

GRAND VALLEY ENGINEERING SOLUTIONS LLC

ELECTRICAL ENGINEERING/SOFTWARE

2961 CIRCLING HAWK COURT

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Loads Program Description:

Purpose:

This program was written to automate a portion of the design of power distribution systems in commercial and industrial buildings. It allows the user to store electrical load and other information about equipment in a building and allocate those loads to circuit breaker panelboards or other types of power distribution equipment. Schedules of equipment and schedules of overcurrent devices in distribution equipment can be rapidly generated, and printed to, or exported into an AutoCad drawing as '.dxf' files.

Program Structure:

This is a windows based program written and compiled using Microsoft's Visual Studio. Each piece of equipment is simulated and stored as an individual object. As a windows application, screens are loosely connected, and the program direction is controlled by the user.

Features:

General:

- Handles voltages from 24 volts single phase to 480 volts three phase
- Handles motor, lighting, receptacle, and 8 other load types
- Has two load types that the user can input demand factors
- Models all elements of the power distribution system
- Determines how each element of the power distribution system are interconnected, and automatically recalculates loads throughout the one line diagram every time a piece of distribution equipment is loaded in memory
- Drop-down menus have been used where possible to limit keystrokes and reduce errors
- Equipment and panel input sheets are included
- Prints hard copies of panels and equipment
- Generates '.dxf' files for direct import into AutoCad drawings

Distribution Equipment:

- Handles both fuses and circuit breakers, and any combination of main and branch devices
- Handles cold and hot sequence metered and unmetered distribution equipment
- Handles distribution equipment bussing from 60 amps single phase to 3000 amps three phase
- Handles both connected and NEC calculated demand loads
- Handles continuous and non-continuous loads
- Capable of sizing branch circuit overcurrent protection – user option
- Automatically refreshes load information of all scheduled loads every time a piece of distribution equipment is loaded in memory
- Automatically recalculates bus and main device size of distribution equipment every time loads change – can be disabled by the user on an individual branch circuit basis

- Provides a 'copy and paste' method to assign equipment and sub-feed panels to circuits in distribution equipment
- Automatically adds the notation 'VIA TRANSFORMER' to the load description in panelboards where equipment or sub-feed panels have a voltage different from the panel they are being fed from.

Equipment:

- Handles motors from 1/6 to 500 HP
- Each piece of equipment may have one or more load types – a roof-top unit can have heating season, cooling season and year round load types, all individually tracked
- Handles equipment manufacturer's MOP and MCA
- Capable of sizing conduit and phase, neutral and ground conductors – user option
- Capable of calculating voltage drop on equipment branch circuits – user option
- Capable of generating a single or multiple automatically alphabetized equipment schedules for each project

Recommendations:

1. Store all equipment for a single project in the same subdirectory, preferably the one which contains the drawings. If this is not done, panel loads won't be updated properly, and it will be more difficult to update '.dxf' files in the drawings.
2. Although free form typing is possible in most cases, the drop-down menus should be used whenever possible, particularly for numerical data such as voltages.

Basic Program Operation:

This program consists of two sections which are accessible from the 'Electrical Loads' form which you see whenever you start the program (see Loads Program Flow Diagram). The first section, the 'Equipment' section is used to create and manipulate equipment and equipment schedules. This is shown on the left side of the flow diagram. The second, the 'Panel' section, is used to create and manipulate distribution equipment and distribution equipment schedules. This is shown on the right side of the flow diagram. These two sections are accessible through the 'File' pull-down. All other forms are similarly accessible through pull-downs at the top of each form.

Perhaps the most difficult form to understand is the 'Equipment Loads' form. This form is intended to enable the user to accumulate loads of different types for multiple components of a single piece of equipment such as a roof-top HVAC unit. First, enter the load in the top half of the form in HP, amps or KVA. Then, in the bottom half, press the (+) button for the desired load type and units. If there are more than one similar components, press the button multiple times. Do this for each unique component, then press the return button to store and return to the main equipment form.

Another form that may not be clear immediately is the 'Panel Circuits' form. All actions in this form are selected through a **left click-right click-left click** sequence. **Left click** an item to highlight it. **Right click** the item to show the drop down selection box, then mover above the action desired to highlight it and

left click on it. The 'Panel Circuits' displays all of the panels in the project on the left, and all of the equipment in the project on the right. The odd and even circuits are shown between. To feed one of the pieces of equipment in the right column from the panel currently loaded in memory, **left click** the desired equipment in the right column then **right click** the highlighted equipment and **left click** 'COPY'. Then **left click** the circuit you want to feed it from in the odd or even circuits columns to highlight it, **right click** to show the drop down menu and move above the 'PASTE PANEL' selection to highlight it and **left click** it. Again, all actions in this form are selected through a **left click-right click-left click** sequence.

Equipment Input Walk-Through:

1. Start the program
2. Print equipment input forms as follows:
 - a. Left click on the **Print** tab on the **Electric Loads** form
 - b. Left click on the **Equipment Input Form** in the drop-down menu
 - c. Left click on the **Equipment Input Key** in the drop-down menu
3. Enter data in the equipment input form using the equipment input key except, skip O. C. TRIP, RACEWAY SIZE, AND WIRE SIZES. Enter or auto-size this data after entering the load components.
4. The bottom portion of the equipment input form is for equipment load components. Most equipment will have a single load component, some will have multiple components.

Single component example: HEATING HOT WATER PUMP

| <u>COMPONENT</u> | <u>LOAD TYPE</u> | <u>LOAD</u> | <u>UNITS</u> | <u>CONNECTION</u> |
|------------------|----------------------|-------------|--------------|-------------------|
| PUMP | MOTOR HEATING SEASON | 1 | HP | A-B-C |

Multi component example: ROOF-TOP HVAC UNIT

| <u>COMPONENT</u> | <u>LOAD TYPE</u> | <u>LOAD</u> | <u>UNITS</u> | <u>CONNECTION</u> |
|------------------|----------------------|-------------|--------------|-------------------|
| COMPRESSOR | MOTOR COOLING SEASON | 53 | AMPS | A-B-C |
| COMPRESSOR | MOTOR COOLING SEASON | 53 | AMPS | A-B-C |
| SUPPLY FAN | MOTOR YEAR ROUND | 15 | HP | A-B-C |
| RETURN FAN | MOTOR YEAR ROUND | 10 | HP | A-B-C |
| ELECTRIC HEAT | ELECTRIC HEAT | 20 | KW | A-B-C |
| CONDENSER FAN | MOTOR COOLING SEASON | .25 | HP | A-B |
| CONDENSER FAN | MOTOR COOLING SEASON | .25 | HP | B-C |
| CONDENSER FAN | MOTOR COOLING SEASON | .25 | HP | C-A |

5. When the equipment input form has been filled out, go back to the program and do the following:
 - a. Left click on the **file** tab on the **Electric Loads** form
 - b. Left click on the **Create New Equipment** in the drop-down menu

- c. The **Save As** dialog box appears. Browse to the subdirectory in which you want to save the new equipment. Enter the equipment designation from the equipment input form beside the **File Name** label and press the **Save** button
6. The partially filled out **Equipment Main** form appears
7. Copy the information from the **Equipment Input Form** using the pull down tabs as much as possible
8. Left click the **View** tab and left click **Loads**
9. The **Equipment Loads** form appears
10. Enter the load of the first component in the proper slot in the top of the form based on load units, and phase connections. Use the **Clear** button if necessary.
11. In the bottom portion of the form, find the line with the correct load type and press the (+) sign in the proper units column to add the load component. Press it multiple to add multiple identical load components. Press the clear button to start again if you make a mistake.
12. Repeat 11 until all of the load components have been added.
13. Press the return button to return to the **Equipment Main** form.
14. There, you can auto-size or manually enter breaker size, raceway size, and wire sizes, and check voltage drop.

Panel Input Walk-Through:

1. Start the program
2. Print panel input forms as follows:
 - a. Left click on the **Print** tab on the **Electric Loads** form
 - b. Left click on the **Panel Input Form** in the drop-down menu
 - c. Left click on the **Panel Circuits Input Form** in the drop-down menu
3. Enter data in the **Panel Input Form**. The bottom portion of the panel input form contains suggested choices for some of the input parameters.
4. Enter circuit data into the Panel Circuits Input Form
5. When the two forms have been filled out, go back to the program and do the following:
 - a. Left click on the **file** tab on the **Electric Loads** form
 - b. Left click on the **Create New Panel** in the drop-down menu
 - c. The **Save As** dialog box appears. Browse to the subdirectory in which you want to save the new panel. Enter the panel designation from the **Panel Input Form** beside the **File Name** label and press the **Save** button
6. The partially filled out **Panel Main** form appears
7. Copy the information from the **Panel Input Form** using the pull down tabs as much as possible
8. Left click the **View** tab and left click **Show Panel Circuits**
9. The **Panel Circuits** form appears
10. Enter panel feeders and equipment branch circuits as described in the basic program operation paragraph.

11. Then enter the first general circuit using the left-right-lift click method. **Left click** on the number of the circuit to be edited. **Right click** to show the drop down menu, and **left click** on '**Edit**'.
12. This brings up the **circuit details** dialog box.
13. In this dialog box, fill out the left side of the form from the previously marked up '**panel circuits input form**'. Enter overcurrent device amps, poles, load types, a description of the circuit, and if desired, an additional note. If you press the **store current circuit** button, the information entered will be copied to the right side of the form for use in other circuits. Notice that the current circuit number is shown in the upper left of the form, and arrows labeled **go to next circuit** and **go to previous circuit** are at the top of the form. Using these buttons, you can navigate to any other circuit. The vertical row of buttons in the middle of the form is used to copy any or all of the previously entered information into a new circuit.

Versions:

This program is offered in three versions. The Standard version is offered to electrical design professionals at a one time cost based on the size of the company that will be using it. Go to the 'software downloads' section of my web site and download the Loads Program Order Blank.

The free demonstration version is a limited time use version of the software that has been modified to prevent free commercial use. It is however fully functional, and it is recommended that if you are considering purchasing this program, that you try out the free demo version first. Go to the 'software downloads' section of my web site and download the Loads Program Demo.

The free facilities maintenance version is intended to be used by facilities managers to track changes to power distribution system in facilities that were originally designed using the standard version of this program. Using this version of the program, a facilities manager can change loads anywhere in the system, and see how those changes affect the system all the way to the service entrance. Printing out revised circuit breaker directories can be done by pressing a single button. Go to the 'software downloads' section of my web site and download the Loads Program Facilities.