

MFG227293

Electromechanical Avengers: How AutoCAD Electrical, Inventor, and Vault All Team Up

Tiffany Bachmeier
Autodesk

Matthew Durst
Autodesk

Thomas Fitzgerald
Autodesk

Learning Objectives

- Understand the Electro-Mechanical link (EMX) file
- Discover key tips to the electro-mechanical workflow within AutoCAD Electrical
- Discover key tips about the electro-mechanical workflow within Inventor
- Understand how Vault handles the EMX files and workflow

Description

If you've been wondering how to put together a dream team to connect your electrical and mechanical designs and have those connections properly maintained with data management, then this is the class for you. Not only will you learn the electro-mechanical workflow between AutoCAD Electrical software and Inventor software, but you will also learn how that workflow ties into Vault software.

Your AU Experts



Tiffany Bachmeier has been an Autodesk Consultant for more than a decade. She is now leading a team focused on enterprise software management and emerging technologies. In the past, her primary focus has been as a technical consultant/instructor for AutoCAD Electrical, but she also focused on AutoCAD, Inventor, and a variety of other products in the Autodesk family. She is an Autodesk Certified Instructor and she (and team) has won awards for developing a full line of online, live, instructor-led training classes for the Autodesk manufacturing products.

Before becoming a consultant, she earned her bachelor's degree from Michigan State University (MSU) and she worked in many different industries gaining valuable CAD experience, including electrical engineering, interior design/architecture, mechanical engineering, and software engineering, and she was part of MSU's CAD Development Team. She started on AutoCAD R10 and has carried a strong passion for Autodesk products ever since.












Matthew Durst is a Senior Implementation Consultant within the Autodesk Consulting organization. His primary focus is on implementing and supporting Autodesk Vault solutions for customers across many different industries and disciplines. Past projects have included customers within Manufacturing, Architectural, Utilities and Pharmaceutical industries. Matthew's expertise also involves working closely in development and deployment of custom applications for Autodesk Inventor, AutoCAD and Vault. He also places a strong emphasis on detail and organization giving him the ability to ensure deliverables are released on time, to specification, and to the highest possible quality. Matthew is also an Autodesk Certified Instructor with excellent communication and presentation skills. Matthew has served as the technical lead in requirements gathering, planning, deployment and support phases of many projects.



Tom Fitzgerald has been with Autodesk Consulting since 2011, specializing in the Manufacturing industry for over 20 years. His background has been focused on heavy machinery and material handling as well as the Utilities industry. In his role as an Implementation Consultant, Tom advises drafters, designers, engineers and administrators to find solutions to their design software needs while helping them enhance their efficiency and productivity. Tom is an Autodesk® Inventor® Certified Expert, a Data Management Implementation Certified Expert and a Microsoft Certified Systems Administrator, as well as a recognized expert consultant in the Autodesk iLogic community. Most recently, Tom has focused on both Fusion 360 consulting and working with clients developing with the Forge platform for their file viewing needs.

Learning Objective 1: Understand the Electro-Mechanical link (EMX) file

Electrical Project	EMX Project	Inventor Assemblies	Supported
1 Electrical Project 	1 EMX File 	>1 Inventor assemblies	
>1 Electrical Project 	1 EMX File 	>=1 Inventor assemblies	
1 Electrical Project 	>1 EMX Files 	>1 Inventor assemblies	

Electromechanical Projects

The electromechanical project integrates the mechanical and electrical disciplines to deliver a collaborative and connected design experience for product development, allowing them to work in parallel in a real-time environment. You can connect your AutoCAD Electrical toolset and Inventor projects by creating an electromechanical link file. You can keep the electromechanical link file on a shared folder location over the network, which can be accessible to AutoCAD Electrical toolset and Inventor users. Once the connection is established, you can initiate the data exchange between AutoCAD Electrical toolset and Inventor designs using synchronization.

Linked projects provide the ability to:

- Associate a 2D schematic representation to a 3D model
- Synchronize project design data in real-time
- View physical properties such as wire lengths in AutoCAD Electrical toolset that helps you estimate actual wire length
- View attributes defined by mechanical users and compare them with electrical attributes defined in AutoCAD Electrical toolset, which helps you to align component properties on logical and physical side
- Export component, wiring, and connection details to Microsoft® Excel format for quick reports
- Automatically route the wires and cables in Inventor based on the connections defined in AutoCAD Electrical toolset

Synchronization

Electromechanical project manages and maintains data integrity between AutoCAD Electrical toolset and Inventor projects through synchronization. Synchronization, in electromechanical project, uses a push and pull approach during the process of data exchange. In case of AutoCAD Electrical toolset users; the Inventor data is first pulled in and your component tree view is updated, and then AutoCAD Electrical toolset data is pushed out to Inventor. Synchronization fails when you are disconnected from the network and the connection to the link file is broken—you can continue to work offline on your drawing files and use the location view tab to manage the components. You can synchronize your offline work after you have re-established the connection to the link file in the network.

Learning Objective 2: Discover key tips to the electro-mechanical workflow within AutoCAD Electrical

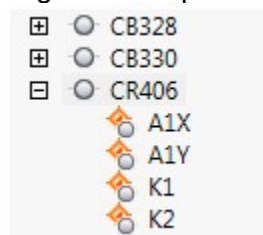
Component Tree

Displays a list of standard components, terminals, PLC modules, connectors, and cable markers. The top node in the tree represents the entire project. Each node under the project represents an Installation value. The nodes under each Installation represent the Location values within that Installation.

The various device types are represented differently in the component tree. When inserting electrical components, it is recommended that you should have unique names (installation code, location code, and component tag), pins, and terminals numbers. For example, if you have cable markers in your drawing, which has duplicate values for cable tag, then you may experience unexpected behavior of the component in the component tree view and in the connections tab. This is more commonly observed for terminals and cable markers in Location View.

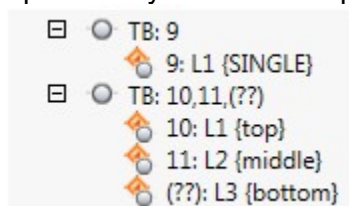
Standard Component

Tag value. Expand to view assigned pins.



Terminal

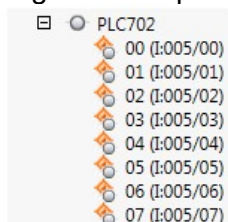
Tagstrip value: terminal number. A multi-level terminal lists each terminal number separated by a comma. Expand to view the level descriptions.



Note: Terminals that take on the wire number show the wire number in place of a terminal number.

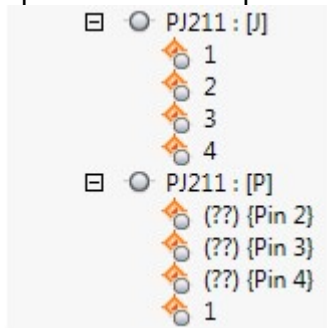
PLC

Tag value. Expand to view each pin and address value.



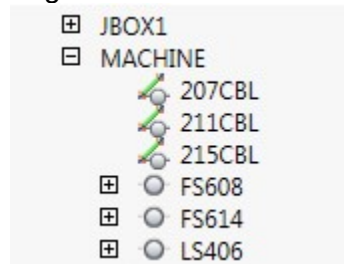
Connector

Tag value separated into two rows, one for the plug side and one for the jack side. Expand to view the pins.



Cable

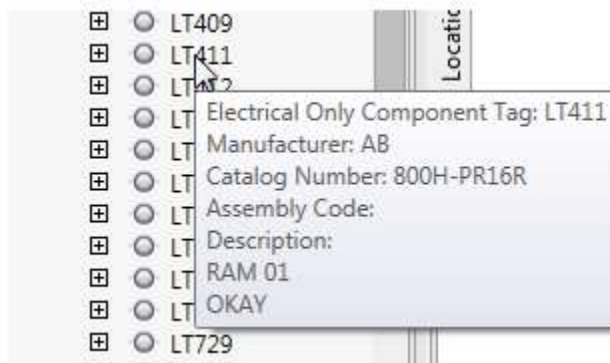
Tag value.



Child

A child component is excluded from the tree until the parent is inserted.

Note: Hover over a device node to display more information about the device, such as catalog and description.



Learning Objective 3: Discover key tips about the electro-mechanical workflow within Inventor

To begin, you must first create an electromechanical link that connects an AutoCAD Electrical project to an Inventor project.

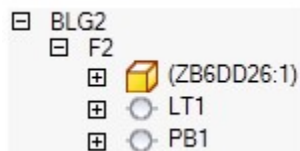
Installation and Location Properties

The Installation and Location dialog box and the Location View tab are available only after the electromechanical link is established in the Electromechanical Link Setup dialog box.

The Location View window is a shared module used by both Inventor and AutoCAD Electrical. Components in the Location View window are organized by Installation and Location properties which are properties inherent to AutoCAD Electrical components. The values display in the Location View window. Specifying Installation and Location properties are not required in AutoCAD Electrical. If the Installation and Location properties have not been specified, the values display as question marks. For example:

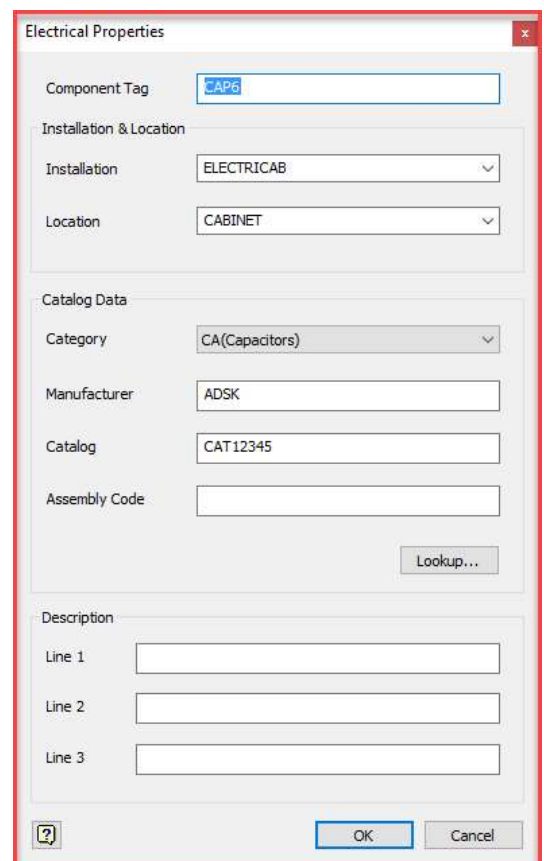


If the values have been specified, they display the property values. For example:



Electrical Properties

The Electrical Properties dialog box displays the AutoCAD Electrical values specified in either AutoCAD Electrical or Inventor. If no values have been specified, only the Component Tag field is populated with the Inventor part component occurrence name.



The screenshot shows the 'Electrical Properties' dialog box. It has a title bar with a close button. The dialog is divided into several sections:

- Component Tag:** A text field containing 'CAP6'.
- Installation & Location:** A section with two dropdown menus: 'Installation' set to 'ELECTRICAB' and 'Location' set to 'CABINET'.
- Catalog Data:** A section with four fields: 'Category' (dropdown set to 'CA(Capacitors)'), 'Manufacturer' (text field 'ADSK'), 'Catalog' (text field 'CAT12345'), and 'Assembly Code' (empty text field). There is a 'Lookup...' button to the right of the 'Assembly Code' field.
- Description:** A section with three text fields labeled 'Line 1', 'Line 2', and 'Line 3', all of which are empty.

At the bottom of the dialog, there is a help icon (question mark in a square), an 'OK' button, and a 'Cancel' button.

Buttons



Filters the tree view by Installation and Location.



Filters the tree view by component status:



Inventor only: - Component in Inventor and not linked to an AutoCAD Electrical component.



Electrical only: - Component in AutoCAD Electrical and not linked to an Inventor component.



Linked - Component synced in both AutoCAD Electrical and Inventor.



Linked with difference: - Linked components that contain a mismatch between the component in Inventor and in AutoCAD Electrical representation and their connections.



Opens the Sync settings dialog box where you can specify whether to sync data between linked projects when saving the assembly file.



Opens the Details and Connections pane. The Details tab shows the component values such as Installation, Location, and catalog values. The Connections tab shows wiring information for the components. Right-click to change the fields to display on each tab.



Sync data between linked projects. The date and time of the last sync displays next to the icon.

Note: The icon is at the bottom of the palette.

Status Icons



Electrical only: An AutoCAD Electrical component not linked to an Inventor component.



Inventor only: An Inventor component not linked to an AutoCAD Electrical component.



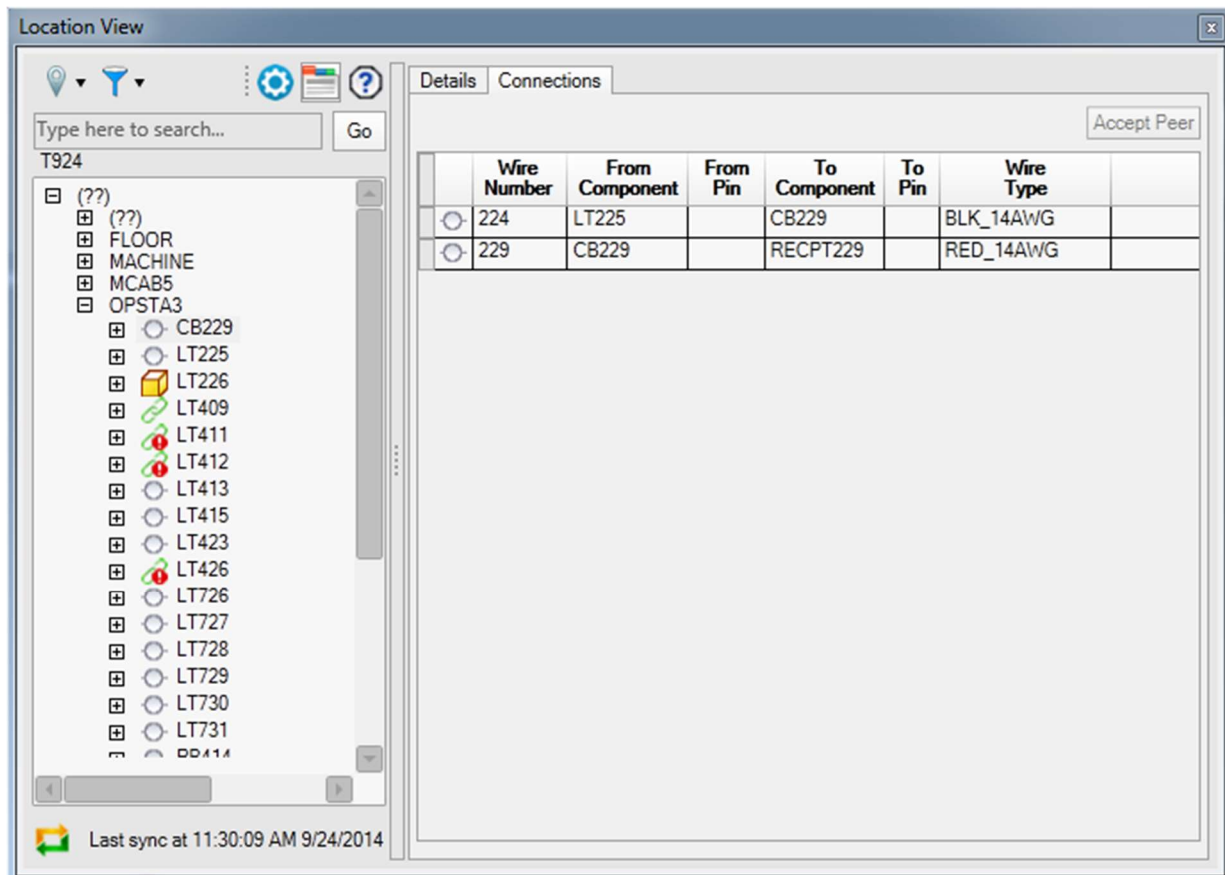
Linked: Linked AutoCAD Electrical and Inventor components.



Linked with difference: Linked, but there is a mismatch between the AutoCAD Electrical and Inventor representations.

Details and Connections Pane

View the wiring and connection information for components.



The screenshot shows the 'Location View' window with a tree of components on the left and a 'Connections' table on the right. The tree is expanded to show a list of components including FLOOR, MACHINE, MCAB5, OPSTA3, and a series of LT components (LT225 through LT731). The 'Connections' table has columns for Wire Number, From Component, From Pin, To Component, To Pin, and Wire Type. Two connections are listed: Wire 224 from LT225 to CB229 (BLK_14AWG) and Wire 229 from CB229 to RECPT229 (RED_14AWG). An 'Accept Peer' button is visible in the top right of the table area.

Wire Number	From Component	From Pin	To Component	To Pin	Wire Type
224	LT225		CB229		BLK_14AWG
229	CB229		RECPT229		RED_14AWG

Last sync at 11:30:09 AM 9/24/2014

Details pane – Provides component-level information in a grid format. For Inventor and AutoCAD Electrical components to be linked without any mismatches, these metadata must match:

- Installation
- Location
- Category
- Manufacturer
- Catalog
- Assembly Code
- Description 1
- Description 2
- Description 3
- Terminal Number

In the component tree view, the linked components (AutoCAD Electrical and Inventor) are merged when you expand the parent nodes. In the Details grid, the linked components are displayed in a single merged row. For linked components with differences in metadata—components are not merged and are displayed in separate rows as individual Inventor and AutoCAD Electrical components. The metadata differences are highlighted in yellow.

Connections pane – Provides wire connection information between Inventor and AutoCAD Electrical components in a grid format. In the Connections grid, you can view these connection differences:

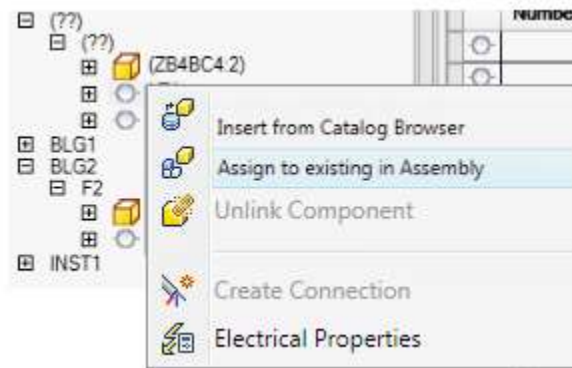
- Pin-wise difference between local (not available in Inventor LT) and (AutoCAD Electrical) peer components.
- Connectivity differences
- Connection metadata differences, which includes:
 - From component
 - To component
 - From pin
 - To pin
 - Wire layer name in AutoCAD Electrical
 - Cable tag

For components that are linked with differences, when you select a row or cell in the connections grid for a component, the corresponding row or cell for the peer component is also highlighted. If you want to merge the differences between components linked with differences, select a row for either an AutoCAD Electrical or Inventor component, and then click the Accept Peer button—accepts the peer definitions for the selected component.

To Associate AutoCAD Electrical Components with Existing Inventor Components

Use the Assign to Existing in Assembly command to associate an AutoCAD Electrical component to an Inventor component in the active assembly.

1. On the ribbon: Electromechanical tab ► Setup panel ► Location View
2. Right-click an AutoCAD Electrical component, and select Assign to Existing in Assembly.
3. In the graphics window or browser panel, select the Inventor component you want to associate with the corresponding AutoCAD Electrical component .




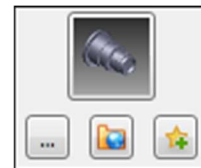
Note: If the [Electrical Catalog](#) data is different between the Inventor and AutoCAD Electrical component, you see an icon in your component tree indicating there is a mismatch. 🚩

To Associate a Component by Inserting a New Component from Catalog Browser

Use Insert from Catalog Browser to link an existing unlinked component with a new component, inserted from the [catalog browser](#).

1. On the ribbon: Electromechanical tab ► Setup panel ► Location View
2. In the Location View window, select and right-click the unlinked AutoCAD Electrical component. Click Insert from Catalog Browser.
3. Select the category for the component you want to insert.

4. If needed, enter a search criteria and click .
5. Select the specific catalog value and specify which part to insert.
6. Click in the graphics window to insert the part.



Note: You cannot insert an assembly (.iam) file.

All attributes from the peer component are copied.

To Create a Connection between Inventor and AutoCAD Electrical components

Cable and wire connections can be defined from Inventor or AutoCAD Electrical. Use Create Connection to create wires and cables connections automatically in Inventor.

- If the connection definitions are defined in AutoCAD Electrical, you can create a cable and harness directly in Inventor according to the defined connections for electrical components in AutoCAD Electrically
 - If the connection definitions are not defined from AutoCAD Electrical, you can create the missing definitions in Inventor.
1. On the ribbon: Electromechanical tab ► Setup panel ► Location View
 2. In the Location View window, select and right-click the top node or a linked component in the browser and select Create Connection.
 3. In the Create Harness dialog box, provide a unique name for the harness subassembly.
 4. Accept the default file location or browse to or enter a different location for the file.

Learning Objective 4: Understand how Vault handles the EMX files and workflow

Once you have set up an electromechanical project, you can see Inventor parts and electrical representation in Location View and information is shared between AutoCAD Electrical and Inventor. If you use Autodesk Vault with Inventor and Electrical, you can use it to back up the electromechanical data along with the native design files.

AutoCAD Electrical and Autodesk Vault

There are a couple of best practices associated with AutoCAD Electrical and Autodesk Vault. Some of the recommendations for backing up electromechanical (EMX) data are:

- The working folder for the project is the shared folder accessible to all multiple Electrical users.
- Every time you work with AutoCAD Electrical you check out all drawings that you are making changes to.
- Your designs that you work on are the latest updated versions from Vault.

Problem

Back up the electromechanical data using Autodesk Vault.

Solution

AutoCAD Electrical electromechanical workflow supports Autodesk Vault in a limited manner. With this workflow you can only rollback your electromechanical project if you decide to roll back the entire project designs for both Electrical and Inventor to a previous state. Here are some tips and frequently asked questions to give you insights on how this workflow works:

How does Autodesk Vault help me?

Autodesk Vault helps you to back up your electromechanical project files. Along with Electrical and Inventor project files, it also backs up the electromechanical files while enabling you to roll back to previous versions.

What are electromechanical files and where are they stored?

Electromechanical files are the *.emx and *.snapshot files for an electromechanical project and they are stored in the shared network folder.

What should I do to backup electromechanical files?

There is no extra setting required for electromechanical Vault support. AutoCAD Electrical by default backs up the electromechanical files with every native design check-in for the project. Users do not need to manually back up these files.

Are electromechanical files checked-in at every Inventor file check-in also.?

No, only AutoCAD Electrical 2019 can check-in your electromechanical files (*.emx and *.snapshot files) with every AutoCAD Electrical check-in.

Where is electromechanical data backed up?

It is backed up in your project's vault folder under the sub folder named EMX>[GUID].



When users should not roll back electromechanical data?

If you just need to rollback your native design files and not entire project's design files, it is advisable roll back to a previous version of native design and do Sync. Sync absorbs your changes and publishes them to other users at the same time thereby avoiding any data loss to other users.

To Add an Electromechanical Project to Autodesk Vault

Use Check In or Check In All for adding an electromechanical linked electrical project to the vault or to check in a file that you have checked out.

To work with a vault, you must log into the Autodesk Vault Server.

1. Click Vault tab ➤ Access panel ➤ Vault. 
2. Enter the user name and password.
3. Click Project tab ➤ Project Tools panel ➤ Manager. 
4. In the Project Manager, do one of the following:
 - a. Right-click the project name and select Check In All.
 - b. Right-click the file name and select Check In.
5. In the Initiate Electromechanical Sync dialog box, click Yes to continue with the check-in.
6. In the Select Vault Location dialog box, navigate to an existing folder or click New Folder to create a vault folder.
7. Click OK.
8. In the Check In dialog box, specify whether to keep the file checked out for further editing or whether or delete the local copy of the file once it is checked in to the vault.

Note: The electromechanical files (*.emx and *.snapshot) are not displayed in the Check In dialog box but are checked in as part of the electromechanical linked AutoCAD Electrical project. You can view these files in the Autodesk Vault Explorer.
9. Click Settings to specify the available check in options, if any.
10. Enter any notes in the comment box and click OK.
11. In the File Save dialog box, click Yes to complete the check-in and close the dialog box.