

AutoCAD[®]

Electrical 2008

Essentials (JIC Standard)

Volume 1

Autodesk[®] Official Training Courseware
(AOTC)

© Copyright 2007 Autodesk, Inc.

All rights reserved. Except as otherwise permitted by Autodesk, Inc., this publication, or parts thereof, may not be reproduced in any form, by any method, for any purpose.

Certain materials included in this publication are reprinted with the permission of the copyright holder.

Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries.

ACIS Copyright © 1989–2001 Spatial Corp.

Copyright © 1999–2000 The Apache Software Foundation. All rights reserved. This product includes software developed by the Apache Software Foundation (<http://www.apache.org>) subject to its license terms and conditions (<http://xml.apache.org/dist/LICENSE.txt>).

Typefaces from the Bitstream® typeface library Copyright © 1992.

HLM © Copyright D-Cubed Ltd. 1996–2006. HLM is a trademark of D-Cubed Ltd.

AutoCAD® 2008 and AutoCAD LT® 2008 are produced under a license of data derived from DIC Color Guide® from Dainippon Ink and Chemicals, Inc. Copyright © Dainippon Ink and Chemicals, Inc. All rights reserved. DIC and DIC Color Guide are registered trademarks of Dainippon Ink and Chemicals, Inc.

Portions of this software are based on the work of the Independent JPEG Group.

Active Delivery™ 2.0 © 1999–2004 Inner Media, Inc. All rights reserved.

ISYS and the ISYS logo are registered trademarks or trademarks of ISYS® Search Software Inc.

Copyright © 1988–1997 Sam Leffler. Copyright © 1991–1997 Silicon Graphics, Inc.

Copyright © Lingea s.r.o. 2006.

The New Features Workshop contains Macromedia Flash™ Player software by Macromedia, Inc. Copyright © 1995–2005 Macromedia, Inc. All rights reserved. Macromedia® and Flash® are registered trademarks or trademarks of Adobe Systems Incorporated in the United States or other countries.

Copyright © 1996–2006 Macrovision Corporation. All rights reserved.

Copyright © 1996–2002 Microsoft Corporation. All rights reserved.

Copyright © 2002 Joseph M. O'Leary.

PANTONE® Colors displayed in the software application or in the user documentation may not match PANTONE-identified standards. Consult current PANTONE Color Publications for accurate color.

PANTONE® and other Pantone, Inc. trademarks are the property of Pantone, Inc. © Pantone, Inc., 2004. Pantone Inc. is the copyright of color data and/or software which are licensed to Autodesk, Inc., to distribute for use only in combination with certain Autodesk software products.

PANTONE Color Data and/or Software shall not be copied onto another disk or into memory unless as part of the execution of this Autodesk software product.

Typefaces from Payne Loving Trust © 1992, 1996. All rights reserved.

RAL DESIGN © RAL, Sankt Augustin, 2004.

RAL CLASSIC © RAL, Sankt Augustin, 2004.

Representation of the RAL Colors is done with the approval of RAL Deutsches Institut für Gütesicherung und Kennzeichnung e.V. (RAL German Institute for Quality Assurance and Certification, re. Assoc.), D-53757 Sankt Augustin.

This product includes code licensed from RSA Security, Inc. Some portions licensed from IBM are available at <http://oss.software.ibm.com/icu4j/>.

The Sentry Spelling-Checker Engine Copyright © 1994–2003 Wintertree Software, Inc.

Portions of this software include one or more Boost libraries. Use of the Boost libraries is subject to its license agreement http://www.boost.org/LICENSE_1_0.txt.

Stingray Objective Toolkit & Objective Grid © Rogue Wave Software, Inc.

promis-e® is a registered trademark of ECT International, Inc.

Trademarks

The following are registered trademarks or trademarks of Autodesk, Inc., in the USA and other countries: 3DEC (design/logo), 3December, 3December.com, 3ds Max, ActiveShapes, Actrix, ADI, Alias, Alias (swirl design/logo), AliasStudio, Alias|Wavefront (design/logo), ATC, AUGI, AutoCAD, AutoCAD Learning Assistance, AutoCAD LT, AutoCAD Simulator, AutoCAD SQL Extension, AutoCAD SQL Interface, Autodesk, Autodesk Envision, Autodesk Insight, Autodesk Intent, Autodesk Inventor, Autodesk Map, Autodesk MapGuide, Autodesk Streamline, AutoLISP, AutoSnap, AutoSketch, AutoTrack, Backdraft, Built with ObjectARX (logo), Burn, Buzzsaw, CAiCE, Can You Imagine, Character Studio, Cinestream, Civil 3D, Cleaner, Cleaner Central, ClearScale, Colour Warper, Combustion, Communication Specification, Constructware, Content Explorer, Create>what's>Next> (design/logo), Dancing Baby (image), DesignCenter, Design Doctor, Designer's Toolkit, DesignKids, DesignProf, DesignServer, DesignStudio, Design|Studio (design/logo), Design Your World, Design Your World (design/logo), DWF, DWG, DWG (logo), DWG TrueConvert, DWG TrueView, DXF, EditDV, Education by Design, Extending the Design Team, FBX, Filmbox, FMDesktop, Freewheel, GDX Driver, Gmax, Heads-up Design, Heidi, HOOPS, HumanIK, i-drop, iMOUT, Incinerator, IntroDV, Inventor, Inventor LT, Kaydara, Kaydara (design/logo), LocationLogic, Lustre, Maya, Mechanical Desktop, MotionBuilder, ObjectARX, ObjectDBX, Open Reality, PolarSnap, PortfolioWall, Powered with Autodesk Technology, Productstream, ProjectPoint, Reactor, RealDWG, Real-time Roto, Render Queue, Revit, Showcase, SketchBook, StudioTools, Topobase, Toxik, Visual, Visual Bridge, Visual Construction, Visual Drainage, Visual Hydro, Visual Landscape, Visual Roads, Visual Survey, Visual Syllabus, Visual Toolbox, Visual Tugboat, Visual LISP, Voice Reality, Volo, and Wiretap.

The following are registered trademarks or trademarks of Autodesk Canada Co. in the USA and/or Canada and other countries: Backburner, Discreet, Fire, Flame, Flint, Frost, Inferno, Multi-Master Editing, River, Smoke, Sparks, Stone, Wire.

Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and/or other countries.

All other brand names, product names, or trademarks belong to their respective holders.

Disclaimer

THIS PUBLICATION AND THE INFORMATION CONTAINED HEREIN IS MADE AVAILABLE BY AUTODESK, INC. "AS IS." AUTODESK, INC. DISCLAIMS ALL WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE REGARDING THESE MATERIALS.

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

Contents

Volume 1

- Introduction xiii**

- Chapter 1: Basic Workflow 1**
 - Lesson: Design Environment 2
 - Overview 2
 - Environment Comparisons 3
 - User Interface 7
 - Help System 12
 - Lesson: Basic Workflow 19
 - Overview 19
 - Basic Circuit Workflow 20
 - Exercise: Explore the Basic Circuit Workflow 23
 - Chapter Summary 30

- Chapter 2: Project Basics 31**
 - Lesson: Project Manager 32
 - Overview 32
 - About Project Files 33
 - About the Project Manager 36
 - Creating New Projects 40
 - Exercise: Create a New Project 44
 - Lesson: Project Drawing List 46
 - Overview 46
 - About the Drawing List 47
 - Creating New Drawings 48
 - Editing the Project Drawing List 51
 - About Drawing Descriptions and Sections 57
 - Adding Drawing Descriptions and Sections 58
 - Changing the Drawing List Display 59
 - Project Batch Plotting 63
 - Exercise: Edit the Project Drawing List 66

Lesson: Moving Through Projects	69
Overview	69
Selecting Drawings Using the Project Manager	70
About Opening the Previous or Next Project Drawing	72
Searching Project Drawings Using the Surfer Tool	73
Exercise: Move Through Project Drawings	78
Lesson: Managing Projects.....	80
Overview.....	80
Opening Projects.....	80
Activating and Closing Projects	82
Copying Projects	85
Exercise: Copy a Project	91
Chapter Summary	93

Chapter 3: Schematic Wiring 95

Lesson: Wires and Ladders.....	96
Overview.....	96
About Wires.....	97
Inserting Wires	100
Layer Assignments	102
Trimming Wires	103
About Ladders and Rungs	105
Referencing	107
Inserting Ladders and Rungs.....	109
Revising Ladders	112
Exercise: Insert Ladders and Wires	114
Lesson: Point-to-Point Wiring	118
Overview.....	118
Point-to-Point Style Drawings.....	119
Point-to-Point Wiring Tools	120
Using Point-to-Point Wiring Tools.....	123
Exercise: Add Point-to-Point Wiring.....	127
Lesson: Wire Numbers and Leaders	132
Overview.....	132
About Wire Numbers and Leaders.....	133
Setting Wire Number and Leader Defaults.....	137
Automatically Adding Wire Numbers and Leaders	140
Manually Adding and Editing Wire Copies and Leaders	141
Exercise: Add Wire Numbers.....	144
Lesson: Source and Destination Signals	147
Overview.....	147
About Source and Destination Signals.....	148
Adding Source and Destination Signals	149
Exercise: Add Source and Destination Signal Arrows	153
Chapter Summary	158

Chapter 4: Schematic Components	159
Lesson: Inserting Schematic Symbols.....	160
Overview.....	160
Schematic Symbol Insertion Process.....	161
About the Insert/Edit Component Dialog Box.....	165
Selecting Existing Catalog Part Numbers	172
Creating Parent-Child Relationships.....	176
Exercise: Insert a Relay Coil and Child Contact.....	179
Lesson: Inserting Schematic Components from Lists.....	184
Overview.....	184
About Equipment, Panel, and Catalog Lists.....	185
Inserting Components from Lists.....	187
Exercise: Insert a Schematic Component from a Panel List	197
Lesson: Connectors.....	201
Overview.....	201
Inserting Connectors	202
Editing Connectors	208
Exercise: Add Connectors and Wiring	213
Lesson: Terminals, Multiple Level Terminals, and Jumpers	220
Overview.....	220
About Terminals and Jumpers	221
About Multiple Level Terminals	224
Inserting Terminals, Multiple Level Terminals, and Jumpers	226
Exercise: Create Terminal Jumpers and Associations.....	237
Lesson: Circuits.....	243
Overview.....	243
About Circuits	244
Moving and Copying Circuits	245
Inserting Wblocked Circuits	248
Saving Circuits to an Icon Menu	250
Inserting Saved Circuits.....	253
Exercise: Copy, Save, and Insert a Circuit	256
Lesson: Multiple Phase Circuits.....	260
Overview.....	260
Adding Multiple-Phase Wires	261
Adding Three-Phase Components.....	265
Exercise: Create a Three-Phase Circuit.....	268
Chapter Summary.....	272
Chapter 5: Schematic Editing	273
Lesson: Basic Utilities	274
Overview.....	274
Changing Component Locations with Scoot.....	275
Changing Component Locations with Move Component	277
Aligning Components Vertically and Horizontally.....	280
Copying Components	282
Deleting Components	284
Toggling Between Normally Open and Normally Closed Contacts ..	286
Exercise: Use Basic Editing Tools	287

Lesson: Copy Catalog and Location Values	290
Overview.....	290
Copying Catalog Assignments	291
Copying Installation/Location Values.....	294
Exercise: Copy Catalog and Location Values.....	296
Lesson: Swapping and Updating Blocks	299
Overview.....	299
About Swapping and Updating Blocks	300
Swapping Blocks	302
Updating Blocks.....	304
Mapping Attributes.....	310
Exercise: Swap and Update Blocks	311
Lesson: Using the Auditing Tools.....	314
Overview.....	314
Using Electrical Audit.....	315
Using Drawing Audit	319
Exercise: Use Electrical Audit and Drawing Audit	321
Lesson: Update and Retag Drawings	324
Overview.....	324
Updating and Retagging Drawings.....	325
Changing Drawing Sequence	330
Exercise: Update and Retag the Schematic Editing Project.....	332
Chapter Summary	334

Chapter 6: Schematic Reports **335**

Lesson: Schematic Reports.....	336
Overview.....	336
About Reports.....	336
Creating Schematic Reports.....	339
Using the Report Generator.....	346
Changing Report Formats	348
Placing Reports in Drawings	350
Saving Reports to Files.....	356
Exercise: Generate Schematic Reports	357
Chapter Summary	362

Chapter 7: Panel Layouts..... **363**

Lesson: Creating Panel Layouts	364
Overview.....	364
Inserting Panel Footprints from a Schematic List.....	365
Assigning Footprint Blocks.....	369
Inserting Panel Footprints Using the Panel Icon Menu	373
About Nameplates	377
Exercise: Create a Panel Layout from a Schematic List	378
Lesson: Using the DIN Rail Tool	384
Overview.....	384
About DIN Rails.....	385
Inserting DIN Rails	387
Exercise: Insert a DIN Rail	391

Lesson: Using the Terminal Strip Editor.....	395
Overview.....	395
Terminal Strip Editor.....	396
Editing Tools.....	400
Preview and Insertion.....	401
Inserting Terminal Strips.....	407
Exercise: Edit and Insert a Terminal Strip.....	411
Lesson: Panel Layout Annotation and Reports.....	418
Overview.....	418
About Panel Drawing Configuration.....	419
About Footprint Layer Configuration.....	421
Configuring Balloons.....	422
Assigning Item Numbers and Inserting Balloons.....	425
Creating Panel Reports.....	429
Exercise: Annotate a Panel Layout.....	430
Chapter Summary.....	434

Volume 2

Chapter 8: Settings and Configurations 1

Lesson: Creating Wire Types.....	2
Overview.....	2
About Wires.....	3
Creating Wire Types.....	4
Renaming User Columns.....	10
Changing, Converting, and Setting Wire Types.....	12
Exercise: Create and Change Wire Type Layers.....	16
Lesson: Using Reference Files.....	21
Overview.....	21
Using Component Reference Files.....	22
About Project Description Line Labels.....	25
About Environment Reference Files.....	27
Overview.....	29
About Drawing Properties.....	30
Drawing Settings.....	32
Components.....	34
Wire Numbers.....	36
Cross-References.....	38
Styles.....	41
Drawing Format.....	43
About WD_M Block Files.....	49
Exercise: Change the Drawing Properties.....	51

Lesson: Project Properties	54
Overview.....	54
About Project Properties.....	55
Project Settings	56
Components	59
Wire Numbers.....	60
Cross-References	63
Comparing and Copying Properties.....	64
Exercise: Change Project Properties.....	67
Chapter Summary	69

Chapter 9: Custom Components 71

Lesson: Schematic Symbols.....	72
Overview.....	72
About Custom Schematic Symbols.....	73
Symbol Naming Convention	73
About Symbol Data Attributes	76
About Symbol Wire Connection and Terminal Attributes.....	78
Creating Symbols Using the Symbol Builder Tool	80
Inserting Standard Symbol Attributes	83
Inserting Wire Connection Attributes.....	86
Exercise: Create a Custom Symbol	90
Lesson: Icon Menu System.....	94
Overview.....	94
Selecting Icon Menus.....	95
Icon Menu Wizard	98
Editing Icon Menus	103
Exercise: Modify the Icon Menu.....	106
Lesson: Panel Footprints	110
Overview.....	110
About Panel Footprints	111
About Panel Footprint Database Files	112
Editing the Panel Footprint Database	114
Exercise: Create a Panel Footprint	118
Chapter Summary	122

Chapter 10: Custom Data 123

Lesson: Managing Part Catalog Databases.....	124
Overview.....	124
About Part Catalog Databases	125
Catalog Structure.....	126
Adding and Editing Catalog Part Numbers	128
Creating Multiple Catalog Subassemblies	133
Exercise: Add Part Numbers and Assemblies to the Part Catalog	137
Lesson: Editing the Pin List Database.....	142
Overview.....	142
About the Pin List Database.....	142
Editing the Pin List Database.....	144
Exercise: Copy and Insert Relay Contacts.....	150

Lesson: Updating Title Block Attributes.....	155
Overview.....	155
Title Block Mapping Options.....	156
Mapping Formats.....	158
Using the Title Block Setup Tool.....	160
Updating Title Block Attributes.....	165
Exercise: Map to a Title Block.....	169
Chapter Summary.....	172
Chapter 11: Automation Tools.....	173
Lesson: Updating Schematics from Spreadsheets.....	174
Overview.....	174
Exporting Data to Spreadsheets.....	175
Updating Data from Spreadsheets.....	178
Exercise: Update a Drawing from a Spreadsheet.....	181
Lesson: Generating Automatic Reports.....	184
Overview.....	184
Creating SET Files.....	184
Generating Reports Automatically.....	188
Exercise: Generate Reports Automatically.....	197
Chapter Summary.....	202
Chapter 12: Autodesk Vault Integration.....	203
Lesson: Working with Autodesk Vault.....	204
Overview.....	204
Opening and Accessing.....	205
Typical Workflow.....	206
About Shared Workspaces.....	208
Checking In Projects and Drawings.....	210
Checking Out Projects and Drawings.....	215
Open from Vault.....	217
Attach from Vault.....	219
Exercise: Access the Vault.....	221
Chapter Summary.....	224
Chapter 13: PLC Modules.....	225
Lesson: Using PLC I/O Modules.....	226
Overview.....	226
About the Parametric PLC Module Structure.....	227
Inserting and Breaking Parametric PLC Modules.....	228
Editing a PLC Component.....	236
About PLC Stand-Alone I/O Points.....	237
Inserting Nonparametric PLC Modules.....	238
Exercise: Insert a Parametric PLC Module.....	240

Lesson: Using the PLC Database File Editor	244
Overview	244
About the PLC Database File Editor	245
PLC Module Specifications	246
Terminal List and Settings	250
Creating a Parametric PLC Module	253
Exercise: Create a PLC Module	259
Lesson: PLC I/O Address-Based Tagging	265
Overview	265
PLC I/O Address Component Tag Format	266
PLC I/O Address Wire Number Tag Format	266
Exercise: Add PLC Address-Based Components	268
Lesson: Using the Spreadsheet to PLC I/O Utility	270
Overview	270
About the Spreadsheet to PLC I/O Utility	271
Spreadsheet to PLC I/O Utility Setup	273
Using the Spreadsheet to PLC I/O Utility	278
Exercise: Create PLC Drawings from a Spreadsheet	284
Chapter Summary	286

Chapter 14: Advanced Tools..... 287

Lesson: Adding Wire Data to Footprints	288
Overview	288
About Wire Connection Annotation Formats	289
About Footprint Wiring Attributes	290
Adding Wiring Information to Panel Footprints	291
Editing Wire Connection Sequences	293
Exercise: Add Wiring Data to Footprints	295
Lesson: Managing Cables	299
Overview	299
About Fan In/Out Signals	299
About Cable Markers	302
Combining Cable Markers and Fan In/Out Signals	305
Exercise: Identify and Label Wires for a Cable	313
Chapter Summary	322

Appendix A: Additional Support and Resources 323

Courseware from Autodesk	324
Autodesk Services & Support	326
Autodesk Subscription	326
Autodesk Consulting	326
Autodesk Partners	327
Autodesk Authorized Training Centers	327
Autodesk Certification	328
Useful Links	328

Introduction

Welcome to the *AutoCAD Electrical 2008: Essentials (JIC Standard)* Autodesk Official Training Courseware, training courseware for use in Authorized Training Center (ATC®) locations, corporate training settings, and other classroom settings.

Although this courseware is designed to be used as a teaching tool for instructor-led courses, it can also be used for self-paced learning. In addition to the coursework, this manual encourages self-learning through the use of the AutoCAD® Electrical Help system.

This introduction covers the following topics:

- Course objectives
- Prerequisites
- Using this courseware
- CD contents
- Completing the exercises
- Installing the exercise data files from the CD
- Notes, tips, and warnings
- Feedback

This courseware is complementary to the software documentation. For detailed explanations of features and functionality, refer to the Help in the software.

Course Objectives

After completing this course, you will be able to:

- Describe the AutoCAD Electrical user interface and follow the basic electrical project design workflow.
- Manage projects and the multiple drawing and inter-drawing relationships contained in electrical projects.
- Insert wires, add wire numbers, manage circuits, and create point-to-point wiring diagrams and drawings.
- Insert and annotate schematic symbols.
- Edit drawings projectwide with commands that are specific to the electrical design environment.
- Extract information from drawings to create Bill of Material, Wiring, and other reports.
- Create and annotate panel layout drawings with lists of components that are extracted from schematic drawings and with other specific panel layout tools, such as the Terminal Strip Editor.
- Change project and drawing configurations by changing the default settings to match your specific electrical design requirements.

- Create custom schematic and panel symbols to meet your specific needs and customize the icon menu system to include the new symbols.
- Add part numbers to the catalog database and change the reference to different catalog databases.
- Use automated processes, such as generating reports and updating drawings from spreadsheets, to improve design productivity.
- Integrate Autodesk® Vault into your electrical design environment to add document management to your design process.
- Insert parametric PLC I/O and standard full-unit modules in your schematic drawings, as well as create custom PLC I/O modules.
- Use advanced tools to add wiring information from schematic drawings to panel footprints and to manage cables in your projects.

Prerequisites

This course is designed for users new to AutoCAD Electrical 2008. It is recommended that you have:

- A background in electrical design (drafting and design experience is a plus).
- A working knowledge of AutoCAD®.
- A working knowledge of Microsoft® Windows® 2000, Microsoft® Windows® XP, or Microsoft® Windows® Vista.

Using This Courseware

The lessons are independent of each other. However, it is recommended that you complete these lessons in the order that they are presented unless you are familiar with the concepts and functionality described in those lessons.

Each chapter contains:

- **Lessons**
Usually two or more lessons in each chapter.
- **Exercises**
Practical, real-world examples for you to practice using the functionality you have just learned. Each exercise contains step-by-step procedures and graphics to help you complete the exercise successfully.

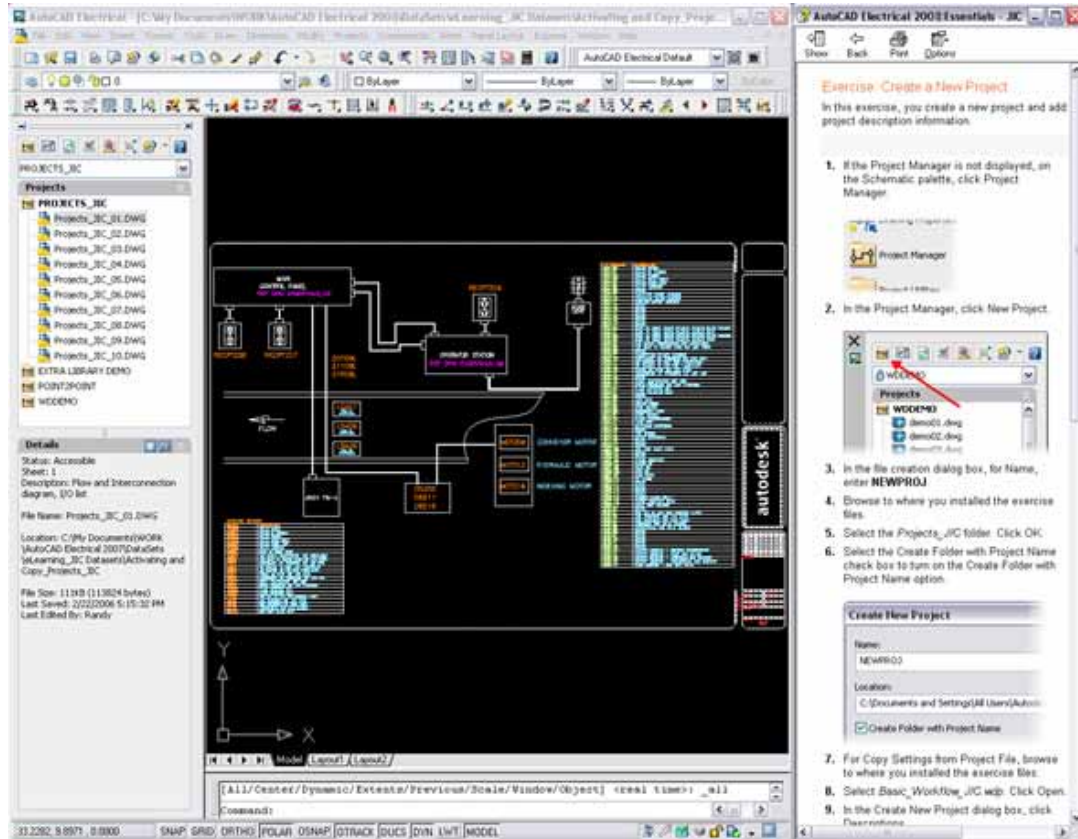
CD Contents

The CD attached to the back cover of this book contains all the data and drawings you need to complete the exercises in this course.

Completing the Exercises

You can complete the exercise in two ways: using the book or onscreen.

- **Using the book**
Follow the step-by-step exercises in the book.
- **Onscreen**
Click the AOTC AutoCAD Electrical 2008 Essentials JIC icon on your desktop, installed from the CD, and follow the step-by-step exercises on the screen. The exercises are the same as those in the book. The onscreen version has the advantage that you can concentrate on the screen without having to glance down at your book.



After launching the onscreen exercises, you might need to alter the size of your application window to align both windows.

Installing the Exercise Data Files from the CD

The following steps describe how to install the data files for the exercises:

1. Insert the courseware CD.
2. When the setup wizard begins, follow the instructions onscreen to install the data.
3. If the wizard does not start automatically, browse to the root directory of the CD and double-click *Setup.exe*.

Unless you specify a different folder, the exercise files are installed in the following folder:

C:\Documents and Settings\All Users\Autodesk Learning\AutoCAD Electrical 2008\Essentials JIC

After you install the data from the CD, this folder contains all the files that are necessary to complete each exercise in this course. You can also use the Autodesk Learning shortcut on your desktop to quickly access the datasets for each AOTC course on your system.

Notes, Tips, and Warnings

Throughout this courseware, notes, tips, and warnings are called out for special attention.



Notes contain guidelines, constraints, and other explanatory information.



Tips provide information to enhance your productivity.



Warnings provide information about actions that might result in the loss of data, system failures, or other serious consequences.

Feedback

Feedback about Autodesk Official Training Courseware is always welcome. After completing this course, if you have suggestions for improvements or if you want to report an error in the book or on the CD, please send your comments to AOTC.feedback@autodesk.com.