

Get Connected Autodesk® Revit® MEP Connectors Demystified

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ASST

MP59319 Having trouble getting your Autodesk Revit MEP families to connect to systems in your project? Having trouble getting the lookup tables you are using to read in your project? This class will cover both major topics by using real world examples to demystify the issues we have all experienced. In this class, we will cover all connectors in the Revit 2011 family editor, and cover in-depth the advanced settings for each. Each family will be tested in a project environment to prove its quality, and represent how the once difficult connector is actually quite easy. You just need the secret decoder ring to get connected.

About the Speaker:

Shawn Zirbes is the Chief Technical Officer for CAD Technology Center, Inc., in Minnesota. With ten years experience using all Autodesk® AEC software, he is an expert in planning and executing software implementations for the AEC industry. He has worked with a wide variety of clients ranging from commercial, residential, health care, and industrial design firms, their consultants, and the building product manufacturers supplying the building materials for these projects. Shawn's wide range of Building Information Modeling experience is being leveraged by Autodesk as a special Revit® consultant for Autodesk Seek.

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Introduction

Connectors are the heart and soul of Autodesk Revit MEP. Without them we could just as well use AutoCAD. The connectors allow data to be transferred intelligently from one piece of content to another.

Yes, Revit has the ability to draw and document other aspects of the MEP model, but think about it. When we tag a section of duct, what properties display? Width and Height? Air Velocity? Air Volume? What is the source of this information? Well, it is the equipment to which the duct is connected, of course. All of that data is translated through the connectors so Revit can assist with calculating the load on any section of duct, or communicate that load to a supplying piece of equipment.

Connectors shouldn't be so mystical, but somehow they seem to be the biggest mystery when creating valuable families for Autodesk Revit MEP. In Revit MEP a family could consist of nothing more than a graphical parametric cube, a few connectors and related shared parameters and be a very valuable family. Another family for the exact same product could be beautifully modeled and contain appropriate parameters and still be useless to an MEP engineer. It could be useless because it either has no connectors, or the connectors it does have are incorrectly configured.

All this said, let's talk about the correct way to implement connectors into our MEP family files.

Connector Essentials

To create connectors we need to first understand how they are used in the project environment. Once we have a firm grasp on the technical project use, we can start to discuss the creation of connectors in families. And, of course, once created, we have to configure the connector's settings.

Project Use Introduced

To most easily learn to use families with connectors within a project, without formal training, we will use a simple tutorial.

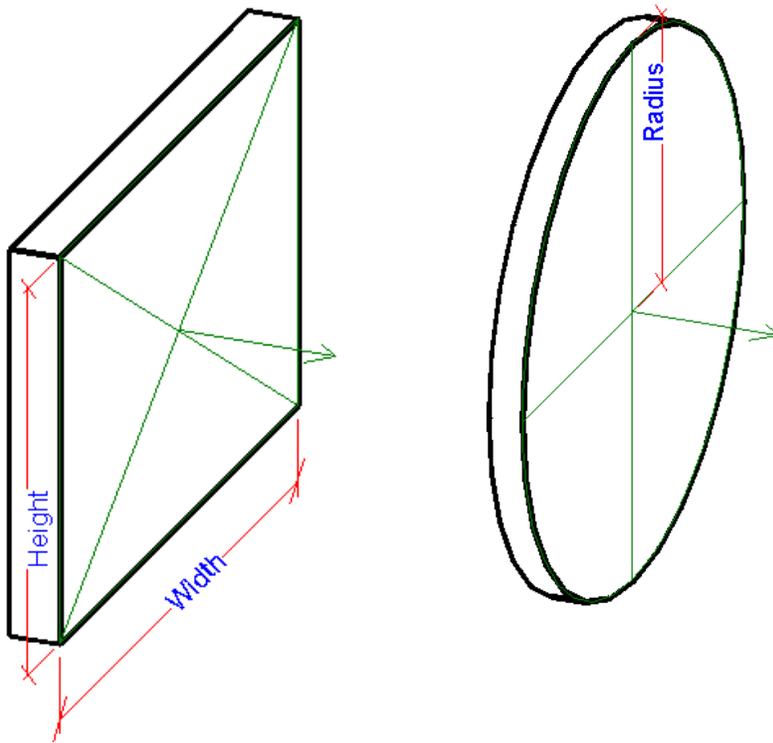
- 1) Open a new project using the Systems – Default.rte template
- 2) Place 2 supply air terminals near each other in the model
- 3) Load and place the “Fan Coil Unit with Plenum - Horizontal Ducted - CHW - Rear Return.rfa”
 - a. Found in the default imperial library under “Mechanical Components → Air-Side Components → Terminal Units” directory.
- 4) Draw a single wall
- 5) Place a power panel onto the face of the wall (NOTE: It may not display depending on the view you are currently accessing)
- 6) Select the 2 air terminals, and select the “Create Supply Air System” from the right side of the ribbon.
- 7) Use the “Select Equipment” option from the ribbon, and select the Fan Coil unit.
 - a. Notice the red dashed “Logical System” lines. They are indicating the connectors that are connected by the systems tool. Revit uses the flow settings on the connectors in both the air terminals, and the Fan Coil unit to decide what should be connected to what.
- 8) Escape out of the system, and re-select the Fan Coil unit.
 - a. Notice that the Fan Coil can be associated to a number of systems
- 9) Use the “Create a Circuit” option
- 10) Use the “Select Panel” option
- 11) Select the panel board
 - a. Wait, you can't... Revit doesn't understand what distribution system the panel can handle. This needs to be associated in the panel's properties first, then it can be chosen as a panel if its distribution system matches the Fan Coil's voltage

This is a very simplified tutorial, but if you can follow it, you are likely ready for the next topic...

Connectors in Families

Now let's open the Fan Coil to investigate its connectors. We aren't going to look so much at how to place them yet, but rather their settings, and options.

First, let's talk about the duct and pipe connector types.



- 1) Notice how the arrows for the connectors point away from the solids of the Fan Coil.
 - a. All too often people think the arrows indicate the flow direction of the connector.
 - b. This couldn't be further from the truth.
 - c. The connector arrows indicate the direction from which the pipe or duct must approach the connector.
- 2) Also notice that one of the connectors for each type of connector will have an "X" through it.
 - a. In most content the "X" means nothing
 - b. It indicates which connector is the "Primary" connector
 - c. The primary assignment is most critical in the creation of fittings or "Global" families
 - d. No other family really cares which connector is "Primary"
- 3) When some of the connectors are selected you may see new arrows appearing between the selected connector, and another connector
 - a. This indicates a link between the connectors
 - b. It is designed to be used for connectors that do not have flow properties internally
 - c. It allows the pipe system and flow information to "Flow" from one connector to the other connected connector.
 - d. This is again only needed on connectors that are "Fitting" or "Global"

We've now covered most of the important "Visible" aspects to a connector, now lets look more deeply at the data, or the connector's settings.

Connector Settings

Each of the connectors has different settings that drive their performance. Here we will briefly overview the settings of each of the connector types. There could exist volumes on this topic alone, so this will truly be only an overview.

NOTE: Remember, this class is intermediate to advanced. We are now going to start stressing the “Advanced” portion, so get ready.

Duct Connectors

Mechanical	
Flow Factor	0.000000
Loss Coefficient	0.000000
Flow Configuration	Calculated
Flow Direction	Bidirectional
System Type	Supply Air
Loss Method	Not Defined

Mechanical - Airflow	
Pressure Drop	0.0000 in-wg
Flow	0 CFM

Dimensions	
Shape	Rectangular
Height	1' 0"
Width	1' 6"
Radius	1' 0"

Identity Data	
Utility	<input type="checkbox"/>
Connector Descript..	

Constraints	
Angle	0.000°

Mechanical	
System Type	Fitting

Dimensions	
Shape	Rectangular
Height	1' 0"
Width	1' 6"
Radius	1' 0"

Pipe Connectors

Properties

Connector Element (1) Edit Type

Mechanical	
Fixture Units	0.000000
K Coefficient	0.000000
Flow Factor	0.000000
Flow	0 GPM
Pressure Drop	0.000 psi
Flow Configuration	Calculated
Flow Direction	Bidirectional
Loss Method	Not Defined
Allow Slope Adjustm...	<input type="checkbox"/>
System Type	Domestic Hot Water
K Coefficient Table	
Dimensions	
Radius	0' 9"
Identity Data	
Utility	<input type="checkbox"/>
Connector Description	

[Properties help](#) Apply

Properties

Connector Element (1) Edit Type

Constraints	
Angle	0.000°
Mechanical	
System Type	Fitting
Dimensions	
Radius	0' 9"

[Properties help](#) Apply

Electrical Connectors

Properties

Connector Element (1) Edit Type

Electrical - Loads

System Type	Power - Unbalanced
Number of Poles	1
Power Factor State	Lagging
Load Classification	Other
Load Sub-Classificati...	<input type="checkbox"/>
Voltage	0.00 V
Apparent Load Phase 1	0.00 VA
Apparent Load Phase 2	0.00 VA
Apparent Load Phase 3	0.00 VA
Power Factor	1.000000

Identity Data

Utility	<input type="checkbox"/>
Connector Description	

[Properties help](#) Apply

Properties

Connector Element (1) Edit Type

Electrical - Loads

System Type	Data
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Identity Data

Utility	<input type="checkbox"/>
Connector Description	

[Properties help](#) Apply

Cable Tray Connector

The image shows the Properties palette for a Cable Tray Connector in Autodesk Revit. The palette is organized into several expandable sections:

- Connector Element (1)**: A dropdown menu with an "Edit Type" button.
- Constraints**: Contains an "Angle" property set to 0.000°.
- Electrical**: Contains a "Connector Type" property set to "Cable Tray Individu...".
- Dimensions**: Contains "Height" and "Width" properties, both set to 1' 0".
- Identity Data**: Contains a "Utility" checkbox (unchecked) and a "Connector Description" text field.

At the bottom of the palette, there is a "Properties help" link and an "Apply" button.

Conduit Connector

The screenshot shows the Properties window for a Conduit Connector. The window is titled "Properties" and contains several sections for configuring the element. At the top, there is a "Connector Element (1)" dropdown menu and an "Edit Type" button. Below this are sections for "Constraints", "Electrical", "Dimensions", "Identity Data", and "Connector Description".

Section	Property	Value
Constraints	Angle	0.000°
Electrical	Connector Type	Conduit Individual ...
Dimensions	Radius	1' 0"
Identity Data	Utility	<input type="checkbox"/>
Connector Description	Connector Description	

At the bottom of the window, there is a "Properties help" link and an "Apply" button.

Validation with Logical Systems

You should always use logical systems in conjunction with the creation of your family files. Using these “Logical Systems” will help to ensure that you have the connections configured properly.

It has been quite often that we have generated a family, and before fully understanding how it actually worked, we made some choices to configure connectors this way or that. In many cases if the family isn't fully understood, connecting it to a logical system will help in understanding how things are to work, and in debugging those things that for some reason do not.

The first demonstration will show how a logical system transfers the data for a basic system using out of the box content.

As you saw, the information transfer should always flow properly in a logical system so the information reports correctly in the system browser. If this is not the case, then something is wrong with the connectors.

Example 1:

An example we will use in this presentation is a wall mounted water closet hanger.

This device is the part that the water closets in the restroom are anchored to when they are wall mounted. There is a little bit of information that sources from the fixture, and this device allows that information, and the information from upstream fixtures to be communicated to the sanitary waste pipe.

We received this family from a manufacturer who was attempting to make it connect, and carry the information properly, but despite what they tried, they couldn't get it to work. Let's look at this in a demonstration...

As you can see, the logical system assisted in the validation of choices made, and even assisted in finding a resolution where one wouldn't have been found otherwise.

Example 2:

Another example where a logical system came to the rescue was in the creation of a 2 pole sight lighting component that was supposed to attach to a 480 volt 3 phase panel on a 3 pole circuit. Again, a demonstration within Revit will clarify better than documentation here...

As you saw, we built a complex family using some validation formulas to work out the circuiting documentation, and load balancing. This allows the manufacturer the ability to distribute this content with the peace of mind that it will not fail when the user is leveraging it properly. It also allows us to use this family as a base for many more situations given its flexibility.

Conclusions

What can we conclude from this session?

1. An understanding of Revit MEP and how it works is critical to valid testing of families
2. An understanding of how this part attaches to various systems is critical for the success of the family
3. Understanding good family editing standards is critical for building families with valid properties that will work in Revit MEP
 - a. Be certain that you understand the difference between “Type” and “Instance” parameters
 - b. Be certain that you understand how to create formulas in the Revit family editor
 - c. Be certain to understand how a and b effect the performance of your family within the Revit project production environment
4. Virtually every Revit family can be configured to work within the scope of the Revit system browser
 - a. It may be necessary to select a system connector property that we may not like, but it is possible
5. Most, but not all of the mysticism behind connectors comes from a lack of understanding 1-3 in this list
 - a. For all things that do not make full sense, be sure to re-check all the above, and be sure to ask others for advice and assistance
 - b. Building families in a vacuum rarely results in valid content

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2 resources exist that you may find helpful in the generation of solid family files.

1. The “Revit 2012 Family Standards and Best Practices” book.
 - a. This book discusses most of the best practices you will need for family creation. It is no substitute for good family training, but it is a great reference to help understand what you should and should not do after training has taken place.
 - b. ISBN: 978-0-9838600-0-6
2. Revit Family processor
 - a. This add-on for Revit will allow for rapid updating, and creation of the parameters and materials that exist in Revit component families. Much of our time spent in families is in the creation of parameters and population of formulas in multiple family files after the initial products have been defined. Use this tool to make both process much faster
 - b. www.revitexpresstools.com