

HOW TO USE MIDNITE SOLAR'S CLASSIC STRING SIZING TOOL

Classic String Sizing Tool

The purpose of the MidNite *Classic String Sizing Tool* is to help you select the best Classic MPPT Charge Controller for your system and provide valuable data needed for designing the solar array. By entering your solar module specifications into the *String Sizing Tool* you will be able to determine the correct number of solar modules per MidNite Solar Charge Controller and how the array should be configured.

It is important to note that generally speaking we want to use the Classic 150 or 200 as they are less expensive and will handle the most power. Another important factor to consider is the input voltage. With MPPT controllers the higher the input voltage the less efficient they are. This is not a large loss in efficiency but it does add up to a little more heat in the controller and less power on the output. Most all MPPT controllers will want to see a minimum of 130% of the actual high battery voltage. For example, we have a 48v battery and it has an Equalize voltage of 62.3 volts. We would multiply that Equalize Voltage by 130% (62.3×1.3) and we would see that we need a minimum of 81 volts on the input on the hottest day of the year in order to have enough headroom for the MPPT to work.

Before you begin using the Classic String Sizing Tool you will need the specifications for your solar modules. The specs should be located on the back of your solar module or found on the datasheet provided by the manufacturer's website. Open up the String Sizing Tool by going to:

<http://www.midnitesolar.com/sizingTool/displaySizing.php>.

MidNite SOLAR, inc

Temperature: C° F°

PV Module Data (STC)
(Found on back of module or spec sheet)

Power (Watts):

VOC (Open Circuit Voltage):

VMP (Maximum Power Point Voltage):

ISC (Short Circuit Amperage):

IMP (Maximum Power Point Amperage):

VOC Temperature Coefficient C° (Default is -0.33%): %

VMP Temperature Coefficient C° (Default is -0.45%): %

Environmental Data

Coldest Ambient Temp C°:

Hottest Ambient Temp C°:

Nominal Battery Voltage (Volts):

PV Array

Number Of Modules In Series:

Number Of Parallel Strings:

Total Modules:

PRINT RESULTS

PV Array

Rated PV Array Power:	880	Watts
Anticipated Array Power @ 40C:	821	Watts
Rated PV Array Current:	15.74	Amps
Battery Charging Current @ 57.6 V:	15.3	Amps
VMP (Maximum Power Point Voltage):	61.2	Volts
VOC (Open Circuit Voltage):	75.2	Volts
VMP @ -30 C°:	76.4	Volts
VOC @ -30 C°:	88.8	Volts

Classic, Classic SL & Classic Lite Charge Controller Selection

	150	200	250
Max Operating Voltage	150	200	250
Max Non operating VOC (HyperVOC) @ 48V Nominal Battery Voltage	198	248	298
Maximum Number Of Modules In Series	3	4	5
Max Number Of Modules In Series (Using HyperVOC)	4	5	6
Max Allowable Output Current Per Classic Based On This Current Configuration	86	78	55
Max Allowable Wattage Per Classic Based On This Current Configuration	5022	4550	3212
Present PV Array Wattage Of This Configuration	880	880	880

Design Check

	150	200	250
Max VOC	OK	OK	OK
Temperature The Classic Will Enter HyperVOC	-276 C°	-478 C°	-679 C°
Array Power (Wattage)	OK	OK	OK
Classics Required	0.2	0.2	0.3

NOTE: MidNite Solar recommends a second controller be added after 1.2

WARNING: MidNite Solar makes no representation, warranty or assumption of liability regarding the use of the String Calculator. This tool uses data provided by other parties (such as PV module specs) and makes calculations based on assumptions which may or may not prove to be valid.

At the very top of the form, select the type of temperature settings you will be using. You have your choice between Celsius or Fahrenheit, but the form defaults to Celsius. In the fields below, enter your solar panel data. You will note that the data is in Standard Test Conditions or STC.

PV Module Data (STC)

1. Power (Watts)
2. VOC (Open Circuit Current)
3. VMP (Maximum Power Point Voltage)
4. ISC (Short Circuit Amperage)
5. IMP (Maximum Power Point Amperage)
6. VOC Temperature Coefficient C° (Default is -0.33%)
7. VMP Temperature Coefficient C° (Default is -0.45%)

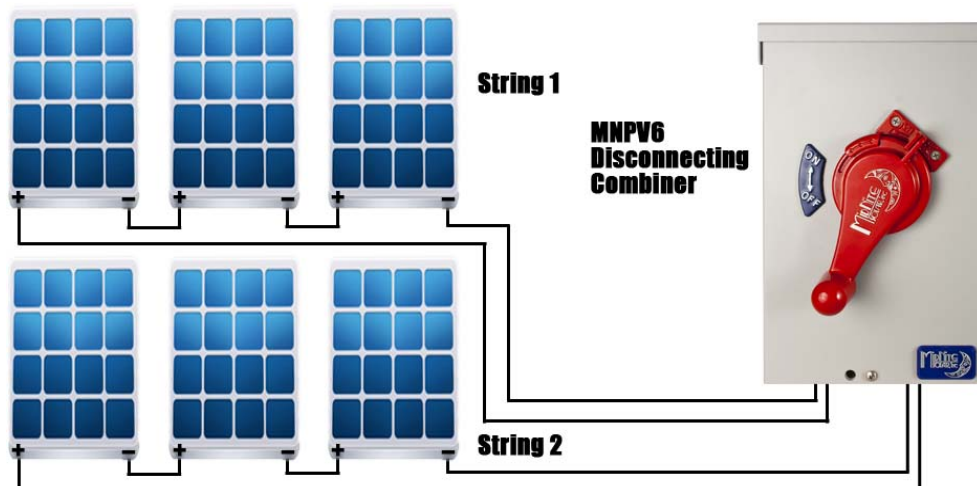
Environmental Data

8. Coldest Ambient Temp C°
9. Hottest Ambient Temp C°
10. Nominal Battery Voltage (Volts)

PV Array

Next input the number of modules that will be in series or wired positive to negative in a string . Then type in the number of parallel strings your system will contain. This is the number of strings wired into a combiner box and then into the charge controller (see example below). You will want to adjust these numbers as you work with the String Sizing Tool. Remember that we want to keep the string voltage low enough to raise efficiency but not so low that the MPPT doesn't have any room to work. The average solar module will have 60 cells and have an open circuit voltage (VOC) of about 37 volts. The general rule is a minimum of one module in series for a 12 volt battery, 2 modules in series for a 24 volt battery and 3 modules in series for a 48 volt battery. You can add more modules in series strings as needed.

For example, you have Five Solar World 250 watt modules and want to charge a 48 volt battery. Five modules do not divide evenly by our "three modules in series for a 48V battery" rule, so we would likely wire all five in series into a Classic 250 (5 modules x 37V each = 185V). Our other option is that we may decide to buy a sixth module and wire two strings of three modules in series (3 modules x 37V each = 111V) and use a Classic 150 which is a more powerful charge controller at a lower cost.



Now click the *Submit Parameters* button and your results will display in the right panel. The **PV Array** section displays the solar array output data for the parameters you entered in the *PV Module Data* Form. The **Classic, Classic SL & Classic Lite Charge Controller Selection** displays the varying capabilities of the 150, 200 & 250 charge controllers and the **Design Check** section is where all the magic happens! Here you will see which Classic Model (150, 200 or 250) will work with the Solar Module Specifications that you entered into the *PV Module Data* form. **Max VOC** will display either OK, MARGINAL or TOO HIGH depending on the input VOC of the solar array.

The line for **Temperature The Classic Will Enter HyperVOC** shows what temperature the charge controller goes into HyperVOC. HyperVOC is a non-operative VOC safety zone over and above the maximum input voltage. It is equivalent to your Classic Model number and the nominal battery voltage. HyperVOC helps protect the charge controller from excessive voltage on those cold winter mornings when the PV array could produce damaging voltage levels. **Array Power (Wattage)** displays which Classic can best handle the wattage generated. If the display shows that over 1.2 Charge Controllers are needed, MidNite Solar recommends a second Charge Controller be added to the system. Similar to most grid tie inverters, the Classic can be over PV'd by a fair amount. Because it naturally limits output current, it will not process more current than it is rated for.