



Standard Substation Circuits in Autodesk® AutoCAD® Electrical

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Standard Substation Design Duke Energy



Class summary

- In this class, you learn to create standard (plates) circuits in Autodesk AutoCAD Electrical software for substations. We cover how to use options in AutoCAD Electrical to insert blocks of standards to complete substation design in a quick, standard, and accurate way. We demonstrate the linking of parts in an assembled circuit, how to add options in a timely manner, and complete your design using all the tools that AutoCAD Electrical has to offer.

Key learning objectives

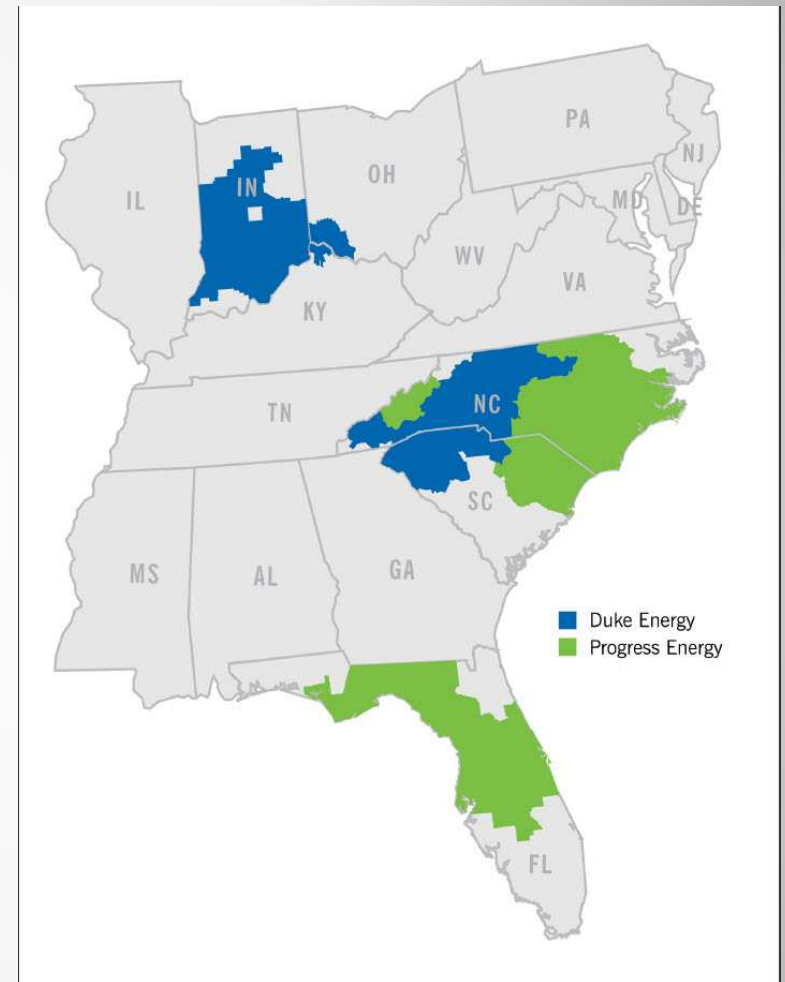
At the end of this class, you will be able to:

- Establish a utility standard for circuit templates using a multi-level device ideology in AutoCAD Electrical
- Create standard devices for a utility that can be used in greenfield and brownfield stations and applied to standard engineering designs in circuits
- Create new or take advantage of existing standard engineering designs in AutoCAD Electrical circuits
- Establish a standard library and selection process for end users to effectively select the correct engineering standard circuits in AutoCAD Electrical

Duke Energy

Transmission Engineering

- 5 Engineering Offices (Charlotte, Raleigh, Lake Mary, Plainfield, Cincinnati)
- Over 7700 Electrical Substations in 6 states





What is a ACADE Circuit



Definition

- A Circuit in ACADE is collect parts in a device or multiple devices that are built together to form a single representation that can be inserted as one selection.

Different Types

- Circuit Builder
- Creating Circuits Using Save Circuit



Circuit Builder



Circuit Builder – Why to **MAYBE** use it

- Very powerful tool that is a part of the out of the box ACADE software
- Can configure different options in one pass
- The user can add catalog data while in the tool to the devices being configured

Circuit Builder – Why not to use it

- Very difficult to program if you are not savvy to code
- You have to build the circuit every time you run the command, no single click method.
- New set of skills to teach your users



Creating Circuits using Save Circuit Option



Save Circuit – Why we use this method

- Lets our users stay in a single environment (Icon Menu) to access the Standard Designs
- Easy to create while building from already created ACADE parts, No programming needed
- Can control the standards more effectively
- Very little learning curve to teach the Parts Builders

Save Circuit – Hard Points

- This is a method for making it Non-configurable
- Makes the user delete the entire standard circuit if not needed, not just certain parts
- Easy way to control which parts are editable to the end user

Save Circuit – Soft Points

- This is a method for making it configurable
- Makes the user delete the parts of the standard circuit if not needed, puts the designer in control but still starting off with a agreed standard
- Easy way to control which parts are editable to the end user



Substation Engineering Standard Circuits



Schematic – Substation Wild Card Characters

- Use a standard set of wildcards, ACADE can take advantage of replacing those wild cards, using export/import, with station specific data
- Also can create custom coding to make the input easier

FD07 Search & Replace

Substation Name Sub #

High Side Voltage Code Drawn

High Side Voltage Tech

Transmission Breaker Switch Number Engr

Low Side Tie Breaker/Switch Number Check

Transformer MVA Date

LINENAME1

LINENAME2 Bank #2

BANK 1 | BANK 2

#C	Line MOS Switch Number	<input type="text"/>
#D	High Side Disconnect (Circuit Switcher) Switch Number	<input type="text"/>
#SD	High Side Circuit Switcher's Disconnect Switch Number	<input type="text"/>
#2C	Low Side Bank #1 Breaker Switch Number	<input type="text"/>
#2D	Feeder Breaker Number	<input type="text"/>
#S2D	Feeder Breaker Disconnect Switch Number	<input type="text"/>
#2E	Feeder Breaker Number	<input type="text"/>
#S2E	Feeder Breaker Disconnect Switch Number	<input type="text"/>
#2F	Feeder Breaker Number	<input type="text"/>
#S2F	Feeder Breaker Disconnect Switch Number	<input type="text"/>
#2G	Feeder Breaker Number	<input type="text"/>
#S2G	Feeder Breaker Disconnect Switch Number	<input type="text"/>
#2M	Transfer Feeder Breaker Number	<input type="text"/>
#S2M	Transfer Feeder Breaker Disconnect Switch Number	<input type="text"/>

Replace Text

Schematic – Substation Wild Card Characters

■ Bank 1 Wild Cards

- #C = Line MOS Switch #
- #D = H. Side Disconnect SW #
- #SD = H. Side Circuit SW Disconnect #
- #2C = L. Side Bank #1 Breaker SW #
- #2D = Feeder Breaker Number
- #S2D = Feeder Breaker Dis SW #
- #2E = Feeder Breaker Number
- #S2E = Feeder Breaker Dis SW #
- #2F = Feeder Breaker Number
- #S2F = Feeder Breaker Dis SW #
- #2G = Feeder Breaker Number
- #S2G = Feeder Breaker Dis SW #
- #2M = Transfer Feeder Breaker Number
- #S2M = Transfer Feeder BKR Dis SW #

■ Bank 2 Wild Cards

- #H = Line MOS Switch #
- #K = H. Side Disconnect SW #
- #SK = H. Side Circuit SW Disconnect #
- #2P = L. Side Bank #1 Breaker SW #
- #2H = Feeder Breaker Number
- #S2H = Feeder Breaker Dis SW #
- #2J = Feeder Breaker Number
- #S2J = Feeder Breaker Dis SW #
- #2K = Feeder Breaker Number
- #S2K = Feeder Breaker Dis SW #
- #2L = Feeder Breaker Number
- #S2L = Feeder Breaker Dis SW #
- #2N = Transfer Feeder Breaker Number
- #S2N = Transfer Feeder BKR Dis SW #

Schematic – Saving Locations using Vault

- Currently
 - saving out on a LAN share drive that only certain personnel have access to for creating or editing
 - Have a routine to run on user machine to copy down to C: Drive
 - Issue is that the current process is a Save As type function
- Future using Vault
 - Have a Version history to see evolution of standard circuit
 - Gives us the ability to go back and revive previous approved versions if needed
 - Have a real time approval standard circuit workflow

Schematic – User Interaction

- Use the Icon Menu to have the user have one point of interaction from parts to accessing standard circuits
- Adding Standard circuits to the icon menu is just as easy as adding components

Panel – Adding Hard (Non-Configurable) Sub Wiring/Panel Circuits

- This is a method for making it Non-configurable
- Makes the user delete the entire standard circuit if not needed, not just certain parts
- Easy way to control which parts are editable to the end user

Panel – Adding Soft (Non-Configurable) Sub Wiring/Panel Circuits

- This is a method for making it Non-configurable
- Using the Footprint database you can add multiple panel items in one entry, using circuits, for inserting multiple pieces using schematic list option
- Also adding a “*” in front of the string on the footprint lookup it will automatically smart explode the multiple device circuit to be interacted with.
 - *HOFFMAN/EN-ENCLOSURES
HARDWARE/A10086CH_ASSY



SEL Creation Circuits

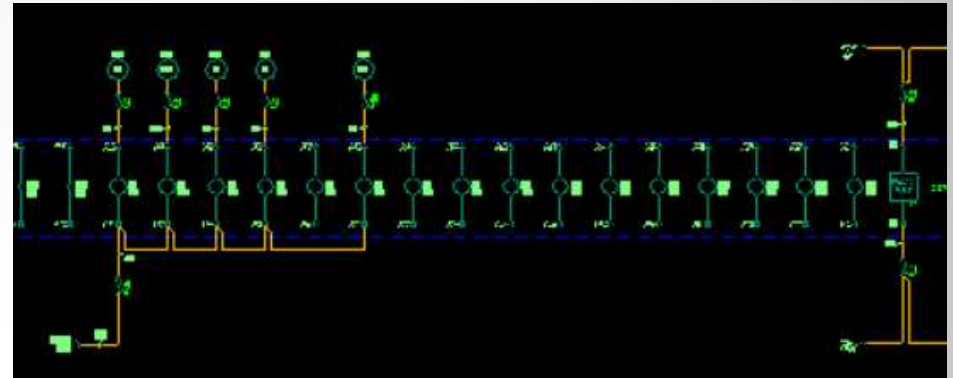


How to Build the Separate SEL Parts to Standards

- For all microprocessor relays, the power supply will be the parent.
 - Relay inputs shall clearly indicate the relay's primary use (INST), name (DESC1), input number (state), and purpose of the input (DESC2).
 - Relay outputs shall clearly indicate the relay's primary use (INST), name (DESC1), output number (state), and purpose of the output (DESC2).
 - Normally Open (1), Normally Closed (2) and Form C (3) outputs will follow AutoCAD Electrical standard pin assignments. AutoCAD Electrical allows the user a method of identifying pins which may not be normally open (NO) or normally closed (NC) as found on general relays. A user defined terminal starting with "4" as been established and will be utilized for various terminal types.
 - The Pinlist standard name will be put in a attribute called PINLIST_TYPE
- **PROTECTIVE RELAY PINLIST TYPE LEGEND**
 - **OUTPUTS**
 - 1 -NORMALLY OPEN CONTACTS
 - 2- NORMALLY CLOSED CONTACTS
 - 3 -FORM C CONTACTS
 - 4S -SPECIAL OUTPUTS (TRANSISTORS)
 - **INPUTS**
 - 4N- INDIVIDUAL CONTROL INPUTS
 - 4NM-CONTROL INPUTS WITH A COMMONTERMINAL
 - 4V -VOLTAGE ELEMENT INPUTS
 - 4C -CURRENT ELEMENT INPUTS
 - **SPECIAL**
 - 4CM -COMMUNICATION / CLOCK TERMINALS
 - 4PB -PUSHBUTTONS
 - 4LT -LIGHTS/LEDS
 - 4DC -DC MONITOR

Putting the SEL Together (Building)

- Add the pinlist information in the pinlist table for the SEL using the format of (1,A01,A02*IN102) in the Catalog Database
 - (Pinlist_type,Pin#, Pin#,*I/O State)
- You add your parent device first in the drawing
- Start to build the SEL with all of the needed I/O and using the parent child ability, link the child I/O.
- Create the SEL as a Save circuit, place in Vault and create the Icon menu button for access to the SEL in the menu



02-12-12-100 - pin numbers in use

Defined but unused contacts, PINLIST_TYPE value = 4N

Pick on pin pair to use.

SheetReference	Type	Pins	Wire Numbers
SAC2, H1		Z01, Z02,Z03,Z04,Z05,Z06...	A1, A2, B1, B2, C1, C2, G1...
SDC1, J1		Z25, Z26	

IN101=A17, A18
IN102=A19, A20
IN103=A21, A22
IN104=A23, A24
IN105=A25, A26
IN106=A27, A28

OK Cancel Help Freshen

Adding User interacted menu selections

- In the Schematic Icon menu create a folder that will house all of the SEL configurations
- Each is broken down by a SEL type folder
 - 351, 531, 351S, etc.
- Have a folder setup to house the individual parts so that the user can access the individual parts needed to add to the current SEL. Also used for the Parts Builder to create the Standard SEL configuration

Thank You

Questions

