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Using ArcGIS® Schematics for Inside Plant Representation

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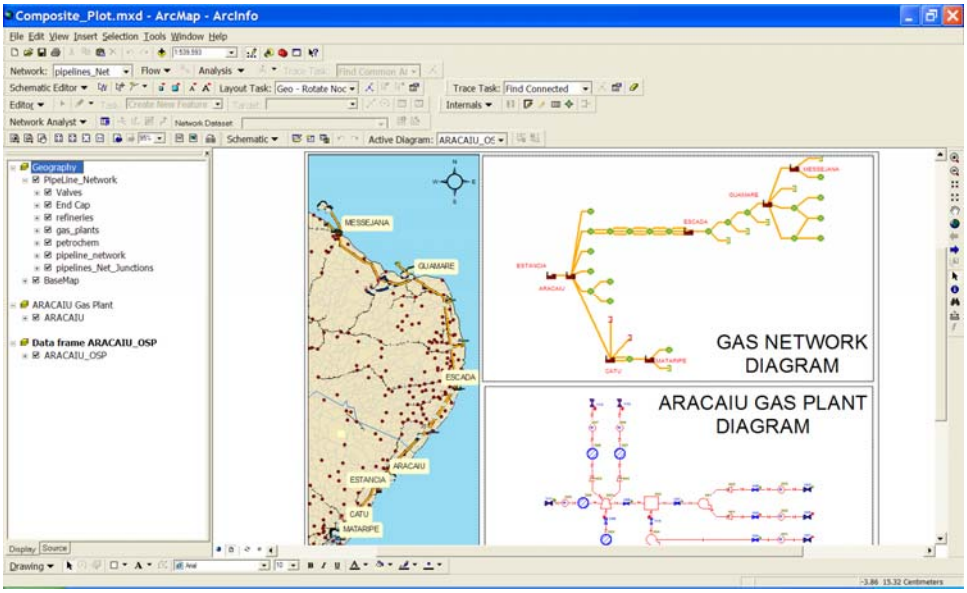


What Is "Inside Plant"?

"Inside plant" is a term that has different meanings depending on what industry is being discussed. In the electric industry, it will most likely be the inside of a substation; in the oil industry, it may be the inside of a gas plant or refinery; and in the telecommunications industry, it may be the inside of a switch cabinet—the list goes on and on. Basically, any data that has to/from node connectivity but is not normally viewable in the GIS can be referred to as an inside plant. Follow the steps below to make a diagram showing your business' organizational chart, for example.

How Do I Create an Inside Plant Diagram Using ArcGIS Schematics?

Each inside plant configuration will vary depending on how detailed it is or how many data sources are involved. In the following example, you will look at adding inside plant representations for a dataset from Brazil that includes gas plants and refineries.

Starting Questions

The following questions need to be answered before getting started:

- Where is the data that will be used to create the schematic features for the inside plant diagrams?
- Is there to/from node connectivity in the data, or is there a way to calculate connectivity from attributes?
- What items do you want to see on the inside plant diagrams?

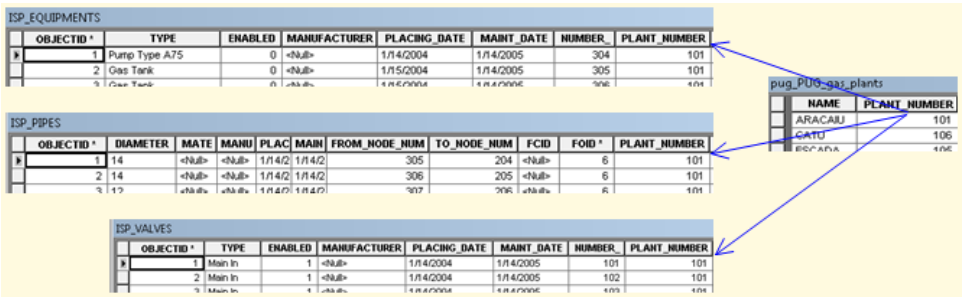
Items to Create in ArcGIS Schematics

The following items will need to be created to represent the inside plant diagram with ArcGIS® Schematics:

- A data source to connect to the external data (if needed).
- A new diagram template representing the inside plant. This defines what will be included in the diagrams that a user generates.
- Node and link schematic feature classes to represent the items that will be displayed in the diagram.

Example

In this example, you will use a file geodatabase called Brazil.gdb that is installed with the tutorial data for Schematics. In the following screen capture, you can see all the tables related to the pug_PUG_gas_plants table. Each of these tables holds the internal contents of a gas plant. You can see that for each gas plant (record in the pug_PUG_gas_plants table), there is a name and a plant number. That plant number can be used to get all the records from the other tables for a particular plant.



The example uses four tables:

- The ISP_EQUIPMENTS table holds all the internal equipment pieces. Equipment is differentiated by the Type field.
- The ISP_PIPES table links all the equipment and valve pieces. Notice the From_Node_Num and To_Node_Num fields. These define the connectivity between all the nodes.
- The ISP_VALVES table keeps track of the valves. Valve types are differentiated by a Type field.
- The pug_PUG_gas_plants table is the feature class representing the gas plants or refineries features that are seen in ArcMap™. These are the keys to both the outside world (ArcMap) and the inside world (inside plant).

All three of the questions from the "Starting Questions" section above have been answered, and you have a database that contains all the items for the internal representations. The Pipes table has two columns, From_Node_Num and To_Node_Num, that define the to/from connectivity for the internals. Based on the three tables (not including the Plants table) and the Type field on the Equipments and Valves tables, you know everything you want to show on the inside plant diagram. So now you are ready to do some work using the ArcGIS Schematics Schematic Dataset Editor application to define the parts and pieces to create the inside plant diagrams.

Please note that this document is intended to give the high-level concepts and show some results. For details on all the steps for this example, go through the Schematics tutorial exercise Quick-Start Guide for Configuring the Standard Builder to Operate from Custom Queries.

For this document, it is assumed that you are going to create a new schematic dataset in the Brazil.gdb geodatabase. You can decide to use some other geodatabase, but you will need to adjust the configuration if you do so.

Configuration Step 1

Start by creating a new schematic dataset. To create a new schematic dataset, you will need to right-click the geodatabase and choose New > Schematic Dataset from the pop-up menu. Rename the dataset as desired (ISP in this example). Right-click the schematic dataset you just created and choose Edit from the pop-up menu. This starts the Schematic Dataset Editor application.

Now that you have the dataset, the first step in the "Items to Create in ArcGIS Schematics" section is to create a new data source. The data source needs to point to your database where the inside plant tables reside. Note that this could be in many databases. If that is the case, you will need to create one data source for each database. If your schematic dataset was created in the same database as the tables for the inside plant elements, then you do not need to create a new data source. Schematics automatically creates a data source called CURRENTDS that points to the database where the schematic dataset was created. So for this example, just use CURRENTDS, which means that step 1 is already complete.

Configuration Step 2

Step 2 in "Items to Create in ArcGIS Schematics" is to create a diagram template. Click the New toolbar button and choose New Schematic Diagram Template from the toolbar drop-down menu. Give the template a name. In this example, it is named ISP_GasPlant. To complete the diagram template definition, you need to define a query that will return the list of possible diagrams. In this example, use SELECT *FROM pug_PUG_gas_plants, from which the plant number and the name can be obtained. You will have to create an attribute to hold the plant number value, which you will later pass into your schematic feature class queries to retrieve the correct data for the diagram.

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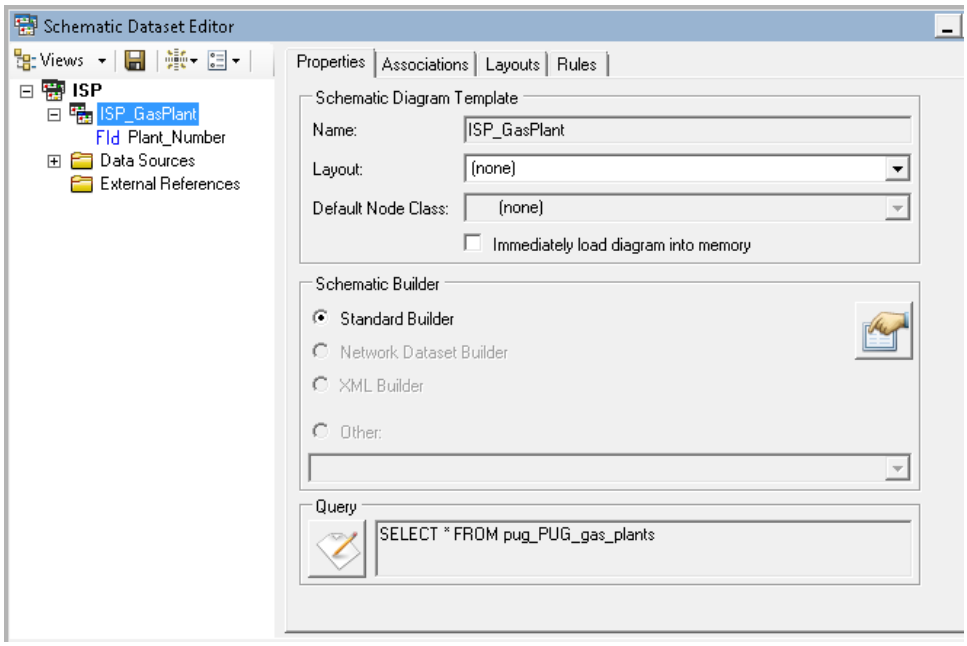
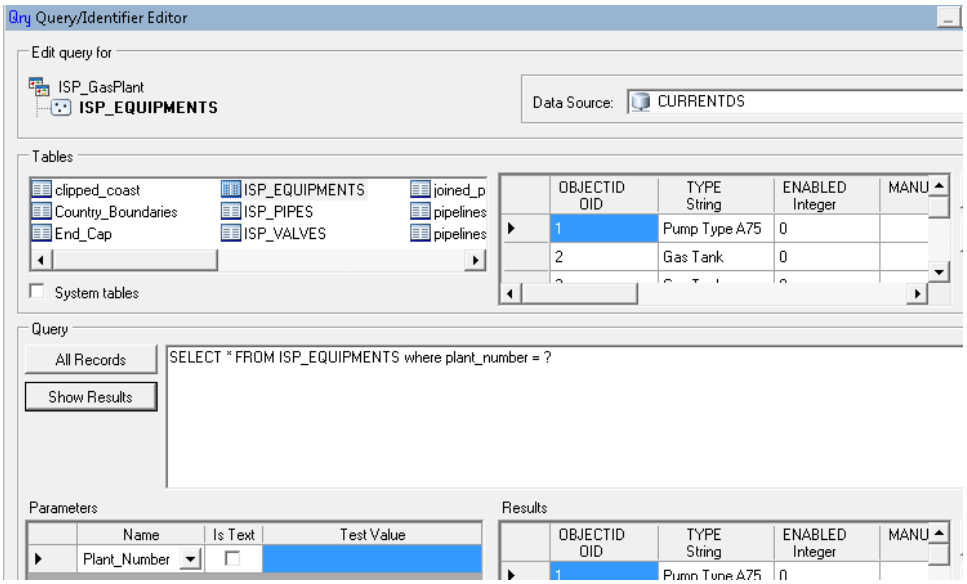


Configuration Step 3

Step 3 from "Items to Create in ArcGIS Schematics" above is to create the schematic feature classes. You will need to create a schematic feature class for each of the object types that you want to see on the diagram. For this particular data, you would need to create two node schematic feature classes (one for ISP_EQUIPMENTS and one for ISP_VALVES) and one link schematic feature class (for ISP_PIPES).

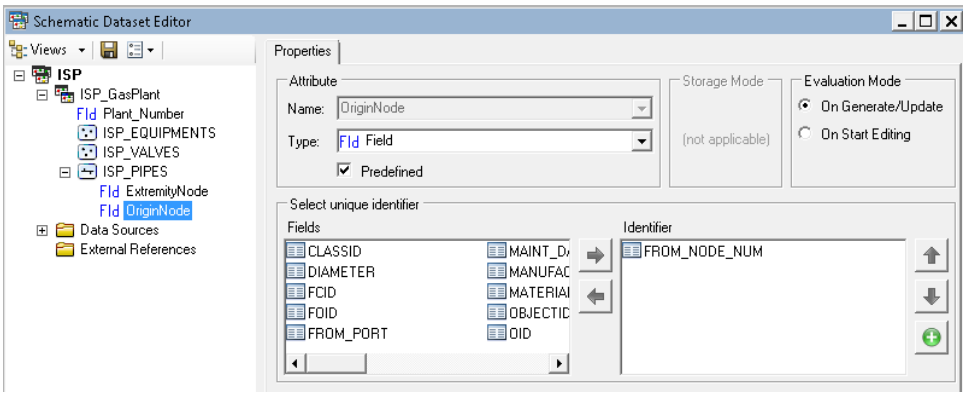
For the node schematic feature classes, right-click the diagram template in the tree view and select the New Schematic Feature Class menu option. Give the new schematic feature class a name (ISP_EQUIPMENTS and ISP_VALVES in this case). Click OK to see your new schematic feature class in the tree view.

Finish the schematic feature class definitions by modifying the query to get all the records from the corresponding table. For the ISP_EQUIPMENTS schematic feature class, the query definition looks like this (exactly the same for the ISP_VALVES schematic feature class):



Notice that the query ends with a question mark. In the query creation screen, it has been identified that the Plant_Number parameter will come from the attribute that you created for the diagram template.

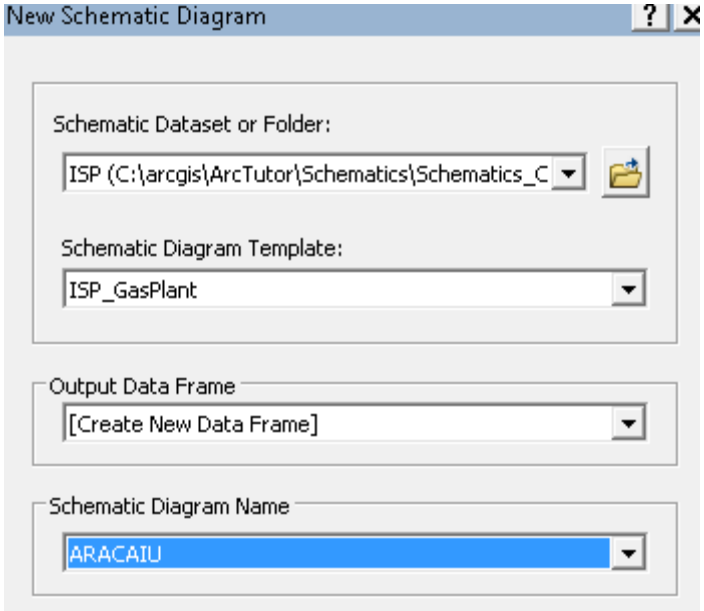
Creating the link schematic feature class is the same as creating a node except that you must select Link in the Type list instead of the default, which is Node, and you also have to define a few more attributes to deal with connectivity.



The mandatory attributes to create are ExtremityNode and OriginNode. These get set to the To_Node_Num and From_Node_Num fields in the ISP_PIPES table.

Final Testing

Once these three schematic feature classes are defined, save the schematic dataset and you are ready to try the application. Open the Brazil.mxd file with ArcMap and click the Generate New Schematic Diagram button on the Schematic toolbar. Notice that this dialog box is already populated with the schematic dataset and diagram template because it is in the same database as the data currently displayed in the map. It displays a list of the diagram names to pick from, which comes directly from the query you defined for the template.



Click the OK button to see the internals for the Aracaiu plant. Note that the first time a diagram is opened, the items will be placed on a grid layout because you did not have the data or definition for initial x- and y-coordinates. After you move items around or use a predefined layout algorithm and save the diagram, the next time it is opened, it will appear as it was last saved from that point on. You can now use ArcMap to modify the symbology and labeling as needed.

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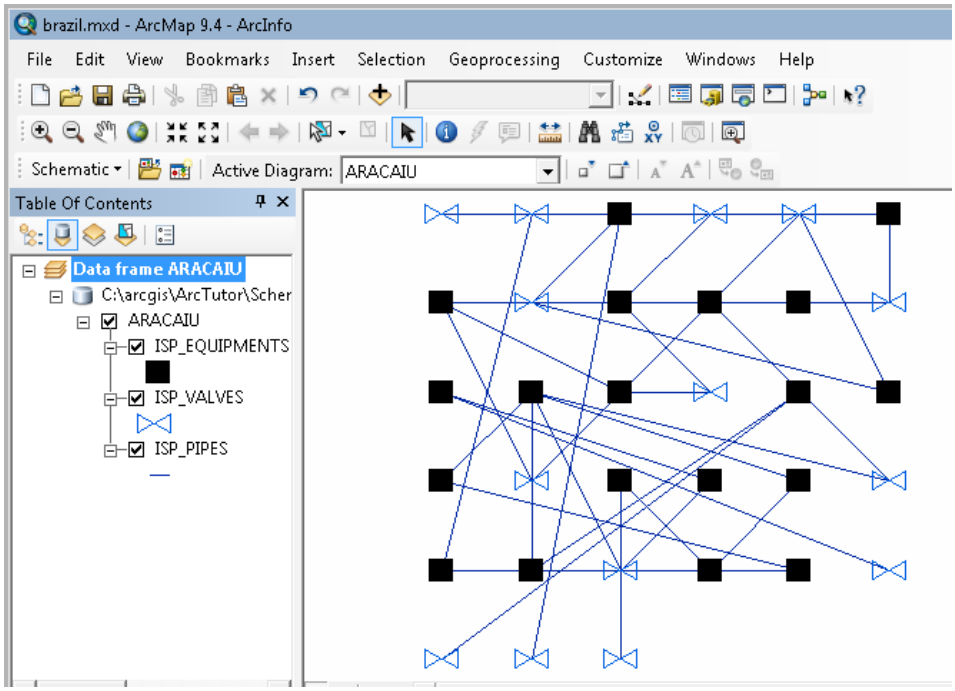
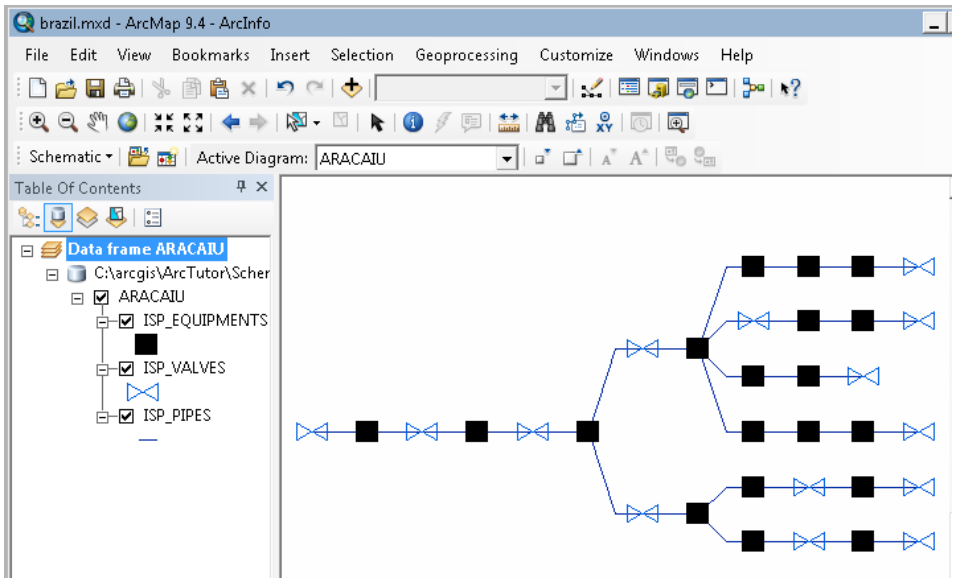
Initial Diagram



After Applying the Hierarchical-Smart Tree Layout Algorithm



Note that you can automate the creation or opening of these diagrams by using code in the map document. For example, you may want to automatically create and open the inside plant diagram when the user right-clicks the real gas plant feature in the pug_PUG_gas_plants feature layer.

Conclusion

This is just one example of how ArcGIS Schematics can be used to create an inside plant representation. For more information, refer to the following topics located at the ArcGIS Resource Center:

- What is Schematics?
- Schematic diagrams by querying tables
- Quick-start guide for configuring the Standard builder to operate from custom queries

About Esri

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