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Necessary Documents:

Concept drawings for management

Single-Lines for engineering

Cable run sheets for installers

Rack layouts

Floor and space plans

Power consumption and heat-load

Bill of Materials

Discrepancy Reports

System ID and port tags

Designation Strips

Delivering a Comprehensive System Design or How to Fool Everyone Into Thinking You are a Genius.

By Christian Holbrook, President HEI --WireCAD

So I'm sitting in my office listening to the Bob and Tom morning show one day when it hits me that people not only need an easy to use system design and documentation tool like WireCAD, but that they need help understanding the design process. So I set out to put some handles on the whole thing. I will try to be agnostic with regard to the set of tools used, but I am sure that my bias will show. Please forgive me.

A comprehensive design package (your deliverable, not the tool-set used to create it) will provide information to all of the people in the process from management through installation and maintenance. If you think about it, each one of the those department needs a very different type of report. Management will need concept drawings with only enough detail to provide an overview of the process. They will also require some sort of budgetary or costing information. Now this is where it gets tricky. For years we have been producing the same set of documents for the installer as we have for the maintenance engineer. This is fundamentally flawed. The maintenance engineer needs to see signal flow for troubleshooting purposes. It makes sense to break the documentation up by signal type and sub-system to aid the troubleshooting effort. This presents a dilemma to the installer that must now search many drawings to find the information about all connections to a particular device. It becomes readily apparent that installing from drawings is an error prone process; not to mention that we need to apply cable numbers.

So let's see. We need concept drawings that show a basic signal flow and probably some rack layouts for management and operations. We need detailed single-line functional block diagrams for the maintenance engineer to troubleshoot from. We need cable labels and run sheets for the installers. We need power consumption and heatload reports for the MEP guys. We need bills of material. We need jackfield designation strips. Sounds like a pretty daunting task to get even the smallest of jobs designed.

That's where having the right design tool comes in. Your tool of choice should produce all of the aforementioned reports and documents, but it will still not tell you how to structure your drawing set or lay out your design, this is left up to you the genius system designer.

So how do you start to put together a design package that meets the specific needs of all those involved in the process? I can't possibly

Flowchart

Define Project Scope

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Create concept flow diagrams/layouts

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Approved

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Create Detailed Single-line functional diagrams / rack layouts

↓

Approved

↓

Print docs, cable labels. etc.

↓

Install

↓

Scope Change

↓

Test and Commission

↓

As-Built Drawings

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answer that. So why then are you wasting your time reading this? I can help with the process. I will start with the assumption that you are not doing this alone – that somewhere in your process you answer to someone. We all do.

Objectives

Let us start by identifying some of the objectives that we need to meet with our design. We'll start with a couple of basic questions:

Who is your audience? I know this may sound like a writing
class but this is key. When we create documentation or designs, who will read them? If they are for the engineering staff, more detail is better, not so with management. If we are presenting to operations, we will need to balance detail with operational aspects of the design, such as where are the knobs and switches and sight-lines that affect the operator. If we are presenting information to the installer the detail must be spot on or we will waist precious on-site installation time.

How will the documents be read? Huh? You say. This is
key. If your documentation or design will always be perused in a well lit area on a drafting board then you can take some liberty with font size as well as sheet size. If, on the other hand, the documents are meant to be used in the field behind equipment racks in poorly lit circumstances, then you better think smaller paper with bigger fonts and more sheets.

Who will be responsible for what? If multiple engineers are
involved with the design you will need clear leadership and project management. Defining the role of the individual will help divert mishaps later in the process.

What will be my deliverable? Spend some time on the front-
end of the project deciding what it is you plan to deliver. The aforementioned questions will help you decide the deliverables. Most projects will include the following:

- Conceptual drawings
- Floor and space plans
- Functional block diagrams
- Elevations
- Equipment lists

- Cable run lists
- Cable labels
- Power consumption / heat-load
- System ID's / Port tags / Designation strips

Sheet set structure

One of the most frequently asked questions at the old WireCAD ranch is how do I decide how many drawings and what goes on each? Using
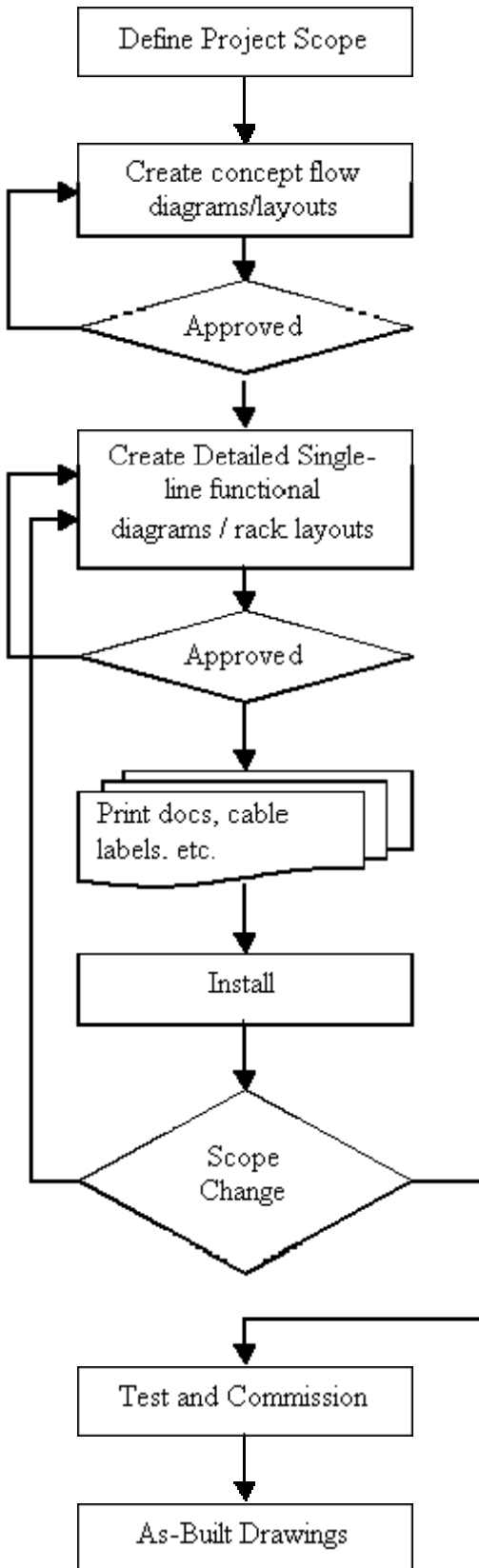
the information gathered above you are now equipped to make decisions regarding the structure of your presentation. There are as many presentation styles and system design styles as there are designers. It is up to you to determine your priorities and proceed. Here is an approach that I use:

Concept

For the concept drawing set I will create a signal flow based on the technical ability of those in the approval chain. If I am going for approval from a very technically savvy group, my concept drawings will reflect that and be more detailed. Conversely, if the technical ability of the approval chain is not so savvy, my concepts will contain a much higher level. I often create an overall concept drawing and several subsystem detail concept drawings. I will also deliver equipment lists, and a first-blush power consumption and heat load report with the concept drawings. Fortunately WireCAD v5 now has a concept tool that feeds the databases and makes reporting easy. Oops my bias is showing!
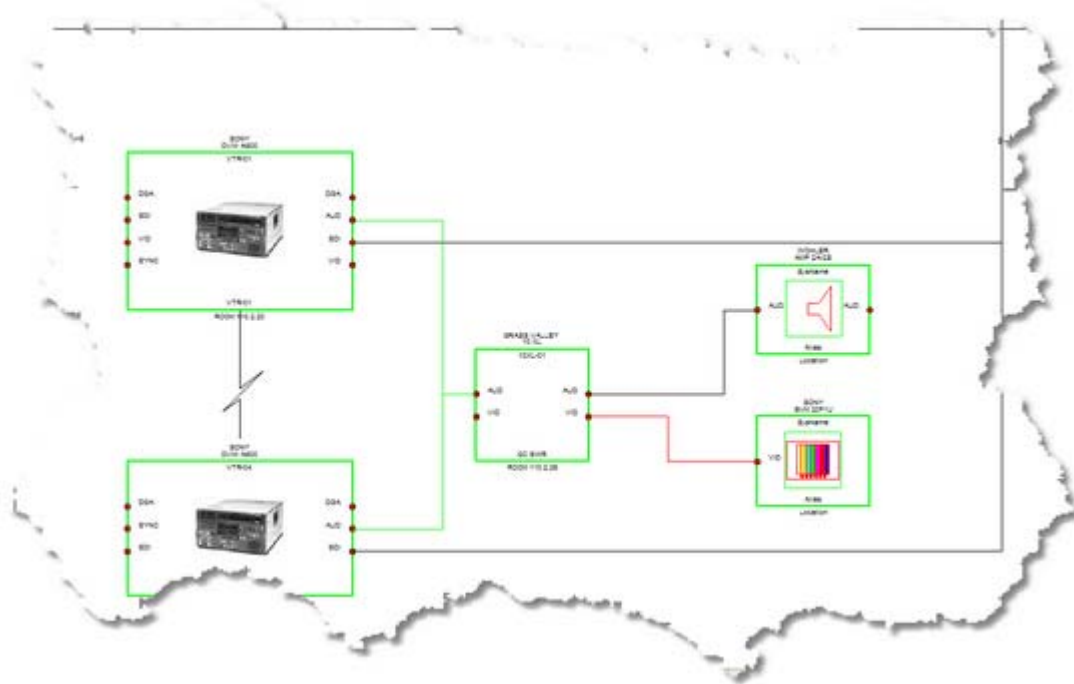
Distributed System Detail

Create a sheet or sheets for each distributed system by signal type. For example, if I have a facility router with an Audio, Video and Control layer, I will create a sheet for each. Determine a good point in the signal flow at which to separate the distributed system from the

subsystems which it serves. I look for opportunities to divide systems from the main distributed systems or infrastructure such as wall panels or other junction or distribution points. In the image below I am demonstrating two different techniques. The top two inputs and outputs of the router feed jacks that in turn feed junction boxes that represent connections to a service panel. The bottom four IO are connected to off-sheet pointers that then continue on the referenced page. This is a salt-to-taste issue with merits to both approaches.
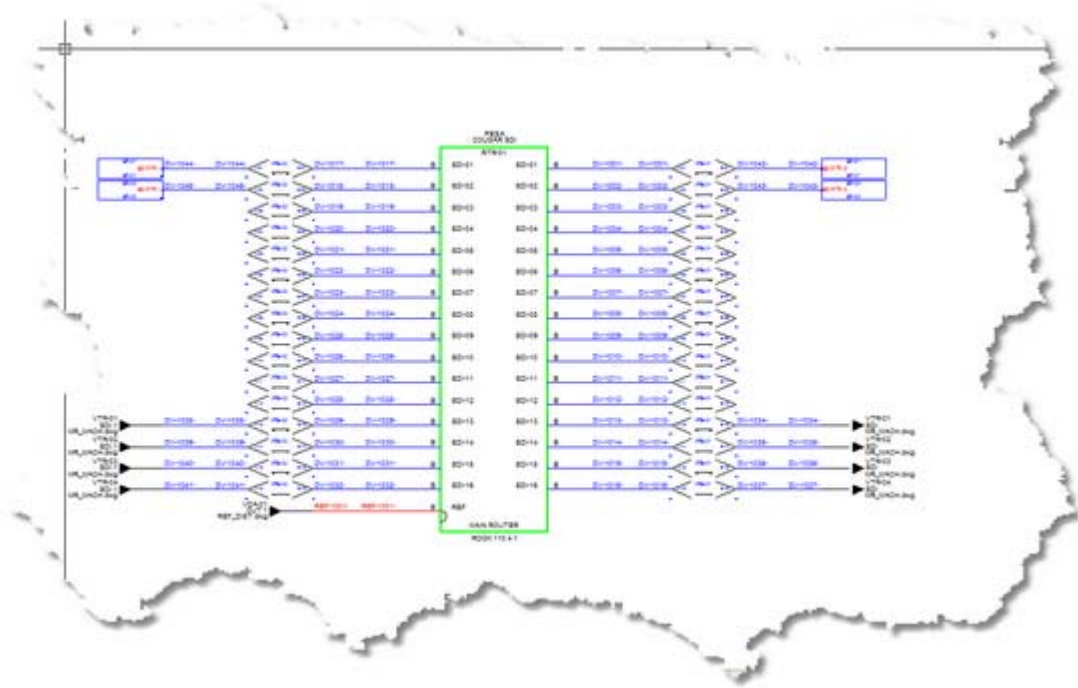

Subsystem Detail

Create a sheet or sheets for each sub system by signal type. It is really up to you to determine what a subsystem consists of. I try to think in terms of the logical unit. If I am designing an edit facility and I have four edit suites that then connect to a machine room. I am going to have a separate drawing for each of the edit suites and signal types. Again, I am trying to think in terms of the audience here. Let's create this set of drawings for the troubleshooter and try to group things together in a manner that aids the troubleshooting process. To complete the analogy I will also have a set of drawings for the machine room area, and depending on its size, I might break those drawings up by rack or other logical subsystem.

Edit 1 Video Signals
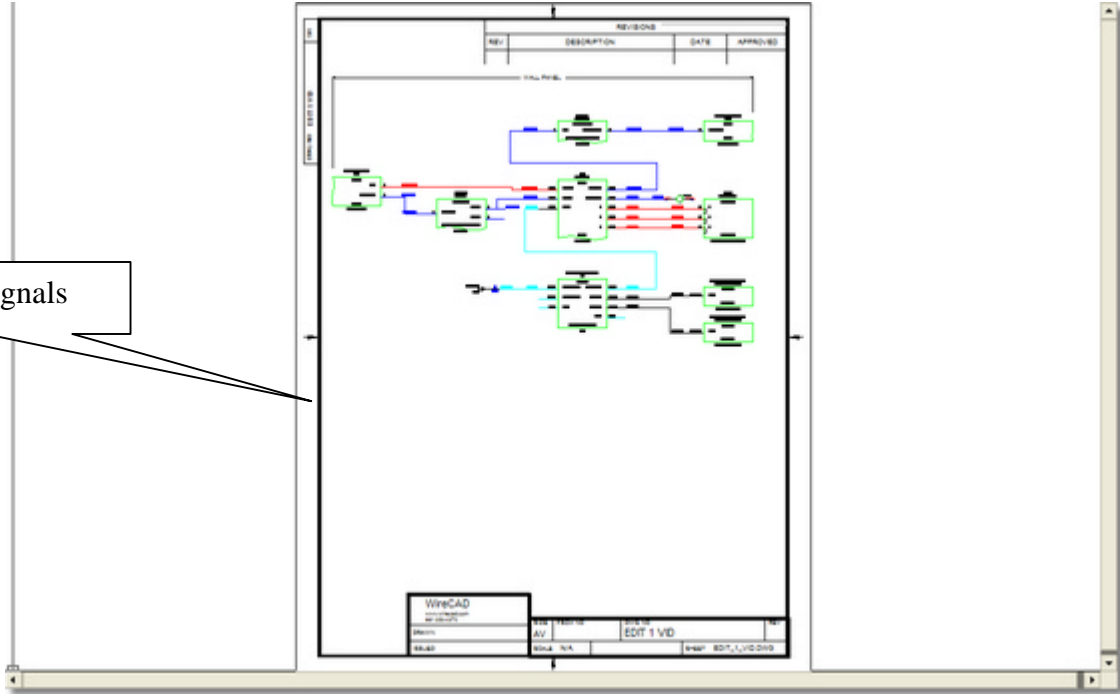
In these details I am showing the same logical system – Edit 1. In the top sheet I am showing only the video related signals, while in the bottom sheet I am showing the audio signals.


Edit 1 Audio Signals
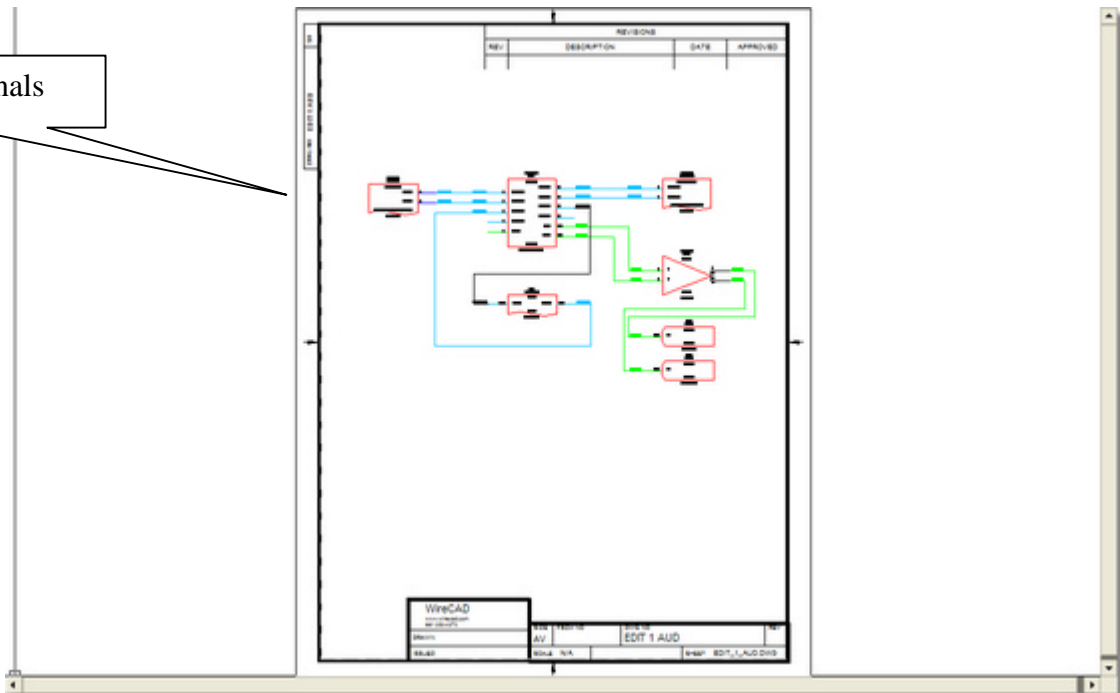
Rack Elevations

We need some sort of positional reference for both the operational and engineering reader of our documents. Fortunately this can usually be the same document. Elevations or rack layouts should provide enough information to help the engineering staff understand where the device is located and also provide operational details such as knob placement and sightlines.
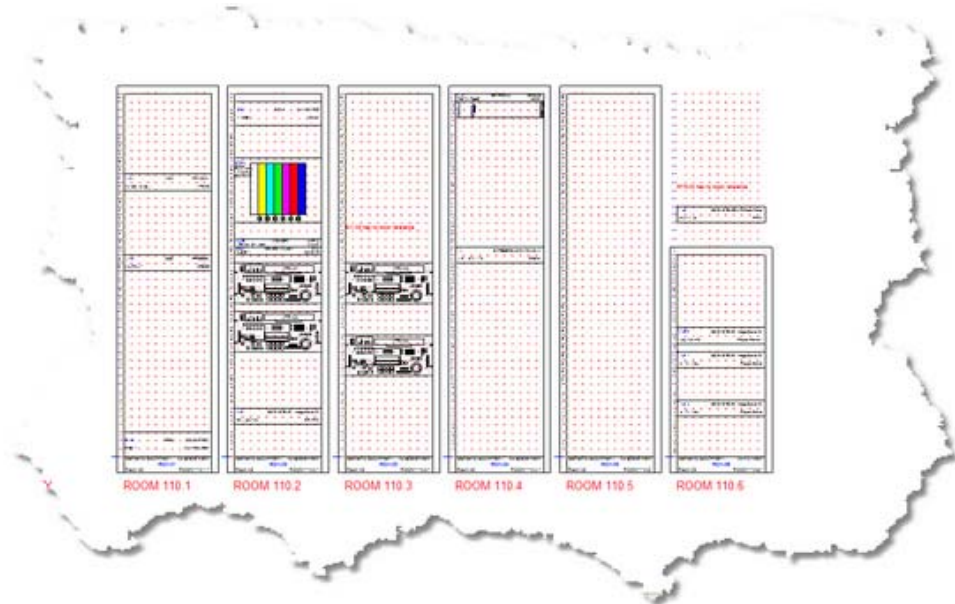
Floor Plans

We will need some sort of floor plan to explain to all involved the placement of the various elements of our design. The layer structure of the CAD file makes it easy for us to add myriad elements to the drawing file and display only those that are pertinent to the current objective.
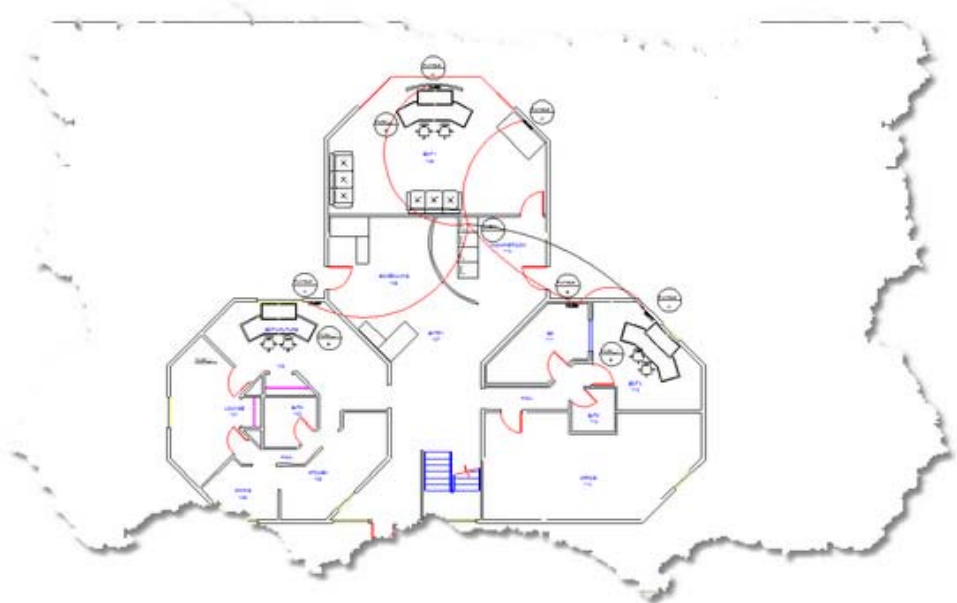
Reports

We will need a whole bunch of reports from our design. Reports like:

- Bill of Materials. This report should show connector, cable, and equipment counts. Optionally, it could provide costing, vendor and status information as well.
- Power consumption and heat-load. This is best done by location since the MEP guys will need it that way.
- Cable run list. I like to put as much detail as possible on the run sheets. I then post a single drawing set on-site for the installation team reference only. I then have the installation team work from different runsheets that have been sorted by location.
- Cable labels. This is up to you to decide what information to put on a cable label. Here are some thoughts: It is nice to see the source and destination information on the cable label. This assumes that you are willing to change the cable label every time you move a wire. A number only scheme fixes that problem but requires that you have the magic decoder ring or a set of drawings to know where the cable is supposed to land. I still see engineers trying to create complex cable number coding schemes. I understand the legacy reasons for this in that the cable number was the only information to come out of the drawing, so it had to contain as much information as possible. Now with tools like WireCAD, all of the information is present. We simply have to decide how to format the information for display.
- Equipment lists by location.
- System ID and port tags. More labeling is better. You will look pro if you label (assuming that your labeling method is not the masking-tape-and-sharpie method).
- Designation strips. This is a giant pain. It is also the area of the install that will set you apart from your competitors. Your jackfields and panels should present the user with accurate information that is easy to read. Key or vital ports should draw the eye. If you get the patchbay layouts structured so that the operator easily understands them and can find the items that they are searching for, you will get high marks from the operational team.

In conclusion I must state that the system design process is obviously tedious. There are many opportunities for mistakes. The tool you choose should help you with the minutiae and check for errors. Even then you will have a lot of decisions to make that software cannot, and should not, make for you. You are the designer. You are the presenter. You are the draftsman. You are the gatherer of information. This is not an easy task, but it is highly rewarding when a system comes on line and functions as planned. I hope this outline has helped to clarify an

approach or at least give you some ideas. If you come up with something better or more elegant, read: simpler, please share.

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