autodesk

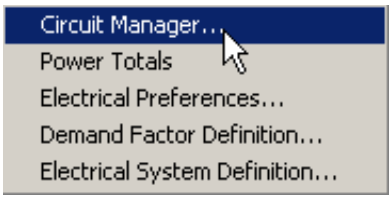
White Paper

Taking the Shock out of Electrical Engineering in Autodesk® Building Systems

Autodesk® Building Systems enables electrical users to provide a more concise logical model of their project. Using the tools provided in Autodesk Building Systems, you can easily maintain, modify and schedule the interconnection of electrical devices to panel boards. Additional enhancements enable you to also connect devices without being forced to draw wiring. The intent of the paper is help you understand how the features of the electrical module of Autodesk Building Systems work, so that you can get started designing.

Command Locations

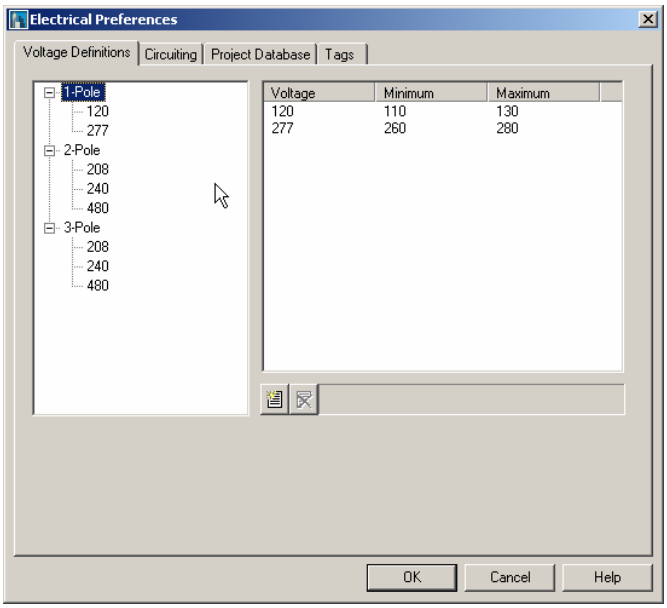
The primary locations for electrical commands in Autodesk Building Systems are from the Tool Palettes and shortcut menus on existing objects in the drawing. The default Electrical tool palette contains many of the commands that you may use however some may not be needed. The tool palettes are flexible and can be customized. You can delete any tool that you don't need and add additional tools from Content Browser or by creating custom tools. Other commands are accessed via the MEP Common pulldown menu. These commands are limited to general purpose commands such as Electrical Preferences and System Definitions. For users that are familiar with pervious versions of the software and wish to migrate to the interface slowly, the legacy pulldown menus are also available. To display one or more of the legacy menus, select the desired menu from the Window -> Pulldowns menu.



Electrical Preferences

In the Electrical Preferences dialog box you can configure settings specific to your electrical drawings, such as voltage definitions. All values for these preferences are stored in the current drawing. The electrical templates provided in Autodesk Building Systems include defined electrical preferences. These templates can be customized to meet specific requirements and standards. It is beneficial to start your drawings using an electrical template such as *Aecb Electrical Model (Imperial – CTB).dwt* to help you start designing quickly. Without defined electrical preferences in a drawing, specifically voltage definitions, circuits cannot be created. If an electrical template is not used, voltage definitions must be created manually before circuits can be added to the drawing.

Voltage Definitions



The Voltage Definitions tab in the Electrical Preferences dialog box is used to define the voltage values to be used for different number of pole circuits in the drawing. The voltage definitions included in the electrical templates are the ones most commonly used in commercial construction, but you can easily customize them to meet the needs of your project. The voltage definitions, which are always applied to circuits, include a minimum and maximum value. These valves determine whether a connector on an electrical object can be connected to a circuit with a specified voltage. When you attempt to connect a circuit to a connector on an electrical object, one of the checks (see the Circuit Connection Rules flow chart on page 6) is for voltage. If the voltage on the connector is between the minimum and maximum values specified in the voltage definition assigned to that circuit, then the connection is valid. Only circuits that can make a valid connection (within voltage tolerances and number of poles) to the connector appear in the Circuit drop-down list in the Connector Properties window in the Add Device dialog box.

Tip: Voltage definitions can be effectively disabled by setting them all at a minimum of 0 and a maximum of 1,000. These settings would effectively disable the voltage check rules between connectors and circuits.

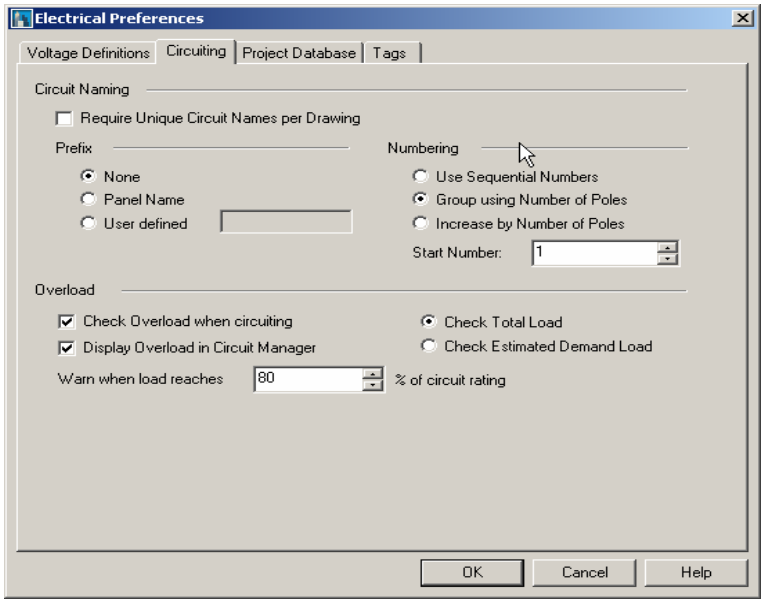
Voltage Definitions and Block Insertion

Voltage definitions work slightly different than other drawing settings when included in a block definition. Typically when one drawing (or block) is inserted into another drawing, settings in the host drawing take precedence over settings in the drawing that is being inserted. However, when one drawing is inserted into another drawing (assuming that both drawings contain voltage definitions), connections between electrical objects and circuits can be broken. Depending on the minimum and maximum settings in both drawings, the voltage definitions could break connection rules in the inserted drawing.

Example: The host drawing has a 120V definition with a minimum of 100 and a maximum of 125. The drawing being inserted has a 120V definition with a minimum of 110 and a maximum of 135. The drawing being inserted has a device with a voltage of 130 connected to a circuit on the 120V definition. If the voltage definitions worked like standard blocks, the device would be disconnected from the circuit when the drawing was inserted. However, when a voltage definition is inserted, the existing definitions are combined and the least strict definitions are used. In this case, the result would be a 120V definition with a minimum of 100V and a maximum of 135V.

Circuiting

The Circuiting tab is used to control the name of circuits created in the drawing. The Circuit Naming options define the naming structure for newly created circuits. If is beneficial to define the circuit naming structure before creating circuits in the drawing. Any existing circuits in the drawing are not automatically updated when the circuit naming options are changed. Therefore, if a circuit is moved to a new panel with a different naming structure, the circuit will need to be renamed manually.



Circuit Naming

Circuit names can be unique per project or per drawing. Requiring unique circuit names per drawing is beneficial for use with data/communications circuits where coordination is required for connections such as telephone extensions where each extension must be unique. In this case, regardless of what panel a circuit exists on, the circuit cannot have the same name as any other circuit in the drawing. When requiring unique circuit names per drawing, circuits are only checked against other circuits in the current drawing. No checking is done to ensure that circuits in the current drawing have unique names compared to other circuits in the project database.

It is also important to note that two circuits on the same panel cannot have the same name, even if they have different voltages, number of poles, systems, system types, and so forth. If a circuit named 1 is copied to a panel that already has a circuit named 1, the newly added circuit is renamed.

Prefix

The prefix value specifies a prefix that is applied to any circuit that is created. Prefixes can be the panel name or a user-defined value, and are separated from the circuit number with a hyphen.

Note: If panel name is selected, the circuit name matches the name of the panel on which the circuit is created, not the panel on which it resides.

Circuit Numbering

You have three options for numbering circuits. Circuits can be created when placing a panel or later using Circuit Manager.

- **Use Sequential Numbers:** When circuits are created, the number of poles that the circuit occupies is ignored. This is most common in switchboards and switchgear, where the breakers are simply numbered 1, 2, 3 and virtually all are three-pole breakers.

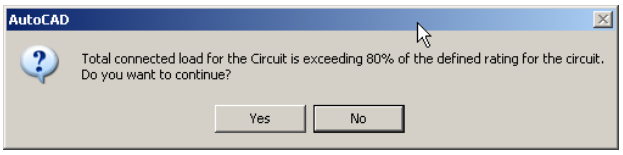
- **Group Using Number of Poles:** This is the method most commonly used in the United States for "branch" panel boards. Panel boards in the United States are numbered 1, 3, 5 and so on down the left side and 2, 4, 6 and so on down the right side. When a multipole breaker is created, it must be created on adjacent circuits within the panel. For example, when creating a two-pole circuit with this option, circuits might be named 7, 9 or 24, 26 so that the spaces that the circuit occupies are adjacent to one another within the panel.
- **Increase by Number of Poles:** This setting is used for most non-ANSI-style branch panelboards. In most countries other than the United States, branch panels are numbered 1, 2, 3, 4 down the left side, and then start at the right side when they get to ½ the number of breakers in the panel. This means that a two-pole breaker might be named 7, 8 or 24, 25.

Start Number

Sometimes facilities have data/communications numbering schemes already in place and they are all four-digit numbers (for example). Using this option, you could start numbering a telephone panelboard at 5000 rather than 1 to indicate phone extensions.

Overload

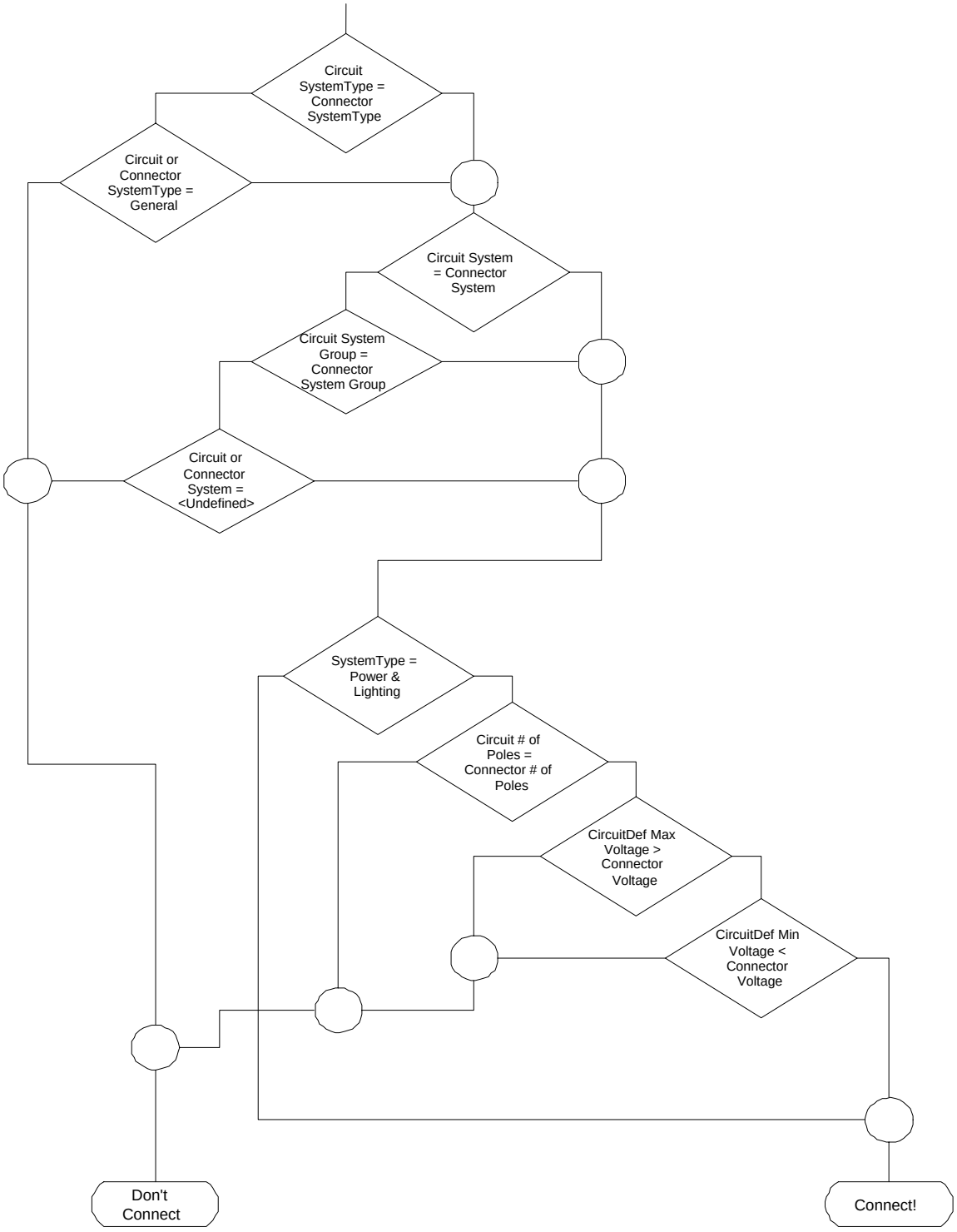
- **Check Overload when Circuiting:** The overload setting determines whether the load of a circuit is checked against the maximum load of a circuit breaker. You can check for overloading when circuiting by adding wiring between devices or when specifying a circuit number when modifying circuits. In either case, if you exceed the maximum load of the circuit breaker, a warning message displays indicating that you have exceeded the maximum load allowance.



- **Display Overload in Circuit Manager:** When checked, overloaded circuits are highlighted in red in Circuit Manager. Even with overload checking turned on, overloads can occur by manually copying existing devices in a drawing. In this case the only way to identify overloaded circuits in Circuit Manager with this option turned on.
- **Check Total Load:** This option determines whether the total load before any demand factors are employed will be used in overload checking.
- **Check Estimated Demand Load:** This option determines whether the adjusted demand load will be used in overload checking.
- **% of Circuit Rating:** The circuit rating setting determines the percentage of the maximum circuit load which will be allowed before warning about overloaded circuit values.

Circuit Connection Rules

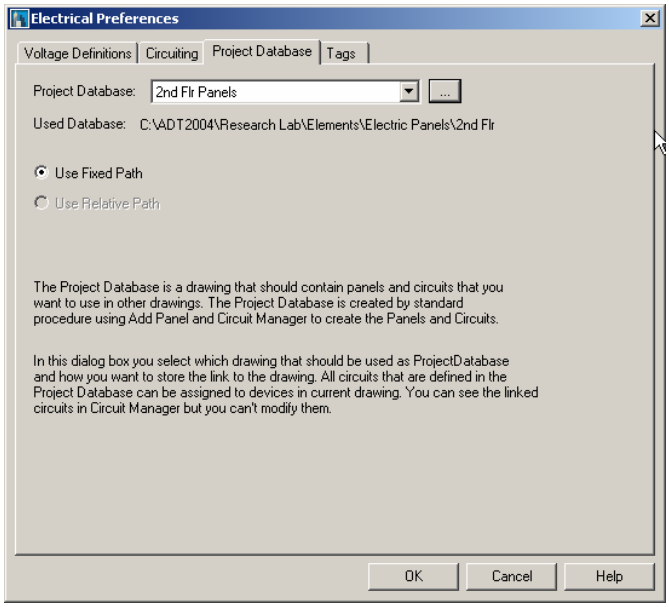
The following flow chart shows how connections are validated.



Project Database

The Project Database allows for circuiting between devices in multiple drawings. Circuits are created and stored in the same drawing as the panel to which they are attached. Normally, devices are connected only to circuits in the same drawing; however, you can connect a device from your current drawing to a circuit in another drawing. You accomplish this by referencing a project database.

The Project Database is a common drawing, shared between multiple drawings that contains panels and circuits. The project database drawing is created using the Add Panel dialog box to add panels to the drawing and Circuit Manager to create the associated circuits. Any electrical drawings that contain circuits or panels can be used as the project database in another drawing. All circuits defined in the project database are displayed in Circuit Manager, and can be assigned to devices in your current drawing.



Before using a project database for your circuits, consider the following pros and cons. A project database provides much needed functionality when you need to have circuits spanning multiple drawings but makes editing circuit data more difficult.

Pros:

- Provides a means for circuits spanning multiple floors and/or drawings

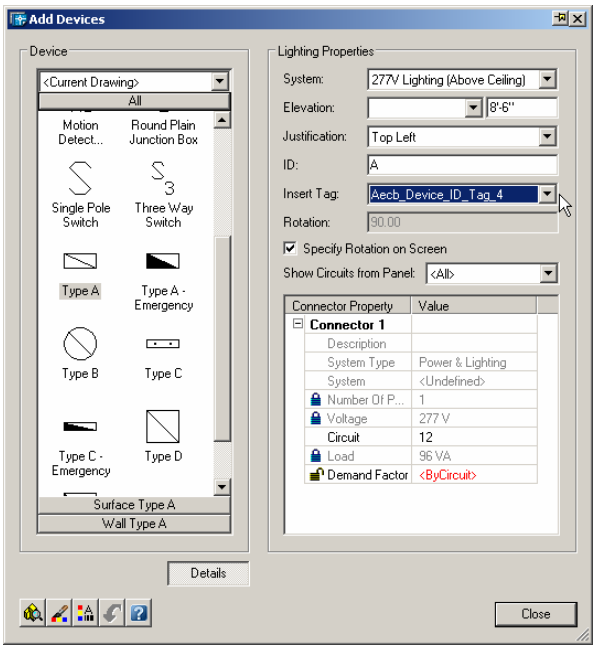
Cons:

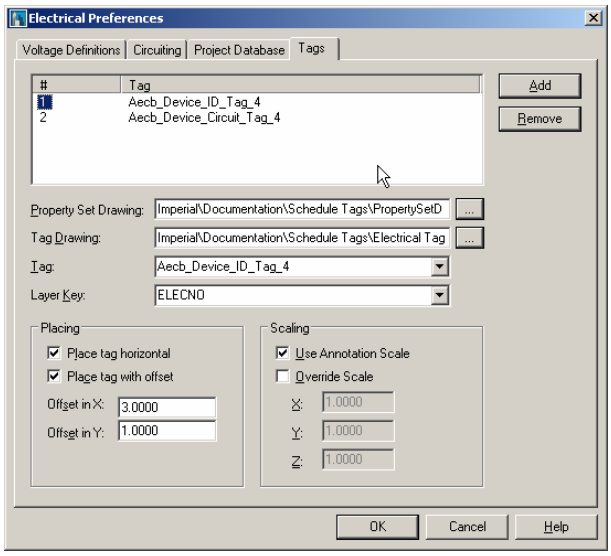
- Need to edit the circuit description in the project database drawing instead of the drawing where the circuit resides
- Number of devices, circuit length, total load and estimated load values are not displayed in Circuit Manager when the circuits are not in the current drawing — however the valves will be extracted and shown when generating panel schedules
- Cannot use the Show Circuited Devices command on circuits not in the current drawing

Tip: Even when using a project database for panels spanning multiple drawings, place local panels in the current drawing to simplify circuit editing. Panels can exist in both the project database and local drawings.

Tags

Tag styles can be defined and tags placed automatically when adding electrical devices to your drawings. For example, the circuit number or light fixture ID can be placed in conjunction with placing the light. Any schedule tag can be used as part of a tag style including custom tags that may be part of your company standards. In addition to the tag definition, you can specify where the tag is located (offset distance from insertion point of device), the property set definitions used by the tag, and the layer that the tag should be inserted on. You can also specify the scale and rotation angle for the tag. You can define multiple tag styles — even combinations using the same schedule tag definition. However, only one tag can be automatically placed when placing the electrical device.





Tip: Different tag styles can be created for different types of devices using the same tag definition but different offset values. For example, you might have different offsets for a 2x2 light than you would a 2x4 light so that the tag would always default to the upper corner of the device.

Circuit Object

The circuit object provides a logical connection between connectors and panels. The circuit object enables you to

- Create three-phase circuits and dynamically document them in the construction documents
- Provide a logical connection of objects in the model to panels without requiring you to add wiring to the model
- Create panel schedules that include three-phase loads like motors and other equipment common to commercial and industrial buildings

System Types

There are there basic types of circuit objects each controlled by their system type. The system types for circuits are Power & Lighting, Other, and General. The system type can be set when the circuit is created and can be saved as part of a device's style definition. If the system type of a circuit is set when the circuit is created, it cannot be changed. To change the system type, the old circuit must be deleted and a new one created.

- **Power & Lighting** system type is the most complex however it offers the most functionality. It is used for items that require power connections to work, such as receptacles, lighting fixtures, motors, mechanical equipment, and so forth. Any circuit that tracks loads on the electrical distribution system would normally have its system type set to Power & Lighting.
- **Other** system type is normally used for any circuit that doesn't track loads on the power system, such as fire alarm devices, data and telephone devices, security components, CCTV, sound and multimedia equipment. The Other system type is a catchall for the other types of systems used in electrical design.
- **General** system type is used for items that need to be connected to other systems but don't necessarily affect the systems. The General system type is not intended to be used as a system type on a circuit, but it is allowed. General circuits can connect to either Power & Lighting connectors or to Other connectors, a property that makes them unique.

The connectors on a device also have a system type associated with them, and the same three selections. Items like junction boxes and switches are by default on the General system type, because they may need to be connected to items with either the Power & Lighting or Other system type. Items from the Power & Lighting system type cannot connect to items from the Other system type.

As you use the application, you may notice that both connectors and circuits have systems associated with them as well as system types. The systems available for the system property in both circuits and connectors are all of the electrical systems in the drawing that are of the same system type as the connector or circuit. The system on a device and the system on the connectors on a device do not have to match. The system on the device is used for controlling the layer of the device. The system on the connector (and circuit) is used to control the interconnection of the circuits and connectors. Systems on both circuits and connectors can be set to <Undefined>. The <Undefined> setting allows the connector or circuit to be connected to any other connector or circuit (of the same system type, and if other connector rules are satisfied).

Circuit Property	Power & Lighting	General	Other
Name	•	•	•
Description	•	•	•
System[2]	•	•	•
Panel	•	•	•
Number of Devices[1]	•	•	•
Circuit Length[1]	•	•	•
Rating	•		
Number of Poles[2]	•		
Voltage[2]	•		
Total Load[1]	•		
Demand Factor	•		
Estimated Demand Load[1]	•		

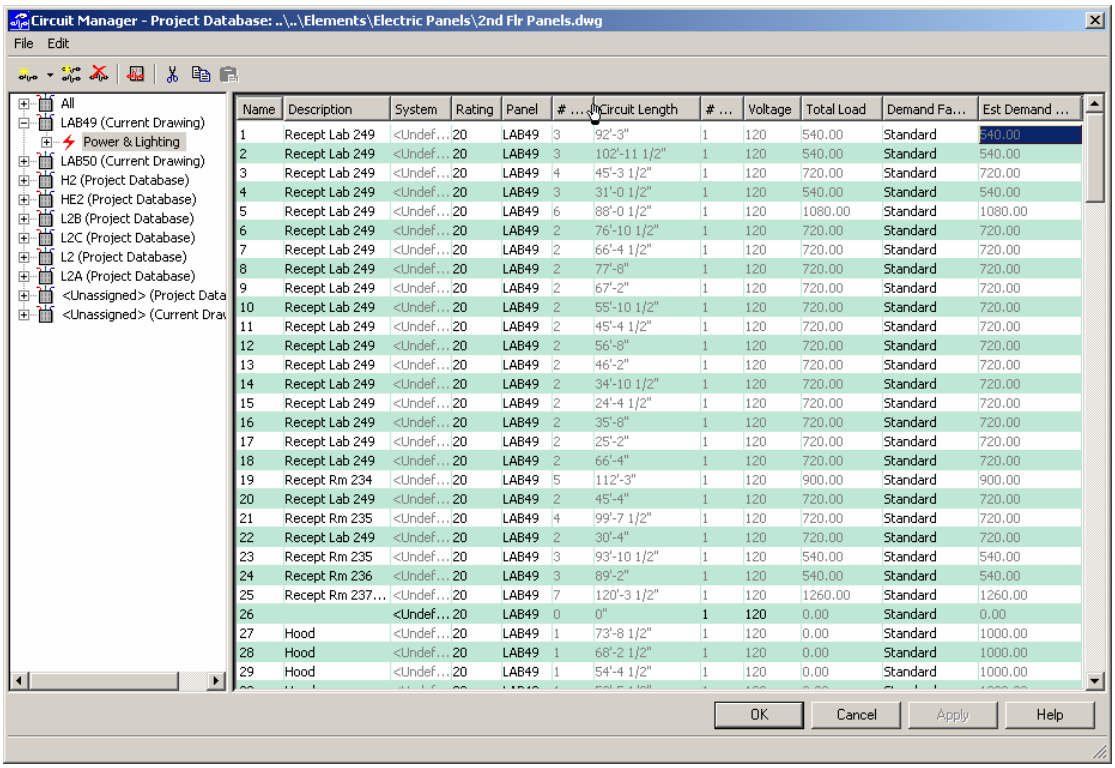
[1] Indicates a read-only property
[2] Indicates a property that is "locked" when devices are connected to the circuit

Tip: Specifying systems on circuits and connectors can make it difficult for someone who doesn't understand electrical concepts to find circuits that connect with connectors. For simple electrical drawings use the <Undefined> system setting.

Tip: Specifying either the circuit's or the connector's system as <Undefined> disables any system check between the circuit and connector (not system type, but system).

Circuit Manager

Circuit Manager's primary function is to provide a method to "see" circuits in a logical view. The Circuit Manager interface includes two panes. The left pane organizes the panels and circuits in a tree structure (similar to Microsoft® Windows® Explorer). The tree structure includes All (which displays all circuits in the drawing and/or project database), the name of each panel (either in the current drawing or defined in the project database), as well as Unassigned (which shows circuits that are not assigned to a panel). Under each panel is the possibility to have three system types (as described earlier). Under each of the system types are the circuits belonging to that system type.



The right pane of Circuit Manager provides detailed information about each circuit. The columns displayed in the right pane vary, depending on what is highlighted in the left pane. Each column represents a specific circuit property (see the circuit property chart on page 8). If a panel is highlighted, you only see the "common" columns. If a system type or a circuit is highlighted, you see the columns applicable to that system type. Circuit Manager enables you to re-sort circuits by simply clicking a column header. Clicking the column header again reverses the sort for that column.

The data that is shown in the right pane varies depending on whether or not the panel and circuit highlighted are in the current drawing or the project database. If the circuit is defined in the current drawing, then data such as the Number of devices on the circuit, the circuit length, total load and estimated load are shown. Circuits are not shown from drawings being

xref'd into the current drawing unless that drawing is specified as the project database. If the circuit is defined in the project database or is part of an external reference drawing, then the data values are listed as 0. However, these values are extracted and displayed when generating panel schedules.

Circuit Manager also enables you to use standard Windows® selection methods to select multiple circuits in the right pane. Holding down the Ctrl key while clicking enables you to select more than one circuit when they are not next to one another. Holding down the Shift key while clicking enables you to select all the circuits between your first and second selections. Circuits can be moved from panel to panel in a number of ways, such as cut-and-paste methods, drag-and-drop, and modifying the panel property of the circuit. Entire system types cannot be moved from one panel to another (all circuits within the system type can be moved, but the system type itself cannot). You can use the Delete key to delete circuits. If the circuits have devices connected to them, you are warned before the circuits are deleted.

You can create circuits one at a time with the Create New Circuit button, or in groups using the Create Multiple Circuits button. Using the Create Multiple Circuits button, you can specify the system type, system, number of poles, voltage, and so forth, and create more than one circuit at a time.

Tip: The Circuit Manager monitors the circuits that you create and tries to match the values for the next circuit you create. If you create a circuit and then set its voltage to 480 and number of poles to 3, the next circuit you create will have those values by default.

Tip: When creating multiple circuits, the circuits are created in the following order: first 3 pole circuits, then 2 pole circuits and finally single pole circuits. If you want the 2 or 3 pole circuits in the middle or at the end of the panel, you should create the circuits in the order in which you want them in the panel. For example, create 20 single pole circuits and then create your 2 or 3 pole circuits.

Show Circuited Devices

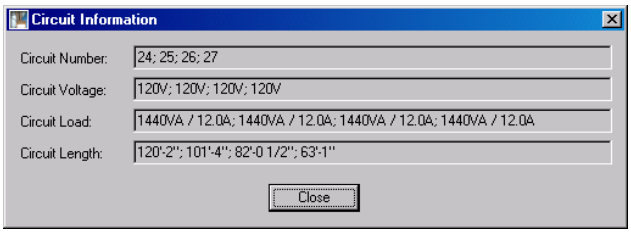
The Show Circuited Devices button in Circuit Manager is useful for locating devices in the drawing. Often, changes need to be made to a circuit, but a specific property cannot be changed because the circuit has a device connected to it. It may be hard to find the device connected to that circuit. The Show Circuited Devices button highlights the devices connected to the selected circuit in the drawing, zooms in on the portion of the drawing containing those devices and includes the devices in the AutoCAD® previous selection set. After showing the devices and exiting Circuit Manager, you can use the Device Modify command, using the AutoCAD Previous selection set, and then modify the device's circuit or load.

Tip: This command is also available as a stand alone command by typing "showcircuits" at the command line or by right clicking on a device or wire and selecting the Show Circuited Objects command on the shortcut menu.

Tip: Show Circuited Devices sets the previous selection set to all the devices highlighted during the Showcircuits command. If the command highlights devices for more than one circuit, then devices from all circuits are selected. If you select a panel, then the devices from each circuit in turn will be highlighted.

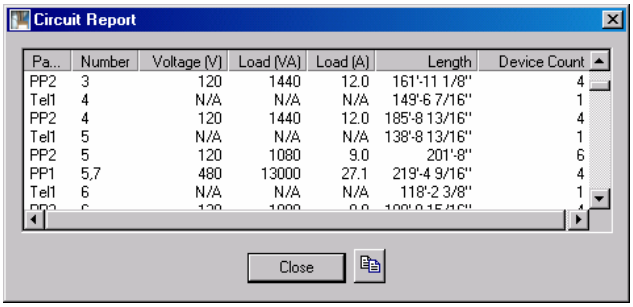
Circuit Info

The Circuit Info command has been enhanced to handle the new circuit objects. Depending on what you select, the results of running this command may be different. If you select a device with circuit info, you get information about all the circuits on all the connectors on that device. (The connector system types need not match. If voltage and load don't exist for the circuit type, then N/A is shown in the dialog box.) If you select a wire, then you get information on all the circuits that are part of the graph that the wire is attached to.



Circuit Report

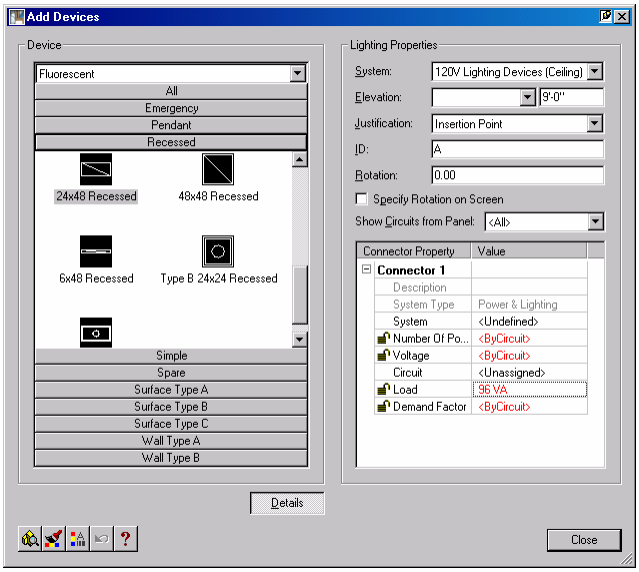
The Circuit Report command uses the same selection logic as Circuit Info. This command is available by typing "circuitreport" at the command line or by right clicking on a device or wire and selecting the Circuit Report command on the shortcut menu. If you select a device, you get information about all connectors on that device. If you select a wire, you get information about all the circuits that the wire includes. If you want to generate a report for all or a large selection of devices in a drawing, use the command line version of the command and then build your selection set accordingly. The command will filter our items that are not devices or wires.



The primary difference in the Circuit Info selection method and the Circuit Report selection method is that Circuit Report enables you to select more than one object on which to operate. A second important difference is that Circuit Report enables you to copy the data shown to the Windows® clipboard. After this data has been copied to the clipboard, you can paste it into standard Microsoft® Office applications, such as Excel or Word.

Devices

Devices include electrical connectors and are the primary graphical object used in electrical drawings. There are also additional 3D blocks for many of the devices making them useful for interior elevations and/or interference detection with other Autodesk Building Systems objects like ducts and pipes. Connectors have be enhanced and have changed how the system that the device is placed on works. In previous releases, the wiring used to connect the device had to be on the same system as the device itself. Because layering is controlled by the system, the device had to be on the same layer as the wiring, contrary to the usual practice of putting devices and wiring on different



layers. In this release the system of the device itself has nothing to do with its connection within the electrical system. The device can be on any system, and the connector on the device can be on the system needed to make the connection.

Tip: Devices can now read the elevation of object snaps. This means that if you are laying out lighting fixtures and using the node object snap on a reflected ceiling, the height of the fixture is automatically set to the height of the ceiling. If you snap to something at an elevation of 0, then the elevation is set to whatever elevation is preset in the Device Add dialog. This enables you to easily snap to various ceiling heights.

Tip: Devices and device categories can be preselected when accessing the Add Devices dialog box via a command tool. Autodesk Building Systems includes tools that filter down to various categories in the Electrical Palette. However, you can also filter down to an individual device by entering code similar to that shown below in a command tool on a tool palette.

Example: To create a "one button" device insertion for a duplex receptacle, you can enter the following code.

(command "_AecbDeviceAdd" "_LI" "Receptacles" "_ST" "Duplex Receptacle")

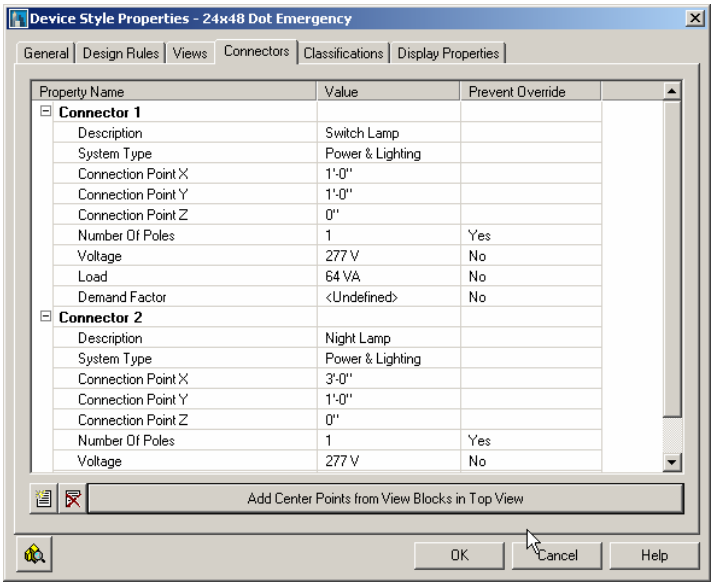
"Receptacles" is the name of the device library and "Duplex Receptacle" is the name of the device style in that library. The following properties can be specified during placement:

[SYstem/Elevation/LIbrary/STyle/Justification/Id/Panel/Connectors/Wire/Tag/Match]

The order of the settings is not important. However, the syntax must include the capitalized property in quotes followed by the desired value in quotes.

Device Styles

The number and type of the electrical connectors on a device are specified in the Device Style Properties dialog box. On the Connectors tab, connectors can be modified or added to the device definition. The connectors on devices do not have to be of the same system type. Devices can support many different connectors with different system types. Multiple connectors can be defined on the same device. Common items that require more than one connector type are transfer switches, starters, control panels, and so forth. These types of items include both power connections as well as data or communications connections.



When a Power & Lighting system type is selected for the connector, some additional functionality is introduced that is not available with the other system types. You can "lock," or prevent the override of, certain properties of the connector. By using this, you ensure that every instance of a specific type of device has the same properties. Light fixture type A, for example, can be configured to always have the same voltage, load, demand factor, and number of poles. These values can also be preset in the device style without being locked. Anytime a value is set in the style that value is automatically set in the Device Add dialog box when the device is selected.

Connector Property	Power & Lighting	General	Other
Description	•	•	•
System[2]	•	•	•
Number of Poles[1,2]	•		
Voltage[1,2]	•		
Circuit	•	•	•
Load[1]	•		
Demand Factor[1]	•		

[1]Indicates a lockable (prevent override) property
[2]Indicates a property that is locked when connected

Tip: Presets can be used in the external content files where the device definitions are stored for insertion into the drawing. This presets the values in the Device Add dialog box if there are no devices of that type already in the drawing.

Tip: Any style definition in the current drawing will override the style definition in the external content. The only way to override the style definition in the current drawing is to copy the styles in Style Manager and use the Overwrite Existing option.

Tip: Only the circuit assigned to the first connector is shown when tagging a device with a circuit number tag.

Voltage Definitions and Connector Filtering

Connector filtering, for Power & Lighting system type connectors, depends on the values specified on the Voltage Definitions tab in the Electrical Preferences dialog box. The connector properties for Power & Lighting are dependent on the values specified here.

Number of Poles

The values for number of poles in the Connector Properties is a static list and is the same as the values in Voltage Definitions. You cannot create or delete number of poles values. The values available on the Number of Poles Connector drop-down list are always <ByCircuit>, 1, 2, and 3. If you select <ByCircuit>, all the circuits, regardless of the number of poles setting for the circuit, are shown (assuming that they meet other criteria). No filtering is done based on the number of poles of a circuit when the connector property is set to <ByCircuit>. The number of poles on a connector can be set even if a drawing has no voltage definitions.

Voltage

On the Voltage drop-down list, you can select from a list or simply enter a value in the box. If <ByCircuit> is selected in Number of Poles, then all the voltage definitions in the drawing are included in the drop-down list. If a specific Number of Poles setting is selected, the values in the Voltage drop-down list are limited to the voltage definitions specified for that Number of Poles setting in the Electrical Preferences dialog box. With Voltage Definitions of 208, 240, and 480, and a Number of Poles setting of 2, the voltages in the Voltage drop-down list would be <ByCircuit> (always available), 208, 240, and 480. Any text typed into the Voltage drop-down list resolves to <ByCircuit>. No filtering is done based on the voltage definition of a circuit when the connector property is set to <ByCircuit>.

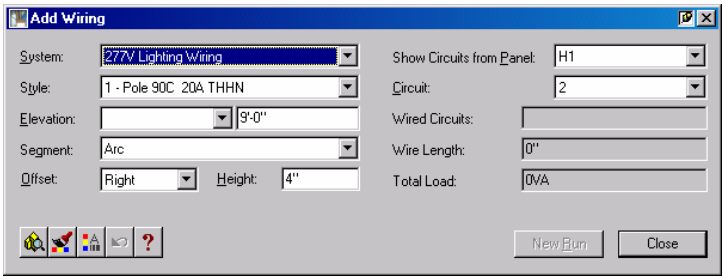
Panel

Panel is not truly a connector property. The Panel drop-down list is, however, a filter. The values available in the Panel drop-down list (in the Device Add, Device Modify, and Device Properties dialog box) are <Unassigned>, <All>, and any panel in the drawing or project database. <Unassigned> shows only the circuits that are not assigned to any panel. <All> shows all the circuits in the drawing, regardless of what panel they are on. Any panel name shows circuits that are currently connected to that panel. If devicemodify or deviceproperties is run on an existing device that has a circuit specified, the panel on which that circuit resides is automatically set in the drop-down list. However, if no circuit is specified the last value selected in Panel is the default.

Tip: On devices that contain multiple connectors, the panel drop-down list will display the panel assigned to connector 1. Additional connectors can be assigned to the same panel or to a different panel.

> **Example:** On an emergency light, you can set connector 1 to panel LP1, circuit 1 and connector 2 to panel EM1 circuit 8. Remember that the panel drop-down list just filters the circuit numbers available based on the number of poles and voltage and therefore won't always match the panel of the selected circuit.

Wiring



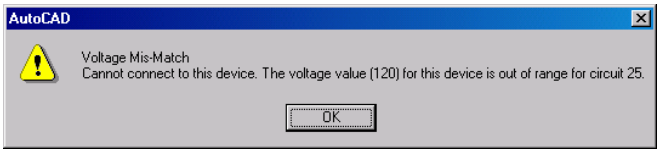
Wiring functionality is similar to that in previous releases, with several improvements to allow it to work with the new circuit object. You can now use wiring to apply circuit values to devices that are currently set to <Unassigned>. Wiring cannot reset the circuit value of a device that has any setting other than <Unassigned>. Any connector that has a circuit property other than <Unassigned> becomes one of the wired circuits for the wiring run. Wiring can use the number of circuits connected to the graph, any group of objects connected by wires, to determine the number of home run arrows shown by the home run (assuming that home runs show). The circuit name property of wires has also been enhanced to include all the circuits listed in the wired circuits value. You cannot revise a wired circuit directly after the circuit has been placed in the drawing. Once the wiring has been placed in the drawing, the only way to modify the wired circuits property is by modifying the devices to which the wiring is connected.

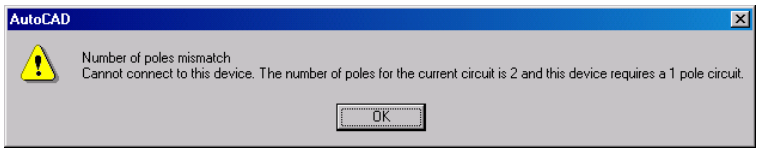
Tip: When drawing wiring the building systems object snaps work better if you turn off the ecur (electrical curve) object snap and leave on the econ (electrical connector) object snap. Turn off all the AutoCAD object snaps as well, to avoid interferences with the econ object snaps.

Filtering

Wiring is filtered in a way that is similar to the filtering in the connector properties lists. The system set in the Wire Add dialog box filters the circuits available in the Circuit drop-down list. The wiring system and the system on the circuit must be in the same system group for the circuits to be available in the Wire Add dialog box (or the circuit can have a system of <Undefined>). The Add Wire dialog box does not filter based on number of poles or voltage. However, when you attempt to make a connection between wiring and devices (actually, a connection between circuits and connectors), the Number of Poles and Voltage settings are checked by the Add Wire dialog box before the connection is allowed.

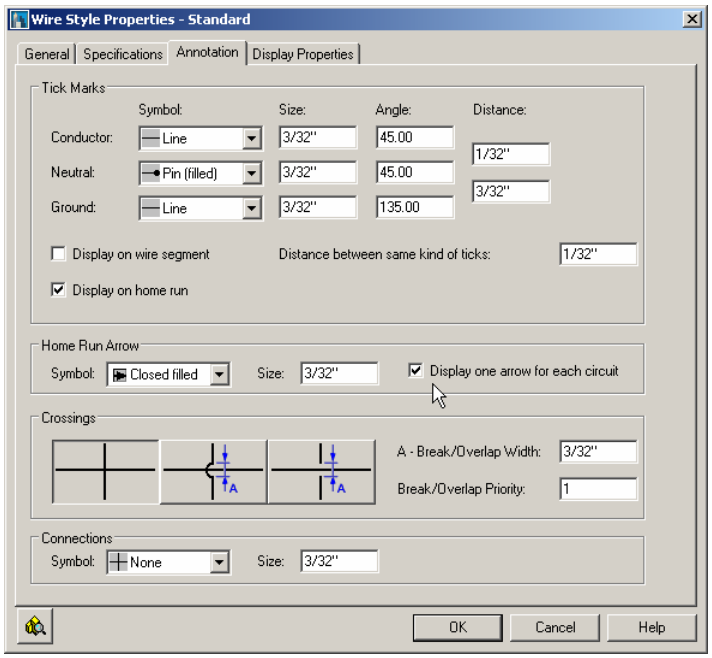
If the connection does not meet the connection rules, a message box explains the reason for the failure. In addition to number of poles and voltage, the Add Wire dialog box also verifies that the system type of the connector matches the system type of the circuit. If the system types don't match, the connection is refused.





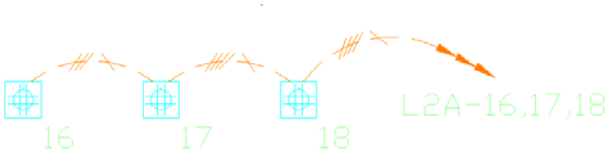
Multicircuit Home Runs

Multicircuit home runs are circuits whose wiring is combined into a single conduit for the connection back at the panelboard. The wiring can be combined in a number of ways. Sometimes the different circuits are allowed to share common conductors (the neutral and ground). At other times separate grounds and neutrals are required to be run for each circuit. When this type of wiring is used, the home run includes an arrow for each circuit used in the wiring run, and the home run tag shows the panel and each of the circuits in the wiring run. Home run arrow appearance is defined in Wire Styles. If no home run arrow is specified (for the custom and standard wire styles in the template) you will not see any home run arrows on the home run, regardless of how many circuits are included in the wiring run.



Wire annotation is now more customizable than ever. You have control over type display (lines, symbols or custom blocks) of wire tick marks, whether or not tick marks should be placed on wire segments, home runs or both and whether or not you want to include a separate arrow head for each circuit in the homerun.

The figure shows wiring for three floor receptacles connected to three separate circuits, with a shared neutral and ground. The receptacles are on panel L2A, circuits 16, 17, and 18.

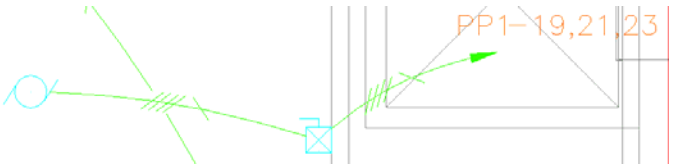


Tip: Electrical connectors work partially through xrefs. The econ Building Systems object snap can be found through an xref, but since there is no actual connection through the xref, the connector properties are not transferred to the wire, and no check for a connection is made.

Tip: Multicircuit homeruns can only be shown on devices if wiring is used to connect the various devices on each circuit to the device with the homerun. If the wiring is deleted after the creation of the homerun, the homerun will default back to a single circuit homerun. The wiring could be placed on a non-plotting layer if the wiring is not desired in the construction drawings.

Multipole Circuits

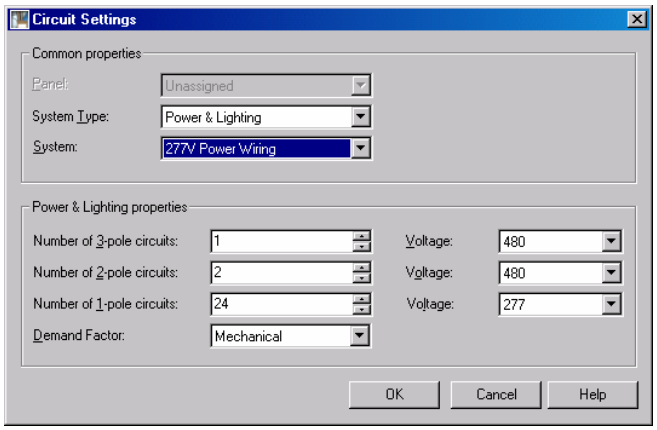
The appearance of a multicircuit (multiple 1 pole circuits) home run is similar to that of a home run for a multipole (2 or 3 pole) circuit. The primary difference in a multicircuit home run and a single home run for a multipole circuit is the number of home run arrows on the home run. A multicircuit homerun including 3 circuits would have 3 arrows whereas a 3 pole homerun would have 1 arrow.



Multipole Circuit Home Run

Panels

Panels are similar to devices but do not have connectors. Panels are the only type of object to which a circuit can belong. The Panel Add dialog box now includes a couple of new items having to do with the circuit object. One is a check box for adding circuits as panels are added, and the other is a command button that opens the Circuit Settings dialog box. The Circuit Settings dialog box enables you to specify the values for any circuits that are created when the panel is inserted into the drawing.



Note: The panel has to be inserted before the circuits are created for that panel. Much like devices, the system of the panel does not have to match the system of the circuits on the panel.

Tip: Panels are set up as branch lighting and appliance panelboards, but their use is not limited to that. You can also use panels as switchboards and switchgear, which allow circuits for major feeders.

Tip: Larger panels could be created quickly by using the model blocks from the switchboard and switchgear MvParts.

Single Phase/Three Phase

Panels can be specified as single phase or three phase. If a panel is specified as being single phase, three-phase circuits cannot be created on that panel. Two-pole circuits are single phase, so it is possible to create a two-pole circuit on a single-phase panel.

Tip: There is no logic to keep a three-phase circuit from being on a panel, just logic to keep it from being created there.

Panel Schedules

Panel schedules in Autodesk Building Systems are created with a VBA routine. The panel schedule has been updated to use the new circuit object but has also been modified to use attributes rather than text in the blocks. The schedule supports three-phase loads (and circuits). Autodesk® Architectural Desktop schedules do not allow the formatting options needed to create a traditional electrical panel schedule. There are virtually no two firms that use the same panel schedule. All are slightly (or vastly) different. That is the reason that the panel schedule is written in VBA rather than a "hard-wired" C routine. Panels schedules have also been enhanced to read the values from the existing panel schedule block rather than erasing and re-creating the block every time. When the panel schedule routine is started, the "non-model" items (volts/phase/wire, panel size and type, main size and type, cabinet, etc) are read from the existing panel schedule and the Panel Schedule dialog box is repopulated with those values. Additional calculation blocks have been added at the bottom and to the right of the actual schedule. These are separate blocks that can be erased or turned off without affecting the panel schedule itself.

Electrical PP2 Schedule

VOLTS/PHASE/WIRE	PANEL SIZE & TYPE	MAIN SIZE & TYPE	CABINET	MIN SCC	FED FROM	NOTES
120-208/3/4	NQOD	100 MCB	SURFACE	22K	XFMR	

CIRCUIT NO.	TRIP AMPS	NO. POLES	AREA SERVED	PHASE LOAD VA A	PHASE LOAD VA B	PHASE LOAD VA C	AREA SERVED	NO. POLES	TRIP AMPS	CIRCUIT NO
1	20	1	RECEP - FOYER	1260						
				1440			RECEPT - WORK 102	1	20	2
3	20	1	RECEPT - WORK 102		1440					
					1440		RECEPT - WORK 102	1	20	4
5	20	1	RECEPT - WORK 102			1080				
						1080	RECEPT - MECH 107	1	20	6
7	20	1	RECEPT - WORK 104	1080						
				1440			RECEPT - OFFICE WEST	1	20	8
9	20	1	RECEPT - OFFICE WEST		1260					
					1440		RECEPT - WORK 104	1	20	10
11	20	1	RECEPT - WORK 104			1440				
						1440	RECEPT - WORK 104	1	20	12
13	20	1	RECEPT - WORK 104	1440						
				1080			RECEPT - WORK 104	1	20	14
15	20	1	RECEPT - WORK 118		1440					
					1440		RECEPT - WORK 118	1	20	16
17	20	1	RECEPT - WORK 118			1260				
						720	RECEPT - CORE	1	20	18
19	20	1	RECEPT - CONFERENCE	1080						
				1620			RECEPT - WORK 102	1	20	20
21	20	1	RECEPT - EAST OFFICES		1440					
					1080		RECEPT - EAST OFFICES	1	20	22
23	20	1	RECEPT - EAST OFFICES			1080				
						1440	RECEPT - WORK 102	1	20	24
25	20	1	RECEPT - WORK 102	1440						
				1440			RECEPT - WORK 102	1	20	26
27	20	1	RECEPT - WORK 102		1440					
					900		RECEPTACLES - CORE	1	20	28
29	20	1				0				
						0		1	20	30
31	20	1		0						
				0				1	20	32
33	20	1			0					
					0			1	20	34
35	20	1				0				
						0		1	20	36
37	20	1		0						
				0				1	20	38
39	20	1			0					
					0			1	20	40
41	20	1				0				
						0		1	20	42
			CONNECTED LOAD	13320	13320	9540	= 36180			

CONN. LOAD VA	CONN. LOAD AMPS	DEMAND FACTOR	EST. LOAD. VA	EST. LOAD. AMPS
1260	10.5	100%	1260	10.5
1440	12.0	100%	1440	12.0
1440	12.0	100%	1440	12.0
1440	12.0	100%	1440	12.0
1080	9.0	100%	1080	9.0
1080	9.0	100%	1080	9.0
1080	9.0	100%	1080	9.0
1440	12.0	100%	1440	12.0
1260	10.5	100%	1260	10.5
1440	12.0	50%	720	6.0
1440	12.0	50%	720	6.0
1440	12.0	50%	720	6.0
1440	12.0	50%	720	6.0
1080	9.0	50%	540	4.5
1440	12.0	50%	720	6.0
1440	12.0	50%	720	6.0
1260	10.5	50%	630	5.3
720	6.0	50%	360	3.0
1080	9.0	50%	540	4.5
1620	13.5	50%	810	6.8
1440	12.0	50%	720	6.0
1080	9.0	50%	540	4.5
1080	9.0	50%	540	4.5
1440	12.0	50%	720	6.0
1440	12.0	50%	720	6.0
1440	12.0	50%	720	6.0
1440	12.0	50%	720	6.0
900	7.5	100%	900	7.5
0	0.0	0.0	0	0.0
0	0.0	0.0	0	0.0
0	0.0	0.0	0	0.0
0	0.0	0.0	0	0.0
0	0.0	0.0	0	0.0
0	0.0	0.0	0	0.0
0	0.0	0.0	0	0.0
0	0.0	0.0	0	0.0
0	0.0	0.0	0	0.0
0	0.0	0.0	0	0.0
0	0.0	0.0	0	0.0
0	0.0	0.0	0	0.0
0	0.0	0.0	0	0.0
0	0.0	0.0	0	0.0
36180	301.5	67%	24300	202.5

LOAD CATEGORY	CONNECTED LOAD VA	DEMAND FACTOR	ESTIMATED LOAD VA
Recept - 1st 10kVA	11520	100%	11520
Recept - Above 10kVA	23760	50%	11880
TOTAL			

Panel schedules have been updated to read circuit data from xref'd drawings. Circuit loads are totaled from each drawing yielding the correct loads for a circuit even if a circuit is split amongst several drawings.

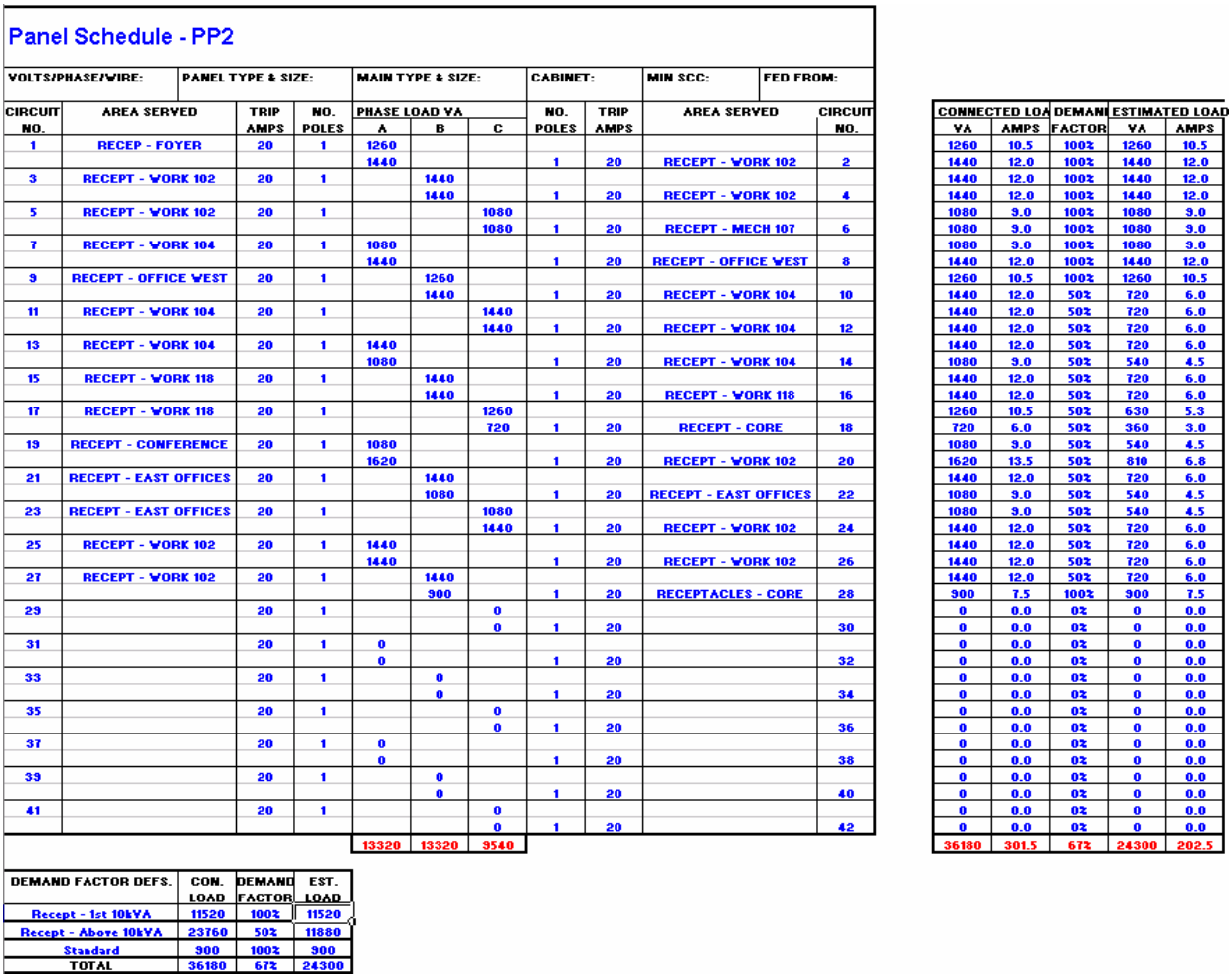
Tip: Panel schedules can be created from externally referenced drawings. To create a sheet of panel schedules for your project, simply xref each lighting or power sheet into the panel schedule drawing. The VBA program will read the data from each drawing, combining device loads from devices on different sheets but the same circuits.

Tip: Don't erase the existing panel schedule before updating it. The routine uses the values in the panel schedule block to repopulate the header information and matches the scale and location of the existing schedule.

Tip: To create main distribution panel schedules, place a temporary placeholder device next to each branch panel schedule assigning the total calculated load from the branch panel and the required circuit numbers from the main panel to that device. The distribution panel can be built from these temporary devices. Before updating the distribution panel, be certain to update each branch panel and verify that the loads match.

Excel Schedules

The panel schedules in Microsoft® Excel are also created with a VBA routine. You can customize this schedule by simply moving the cells in the template. All of the “base” cells are named. When any of these cells are moved, the VBA routine simply copies them “down” the sheet in the current horizontal location.



Panel Schedule - PP2

VOLTS/PHASE/WIRE:	PANEL TYPE & SIZE:	MAIN TYPE & SIZE:	CABINET:	MIN SCC:	FED FROM:

CIRCUIT NO.	AREA SERVED	TRIP AMPS	NO. POLES	PHASE LOAD VA A	PHASE LOAD VA B	PHASE LOAD VA C	NO. POLES	TRIP AMPS	AREA SERVED	CIRCUIT NO.
1	RECEP - FOYER	20	1	1260						
				1440			1	20	RECEPT - WORK 102	2
3	RECEPT - WORK 102	20	1		1440					
					1440		1	20	RECEPT - WORK 102	4
5	RECEPT - WORK 102	20	1			1080				
						1080	1	20	RECEPT - MECH 107	6
7	RECEPT - WORK 104	20	1	1080						
				1440			1	20	RECEPT - OFFICE WEST	8
9	RECEPT - OFFICE WEST	20	1		1260					
					1440		1	20	RECEPT - WORK 104	10
11	RECEPT - WORK 104	20	1			1440				
						1440	1	20	RECEPT - WORK 104	12
13	RECEPT - WORK 104	20	1	1440						
				1080			1	20	RECEPT - WORK 104	14
15	RECEPT - WORK 118	20	1		1440					
					1440		1	20	RECEPT - WORK 118	16
17	RECEPT - WORK 118	20	1			1260				
						720	1	20	RECEPT - CORE	18
19	RECEPT - CONFERENCE	20	1	1080						
				1620			1	20	RECEPT - WORK 102	20
21	RECEPT - EAST OFFICES	20	1		1440					
					1080		1	20	RECEPT - EAST OFFICES	22
23	RECEPT - EAST OFFICES	20	1			1080				
						1440	1	20	RECEPT - WORK 102	24
25	RECEPT - WORK 102	20	1	1440						
				1440			1	20	RECEPT - WORK 102	26
27	RECEPT - WORK 102	20	1		1440					
					900		1	20	RECEPTACLES - CORE	28
29		20	1			0				
						0	1	20		30
31		20	1	0						
				0			1	20		32
33		20	1		0					
					0		1	20		34
35		20	1			0				
						0	1	20		36
37		20	1	0						
				0			1	20		38
39		20	1		0					
					0		1	20		40
41		20	1			0				
						0	1	20		42
				13320	13320	9540				

CONNECTED LOA VA	DEMANI AMPS	ESTIMATED LOAD FACTOR	ESTIMATED LOAD VA	ESTIMATED LOAD AMPS
1260	10.5	100%	1260	10.5
1440	12.0	100%	1440	12.0
1440	12.0	100%	1440	12.0
1440	12.0	100%	1440	12.0
1080	9.0	100%	1080	9.0
1080	9.0	100%	1080	9.0
1080	9.0	100%	1080	9.0
1440	12.0	100%	1440	12.0
1260	10.5	100%	1260	10.5
1440	12.0	50%	720	6.0
1440	12.0	50%	720	6.0
1440	12.0	50%	720	6.0
1440	12.0	50%	720	6.0
1080	9.0	50%	540	4.5
1440	12.0	50%	720	6.0
1440	12.0	50%	720	6.0
1260	10.5	50%	630	5.3
720	6.0	50%	360	3.0
1080	9.0	50%	540	4.5
1620	13.5	50%	810	6.8
1440	12.0	50%	720	6.0
1080	9.0	50%	540	4.5
1080	9.0	50%	540	4.5
1440	12.0	50%	720	6.0
1440	12.0	50%	720	6.0
1440	12.0	50%	720	6.0
1440	12.0	50%	720	6.0
900	7.5	100%	900	7.5
0	0.0	0%	0	0.0
0	0.0	0%	0	0.0
0	0.0	0%	0	0.0
0	0.0	0%	0	0.0
0	0.0	0%	0	0.0
0	0.0	0%	0	0.0
0	0.0	0%	0	0.0
0	0.0	0%	0	0.0
0	0.0	0%	0	0.0
0	0.0	0%	0	0.0
0	0.0	0%	0	0.0
0	0.0	0%	0	0.0
36180	301.5	67%	24300	202.5

DEMAND FACTOR DEFS.	CON. LOAD	DEMAND FACTOR	EST. LOAD
Recept - 1st 10kVA	11520	100%	11520
Recept - Above 10kVA	23760	50%	11880
Standard	900	100%	900
TOTAL	36180	67%	24300

Tip: Only use the Excel form of the panel schedule if the desired end result is an Excel sheet. If the Excel sheet is going to be inserted back into AutoCAD, then use the version of the panel schedule program that is available directly inside of Autodesk Building Systems.

Tip: The default location for the Excel template is *C:\Documents and Settings\All Users\Application Data\Autodesk\Autodesk Building Systems\R16.0\enu\Aecb Content 4\Electrical\Panels\Branch Circuit Panel Schedule.xlt*.

autodesk

Autodesk, Inc.
111 McInnis Parkway
San Rafael, CA 94903
USA