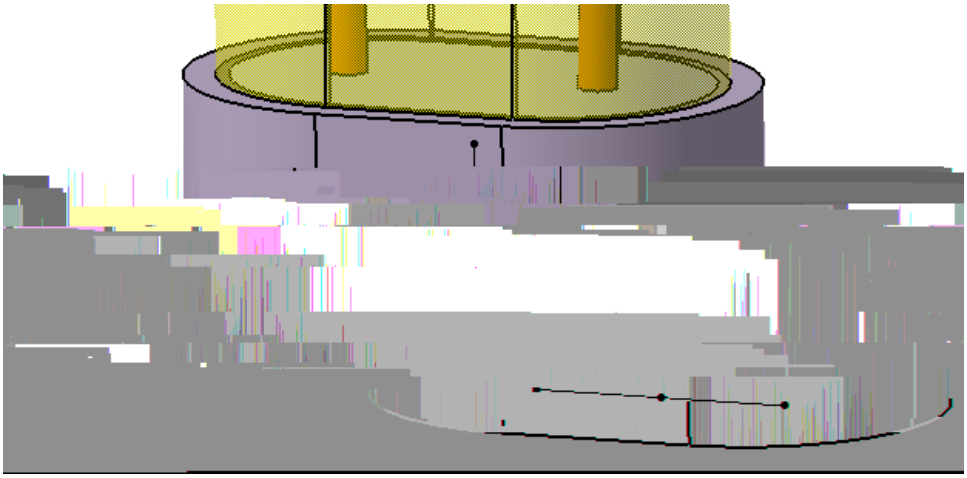


This device has a cavity connection point called *Light connection*.

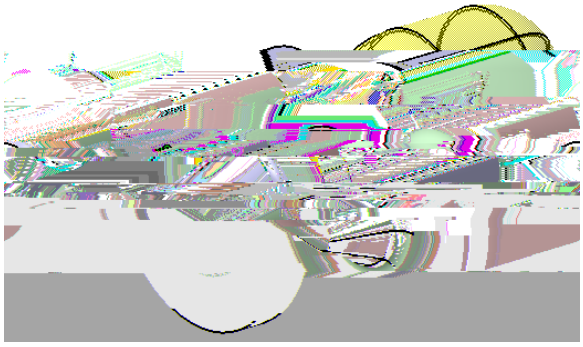
Double select on the *Light connection* cavity connection point from the specification tree until you can see the *Cavity Connection Point* definition window. You may need to do this twice. The first double select will activate the detail part. The second double click will actually display the connection point window.



All three placement constraints are defined. If you unhide *Line.1* and *Line.2* you would find that they make a "T" shape at the bottom of the light to allow the coincidence of the centerline and the orientation of the socket.



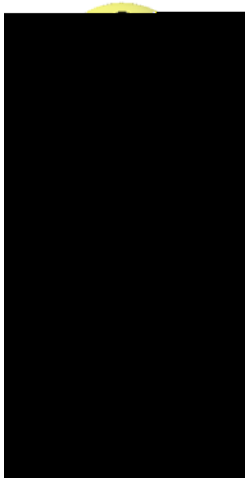
Select the *Light Socket* connection. Notice this assembles the two items together.



Select *Undo*. This will disassemble them from each other.

Select the Connect Electrical Devices icon again.  This time you are going to select them in the opposite order.

Select the socket, then select the light. Notice anything different?



This time, instead of the light moving to the socket, the socket moved to the light. This is only important to note when you desire not to have one item move. The first item selected will always move to the second item. Just like in Assembly Design, it is a good idea to always fix a component first, then assemble everything around the fixed item.

Expand the *Constraints* branch of the specification tree.

Notice that by connecting the two devices, you are automatically creating constraints.

Electrical Assembly Constraints

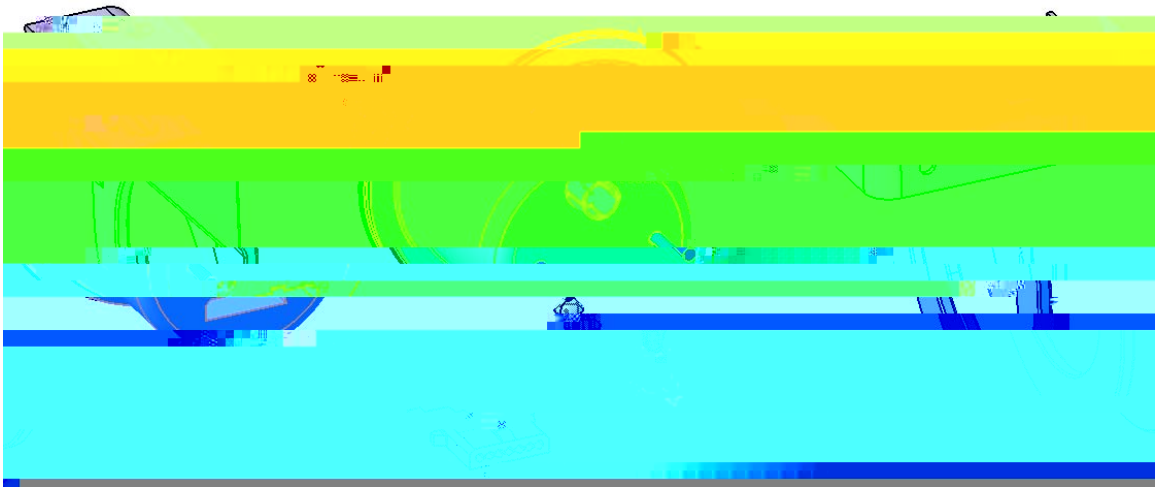
When you electrically connect two devices together, you are automatically creating the necessary assembly constraints to hold the two together. This is done through the placement constraints. If you remember right, there were three basic placement constraints that you defined; a *Contact*, *Coincidence*, and *Orientation* placement constraint. Each of these placement constraints will constrain to each other when the two have been defined. If you had one device that had an *Orientation* placement constraint and another that did not have one, you would not get a constraint.

The method in which the constraints are defined is simple. Anytime two faces are defined for the same placement constraint, a surface contact constraint is applied. Anytime any other geometry, or combination of geometry is defined for a placement constraint, a coincidence constraint is defined. This is why you want to be sure to have all the geometry for each placement constraint in the exact same location for each model. If you were to pick edges of a part as the orientation placement constraint, and it did not exactly match the other device's orientation edge, then you would have an over constrained assembly.

At this point, you are ready to -M l ф l й ‘

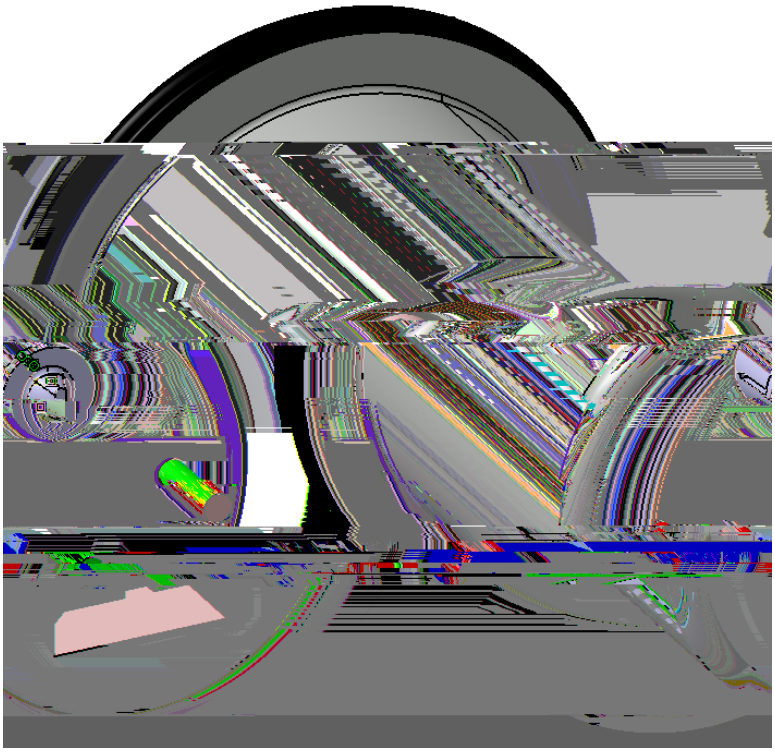
Connect the light and the socket together. All you will need to do is select the Connect Electrical Devices icon and select the Light and the Socket.

Select the Connect Electrical Devices icon and select the socket and the gage. 
Notice nothing happens other than the gage highlighting.



This is due to the gage having multiple cavities that the socket can connect to.

Select the *Light Socket* text on the gage. This will assemble the light socket to the gage.



Select the Connect Electrical Devices icon and select the plug and the gage.
Even though there are two cavities, since one of them is alread

Electrically connect the gage to the gage mount. Remember, you will need to switch back to the Electrical Assembl