The Software is a “commercial item” as that term is defined at 48
C.F.R. 2.101 (OCT 1995), consisting of “commercial computer
software and “commercial software documentation” as such terms are used in 48
C.F.R. 12.212 (SEP 1995) and is provided to the U.S. Government (a) for acquisition
by or on behalf of civilian agencies, consistent with the policy set forth in 48 C.F.R.
12.212; or (b) for acquisition by or on behalf of units of the department of Defense,
consistent with the policies set forth in 48 C.F.R. 227.7202-1 (JUN 1995) and
227.7202-4 (JUN 1995).

In the event that you receive a request from any agency of the U.S. government to
provide Software with rights beyond those set forth above, you will notify DS
SolidWorks of the scope of the request and DS SolidWorks will have five (5) business
days to, in its sole discretion, accept or reject such request.

Contractor/Manufacturer: Dassault Systèmes SolidWorks Corporation, 175 Wyman
Street, Waltham, Massachusetts 02451 USA.

Portions of this software © 1986-2013 Siemens Product Lifecycle
Management Software Inc. All rights reserved.

This work contains the following software owned by Siemens Industry Software
Limited:
- D-Cubed™ 2D DCM © 2013. Siemens Industry Software
  Limited. All Rights Reserved.
- D-Cubed™ 3D DCM © 2013. Siemens Industry Software
  Limited. All Rights Reserved.
- D-Cubed™ PGM © 2013. Siemens Industry Software Limited. All Rights
  Reserved.
- D-Cubed™ CDM © 2013. Siemens Industry Software Limited. All Rights
  Reserved.
- D-Cubed™ AEM © 2013. Siemens Industry Software Limited. All Rights
  Reserved.

For more DS SolidWorks copyright information, see Help > About
SolidWorks.

Copyright Notices for SolidWorks Simulation Products
Portions of this software © 2008 Solversoft Corporation.
PCGLSS © 1992-2013 Computational Applications and System
Integration, Inc. All rights reserved.

Copyright Notices for SolidWorks Enterprise PDM Product
Outside In® Viewer Technology, © 1992-2012 Oracle © 2011,
Microsoft Corporation. All rights reserved.

Copyright Notices for eDrawings Products
Portions of this software © 2000-2013 Tech Soft 3D.

Portions of this software © 1995-1998 Jean-Loup Galilly and Mark
Adler.

Portions of this software © 1998-2001 3Dconnexion.

Portions of this software © 1998-2013 Open Design Alliance. All rights reserved.

Portions of this software © 1995-2012 Spatial Corporation.
The eDrawings® for Windows® software is based in part on the work of the
Independent JPEG Group.

Portions of eDrawings® for iPad® copyright © 1996-1999 Silicon
Graphics Systems, Inc.

Portions of eDrawings® software is protected by U.S. Patent 7,184,044; U.S.
patents, (e.g., EP 1,116,190 B1 and JP 3,517,645).

eDrawings® software is protected by U.S. Patent 7,184,044; U.S.

Dassault Systèmes SolidWorks, SolidWorks Composer are product names of DS SolidWorks.

Other brand or product names are trademarks or registered trademarks of their
respective holders.

COMMERICAL COMPUTER SOFTWARE - PROPRIETARY

The Software is a “commercial item” as that term is defined at 48
C.F.R. 2.101 (OCT 1995), consisting of “commercial computer
software and “commercial software documentation” as such terms are used in 48
C.F.R. 12.212 (SEP 1995) and is provided to the U.S. Government (a) for acquisition
by or on behalf of civilian agencies, consistent with the policy set forth in 48 C.F.R.
12.212; or (b) for acquisition by or on behalf of units of the department of Defense,
consistent with the policies set forth in 48 C.F.R. 227.7202-1 (JUN 1995) and
227.7202-4 (JUN 1995).

In the event that you receive a request from any agency of the U.S. government to
provide Software with rights beyond those set forth above, you will notify DS
SolidWorks of the scope of the request and DS SolidWorks will have five (5) business
days to, in its sole discretion, accept or reject such request.

Contractor/Manufacturer: Dassault Systèmes SolidWorks Corporation, 175 Wyman
Street, Waltham, Massachusetts 02451 USA.

Portions of this software © 1998-2013 Geometric Ltd.

Portions of this software incorporate PhysX™ by NVIDIA 2006-2010.

Portions of this software © 2001-2013 Luxology, LLC. All rights
reserved, patents pending.

Portions of this software © 2007-2013 DriveWorks Ltd.

Copyright 1984-2010 Adobe Systems Inc. and its licensors. All rights
reserved. Protected by U.S. Patents 5,929,866; 5,943,063; 6,289,364; 6,563,502; 6,639,593; 6,754,382; Patents Pending.

Adobe, the Adobe logo, Acrobat, the Adobe PDF logo, Distiller and
Reader are registered trademarks or trademarks of Adobe Systems Inc. in the U.S.
and other countries.

For more DS SolidWorks copyright information, see Help > About
SolidWorks.

Copyright Notices for SolidWorks Products
Portions of this software © 1986-2013 Siemens Product Lifecycle
Management Software Inc. All rights reserved.
# Table of Contents

**WHAT IS SOLIDWORKS ELECTRICAL?** ................................................................. 1

**UNDERSTANDING THE WORKFLOW** ................................................................. 1

- **STARTING SOLIDWORKS ELECTRICAL** ...................................................... 3
- **THE USER INTERFACE** .................................................................................. 3
- **CREATING AND OPENING PROJECTS** .......................................................... 4
- **CREATING A NEW PROJECT** .......................................................................... 4
- **PROJECT OVERVIEW** .................................................................................. 4

**SINGLE LINE DIAGRAMS** .............................................................................. 5

- **ZOOMING AND SCROLLING** .......................................................................... 5
  - **MOUSE ZOOM** .......................................................................................... 5
  - **MOUSE SCROLL** ....................................................................................... 5
  - **WHERE TO FIND IT** ................................................................................ 6
- **INSERTING SYMBOLS** .................................................................................. 6
- **ADDING CABLES** ....................................................................................... 8

**SOLIDWORKS ELECTRICAL 3D** ................................................................. 10

- **INSERT 3D COMPONENTS** .......................................................................... 11
- **ROUTE CABLES IN 3D** ............................................................................... 12

**POWER AND CONTROL CIRCUITS** ............................................................. 13

- **DRAWING WIRES** ...................................................................................... 13
- **OPTIONAL – CUSTOMIZING THE USER INTERFACE** .................................... 14
  - **KEYBOARD SHORTCUTS** ....................................................................... 14
  - **GRAPHICS OPTIONS** ............................................................................. 15
- **ADDING SYMBOLS FROM THE PALETTE** .................................................. 16
- **ADDING SYMBOLS FROM EXISTING COMPONENTS** ............................... 19
- **TERMINALS AND TERMINAL STRIPS** ..................................................... 19
- **CONTROL DIAGRAMS** .............................................................................. 21
- **OPTIONAL – MACROS** ............................................................................... 24
- **WIRE ORIGIN – DESTINATION ARROWS** .................................................. 25
- **WIRE NUMBERS** ....................................................................................... 27
- **OPTIONAL - CREATE A MANUFACTURER PART** ....................................... 28

**SOLIDWORKS PANEL LAYOUT** ................................................................. 28

- **ROUTE WIRES** ............................................................................................ 31

**REPORTS** .................................................................................................... 32

- **REORGANIZING THE PROJECT** ................................................................. 34

**OPTIONAL – PUBLISH TO ENTERPRISE PDM** ............................................. 34
SolidWorks Electrical

Hands-On Test Drive

What is SolidWorks Electrical?
SolidWorks Electrical provides a project-based approach to developing electrical designs. All documentation for an electrical design is contained in the project including single line diagrams, power, control and PLC schematics, tables and reports, terminal strip drawings and 3D SolidWorks models along with any additional documentation you wish to attach.

Projects are controlled and stored in a SQL database to allow fast and flexible project access. Multiple users can work on a single project. While an electrical designer is working out the schematic, another user can be inserting components in SolidWorks assemblies and routing wires. Projects are updated real-time with changes for every user to ensure design accuracy.

Components in an electrical design are managed by SolidWorks Electrical so that every symbol and 3D part is interconnected. The manufacture part reference is associated with each symbol. For example, a power contactor is represented by several symbols representing the coil and each contact along with a 3D SolidWorks part that will be placed in a cabinet. Every one of these representations of the same physical part is connected to manufacturer’s part data. If you choose to change the manufacturer’s part, you change it once and all symbols and representations are updated.

Wires and cables also have built-in intelligence. Wire numbering in SolidWorks Electrical is incredibly flexible to accommodate a variety of standards and styles. Cables reference a manufacturer’s part just as any other component with the addition of cores and diameters. When routed in SolidWorks Electrical 3D, they are represented completely and lengths are automatically calculated.

Cross-referencing is automatic in projects. The various symbols for physical components are linked by mark, by hyperlink and by schematic location so you are sure to never have overused components or miss-wiring.

SolidWorks Electrical also provides critical design automation for PLCs, reports and terminal strips along with 3D wire, cable and harness routing so that your project documentation is complete without additional manual drafting required.

Understanding the Workflow

Single line diagrams provide an excellent project overview along with a quick means to creating basic cable connections. Symbols are first placed that represent each major electrical component. These components can be associated to a manufacturer’s part at any time. Cables are then drawn to visually connect components and optionally connect circuits.
Schematics are built for power and control circuits using symbols tied to components. Single or multiple wires can be drawn between symbols and wires are numbered and trimmed automatically. Origin and destination arrows are created easily to ensure multi-page schematics are wired correctly. SolidWorks Electrical also prevents origin – destination arrows from connecting to the wrong wire type to avoid connecting ground to power. Additional schematic tools automate the placement and organization of terminals, PLCs and black box components.

As symbols are added, a Component tree is built dynamically. Locations can be defined for the project so that components can be identified with them. This helps with documentation as well as organization. The component tree can be used in schematics and 3D to insert their corresponding symbols and 3D models.
SolidWorks Electrical 3D can be used to assemble components along with their mechanical counterparts to create complete 3D models. Finally, wires and cables are routed automatically along guide lines to layout route locations as well as calculate lengths.

The symbol and manufacture part libraries can be tailored to your companies needs by removing or importing symbols and parts. Parts can be added individually as they are used and are shared with all Electrical users through SQL database.

**Starting SolidWorks Electrical**

1. **Start SolidWorks Electrical.** Double-click SolidWorks Electrical.

**The User Interface**

The SolidWorks Electrical user interface is divided up into four main sections.

The **Side Panel** provides access to project documents as well as components, macros and symbols. It also includes a command tab and options when a command is active.

The **Ribbon**, or **CommandManager** menu, contains input commands sorted into multiple groupings (tabs).
The **Graphics Zone** is limited to drawing access and editing.

The **Status Bar** shows the cursor position and allows you to toggle modes like SNAP on and off.

### Creating and Opening Projects

A Project is used to store the many different types of files used to create the reports, data and other files that together fully define the project.

A project contains one or more document books. Each document book can contain many files of different types including multiple drawings.

### Creating a New Project

Creating a new project automatically creates multiple files of several different types. Additional drawings and other files can be added manually. The structure of a new project is based on a template. You only need to create an initial project structure and configure its settings once. It can then be saved as a template to keep all projects consistent and to speed up initial design.

### Project Overview

Your goal for this test drive is to complete the electrical documentation and 3D assembly of a three phase motor control panel that includes a wireless control system.
Let’s get started by opening the existing project and working on a single line diagram.

2. **Open project.** Click Projects Manager 📁. From the Projects Manager, select SolidWorks Electrical Hands-On and click Open 📍.

3. **Files.** The project is opened including book and schematic files. The drawings appear under the Documents tab 📁 in the Side Panel.

   Click Drawings preview and click 03 – Line diagram to see the preview.

4. **Opening a drawing.** Double-click 03 – Line diagram to open the drawing in the Graphics Zone.

**Single Line Diagrams**
A Single Line Diagram, here named 03 - Line diagram, is a simplified representation of the cabling that will be used in the project. It shows the original concept of the project, optionally with drawing graphics, rather than the final result.

*Note: The single line diagram is not required but it is useful in managing the cables used in the project.

**Zooming and Scrolling**
Zooming or scrolling the drawing can be done in many ways but the most direct is by rotating or dragging the middle mouse scroll wheel.

**Mouse Zoom**
Rotate the middle mouse scroll wheel down to zoom out (further away).
Rotate the middle mouse scroll wheel up to zoom in (closer).

**Mouse Scroll**
Press and drag the middle mouse scroll wheel to pan the view left, right, up
Where to Find It
Mouse Button: Rotate or drag with the middle mouse scroll wheel.

Inserting Symbols
We need to represent the black box and RF connectors on the line diagram and connect them with a cable. Connectors will be used in this example since they are part of the cable assembly. If the connectors were part of the component being connected, via screw terminals for example, they would not need to be included.

5. Select symbol. From the Line diagram tab, click Insert Symbol. If the Symbols selector dialog is not visible, click the Other symbol button. Select Black boxes from the Classification list, click Black box1 and click Select.

You can now place the Black box1 symbol on the sheet. Place it to the left of the antenna as shown.

6. Symbol properties. After placing a symbol, the Symbol properties dialog will be displayed. Leave the default location and root mark. Select the Manufacturer part and circuits tab and click Search. Choose XTL as the Manufacturer and click Search. Double-click XTL Black box1 and click Select to associate the manufacturer part data to the symbol. Click OK.

7. Select symbol. From the Line diagram tab, click Insert Symbol. Click the Other symbol button. Select Connectors from the Classification list and double-click RF Connector.
You can now place the RF Connector symbol on the sheet. Place it to the right of the black box as shown.

8. Choose the following manufacturer part data in the Symbol properties dialog.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samtec</td>
<td>RFXXX-01SP1</td>
<td>50 OHM RF CABLE ASSEMBLY MALE</td>
</tr>
</tbody>
</table>

Notice the two circuits available in the manufacturer part data. These will be used to connect an RF cable core and shielding.

9. **Copy symbol. Copy and paste** the RF connector symbol from the black box to the antenna as shown. All manufacturer part information will be copied and the mark will increment to the next available number.
**Adding Cables**

A cable contains one or more cable cores which will be assigned wires. It is used to connect the symbols in the drawing.

The cables are drawn to show connections between components. There is not yet any assignment of cores or wires to the cable when it is first created.

10. **Cable.** Click **Draw cable** and connect the symbols by clicking as shown. Click the Esc key to stop creating cables.
11. **Detailed cabling.** Double-click the newly created cable to bring up the Detailed cabling dialog. This interface is used to associate cables with single line cables and connect the wires or cores to the corresponding circuit terminals on the connected components.

![Detailed cabling interface](image)

12. **Cores reservation.** Select Cores reservation to associate an existing cable. Check W5 – RF316 RG316 to select the desired cable. Notice it has one core and shielding available for connection. Click OK.

![Cables and cores reservation interface](image)

13. **Connect cores to components.** Select terminal 1 from X1 and the green cell to the left of the Shield on W5. Click Associate wires. Repeat the same process to connect all terminals to the cable cores for both connectors. Click Close.
The cable label is now shown on the red cable in the line diagram.

*Note: if you would like to display the label in a different location on the cable, right click on the desired location and select Show/hide cable cores texts. Delete or hide the undesired labels.*

**SolidWorks Electrical 3D**

As soon as you have created components, wires and/or cables in SolidWorks Electrical, you can begin placing the components and routing them in SolidWorks assemblies.


15. From the SolidWorks Electrical menu, select the **Projects Manager**.

16. Open project. Select the red project, SolidWorks Electrical Hands-On, and select Open. The project is red since it is already open by another user. You will see the following message explaining who has the project open. Click **OK**.
17. **Open SolidWorks assembly.** From the SolidWorks Electrical Task Pane, you can explore and view drawings and documents from the open project. Open the 05 Main electrical closet assembly by double-clicking on it.

### Insert 3D Components

Once an electrical assembly is opened in SolidWorks, the SolidWorks Electrical component tree displays in the Property Manager pane on the left. Components that have 3D models to be inserted will display those parts under the component mark 🟢.

18. **Insert Black box1.** Insert A1, Black box1 by right-clicking on A1 and select **Insert**. Move the cursor to the position shown in the image below and click to place the component. A Mate Reference exists in the black box model to automate a coincident mate to the back of the cabinet. Click ✅ to add the mate.
19. **Move with triad.** Right-click on the black box part and select **Move with triad.** Click and drag the blue ring to rotate the model $180^\circ$. Use the ruler snapping to get to an exact angle.

20. **Change view.** Using the **View Orientation** tool (space bar or $-$), select the view named Black Box.

21. **Insert X1.** Right-click on the X1 component and select **Insert.** Move the cursor to the end of the connection on the black box and click to automatically mate the X1 connector into position.

22. **Insert X2.** From the **View Orientation** tool, select the view named Antenna. Alternatively, **zoom** and **rotate** to the end of the antenna. Repeat the insertion process for X2 and locate it on the end of the antenna.

23. **Default view.** From the **View Orientation** tool, select the view named Default to prepare for cable routing.

**Route cables in 3D**

After inserting components into your SolidWorks assembly, the associated cable and wire routes can be created. SolidWorks Electrical provides an
Electrical Component Wizard to walk through the required setup of parts to include wire and cable points and mate references to help you use your own parts or downloaded components.

24. **Route cables.** From the SolidWorks Electrical 3D Command Manager tab, select **Route Cables**. Select **SolidWorks Route** as the route type, leaving all other default settings and click **OK**. A new route sub assembly will be created with the newly routed cable.

25. **Move components.** Click and drag the black box to move its location in the assembly. Click **Rebuild** to update the cable route.

**Optional** Edit the route and add a clip. Auto-route the cable through the clip.

**Power and Control Circuits**

The next step is to complete the power and control circuit diagram. A three-phase motor needs to be added with its protection, power contacts and terminals. The control circuit also needs to be completed to add contacts, terminals and an indicator light.

26. **Return to SolidWorks Electrical.** Switch back to SolidWorks Electrical to continue building schematics.

27. **Open 04 – Power and control.** Double-click on 04 – Power and control to open the schematic.

**Drawing Wires**

Wires are more than just lines on the schematic. They contain wire information such as diameter, color and type, and make connections between terminals on component symbols. Wires can be drawn individually or in groups of the same wire or groups of different wire types such as in a three phase power system. SolidWorks Electrical will automatically join overlapping wires, will create connections where wire ends touch another wire, and will automatically trim them to symbols.

28. **Draw three phase power wires.** From the Schematic tab, select **Draw multiple wires**. Click next to the wire style Name, to open the **Wire style selector**. Select the multi-phase N L1 L2 L3 wire style Each phase with a color and click **Select**.
Set the additional settings as shown, unselecting the neutral wire.

![Electrical wires interface]

Start the wire group by clicking on the red wire in the **Graphics Zone**, second from the left. A phase direction line displays. Move the cursor down and click to define the phase direction as shown.

![Diagram of wire group]

Click the endpoint of the wire group near the column divider, then right-click to end the wire group.

*Note: wire group direction can be toggled using the Space bar. Wire folds or corners can be created by typing C.*

**Optional – Customizing the User Interface**

SolidWorks Electrical allows the user to tailor the user interface to work the way you work. You can create your own keyboard shortcuts for common commands, turn tools on and off, and configure the display to meet your preferences.

**Keyboard Shortcuts**
29. **Keyboard shortcuts.** Right-click on any command button or **CommandManager** tab and select **Customize Quick Access Toolbar.** Select the **Keyboard** tab and select **View** category.

![Customize Quick Access Toolbar](image)

Type **F** into the **Press new shortcut key** box and click **Assign.** Typing **F** on the keyboard will now zoom the sheet to fit the screen.

*Note: keyboard shortcuts are specific to the document type.*

**Graphics Options**
You can also configure the user interface including colors and cursor size by selecting **Interface configuration** on the **Tools** tab of the **CommandManager.**

![Interface configuration](image)
30. **Symbols palette.** Select the **Symbols tab** from the **Side Panel** and click **Search**. Type in the word *motor* and click **Find**. All schematic symbols that contain motor in the name or description display in the symbols palette.

![Symbols palette](image)

31. **Insert motor symbol.** **Double-click** on the three phase motor symbol with a ground connection and place it towards the end of the three phase wire group. Make sure the symbol is inserted on the top red wire.

![Motor symbol](image)

When the **Symbol properties** dialog is displayed, expand **L3 – Conveyor** location and select **F1-M1 – Motor**. This will associate this new motor symbol with an already existing motor component. The existing motor component has already been assigned manufacturer part information that will display on attributes around the symbol.
Click **OK**.

*Note: you can also associate a symbol to an existing component by typing in the same root mark and number and clicking ![OK](image).*

32. **Hide attributes.** Any unnecessary attributes can be hidden on the symbol in the **Graphics Zone**. Right-click the newly added motor symbol. Select **Attributes** and uncheck **Degree of protection IP:** “IP 55 Dust_Hosed water resistant”. Symbols can also be edited and attributes can be added or removed.

33. **Stretch.** If needed, use **Stretch** ![Stretch](image) to shift the motor and its wires to make room for attribute text.