

TECHNICAL BULLETIN

Voltage Rise Calculation

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Chilicon Power microinverters require a minimum design effort compared to conventional optimizer/string based systems. In addition to maximum branch sizing determination*, the only other calculation needed to ensure that all micros operate within code defined limits is that of voltage rise. However, as Chilicon Power uses #10 AWG wire in our cabling, voltage rise values are modest compared to competing microinverter systems.

Voltage Rise: Any time a current flows through a device with internal resistance, Ohm’s Law states that a voltage change will result. As each microinverter acts as a current source, the voltage along a chain will increase with the largest voltage present at the furthest microinverter on the branch circuit. Residential grids should supply 240V at the service panel, with the microinverters allowed to operate up to 264V (229V for 208V systems).

To calculate the predicted voltage at the last microinverter, first calculate the voltage increase based on the number of daisy chained cable drops listed in the table below. The table is calculated using landscape lengths, so it presents a worst cases scenario.

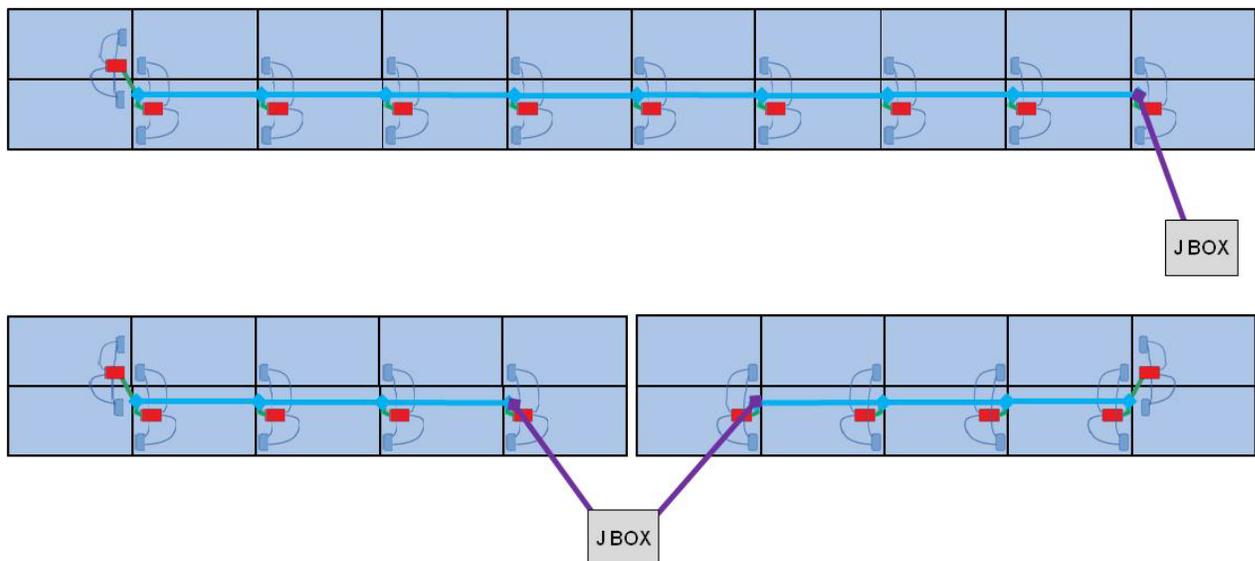
Cable Drop	240V System		Cable Drop	208V System	
	Full Current	2.4A Limited		Full Current	2.66A Limited
1	0.1	0.1	1	0.1	0.1
2	0.3	0.2	2	0.3	0.3
3	0.6	0.5	3	0.7	0.5
4	1.0	0.8	4	1.2	0.9
5	1.6	1.3	5	1.8	1.4
6	2.2	1.8	6	2.5	2.0
7	2.8	2.3	7	NA	2.5
8	NA	2.9	8	NA	3.2
9	NA	3.6			

Next, add the voltage rise associated with the length and wire size of the cabling from the service panel to the first microinverter. A number of programs are available to assist with this calculation such as:

<https://www.calculator.net/voltage-drop-calculator.html>

Note: It is highly recommended that the installer first measure the voltage at the panel box to confirm its initial value. Should a system design result in a voltage in excess of the maximum permitted, there several options to rectify the situation.

- 1) Increase the wire gauge or shorten the distance to the service panel.
- 2) Center tap the connection to the branch circuits. This involves splitting the branch circuit into two sections and connecting to the *middle*. For example: taking a ten micro branch circuit of nine drops (3.6V) and splitting in two of four drops each, decreases the voltage increase to only 0.8V.



- 3) For systems fed by a grid in excess of the standard voltage or for post-installation correction, it is possible to increase the operational voltage range of the Chilicon microinverters via the CP-100 gateway. Contact Chilicon Power for additional information on this procedure.

* Please refer to Technical Bulletin TBT4: *Power Limiting of Microinverters*