Application Note: Connecting SolarEdge Power Optimizers to Multiple PV Modules

Version History

- Version 1.5, February 2023
  - Added Section on "Serial Input Optimizer, Connecting Multiple Modules in parallel with Input Branch Cable."
  - Implemented editorial changes.
- Version 1.4, February 2023
  - Added serial and parallel connection scenarios with modules installed in portrait and landscape orientations.
- Version 1.3, August 2022
  - Added serial and parallel connection scenarios with modules installed in portrait and landscape orientations.
  - Removed M-series power optimizer connection instructions.
  - Removed connection instructions for superseded optimizers: M2640, M1600.

Contents

General Guidelines

When connecting SolarEdge Power Optimizers to multiple modules, the modules must be of the same type.
When connecting two modules to one Power Optimizer, both modules must be positioned at the same orientation and tilt angle.

NOTE

The following Power Optimizers have dual inputs for the connection of two modules in parallel:

- P485
- P800p
- P860/P960 (US only)

When connecting a single module to these Power Optimizers, seal the unused input connectors with the supplied pair of seals.
You can use SolarEdge Designer to check the compatibility of modules and Power Optimizers. Designer can be accessed using the following link: https://www.solaredge.com/products/installer-tools/designer.
For guidelines on how to use extension and adapter cables with Power Optimizers, see:
https://www.solaredge.com/sites/default/files/se-extension-cables-with-power-optimizer-application-note.pdf.

Electrical Considerations

When connecting SolarEdge Power Optimizers to multiple modules, the following conditions must be met:

- The cumulative module power must not exceed the Power Optimizer rated input DC power[1].
- The maximum open circuit voltage (Voc) at the lowest temperature must not exceed the absolute maximum input voltage of the Power Optimizer. Refer to the Power Optimizer datasheet to determine the absolute maximum input voltage. When connecting multiple modules in series, the cumulative voltage must be used.

NOTE

Connecting high voltage PV modules in series to SolarEdge Power Optimizers may result in a cumulative open-circuit voltage that exceeds the maximum input voltage and can possibly damage the Power Optimizers and void the product warranty.

- The maximum short-circuit current must not exceed the maximum input short circuit current of the Power Optimizer. Refer to the Power Optimizer datasheet to determine the maximum input short circuit current. When connecting multiple modules in parallel, the cumulative current must be used.

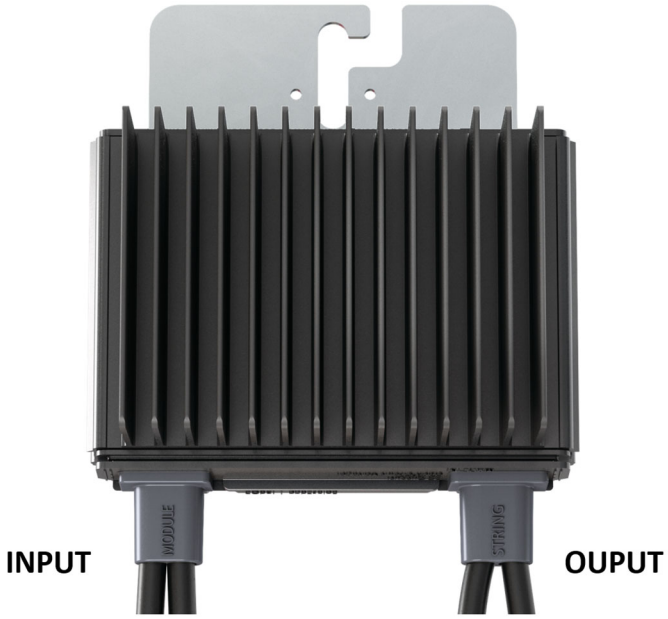
NOTE

Connection of PV modules with high short circuit current in parallel to SolarEdge Power Optimizers may result in a cumulative current that exceeds the maximum input current and can possibly damage the Power Optimizers and void the product warranty.

[1] The rated power of the module at STC may not exceed the Power Optimizer "Rated Input DC Power". Modules with up to +5% power tolerance are allowed. For information on compatibility with bi-facial modules, see:
https://www.solaredge.com/sites/default/files/compatibility_of_bi_facial_modules_with_SE_optimizers.pdf

Optimizer Orientation

The following diagram shows the Power Optimizer's correct mounting orientation. This is the orientation shown in all subsequent figures. When facing the heatsink of the Power Optimizer the input connectors, for connecting to the PV modules, are on the left and the output connectors, for connecting to the PV string, are on the right.



IMPORTANT NOTE

- Power Optimizer INPUT is connected to PV Modules. S-Series Power Optimizer INPUT is marked "MODULE".
- Power Optimizer OUTPUT is connected to PV String. S-Series Power Optimizer OUTPUT is marked "STRING".

Mechanical Considerations

When connecting SolarEdge Power Optimizers to multiple modules, the following conditions must be met:

- If you install Power Optimizers before the PV Modules, protect the connectors from rain and dust by using the seals provided. Seal kits can be purchased separately (part ID: OPT-SEAL-100) if required.
- When fastening the Power Optimizer to a mounting structure or a rail, do not use an electric drill or an impact screwdriver. Drilling vibrations can damage the Power Optimizer and will void the warranty. Use a manual screwdriver.
- Ensure that the modules are equipped with the original Staubli MC4 connectors or with a connector approved by SolarEdge that matches the input connector on the Power Optimizer. In addition, ensure that the input connector of the Power Optimizer and the output connector of the modules are of the identical brand. For more details, refer to the application note: https://www.solaredge.com/sites/default/files/optimizer-input-connector-compatibility.pdf
- Ensure that the module output cables are long enough to be connected to the Power Optimizer without the need for an extension cable. We recommend that you order modules with long output cables for landscape orientation scenarios as shown in the figures below.

IMPORTANT NOTE

- PV modules with short cables must be connected to Power Optimizers with long cables.
- Using PV modules with long cables in landscape orientation enable you to use with short cables.

Connection Diagrams

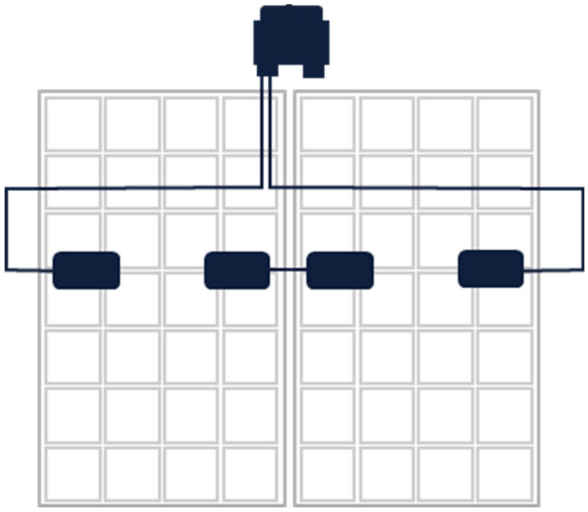
The options for connecting Power Optimizers to multiple modules appear in the following figures.

NOTE

The diagrams below depict modules with split junction boxes. The same connection logic is valid for modules with single junction boxes as well.

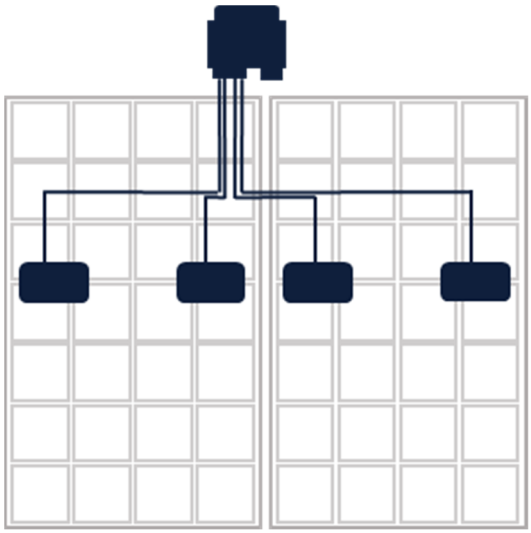
Serial Input Power Optimizer - Modules in Portrait Orientation

This connection scheme is supported by single-input Power Optimizers for installations in which the PV modules are connected in series.



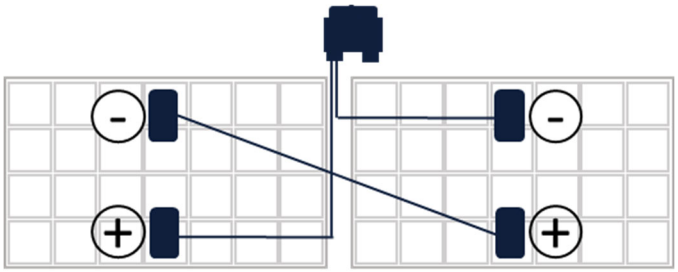
Parallel Input Power Optimizer with Dual Input - Modules in Portrait Orientation

This connection scheme is supported by the P860, P960, and P800p Power Optimizers:



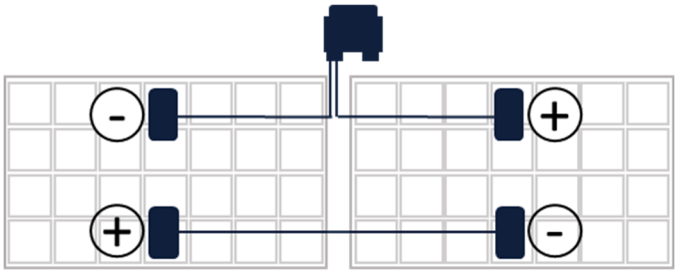
Serial Input Power Optimizer - Modules in Landscape Orientation - Uniform Placement

In this case, all modules are placed in the same direction.



Serial Input Power Optimizer - Modules in Landscape Orientation - Alternate Placement

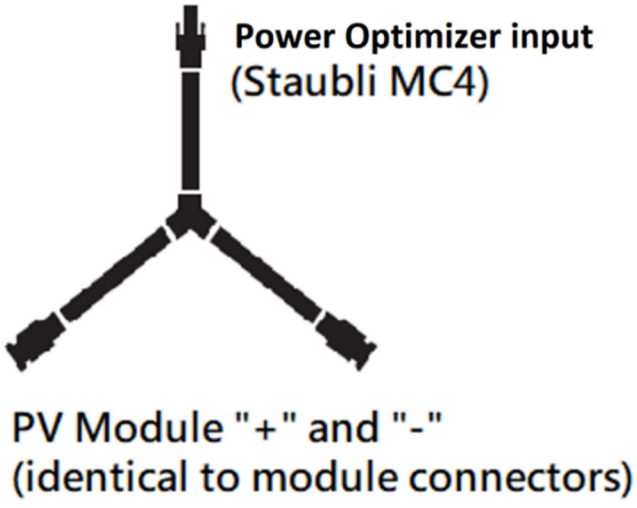
In this case, every second module is rotated by 180 degrees so that the positive "+" terminal of one module is as close as possible to the negative "-" terminal of the next module. In this way the cabling is simplified.



Serial Input Power Optimizer - Multiple Modules in Parallel - Input Branch Cable

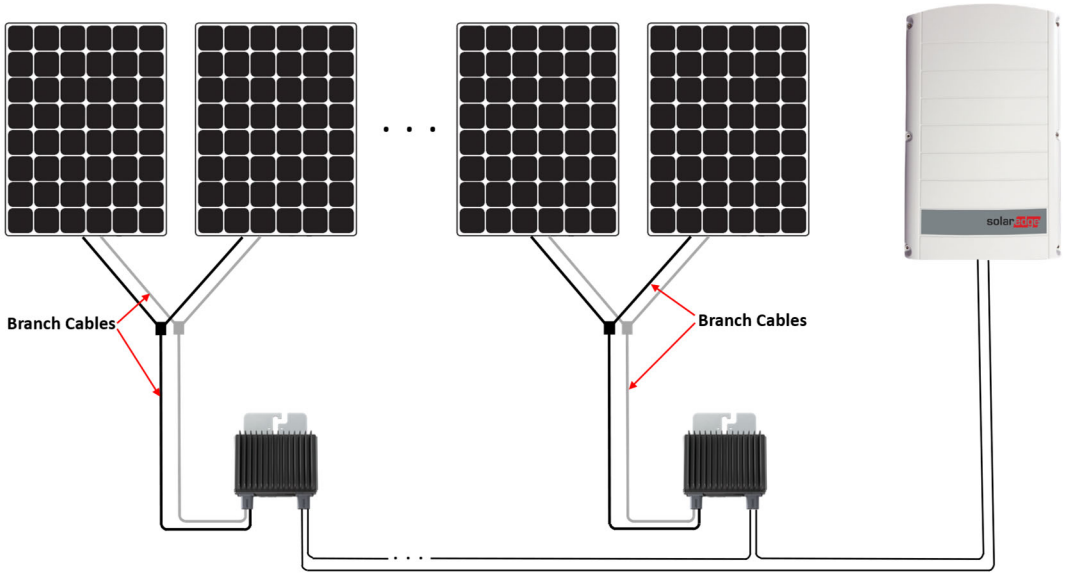
Commercial S-Series Power Optimizers with Single-input can support up to two (2) PV modules connected in parallel configuration using a Branch cable as long as the Power Optimizer's electrical requirements are met. The Branch Cable must meet the following requirements:

- The connector on the optimizer side of the Branch Cable must be a Staubli MC4 connector. i.e. it must be identical to the Power Optimizer input connector. Refer to the figure below.



- The connector on the module side of the Branch Cable must be identical in brand and model to the PV Module output cable.
- Field Crimping is not allowed and voids the warranty.
- Current carrying capacity shall not be less than:
  *Short Circuit Current (I_{sc}) of a connected PV Module * 1.25 * number of modules per Branch Cable*
- Conductor cross-section area is not less than 4mm^2.
- Double-insulated PV cable rated to a maximum system voltage of at least 1000V_{dc}.
- Rated Temperature is -40°C to 90°C.
- The maximum length from Branch Cable input to output shall not exceed 1.3m[2].

An example of a system connected using Branch Cables is shown below.



NOTES

- S-Series Power Optimizers which support SenseConnect only monitor the connectors on the short input cable attached to the Power Optimizer. All other Branch Cable connectors are not monitored by SenseConnect.
- The Input Branch Cable between multiple PV Modules and the Power Optimizer is auxiliary equipment and is not covered by the SolarEdge warranty.

[2] For Power Optimizer models other than S-Series models, the maximum length of the Branch Cable cannot exceed the defined maximum extension length as defined in the section: "Between a Power Optimizer and a Module" in the extension cable policy : "https://knowledge-center.solaredge.com/sites/kc/files/se-extension-cables-with-power-optimizer-application-note.pdf

Safety Symbols Information

The following safety symbols are used in this document. Familiarize yourself with the symbols and their meaning before installing or operating the system.

WARNING

Denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in **injury or loss of life**. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.

CAUTION!

Denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in **damage or destruction of the product**. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

NOTE

Denotes additional information about the current subject.

IMPORTANT SAFETY FEATURE

Denotes information about safety issues.

Disposal requirements under the Waste Electrical and Electronic Equipment (WEEE) regulations:

NOTE

Discard this product according to local regulations or send it back to SolarEdge.

Support Contact Information

If you have technical problems concerning SolarEdge products, please contact us:

https://www.solaredge.com/service/support

Before contact, make sure to have the following information at hand:

- Model and serial number of the product in question.
- The error indicated on the product SetApp mobile application LCD screen or on the monitoring platform or by the LEDs, if there is such an indication.
- System configuration information, including the type and number of modules connected and the number and length of strings.
- The communication method to the SolarEdge server, if the site is connected.
- The product's software version as it appears in the ID status screen.