



Saving Time and Energy with Automatic Creation of Wiring Diagrams

TECHNICAL ARTICLE

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Abstract

Wiring diagram creation can be time consuming. When creating a new project, drawing a wiring diagram can be helpful to the development process as the engineer works through technical issues and fine tunes the design. However, when re-creating a design from existing sources, it is not necessary (or a good use of time) to redraw the wiring diagram when tools exist to create these diagrams automatically. Since wiring diagrams are necessary for documentation and servicing, the need for these drawings will be around for a long time to come.

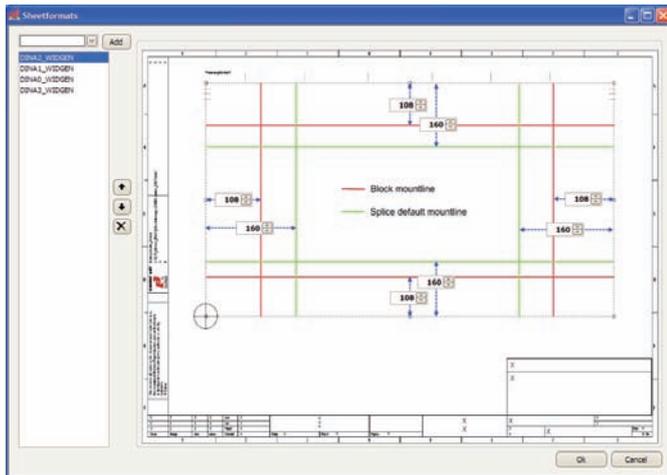
The question is, when and how to do it? What are the advantages and the drawbacks?



E³.Wiring Diagram Generator is Zukens tool for automatic wiring diagram generation

When to Draw Manually and When to Automatically Generate

When creating a new design where the wiring diagram is the primary engineering development document, drawing a wiring diagram manually is usually the only way to go. It permits you to design as you go, to examine what-if scenarios, fine tune your design, and create final documentation for testing and service. This is the traditional way wiring diagrams have been created and there are many good tools for this purpose and a number top-rated tools that excel at this task.



Definition of standard placement areas in the configuration

However, not all wiring diagrams are started from scratch and a number of them are simply recreations of a wiring diagram that already exists. In these situations, manually redrawing a wiring diagram simply to get it into the right format or system can be a tedious task where manually drawing is not a good use of time or resources. In this case, automatic wiring diagram generation is a better way to go.

Sources Which Lend Themselves To Automatic Generation

In today's world, there is often a need to move data from one vendor's system to another. This usually comes about because either your current vendor cannot meet your needs, or because you have acquired (or been acquired by) another company and you want to consolidate on a single CAD system or vendor.

When this happens, a lot of wiring diagram data exists in your old system that you want to move to your current solution. Often, this is a simple recreation of the existing design for archive or documentation purposes. On the other hand, the wiring diagrams in the old system are frequently needed to form the base of a new project. Sometimes, these are small changes that bring a project up to date for continued production, and other times they form the basis for brand new projects with extensive engineering. A tool that automatically generates diagrams from the old source is ideal in these situations.

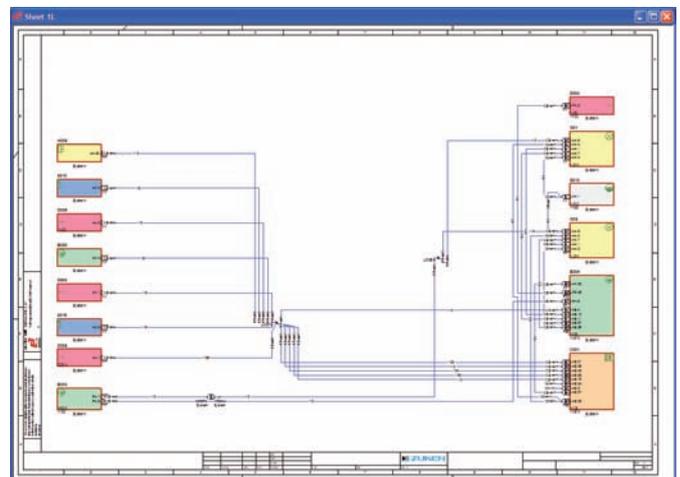
Another use for automatic diagram generation is when a design is started from a BOM and a spreadsheet rather than a wiring diagram. Once the design is proven and ready for documentation, a wiring diagram is needed. Using a netlist and part list extracted from the spreadsheet, a wiring diagram can easily be generated from this input.

Frequently, the creation of service manuals requires that all wiring diagrams follow the same style and formatting rules. In these circumstances, countless unproductive hours are spent redrawing the wiring diagrams to conform to the proper standards. By setting the wiring diagram generator's rules and parameters to correspond to the necessary guidelines, all drawings are produced in the same style and format.

Lastly, new design methods have arisen where the system is described functionally and then a detailed wiring diagram is created from the functional design or system design.

This is the first phase of a top-down approach where the functional or system design represents blocks of functionality that connect together to create a whole system. These functional blocks carry the data necessary to derive the overall design intent from which a formal wiring diagram can be created. Because the project was started as a functional design, the fine tuning was done by the engineer during that phase.

The detailed wiring diagram needed for testing and service can be automatically generated from the functional design.



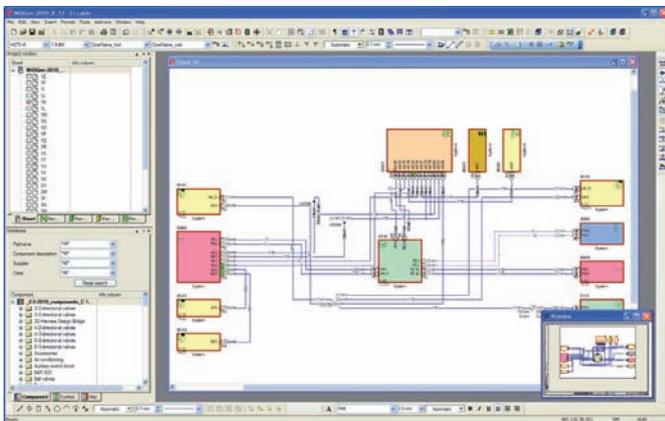
System related horizontal placement

How Does It Work?

This may initially seem like an isolated part of the cable design process, but the physical reality of a buildings structure can have a massive impact on what additional parts are selected and incorporated into any cable design, whether it is a plug, socket, gland or insert etc – each part needs to be compatible with the cable and the connector and the space with which it is having to fit into and obstacles it has to work around. The size and shape of the cable trays and ducting are also determined by the parameters set by the building contractor. Pure educated guess work can prove very costly.

An automatic wiring diagram generator accepts a CSV format connection list as input. At a minimum, the connection list contains from/to connections, reference designators, and component or equipment types. Additional data, such as pin, wire, and device attributes can also be included and, when they exist, enhance the details in the wiring diagram. As the diagram is generated, block components, connectors, and pins are automatically created for each component in the diagram.

To achieve an optimal result, rules are configured to control the appearance and density of the diagram, and to enable the user to configure the output to conform to their company standards and practices. Some rules have trade-offs to consider. For example, wire routing obeys a crossing weight parameter which instructs the router to avoid crossing lines when possible. The higher the value, fewer lines will cross, but it will take longer to find a path and more space will be used on the sheet.



System related placement around a central base block

Other rules control the component and line density on the sheet. Settings for block size (height and width), orientation, text size, and pin spacing dictate the size of the block components and connectors on the sheets. Placement settings allow the user to control the horizontal and vertical space between components.

Modifications to the entire system or specific subsystems can be implemented using the update function. This function allows you to import a second or modified connection list.

The new connection list is compared to the current project and components, connectors, and wires are updated or, in the case of major changes, the modified sheets are regenerated. A report is generated which displays the changes. Optionally, revisions are highlighted in the drawing.

By changing parameters, you can regenerate the project in whole or in part to achieve further optimization of the diagrams. Because the wiring diagram generator is fast, regenerating the whole project is quick and easy. However, for various reasons you may want to change only a single page, or part of a page. In these cases, the reroute and regenerate functions assist you. With reroute, you can select a component or pin and reroute only those connections. With regenerate, you can regenerate a sheet or group of sheets using new or modified parameters.

For ease of use, command functions are included in a toolbar that is available in the wiring diagram drawing environment. These functions include import, regenerate, remove, reroute, update, reset highlights, and rules configuration.

A broad range of diagrams from simple from-to connections to more complex environments can be processed. For example, diagrams that include variants, splices, inline connectors, wiring and different display symbols are all supported.

Use in Electrical System Engineering

Using this method, FIAT significantly reduced their electrical architecture design cycle. Paulo Puiatti, Engineering & Design Electrical / Electronics – Power & Signal Distribution Manager at FIAT Group Automobiles comments, “Our objective three years ago was to reduce the electrical architecture design cycle for a new car by 20%, requiring no extra resources, just improved process and product development integration. E³.Wiring Diagram Generator is proving to be instrumental in making this possible.”

Summary

The introduction of the wiring diagram generator has been driven by customer demand, calling for a solution that will quickly draw a cable or wire harness system. In the automotive industry for example, wiring diagrams historically had to be drawn manually for production documentation and service support, adding time and cost to the project. Now, an entire vehicle can be documented in just a few minutes rather than the hours or days it might take to draw the cable or wire harness system manually.

Tasks that would have previously taken hours or days, now only take minutes. This speeds up the creation of new documentation without the need for labor-intensive redrawing of wiring diagrams or error-prone graphic file conversions. In these days of “do more with fewer resources,” that can make all the difference.