PV String Sizing Tool

Downloading

The String Sizing Tool is available under the Support tab at www.outbackpower.com. Along with these instructions, the page has a video with a brief description of using the tool.

The page has separate tools for different operating systems: Windows, Mac, and Linux. See the circled area in Figure 1.

Click on the appropriate selection to download a compressed folder. Extract the files to the desktop and then run the executable file.

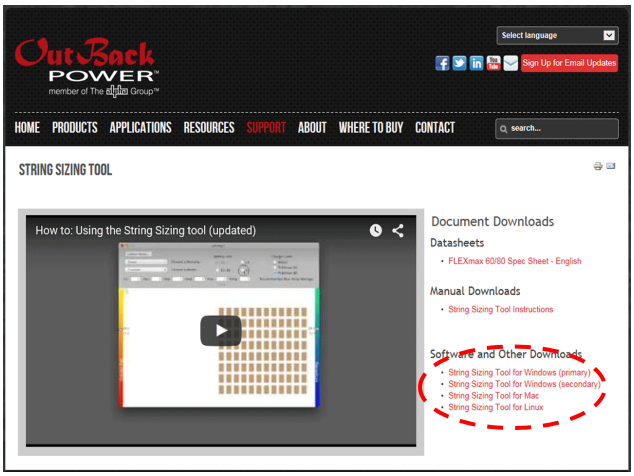


Figure 1

How to use the Tool

After opening the tool, enter data on the PV modules, installation, and site.

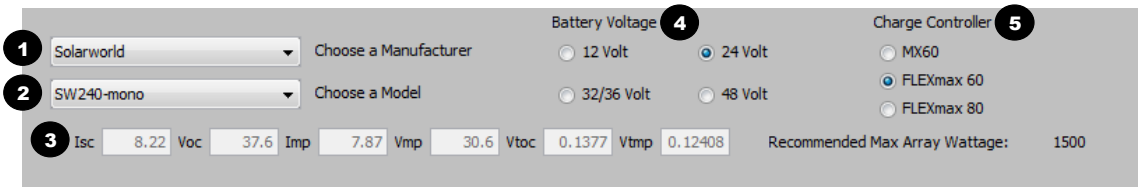


Figure 2

In Figure 2, 1 and 2 are drop-down menus with full lists of manufacturers and models. Select the appropriate items. If a model or manufacturer is not present, select ***Yours*** as the manufacturer and select ***Custom*** as the model.

3 is populated with the specifications of the selected PV module. If the model is ***Custom***, these specifications can be manually entered. Enter the following specifications.

- I_{sc} (short-circuit current)
- V_{oc} (open-circuit voltage)
- V_{mp} (maximum-power voltage)
- V_{toc} (V_{oc} multiplied by the module coefficient per degree C and divided by 100)
- V_{tmp} (V_{mp} multiplied by the module coefficient per degree C and divided by 100)

4 is the nominal voltage of the battery system. Select one of the options shown.

5 is the model of OutBack charge controller to be used. Select one of the options shown.

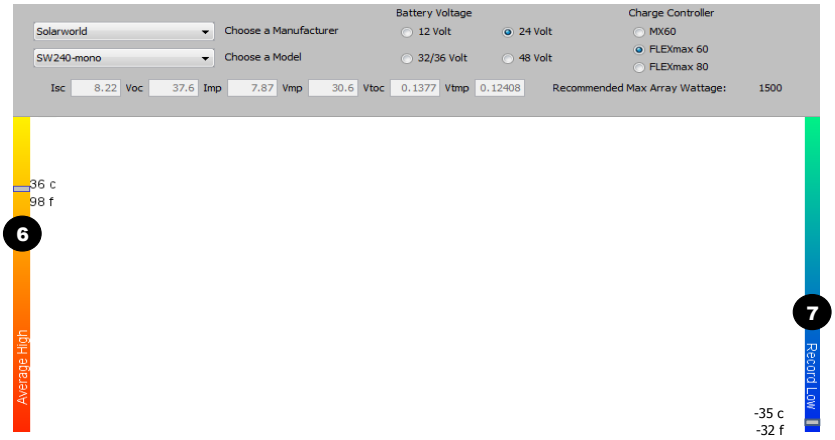


Figure 3

6 and 7 are sliding bars which set the temperature range for the installation. 6 should be set to the average high temperature for that area. 7 should equal the lowest recorded temperature.

CAUTION: Equipment Damage

Low temperatures can result in high PV voltages. Failure to allow for extreme temperatures could result in damage to charge controller.

The pattern of blocks appearing in Figure 4 is a possible range of array sizes. Each block represents one module of the selected type. Blocks arranged horizontally (to the right) are modules in parallel. Blocks arranged vertically are modules in a series string.

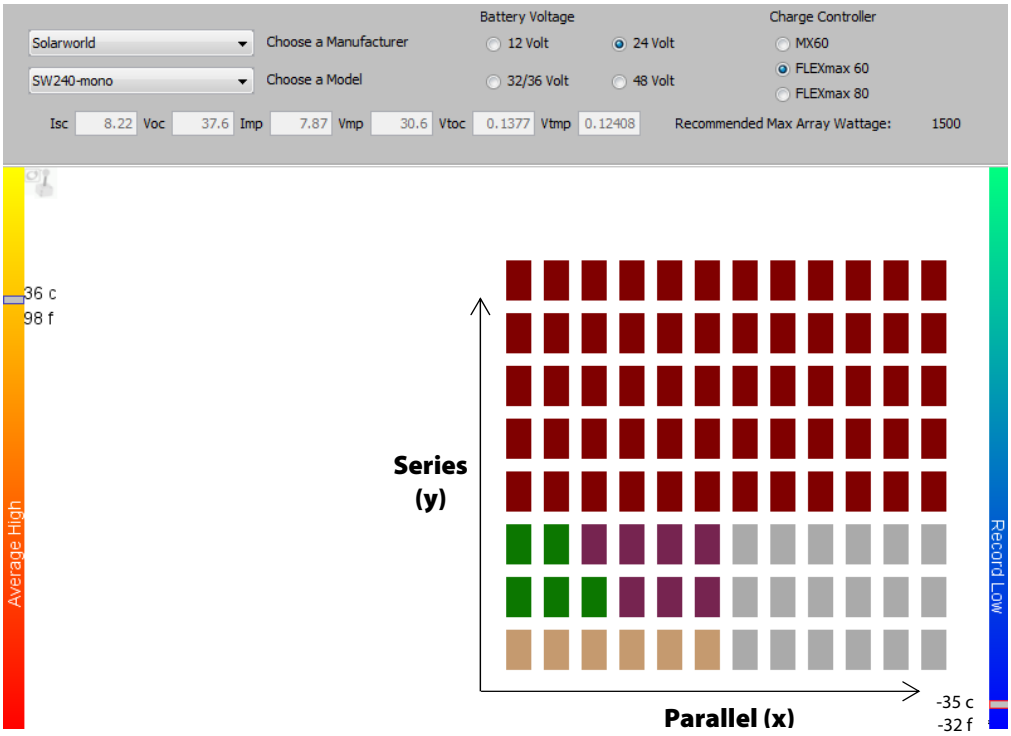
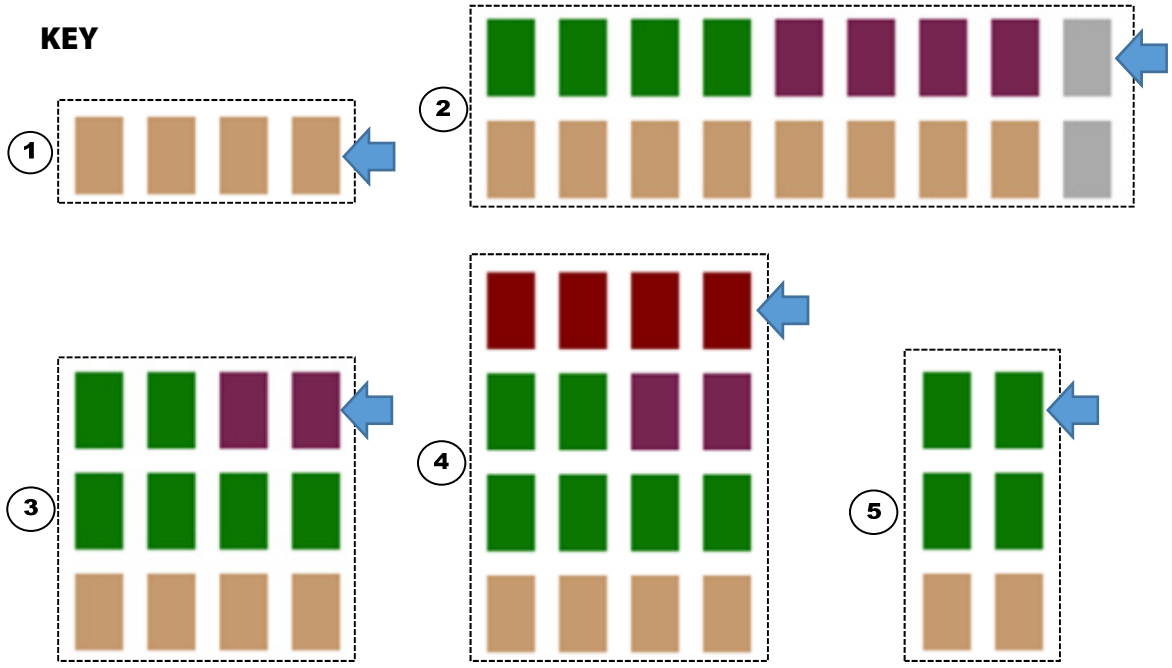


Figure 4

An array consists of **x** strings in parallel, with **y** modules making up a series string. This is shown in Figure 5 by taking a section from the lower left of the Figure 4 block pattern. The height is the string length (the number of modules in series). The width is the number of parallel strings. The upper right block shows the maximum voltage and wattage of the array. The descriptions below explain whether the array is recommended based on the color of this block. (Other blocks are ignored.)



1

In this example: More than one module is needed in a series string.

General rule: Vmp of array is too low to charge batteries. Do not use this type of array due to poor performance.

2

In this example: Too many strings are in in parallel.

General rule: Wattage and Isc of array are higher than charge controller rating. Do not use this type of array due to potential overcurrent.

3

In this example: Too many strings are in in parallel.

General rule: Wattage of array is higher than charge controller output. This type of array can be used but some power will not be harvested.

4

In this example: Too many modules are in in a series string.

General rule: Wattage of array is greater than charge controller output; V_{oc} of array is higher than charge controller rating. **Do not use this type of array due to possible controller damage.**

5

In this example: This is an acceptable array.

General rule: Wattage, V_{mp}, and I_{sc} are all acceptable. This type of array can be used freely.

Figure 5

Example #1

Location: Mountain Home, Wyoming

Temperature: High = 98°F, Low = -30°F

Array: SolarWorld 240 W modules, total array size 3,500 W

Battery: 48 Vdc, 360 Ah (strings of EnergyCell RE 200, 2 in parallel)

The String Sizing tool shows the pattern displayed in Figure 6. The arrow points to the block which represents the maximum array size.

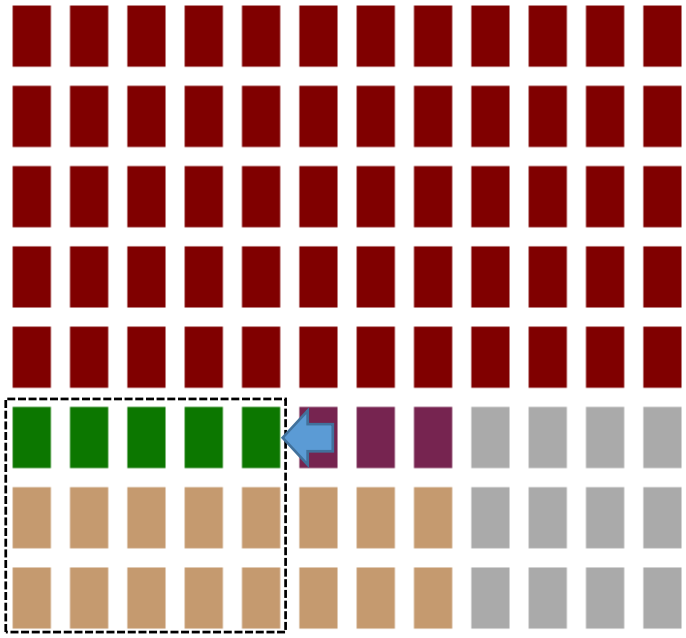


Figure 6

RESULT

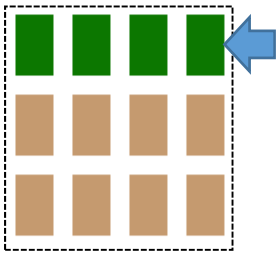
Modules in series (string length): 3.

Modules (strings) in parallel: Up to 5.

Maximum number of modules: 15.

One or two modules in series do not create enough voltage to charge the batteries. Four or more modules in a string create voltages which could damage the controller.

More than five strings in parallel will exceed the size of the controller. Although the controller will operate, it will be unable to harvest all available array power. This power will be wasted.



However, if a smaller array is required for financial or other reasons, it is are acceptable as long as string lengths are observed. This means that an array could also incorporate twelve, nine, six, or as few as three modules. This is shown in Figure 7.

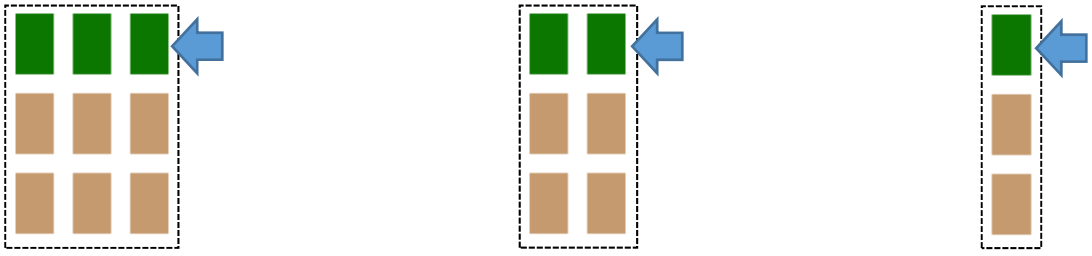


Figure 7

Example #2

This example uses the same site as example #1 with the exception of the battery voltage.

Location: Mountain Home, Wyoming

Temperature: High = 98°F, Low = -30°F

Array: SolarWorld 240 W modules, total array size 3,500 W

Battery: 48 Vdc, 360 Ah (strings of EnergyCell RE 200, 2 in parallel)

The String Sizing tool shows the pattern displayed in Figure 8. The arrow points to the block which represents the maximum array size.

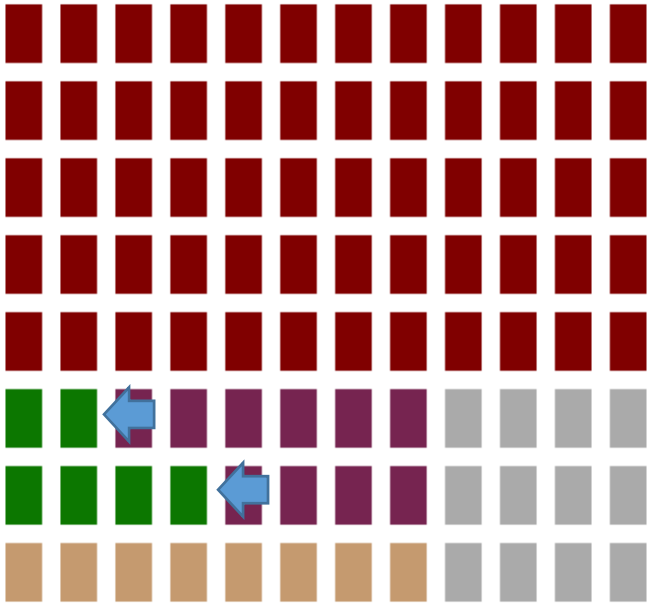


Figure 8

RESULT

Modules in series (string length): Either 2 or 3.

Modules (strings) in parallel: 2 for a string of 3 modules, 4 for a string of 2 modules.

Maximum number of modules: Either 6 or 8. An 8-module array provides the greatest wattage.

One module without series connections does not create enough voltage to charge the batteries. Four or more modules in a string create voltages which could damage the controller.

With a string of two modules, more than four in parallel exceed the size of the controller. Although the controller will operate, it will be unable to harvest all available array power. This power will be wasted. This is also true for strings of three modules, but fewer parallel strings are allowed due to the controller's current limitations.

However, smaller arrays are acceptable as long as string lengths are observed. With strings of two modules, arrays of six, four, or only two modules could be used. A single three-module string could also be used. This is shown in Figure 9.

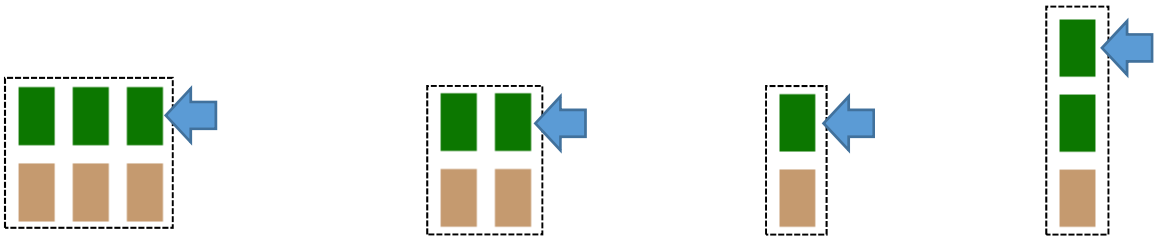


Figure 9

Masters of the Off-Grid.™ First Choice for the New Grid.

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