

Is 3D Control Cabinet Design Software Cost Effective?

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Introduction:

The use of 3D solid design tools for mechanical design has been proven to be effective for decades. The latest trend is to shift this 3D technology over to the design of Control Cabinets. With over 20 years of delay between using 3D design software for mechanical and controls, the obvious question is if 3D Control Cabinet Software is now worth the extra software and learning costs?

Some managers appear to hope that these software packages will allow for less qualified engineers and wireman. However, software should never be used to replace good professional judgment in any field, and this definitely applies to qualified controls engineer and wireman.

There are three general areas of opportunity within the process of designing Control Systems. Software can automate the developing the electrical schematic, generating drawing packages, and improving the efficiency of the assembly and wiring of control cabinets. The cost effectiveness of software to automate each of these three major areas is discussed.

The development of electrical Schematics:

Various software products for the design of Control Systems have been introduced to the market since the mid 1980's. The general approach for these packages has been to start with data entry of systems requirements. The software packages would then generate electrical schematics and a list of required components. Many of these packages would then generate the drawings to build the control cabinets.

In concept this all seems to be reasonable. However, the initial cost of the software, the cost of training, the learning curve costs, and the dependability of the software have all contributed to poor rates of return for these software packages.

Even after so many decades, there doesn't seem to be a package that has become a pseudo standard for designing control systems.

A good controls engineer can develop electrical schematics extremely effectively with simple 2D software. So, while software for automatically generating schematics may provide some benefits, overall the cost savings will probably continue to be marginal for generating electrical schematics.

2D vs. 3D design Drawing Package design Software:

For well over 50 years, various 2D methods have been successfully used to generate Control Cabinet designs. To compare 2D vs. 3D design software it is important to understand the 2D design process.

The general approach for the 2D process is to develop a scale drawing for the expected "mounting" spaces, such as the back panel or the door. "Scaled shapes" for each of the components are then placed within the mounting space. What this functionally means is that little scale boxes were drawn

and moved around inside of the mounting surface. While this is as crude as it sounds, this method is simple and very efficient. Virtually no overhead or training is required.

Of course simple boxes are not the most accurate representatives of the actual part, but after a few projects it is not difficult for the designer or engineer to be able to develop a "feel" for these designs.

In addition, the common method of building Control Panels is to lay the mounting surface (such as a back panel) on a horizontal surface, then to place each of the components close their mounting positions. At that point, an experienced wireman, with the parts in hand, and a good understanding of required working space around various components would be able to easily make any necessary adjustments to the layout.

The simplicity and efficiency of using 2D design packages has created significant obstacles for moving to 3D design software. However advancements in 3D design software provides a number of areas of opportunities:

BOM's: However, as the 3D design software has matured, there are now a number of advantages over the old 2D methods. One of the major areas of time savings is the generation of BOM's. With the manual 2D approach it is typically required to verify, edit and/ or enter each BOM item. Not only is this time consuming and tedious but the probability of typing errors is much higher. If a 3D design software package is properly set up with an appropriate library, there is a considerable savings as BOM's are automatically populated.

Sub-Assemblies: Another significant cost savings of 3D over 2D software libraries is the growing number of control components that are comprised of sub-components. An example of this is a 22.5mm Allen Bradley lighted push button. In this example a single operator interface is comprised of the actuator, a mounting ring, an LED module, NO and NC contact blocks, etc. As the number of these types of assembled components is needed in a design, the time required to account for all of the sub-components can become considerable when working with 2D process. However, in the 3D environment, a single assembly component can be "dropped" from the library into the design and all of the sub-components will be automatically handled in the background, saving significant time and improving accuracy.

Panel Cutouts: For projects using 2D techniques, it is fairly common for the wireman to determine the final locations of components and then to manually cut out the required holes as needed. Cutting these holes requires significant effort and time. If the library components in 3D software are setup properly, "Smart Features" can be built into components. Smart Features allows for the mounting holes of various components to be "reflected" onto the surface with which they will be mounted. So, with a few clicks, the information for accurate shape and size of holes can be included into the CAD models needed. If manual techniques are used to build cabinets, Smart Features for components does not provide much value. However, with 3D models, Smart Feature information can be used to automatically cutout the required holes with CNC equipment.

Misc: There are other advantages than are mentioned above, but fundamentally, 3D design software provides a more automated environment than the 2D techniques, saving time and improving quality for the design and building of Control Cabinets.

Conclusion: The obvious question is if the 3D software cost effective over 2D methods? In a case study, using the Manufacturing Systems Inc. Controls Library within Solidworks a control cabinet design that would normally require between 6 to 8 hours to develop was completed in a little over 2 hours. The cabinet is shown below and includes over 80 items on the BOM.

The conclusion is that 3D software with an appropriate library provides higher quality drawing packages with significant time savings.



Assembly and Wiring:

Some of the new 3D design packages attempt to improve the Assembly and Wiring of Control Cabinets by "aiding" in the placements of wires. Apparently, the assumption is that less experienced wiremen can perform the wiring as they only need to follow the "pictures" of each individual wire as they are displayed. While this may sound attractive to some, experience has consistently shown that the value of a qualified wireman should never be underestimated. A good wireman will not only mount components and connect wires but will use extra caution with more valuable components, verify the quality of the work, and quickly correct any wiring errors before releasing the Control Cabinet.

With an electrical schematic and an assembly drawing, a good wireman will assemble and wire a control panel very efficiently. It is extremely doubtful that having pictures of individual wires will result in significant time savings. Thus, the value of such features provided by Software packages is questionable.

Summary:

There are three areas of opportunities to use software to automate the design process of Control Systems. The first area is the development of electrical Schematics. The second area is the design of Control Cabinets. The third area is the assembly and wiring of the Control Cabinets.

While software packages are available to assist in all three areas, from my experience, **out of the three potential areas, only the 3D design of Control Cabinets is cost effective.** To gain the benefits of 3D design software for designing Control Cabinets all that is needed is a Controls Library. No additional software costs or installation or training is necessary. A customized Controls library may require a relatively small cost, but will be very cost effective. In addition other benefits, since only standard CAD features and commands are needed, the dependability of the software is not compromised.

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