Example Single-Line Diagram for a SolarEdge® string inverter system (with power optimizers)

SolarEdge Power Optimizer cable/#10 AWG Cu PV Wire, and a solid #6 copper EGC extending from J-box to roof racking/modules/optimizers, wiring in free-air under modules.

(25) 265W SolarWorld Modules (each module with its own Power Optimizer)

Soladeck J-box

Inverter's DC disconnect

AC disconnect located next to inverter if inverter is not next to 40A AC breaker. Otherwise, disconnect is not required (per the NEC, but may be required per the utility).

(2) #10 AWG THWN-2 Cu, with #10 AWG Cu EGC, ¾” EMT, wiring in attic

(3) #8 AWG THWN-2 Cu, with #10 AWG Cu EGC, ¾” EMT

Service conductors extending to utility

Existing Loads

Existing Service panelboard

40A meter

Note: this wiring diagram is simply an example. Diagrams may vary.
Example Single-Line Diagram (for a micro inverter system)

(13) 265W SolarWorld Modules each connecting to its own Enphase M250 micro inverter.

(13) 265W SolarWorld Modules each connecting to its own Enphase M250 micro inverter.

(10) 265W SolarWorld Modules each connecting to its own Enphase M250 micro inverter.

#12 AWG TCER trunk cable which includes a #12 AWG Cu EGC.

Three separate #12 AWG 3-wire NM cable ran through attic.

(3) #8 AWG THWN-2 Cu, with #10 AWG Cu EGC, ¾” EMT

(9) #12 AWG Cu THWN-2 with #12 AWG EGC, in ¾” EMT leading from roof eave down to AC combiner.

60A rated AC combiner panelboard (dedicated only for solar PV

Soladeck J-box (for transition of trunk cable to NM cable).

J-box mounted at roof eave (for transition of NM cable to THWN-2 wire in conduit.

AC disconnect (as shown) is not required per the NEC, but may be required per the utility.

Existing Loads

Existing Service panelboard

45A

20A

20A

20A

Service conductors extending to utility

Note: this wiring diagram is simply an example. Diagrams may vary.
Grid-tied PV System With Battery Backup (example diagram)

Note: this wiring diagram is simply an example. Diagrams may vary.

- **#10 AWG Cu PV Wire, and a solid #6 copper EGC extending from J-box to roof racking/modules, wiring in free-air under modules**
- **(3) #8 AWG THWN-2 Cu, with #10 AWG Cu EGC, ¾” EMT**
- **(4) #10 AWG THWN-2 Cu, with #10 AWG Cu EGC, ¾” EMT, wiring in attic**
- **SolarCity® H6 Hybrid Inverter**
- **AC disconnect located next to inverter if inverter is not next to 40A AC breaker. Otherwise, disconnect is not required (per the NEC, but may be required per the utility).**
- **SolarWorld modules in series.**
- **(2) #10 AWG THWN-2 Cu, with #10 AWG Cu EGC, ¾” EMT**
- **(10) 265W SolarWorld modules in series.**
- **(10) 265W SolarWorld modules in series.**

Note: Rapid shutdown equipment and wiring not shown in this diagram but may be required depending on the type of battery system to be installed.
Example Single-Line Diagram (for an SMA® Sunny Boy string inverter system with rapid shutdown)

Note: this wiring diagram is simply an example. Diagrams may vary.

- (12) 265W SolarWorld modules in series.
- (12) 265W SolarWorld modules in series.
- (12) 265W SolarWorld modules in series.

#10 AWG Cu PV Wire, and a solid #6 copper EGC extending from J-box to roof racking/modules, wiring in free-air under modules

(3) #8 AWG THWN-2 Cu, with #10 AWG Cu EGC, ¾” EMT

(6) #10 AWG THWN-2 Cu, with #10 AWG Cu EGC, ¾” EMT, wiring in attic

Inverter's DC disconnect

SMA rapid shutdown box mounted under solar modules

SMA rapid shutdown push button disconnect switch (mounted outside and adjacent to the service panel)

#18 AWG THWN, 600V rated wire, ½” EMT

AC disconnect located next to inverter if inverter is not next to 40A AC breaker. Otherwise, disconnect is not required (per the NEC, but may be required per the utility).

Existing circuit to air conditioner

Service conductors extending to utility

Existing Service panelboard

40A

150A

meter

SB 7000W inverter

Soladeck J-box

RS

Existing 2/0 alum. Feeders extending to existing sub-panel in home.
A site plan is required for all solar PV plan submittals and must show locations of all equipment.

Roof racking support spacing not to exceed 4’ spacing. All supports must be staggered from one row of racking to the next so not all supports are bearing on the same trusses.

A rapid shutdown equipment may also need to be shown on the site plan if the PV system is required to have such system.

Solar PV modules (panels) cannot be installed over or block any attic vents, plumbing vents, furnace or water heater vents etc.

All wiring must be properly supported by devices or mechanical means designed and listed for such use and wiring must be permanently and completely held off of the roof surface. See NEC 110.2, 110.3(A), 110.3(B), and 300.4. Please be aware that zip ties are typically not allowed since they are easily broken and do not provide a reliable method of supporting wires up off of the roof.

Location of SMA Sunny Boy® inverter (in garage – East wall)

Location of service panelboard

Location of SMA rapid shutdown disconnect switch

Flashed roof J-boxes
Hipped Roof Access – *IFC 605.11.3.2.3* (continued)

- Minimum of 3’ from top of solar modules to ridge
- Minimum of one 3’ wide pathway from eave to ridge
- Minimum of one 3’ wide pathway from eave to ridge
- Minimum of 18” from edges of PV modules to the hip

![Diagram showing hipped roof access requirements](image-url)
Signage requirements

Please provide the following signage requirements on the plans (and specify on the plans the location where each sign will be mounted): Please be aware that not every sign noted below is required depending on the type of system to be installed.

A. Please specify on the plans that all signage must be permanently attached and be weather resistant/sunlight resistant and cannot be hand-written.

B. A sign is required at the service panel stating that the home has a solar PV system as an additional power source. NEC 705.10.

C. A sign is required at the home’s service meter panelboard noting the location of the inverter if the inverter is not located next to the utility service panel. NEC 690.4(D) and NEC 705.10.

D. A sign is required at the main PV system disconnect labeling it as such. NEC 690.13(B).

E. For the backfed PV breaker at the existing panelboard, please specify a sign is required next to such breaker and states the following: “Warning, Inverter Output Connection, Do Not Relocate This Overcurrent Device.” This is required per NEC 705.12(B)(2)(3)(b).

F. Please specify a sign is required at the service panelboard noting the total rated AC amps and AC voltage of the PV system. NEC 690.54.

G. A sign is required at the inverter noting the total DC system STC rated max current (Impp), the rated max DC voltage (Vmpp), the DC open circuit voltage (Voc) which has been increased for coldest possible outside temperature, and DC short circuit current (Isc). NEC 690.53.

H. Specify that any conduits, enclosures, or MC cable that contain DC circuits shall be marked on their exterior with the wording “WARNING: PHOTOVOLTAIC POWER SOURCE.” The markings shall be provided at every enclosure, every 10’ along conduit or MC cable, and at each side of where the conduit or cable passes through a wall, floor, or any other partition. The markings shall be permanently affixed and visible after installation. NEC 690.31(G).

I. There must be a sign located at the service equipment which notes the following: “PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN.” The sign must be reflective, with all letters capitalized, and letters are at least 3/8” in height. Wording must also be white on a red background. Please specify this information on the plans. See NEC 690.56(C). (see also next sheet for additional rapid shutdown signage requirements).

J. A sign is required to be provided adjacent on on the rapid shutdown disconnect(s) labeling it/them as “Rapid Shutdown Switch for Solar PV System,” per NEC 690.56(C)(3). Please specify this on the plans.
This sign required at service panel if string-level rapid shutdown is provided.

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN CONDUCTORS OUTSIDE THE ARRAY. CONDUCTORS WITHIN THE ARRAY REMAIN ENERGIZED IN SUNLIGHT.

This sign required at service panel if module-level rapid shutdown is provided.

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN THE ARRAY.
SolarEdge Single Phase Inverters
For North America


The best choice for SolarEdge enabled systems

- Integrated arc fault protection (Type 1) for NEC 2011 690.11 compliance
- Superior efficiency (98%)
- Small, lightweight and easy to install on provided bracket
- Built-in module-level monitoring
- Internet connection through Ethernet or Wireless
- Outdoor and indoor installation
- Fixed voltage inverter, DC/AC conversion only
- Pre-assembled Safety Switch for faster installation
- Optional – revenue grade data, ANSI C12.1
## Single Phase Inverters for North America


### OUTPUT

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal AC Power Output</td>
<td>3000</td>
<td>3800</td>
<td>5000</td>
<td>6000</td>
<td>7600</td>
<td>9980 @ 208V</td>
<td>10000 @ 208V</td>
</tr>
<tr>
<td>Max. AC Power Output</td>
<td>3300</td>
<td>4150</td>
<td>5400 @ 208V</td>
<td>5450 @ 240V</td>
<td>6000</td>
<td>8350</td>
<td>10800 @ 208V</td>
</tr>
<tr>
<td>AC Output Voltage Min.-Nom.-Max.</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>-</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>AC Output Voltage Min.-Nom.-Max.</td>
<td>183 - 208 - 229 Vac</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>-</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>AC Frequency Min.-Nom.-Max.</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>AC Frequency Min.-Nom.-Max.</td>
<td>59.3 - 60 - 60.5 (with HI country setting 57 - 60 - 60.5)</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>-</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Max. Continuous Output Current</td>
<td>12.5</td>
<td>16</td>
<td>24 @ 208V</td>
<td>21 @ 240V</td>
<td>25</td>
<td>32</td>
<td>48 @ 208V</td>
</tr>
<tr>
<td>GFDI Threshold</td>
<td>1</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Utility Monitoring, Islanding Protection, Country Configurable Thresholds
- Yes
- Yes

### INPUT

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum DC Power (STC)</td>
<td>4050</td>
<td>5100</td>
<td>6750</td>
<td>8100</td>
<td>10250</td>
<td>13500</td>
<td>15350</td>
</tr>
<tr>
<td>Transformer-less, Ungrounded</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Nom. DC Input Voltage</td>
<td>325 @ 208V / 350 @ 240V</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Max. Input Voltage Current</td>
<td>9.5</td>
<td>13</td>
<td>16.5 @ 208V</td>
<td>15.5 @ 240V</td>
<td>18</td>
<td>23</td>
<td>33 @ 208V</td>
</tr>
<tr>
<td>Max. Input Short Circuit Current</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Reverse-Polarity Protection</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Ground-Fault Isolation Detection</td>
<td>-</td>
<td>-</td>
<td>600k Sensitivity</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Maximum Inverter Efficiency</td>
<td>97.5</td>
<td>98</td>
<td>98.2</td>
<td>98.3</td>
<td>98.3</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>CEC Weighted Efficiency</td>
<td>97.5</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>Nighttime Power Consumption</td>
<td>&lt; 2.5</td>
<td>&lt; 4</td>
<td>&lt; 2.5</td>
<td>&lt; 4</td>
<td>&lt; 2.5</td>
<td>&lt; 4</td>
<td>&lt; 4</td>
</tr>
</tbody>
</table>

### ADDITIONAL FEATURES

#### Supported Communication Interfaces
- RS485, RS232, Ethernet, ZigBee (optional)

#### Rapid Shutdown – NEC 2014 690.12
- Functionality enabled when SolarEdge rapid shutdown kit is installed.

### STANDARD COMPLIANCE

#### Safety
- UL1741, UL1699B, UL1998, CSA 22.2

#### Grid Connection Standards
- IEEE1547

#### Emissions
- FCC part15 class B

### INSTALLATION SPECIFICATIONS

| AC output conduit size / AWG range | 3/4" minimum / 16-6 AWG |
| DC input conduit size / # of strings / AWG range | 3/4" minimum / 1-2 strings / 14-6 AWG |
| Dimensions with Safety Switch (HxWxD) | 30.5 x 12.5 x 7.2 / 775 x 315 x 184 |
| Weight with Safety Switch | 51.2 / 23.2 |

### Cooling
- Natural Convection
- Natural convection and internal fan (user replaceable)
- Fans (user replaceable)

### Protection Rating
- NEMA 3R

---

1. For other regional settings please contact SolarEdge support.
2. A higher current source may be used; the inverter will limit its input current to the values stated.
SolarEdge Power Optimizer
Module Add-On For North America
P300 / P320 / P400 / P405

PV power optimization at the module-level
- Up to 25% more energy
- Superior efficiency (99.5%)
- Mitigates all types of module mismatch losses, from manufacturing tolerance to partial shading
- Flexible system design for maximum space utilization
- Fast installation with a single bolt
- Next generation maintenance with module-level monitoring
- Module-level voltage shutdown for installer and firefighter safety
### SolarEdge Power Optimizer

**Module Add-On for North America**

P300 / P320 / P400 / P405

<table>
<thead>
<tr>
<th>INPUT</th>
<th>P300 (for 60-cell modules)</th>
<th>P320 (for high-power 60-cell modules)</th>
<th>P400 (for 72 &amp; 96-cell modules)</th>
<th>P405 (for thin film modules)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Input DC Power</td>
<td>300</td>
<td>320</td>
<td>400</td>
<td>405</td>
</tr>
<tr>
<td>Absolute Maximum Input Voltage (Voc at lowest temperature)</td>
<td>48</td>
<td>80</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>MPPT Operating Range</td>
<td>8 - 48</td>
<td>8 - 80</td>
<td>12.5 - 105</td>
<td></td>
</tr>
<tr>
<td>Maximum Short Circuit Current (Isc)</td>
<td>10</td>
<td>11</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Maximum DC Input Current</td>
<td>12.5</td>
<td>13.75</td>
<td>12.5</td>
<td></td>
</tr>
<tr>
<td>Maximum Efficiency</td>
<td>99.5</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weighted Efficiency</td>
<td>98.8</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overvoltage Category</td>
<td>II</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)

| Maximum Output Current | 15 | |
| Maximum Output Voltage | 60 | 85 |

### OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)

| Safety Output Voltage per Power Optimizer | 1 | |

### STANDARD COMPLIANCE

| EMC | FCC Part15 Class B, IEC61000-6-2, IEC61000-6-3 |
| Safety | IEC62109-1 (class II safety), UL1741 |
| RoHS | Yes |

### INSTALLATION SPECIFICATIONS

| Maximum Allowed System Voltage | 1000 | Vdc |
| Compatible inverters | All SolarEdge Single Phase and Three Phase inverters |
| Dimensions (W x L x H) | 128 x 152 x 27.5 | 128 x 152 x 35 | 128 x 152 x 48 | mm / in |
| Weight (including cables) | 770 / 1.7 | 930 / 2.05 | 930 / 2.05 | gr / lb |

### PV SYSTEM DESIGN USING A SOLAREDGE INVERTER(2)

<table>
<thead>
<tr>
<th>SINGLE PHASE</th>
<th>THREE PHASE 208V</th>
<th>THREE PHASE 480V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum String Length (Power Optimizers)</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Maximum String Length (Power Optimizers)</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Maximum Power per String</td>
<td>5250</td>
<td>6000</td>
</tr>
</tbody>
</table>

(2) It is not allowed to mix P405 with P300/P400/P600/P700 in one string.
**Rapid Shutdown Kit - Installation and Configuration**

**(Single Phase Inverters)**

This document describes how to install the rapid shutdown kit in the SolarEdge Safety Switch, and how to enable the rapid shutdown feature in the inverter in order to provide the functionality described in the Rapid Shutdown clause of NEC2014 690.12 (1) through (4).

**Kit Contents**

- Rapid shutdown cables
- Micro-SD card and SD card adapter with firmware files (Note: DO NOT THROW AWAY THE CARD AND THE ADAPTER; keep them for installation of other rapid shutdown kits)

**Cable Installation**

Perform this procedure before connecting the strings to the Safety Switch [Chapter 4: Connecting the AC and the Strings to the Safety Switch in the SolarEdge Installation Guide].

1. Turn the inverter ON/OFF switch to OFF. If installing the kit in an inverter that is already operating, wait until the LCD indicates that the DC voltage is safe (<50V), or wait five minutes before continuing to the next step.

2. Turn the Safety Switch and the AC switch on the main circuit board to OFF.

   **WARNING!**

   If you cannot see the inverter panel, or if a malfunction is indicated on the LCD panel, wait five minutes for the input capacitors of the inverter to discharge.

3. Loosen the four Allen screws on the front cover of the Safety Switch, and open the cover.

4. Carefully disconnect the two DC cables from the left side of the switch and from the DC connection spring clamp terminals, as illustrated below\(^1\). Use a standard straight-bladed screwdriver to disconnect the cables from the terminals.

---

\(^1\) The internal components may vary depending on the Safety Switch model; the figures in this documents show the AC/DC Safety Switch for single phase 7.6-11.4 kW inverters.
The rapid shutdown cables have a resistor connected to one end (on the red cable). Connect these ends to the switch, making sure that the red and black cables are reversed relative to the cables connected at the top of the switch (going into the DC side conduit between the inverter and the Safety Switch), as detailed below. Apply a torque of 2 N*m (18 lb*in):

- If the cables at the top are red and black from left to right, connect as shown below.

![Figure 2: Rapid shutdown cable connected – option 1](image1)

- If the cables at the top are black and red from left to right, connect as shown below.

![Figure 3: Rapid shutdown cable connected – option 2](image2)

6 Use a standard straight-bladed screwdriver to connect the other end of the rapid shutdown cables to the DC connection spring-clamp terminals: Connect the black cable from the switch to the DC- terminal block, and connect the red cable from the switch to the DC+ terminal block.

7 Check that the cables are located and connected in the correct positions to ensure the rapid shutdown functionality.

8 Close the cover: Attach the switch cover and secure it by tightening the four screws with a torque of 0.9 ft.*lb / 1.2 N*m.
Inverter Software Compatibility Check and Upgrade

Perform this procedure after activating the inverter [Step 1 in Chapter 5: Commissioning of the SolarEdge Installation Guide], and before pairing [Step 2 in Chapter 5 of the SolarEdge Installation Guide].

To use the rapid shutdown feature, the inverter communication board firmware (CPU) must be:

- Version 2.0700 or higher, if the CPU version is 2.0xxx
- Version 3.0700 or higher, if the CPU version is 3.0xxx

**To check the inverter CPU version:**

1. Verify that the inverter has been activated using the activation card supplied with the inverter.
2. Press the LCD light button short presses until the screen below is reached.

   **ID**: ####### 
   CPU: 2.0700
   **Country**: XXXXX

3. Check the CPU version number. If lower than 2.0700, upgrade the inverter software as described below; otherwise proceed to “Power Optimizer Pairing”.

**To upgrade the inverter software:**

Use the supplied SD card adapter or the micro-SD card, which can be removed from the adapter, according to the activation card slot on your inverter communication board, labeled [CARD]

1. Verify that the AC breaker connected to the inverter is OFF.
2. Open the inverter cover’s six Allen screws and carefully pull the cover horizontally before lowering it, as described in its manual.
3. Insert the card into the card slot on the communication board. If the communication board has an SD card slot, use the supplied SD card adapter. If there is a micro-SD card slot, remove the micro-SD card from the adapter and insert it.
4. Close the inverter cover and turn the AC on. If upgrade is required (as described above), it starts automatically.
5. Wait for the message “Done” to be displayed on the LCD.
6. Verify the correct version as described above.
7. Remove the card from the inverter and keep it for additional kit installations.

Power Optimizer Pairing

Pairing at this stage will reprogram the power optimizers to perform rapid shutdown.

1. Verify that the ON/OFF switch at the bottom of the inverter is OFF.
2. Turn ON the AC breaker and the Safety Switch.

Enabling Rapid Shutdown

There is an option in setup mode to enable the functionality of rapid shutdown.

1. Verify that the ON/OFF switch at the bottom of the inverter is ON.
2. Enter Setup mode by pressing and holding the LCD light button.

**NOTE:**
Whenever replacing, removing or adding a component in the string, perform Pairing and rapid shutdown setting.

Troubleshooting

If the inverter does not enter production mode and the LCD displays Night Mode, the connection order of the rapid shutdown cables may be incorrect. Recheck the cables and make sure that the rapid shutdown cables connected to the bottom of the switch are reversed relative to the cables connected at the top of the switch (see Figure 2 and Figure 3).
The Sunny Boy 3000TL-US/4000TL-US/5000TL-US represents the next step in performance for UL certified inverters. Its transformerless design means high efficiency and reduced weight. Maximum power production is derived from wide input voltage and operating temperature ranges. Multiple MPP trackers and OptiTrac™ Global Peak mitigate the effect of shade and allow for installation at challenging sites. The unique Secure Power Supply feature provides daytime power in the event of a grid outage. High performance, flexible design and innovative features make the Sunny Boy TL-US series the first choice among solar professionals.
## Technical data

### Input (DC)
- **Max. DC power**: $[@ \cos \phi = 1]$
  - Sunny Boy 3000TL-US: 3200 W
  - Sunny Boy 4000TL-US: 4200 W
  - Sunny Boy 5000TL-US: 5300 W
- **Max. DC voltage**: 600 V
- **MPP voltage range**: 175 – 480 V
- **Min. DC voltage / start voltage**: 125 / 150 V
- **Max. input current / per MPP tracker**: 18 A / 15 A
  - sunny boy 3000TL-US: 3200 W
  - sunny boy 4000TL-US: 4200 W
  - sunny boy 5000TL-US: 5300 W
- **Number of MPP trackers / strings per MPP tracker**: 2 / 2

### Output (AC)
- **AC nominal power**: 3000 W
  - sunny boy 3000TL-US: 3200 W
  - sunny boy 4000TL-US: 4200 W
  - sunny boy 5000TL-US: 5300 W
- **Max. AC apparent power**: 3900 VA
  - sunny boy 3000TL-US: 4000 VA
  - sunny boy 4000TL-US: 4450 VA
  - sunny boy 5000TL-US: 5000 VA
- **Nominal AC voltage / adjustable**: 208 V / ●
  - sunny boy 3000TL-US: 240 V / ●
  - sunny boy 4000TL-US: 240 V / ●
  - sunny boy 5000TL-US: 240 V / ●
- **AC voltage range**: 183 – 229 V
  - sunny boy 3000TL-US: 211 – 264 V
  - sunny boy 4000TL-US: 211 – 264 V
  - sunny boy 5000TL-US: 211 – 264 V
- **Max. AC grid frequency; range**: 60 Hz / 59.3 – 60.5 Hz
  - sunny boy 3000TL-US: 60 Hz / 59.3 – 60.5 Hz
  - sunny boy 4000TL-US: 60 Hz / 59.3 – 60.5 Hz
  - sunny boy 5000TL-US: 60 Hz / 59.3 – 60.5 Hz
- **Max. output current**: 15 A
  - sunny boy 3000TL-US: 20 A
  - sunny boy 4000TL-US: 20 A
  - sunny boy 5000TL-US: 20 A
- **Power factor (cos ϕ)**: 1
  - sunny boy 3000TL-US: 1
  - sunny boy 4000TL-US: 1
  - sunny boy 5000TL-US: 1
- **Output phases / line connections**: 1 / 2
- **Harmonics**: < 4%
  - sunny boy 3000TL-US: < 4%
  - sunny boy 4000TL-US: < 4%
  - sunny boy 5000TL-US: < 4%

### Efficiency
- **Max. efficiency**: 96.8%
  - sunny boy 3000TL-US: 97.1%
  - sunny boy 4000TL-US: 97.2%
  - sunny boy 5000TL-US: 97.1%
- **CEC efficiency**: 96%
  - sunny boy 3000TL-US: 96.5%
  - sunny boy 4000TL-US: 96.5%
  - sunny boy 5000TL-US: 96.5%

### Protection devices
- **DC disconnection device**: ●
- **DC reverse-polarity protection**: ●
- **Ground fault monitoring / Grid monitoring**: ●
- **AC short circuit protection**: ●
- **All-pole sensitive residual current monitoring unit**: ●
- **Arc fault circuit interrupter (AFCI) compliant to UL 1699B**: ●
- **Protection class / overvoltage category**: I / IV

### General data
- **Dimensions (W / H / D) in mm (in)**
  - sunny boy 3000TL-US: 490 / 519 / 185 (19.3 / 20.5 / 7.3)
  - sunny boy 4000TL-US: 490 / 519 / 185 (19.3 / 20.5 / 7.3)
  - sunny boy 5000TL-US: 490 / 519 / 185 (19.3 / 20.5 / 7.3)
- **DC Disconnect dimensions (W / H / D) in mm (in)**
  - sunny boy 3000TL-US: 187 / 297 / 190 (7.4 / 11.7 / 7.5)
  - sunny boy 4000TL-US: 237 / 297 / 190 (9.3 / 11.7 / 7.5)
  - sunny boy 5000TL-US: 237 / 297 / 190 (9.3 / 11.7 / 7.5)
- **Packing dimensions (W / H / D) in mm (in)**
  - sunny boy 3000TL-US: 617 / 597 / 266 (24.3 / 23.5 / 10.5)
  - sunny boy 4000TL-US: 617 / 597 / 266 (24.3 / 23.5 / 10.5)
  - sunny boy 5000TL-US: 617 / 597 / 266 (24.3 / 23.5 / 10.5)
- **Weight / DC Disconnect weight**: 24 kg (53 lb)
  - sunny boy 3000TL-US: 24 kg (53 lb)
  - sunny boy 4000TL-US: 24 kg (53 lb)
  - sunny boy 5000TL-US: 24 kg (53 lb)
- **Packing weight / DC Disconnect packing weight**: 27 kg (60 lb)
  - sunny boy 3000TL-US: 27 kg (60 lb)
  - sunny boy 4000TL-US: 27 kg (60 lb)
  - sunny boy 5000TL-US: 27 kg (60 lb)
- **Operating temperature range**: -40 °C ... +60 °C
  - sunny boy 3000TL-US: -40 °C ... +60 °C
  - sunny boy 4000TL-US: -40 °C ... +60 °C
  - sunny boy 5000TL-US: -40 °C ... +60 °C
- **Noise emission [typical]**
  - sunny boy 3000TL-US: < 25 dB(A)
  - sunny boy 4000TL-US: < 25 dB(A)
  - sunny boy 5000TL-US: < 25 dB(A)
- **Internal consumption at night**: < 1 W
  - sunny boy 3000TL-US: < 1 W
  - sunny boy 4000TL-US: < 1 W
  - sunny boy 5000TL-US: < 1 W
- **Topology**: Transformerless
  - sunny boy 3000TL-US: Transformerless
  - sunny boy 4000TL-US: Transformerless
  - sunny boy 5000TL-US: Transformerless
- **Cooling concept**: Convection
  - sunny boy 3000TL-US: Convection
  - sunny boy 4000TL-US: Convection
  - sunny boy 5000TL-US: Convection
- **Electronics protection rating**: NEMA 3R
  - sunny boy 3000TL-US: NEMA 3R
  - sunny boy 4000TL-US: NEMA 3R
  - sunny boy 5000TL-US: NEMA 3R

### Features
- **Secure Power Supply**: ●
- **Display: graphic**: ●
- **Interfaces: RS485 / Webconnect**: ○ / ○
  - sunny boy 3000TL-US: ○ / ○
  - sunny boy 4000TL-US: ○ / ○
  - sunny boy 5000TL-US: ○ / ○
- **Interface: ZigBee**: ○
  - sunny boy 3000TL-US: ○
  - sunny boy 4000TL-US: ○
  - sunny boy 5000TL-US: ○
- **Warranty: 10 / 15 / 20 years**: ● / ○ / ○
  - sunny boy 3000TL-US: ● / ○ / ○
  - sunny boy 4000TL-US: ● / ○ / ○
  - sunny boy 5000TL-US: ● / ○ / ○
- **Certificates and permits (more available on request)**

### NOTE: US inverters ship with gray lids

### Type designation

### Accessories
- **Speedwire/Webconnect interface**
  - SWDM-US-10
- **RS485 interface**
  - DM-485CB-US-10
- **Fan kit**
  - FANKIT02-10

---

*Standard feature ○ Optional feature — Not available

Data at nominal conditions
RAPID SHUTDOWN SYSTEM

Cost-effective system compliance

The SMA Rapid Shutdown System is the most cost-effective way to achieve 2014 NEC 690.12 Rapid Shutdown compliance for systems using Sunny Boy inverters. This DC powered system allows for the use of Secure Power Supply, providing opportunity power to homeowners during daytime grid outages. Hybrid switches and automatic self-test ensure system safety and durability, reducing risk and costs. Each component plays a critical role in a PV system; don’t compromise your Sunny Boy’s performance with any other rapid shutdown solution.
### Technical data

#### Rapid Shutdown Box

<table>
<thead>
<tr>
<th><strong>General data</strong></th>
<th><strong>Rapid Shutdown Box</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum input voltage</td>
<td>600 V DC</td>
</tr>
<tr>
<td>Minimum input voltage</td>
<td>110 V DC</td>
</tr>
<tr>
<td>Number of DC inputs</td>
<td>4 strings, 2 in parallel per channel</td>
</tr>
<tr>
<td>DC operating current per channel</td>
<td>20 A DC</td>
</tr>
<tr>
<td>Maximum channel short circuit current per channel</td>
<td>36 A DC</td>
</tr>
<tr>
<td>Integrated power supply</td>
<td>DC powered by PV array (max. 5W)</td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>-40°C to +75°C</td>
</tr>
<tr>
<td>Dimensions without pre-wired cables (W x H x D)</td>
<td>542 x 340 x 75 mm / 21.3 x 13.4 x 2.95 in</td>
</tr>
<tr>
<td>Weight</td>
<td>3.8 kg / 8.4 lb</td>
</tr>
<tr>
<td>DC input</td>
<td>Cable whips with MC4 connectors</td>
</tr>
<tr>
<td>Wire size DC outputs</td>
<td>AWG 12 to AWG 6</td>
</tr>
<tr>
<td>Wire size control wires</td>
<td>AWG 18 to 16</td>
</tr>
<tr>
<td>Wire size grounding</td>
<td>AWG 10 to AWG 6</td>
</tr>
<tr>
<td>Enclosure rating</td>
<td>Type 4X</td>
</tr>
<tr>
<td>Enclosure finish</td>
<td>Aluminum</td>
</tr>
<tr>
<td>Conduit size (home run)</td>
<td>3/4 inch conduit</td>
</tr>
<tr>
<td>Conduit size (control wires)</td>
<td>2 x 1/2 inch for daisy chain wiring</td>
</tr>
<tr>
<td>Warranty</td>
<td>10 years</td>
</tr>
<tr>
<td>Compliance</td>
<td>NEC 2014, article 690.12</td>
</tr>
<tr>
<td>Safety listing and certification</td>
<td>UL 1741</td>
</tr>
<tr>
<td><strong>Type designation</strong></td>
<td>RSB-2S-US-10</td>
</tr>
</tbody>
</table>

#### Technical data

#### Rapid Shutdown Controller

<table>
<thead>
<tr>
<th><strong>General data</strong></th>
<th><strong>Rapid Shutdown Controller</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Status indicator</td>
<td>2 LEDs</td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
<td>80 x 153 x 104 mm / 3.15 x 6.02 x 4.1 in</td>
</tr>
<tr>
<td>Weight</td>
<td>0.3 kg / 0.72 lb</td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>-25°C to +70°C</td>
</tr>
<tr>
<td>Enclosure rating</td>
<td>Type 4X</td>
</tr>
<tr>
<td>Enclosure finish</td>
<td>Polycarbonate</td>
</tr>
<tr>
<td><strong>Type designation</strong></td>
<td>RSC-1X-US-10</td>
</tr>
</tbody>
</table>

---

**First Responder Safety**
LED indicator lights ensure safe operation for first responders.

**Rapid Shutdown Controller**
Mounting in close proximity to the inverter is not required.

**Secure Power Supply (SPS)**
Rapid Shutdown System ensures SPS functionality by using PV array’s DC power.
The **Enphase® M250 Microinverter** delivers increased energy harvest and reduces design and installation complexity with its all-AC approach. With the M250, the DC circuit is isolated and insulated from ground, so **no Ground Electrode Conductor (GEC) is required for the microinverter.** This further simplifies installation, enhances safety, and saves on labor and materials costs.

The Enphase M250 integrates seamlessly with the Engage® Cable, the Envoy® Communications Gateway™, and Enlighten®, Enphase’s monitoring and analysis software.

**PRODUCTIVE**
- Optimized for higher-power modules
- Maximizes energy production
- Minimizes impact of shading, dust, and debris

**SIMPLE**
- No GEC needed for microinverter
- No DC design or string calculation required
- Easy installation with Engage Cable

**RELIABLE**
- 4th-generation product
- More than 1 million hours of testing and millions of units shipped
- Industry-leading warranty, up to 25 years
## INPUT DATA (DC)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>M250-60-2LL-S22, M250-60-2LL-S25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended input power (STC)</td>
<td>210 - 310 W</td>
</tr>
<tr>
<td>Maximum input DC voltage</td>
<td>48 V</td>
</tr>
<tr>
<td>Peak power tracking voltage</td>
<td>27 V - 39 V</td>
</tr>
<tr>
<td>Operating range</td>
<td>16 V - 48 V</td>
</tr>
<tr>
<td>Min/Max start voltage</td>
<td>22 V / 48 V</td>
</tr>
<tr>
<td>Max DC short circuit current</td>
<td>15 A</td>
</tr>
</tbody>
</table>

## OUTPUT DATA (AC)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>@208 VAC</th>
<th>@240 VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak output power</td>
<td>250 W</td>
<td>250 W</td>
</tr>
<tr>
<td>Rated (continuous) output power</td>
<td>240 W</td>
<td>240 W</td>
</tr>
<tr>
<td>Nominal output current</td>
<td>1.15 A (A rms at nominal duration)</td>
<td>1.0 A (A rms at nominal duration)</td>
</tr>
<tr>
<td>Nominal voltage/range</td>
<td>208 V / 183-229 V</td>
<td>240 V / 211-264 V</td>
</tr>
<tr>
<td>Nominal frequency/range</td>
<td>60.0 / 57-61 Hz</td>
<td>60.0 / 57-61 Hz</td>
</tr>
<tr>
<td>Extended frequency range*</td>
<td>57-62.5 Hz</td>
<td>57-62.5 Hz</td>
</tr>
<tr>
<td>Power factor</td>
<td>&gt;0.95</td>
<td>&gt;0.95</td>
</tr>
<tr>
<td>Maximum units per 20 A branch circuit</td>
<td>24 (three phase)</td>
<td>16 (single phase)</td>
</tr>
<tr>
<td>Maximum output fault current</td>
<td>850 mA rms for 6 cycles</td>
<td>850 mA rms for 6 cycles</td>
</tr>
</tbody>
</table>

## EFFICIENCY

<table>
<thead>
<tr>
<th>Parameter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CEC weighted efficiency</td>
<td>96.5%</td>
</tr>
<tr>
<td>Peak inverter efficiency</td>
<td>96.5%</td>
</tr>
<tr>
<td>Static MPPT efficiency (weighted, reference EN50530)</td>
<td>99.4 %</td>
</tr>
<tr>
<td>Night time power consumption</td>
<td>65 mW max</td>
</tr>
</tbody>
</table>

## MECHANICAL DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature range</td>
<td>-40ºC to +65ºC</td>
</tr>
<tr>
<td>Dimensions (WxHxD)</td>
<td>171 mm x 173 mm x 30 mm (without mounting bracket)</td>
</tr>
<tr>
<td>Weight</td>
<td>1.6 kg (3.4 lbs)</td>
</tr>
<tr>
<td>Cooling</td>
<td>Natural convection - No fans</td>
</tr>
<tr>
<td>Enclosure environmental rating</td>
<td>Outdoor - NEMA 6</td>
</tr>
<tr>
<td>Connector type</td>
<td>M250-60-2LL-S22: MC4</td>
</tr>
<tr>
<td></td>
<td>M250-60-2LL-S25: Amphenol H4</td>
</tr>
</tbody>
</table>

## FEATURES

<table>
<thead>
<tr>
<th>Parameter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Compatibility</td>
<td>Compatible with 60-cell PV modules</td>
</tr>
<tr>
<td>Communication</td>
<td>Power line</td>
</tr>
<tr>
<td>Integrated ground</td>
<td>The DC circuit meets the requirements for ungrounded PV arrays in NEC 690.35. Equipment ground is provided in the Engage Cable. No additional GEC or ground is required. Ground fault protection (GFP) is integrated into the microinverter.</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Enlighten Manager and MyEnlighten monitoring options</td>
</tr>
<tr>
<td>Compliance</td>
<td>UL1741/IEEE1547, FCC Part 15 Class B, CAN/CSA-C22.2 NO. 0-M91, 0.4-04, and 107.1-01</td>
</tr>
</tbody>
</table>

* Frequency ranges can be extended beyond nominal if required by the utility.
Sunmodule® Plus
SW 280 MONO

TUV Power controlled:
Lowest measuring tolerance in industry

Every component is tested to meet 3 times IEC requirements

Designed to withstand heavy accumulations of snow and ice

Sunmodule Plus:
Positive performance tolerance

25-year linear performance warranty and 10-year product warranty

Glass with anti-reflective coating

World-class quality
Fully-automated production lines and seamless monitoring of the process and material ensure the quality that the company sets as its benchmark for its sites worldwide.

SolarWorld Plus-Sorting
Plus-Sorting guarantees highest system efficiency. SolarWorld only delivers modules that have greater than or equal to the nameplate rated power.

25-year linear performance guarantee and extension of product warranty to 10 years
SolarWorld guarantees a maximum performance digression of 0.7% p.a. in the course of 25 years, a significant added value compared to the two-phase warranties common in the industry. In addition, SolarWorld is offering a product warranty, which has been extended to 10 years.*

*In accordance with the applicable SolarWorld Limited Warranty at purchase. www.solarworld.com/warranty

solarworld.com
Sunmodule® Plus
SW 280 MONO

PERFORMANCE UNDER STANDARD TEST CONDITIONS (STC)*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum power</td>
<td>$P_{max}$ 280 Wp</td>
</tr>
<tr>
<td>Open circuit voltage</td>
<td>$V_{oc}$ 39.5 V</td>
</tr>
<tr>
<td>Maximum power point voltage</td>
<td>$V_{mpp}$ 31.2 V</td>
</tr>
<tr>
<td>Short circuit current</td>
<td>$I_{sc}$ 9.71 A</td>
</tr>
<tr>
<td>Maximum power point current</td>
<td>$I_{mpp}$ 9.07 A</td>
</tr>
<tr>
<td>Module efficiency</td>
<td>$\eta_{m}$ 16.70 %</td>
</tr>
</tbody>
</table>

*STC: 1000 W/m², 25°C, AM 1.5
1) Measuring tolerance ($\eta_{m}$) traceable to TUV Rheinland: +/- 2% (TUV Power Controlled)

THERMAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOCT</td>
<td>46 °C</td>
</tr>
<tr>
<td>$T_C I_{sc}$</td>
<td>0.04%/°C</td>
</tr>
<tr>
<td>$T_C V_{oc}$</td>
<td>-0.30%/°C</td>
</tr>
<tr>
<td>$T_C P_{mpp}$</td>
<td>-0.41%/°C</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-40°C to 85°C</td>
</tr>
</tbody>
</table>

PERFORMANCE AT 800 W/m², NOCT, AM 1.5

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum power</td>
<td>$P_{max}$ 209.2 Wp</td>
</tr>
<tr>
<td>Open circuit voltage</td>
<td>$V_{oc}$ 36.1 V</td>
</tr>
<tr>
<td>Maximum power point voltage</td>
<td>$V_{mpp}$ 28.5 V</td>
</tr>
<tr>
<td>Short circuit current</td>
<td>$I_{sc}$ 7.85 A</td>
</tr>
<tr>
<td>Maximum power point current</td>
<td>$I_{mpp}$ 7.33 A</td>
</tr>
</tbody>
</table>

Minor reduction in efficiency under partial load conditions at 25°C: at 200 W/m², 100% (+/-2%) of the STC efficiency (1000 W/m²) is achieved.

COMPONENT MATERIALS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cells per module</td>
<td>60</td>
</tr>
<tr>
<td>Cell type</td>
<td>Mono crystalline</td>
</tr>
<tr>
<td>Cell dimensions</td>
<td>6.14 in x 6.14 in (156 mm x 156 mm)</td>
</tr>
<tr>
<td>Front</td>
<td>Tempered glass (EN 12150)</td>
</tr>
<tr>
<td>Frame</td>
<td>Clear anodized aluminum</td>
</tr>
<tr>
<td>Weight</td>
<td>39.5 lbs (17.9 kg)</td>
</tr>
</tbody>
</table>

SYSTEM INTEGRATION PARAMETERS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum system voltage SC II / NEC</td>
<td>1000 V</td>
</tr>
<tr>
<td>Maximum reverse current</td>
<td>16 A</td>
</tr>
<tr>
<td>Number of bypass diodes</td>
<td>3</td>
</tr>
<tr>
<td>Design Loads*</td>
<td></td>
</tr>
<tr>
<td>Two rail system</td>
<td>170 psf downward</td>
</tr>
<tr>
<td>Three rail system</td>
<td>71 psf upward</td>
</tr>
<tr>
<td>Edge mounting</td>
<td>30 psf downward</td>
</tr>
</tbody>
</table>

* Please refer to the Sunmodule installation instructions for the details associated with these load cases.

ADDITIONAL DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power sorting</td>
<td>-0 Wp / +5 Wp</td>
</tr>
<tr>
<td>J-Box</td>
<td>IP65</td>
</tr>
<tr>
<td>Module leads</td>
<td>PV wire per UL4703 with H4 connectors</td>
</tr>
<tr>
<td>Module type (UL 1703)</td>
<td>1</td>
</tr>
<tr>
<td>Glass</td>
<td>Low iron tempered with ARC</td>
</tr>
</tbody>
</table>

VERSION 2.5 FRAME

- Compatible with both "Top-Down" and "Bottom" mounting methods
- Grounding Locations:
  - 4 corners of the frame
  - 4 locations along the length of the module in the extended flange

All units provided are imperial. SI units provided in parentheses.
SolarWorld AG reserves the right to make specification changes without notice.
Series 100 Residential Roof Mount System

The SnapNrack Series 100 UL Roof Mount System is an efficient, visually appealing, photovoltaic (PV) module installation system. Series 100 UL is listed to the UL 2703 for grounding/bonding and fire classification. The System's components provide an adequate bonding path which has eliminated the need for grounding lugs and washers at each module, and bonding jumpers between splices. In addition to grounding and bonding, the roof mount system, Series 100 UL, is Class A Fire Rated when installed with Type I and Type II Modules. SnapNrack’s UL 2703 Certification and Compliance ensures that SnapNrack installers can continue to provide the best in class installations in quality, safety and efficiency.

- Appealing design with built-in aesthetics
- No grounding lugs required for modules
- All bonding hardware is fully integrated into the components
- Rail splices bond rails together, no rail jumpers required
- Proprietary SnapNrack grounding lug snaps in the rail channel
- No drilling of rail or reaching for other tools required
- Class A Fire Rating for Type 1 and 2 modules

System Features Include

- Snap in Hardware
- Single Tool Installation
- Easy Leveling
- Integrated Wire Management
- Preassembled hardware
- Integrated bonding
- No Cutting or Drilling
- UL 2703 Certified

Resources snapnrack.com/resources  |  Design configure.snapnrack.com  |  Where to Buy snapnrack.com/buy
SERIES 100 TECHNICAL DATA

Materials
- 6000 Series aluminum
- Stainless steel
- Galvanized steel and aluminum flashing

Material Finish
- Clear and black anodized aluminum
- Mill finish on select components

Calcs. & Certifications
- Listed to UL Standard 2703 for Grounding/Bonding and Fire Classification
- Class A Fire Rating Type 1 and Type 2 modules
- Stamped Structural Engineering Reports for all 50 States

Grounding
- SnapNrack Grounding Lug (One lug per individual row of modules)
- Integrated bonding components

Warranty
10 year limited product warranty; 5 year limited finish warranty
## 0-30 ft. Roof Height

### Table 1C: Rail Spans (in) for Roof Slopes and Tilt Angles 37° to 45° 6063 Alloy

<table>
<thead>
<tr>
<th>Vult</th>
<th>110</th>
<th>115</th>
<th>120</th>
<th>125</th>
<th>130</th>
<th>135</th>
<th>140</th>
<th>145</th>
<th>150</th>
<th>155</th>
<th>160</th>
<th>170</th>
<th>180</th>
<th>190</th>
</tr>
</thead>
<tbody>
<tr>
<td>P_e</td>
<td>6.2</td>
<td>6.4</td>
<td>6.7</td>
<td>7.0</td>
<td>7.3</td>
<td>7.5</td>
<td>7.8</td>
<td>8.0</td>
<td>8.2</td>
<td>8.4</td>
<td>8.6</td>
<td>8.8</td>
<td>9.0</td>
<td>9.2</td>
</tr>
<tr>
<td>P_i</td>
<td>6.9</td>
<td>7.0</td>
<td>7.1</td>
<td>7.2</td>
<td>7.3</td>
<td>7.4</td>
<td>7.5</td>
<td>7.6</td>
<td>7.7</td>
<td>7.8</td>
<td>7.9</td>
<td>8.0</td>
<td>8.1</td>
<td>8.2</td>
</tr>
<tr>
<td>Gnd. Slope Load (psf)</td>
<td>0</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>20</td>
<td>22</td>
<td>24</td>
<td>26</td>
<td>28</td>
<td>30</td>
<td>32</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>106</td>
<td>108</td>
<td>110</td>
<td>112</td>
<td>114</td>
<td>116</td>
<td>118</td>
<td>120</td>
<td>122</td>
<td>124</td>
<td>126</td>
<td>128</td>
<td>130</td>
</tr>
<tr>
<td>10</td>
<td>120</td>
<td>122</td>
<td>124</td>
<td>126</td>
<td>128</td>
<td>130</td>
<td>132</td>
<td>134</td>
<td>136</td>
<td>138</td>
<td>140</td>
<td>142</td>
<td>144</td>
<td>146</td>
</tr>
<tr>
<td>20</td>
<td>130</td>
<td>132</td>
<td>134</td>
<td>136</td>
<td>138</td>
<td>140</td>
<td>142</td>
<td>144</td>
<td>146</td>
<td>148</td>
<td>150</td>
<td>152</td>
<td>154</td>
<td>156</td>
</tr>
<tr>
<td>30</td>
<td>140</td>
<td>142</td>
<td>144</td>
<td>146</td>
<td>148</td>
<td>150</td>
<td>152</td>
<td>154</td>
<td>156</td>
<td>158</td>
<td>160</td>
<td>162</td>
<td>164</td>
<td>166</td>
</tr>
<tr>
<td>40</td>
<td>150</td>
<td>152</td>
<td>154</td>
<td>156</td>
<td>158</td>
<td>160</td>
<td>162</td>
<td>164</td>
<td>166</td>
<td>168</td>
<td>170</td>
<td>172</td>
<td>174</td>
<td>176</td>
</tr>
</tbody>
</table>

### Table 1D: Rail Spans (in) for Roof Slopes and Tilt Angles 46° to 60° 6063 Alloy

<table>
<thead>
<tr>
<th>Vult</th>
<th>110</th>
<th>115</th>
<th>120</th>
<th>125</th>
<th>130</th>
<th>135</th>
<th>140</th>
<th>145</th>
<th>150</th>
<th>155</th>
<th>160</th>
<th>170</th>
<th>180</th>
<th>190</th>
</tr>
</thead>
<tbody>
<tr>
<td>P_e</td>
<td>6.3</td>
<td>6.5</td>
<td>6.7</td>
<td>6.9</td>
<td>7.1</td>
<td>7.3</td>
<td>7.5</td>
<td>7.7</td>
<td>7.9</td>
<td>8.1</td>
<td>8.3</td>
<td>8.5</td>
<td>8.7</td>
<td>8.9</td>
</tr>
<tr>
<td>P_i</td>
<td>6.9</td>
<td>7.0</td>
<td>7.1</td>
<td>7.2</td>
<td>7.3</td>
<td>7.4</td>
<td>7.5</td>
<td>7.6</td>
<td>7.7</td>
<td>7.8</td>
<td>7.9</td>
<td>8.0</td>
<td>8.1</td>
<td>8.2</td>
</tr>
<tr>
<td>Gnd. Slope Load (psf)</td>
<td>0</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>20</td>
<td>22</td>
<td>24</td>
<td>26</td>
<td>28</td>
<td>30</td>
<td>32</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>106</td>
<td>108</td>
<td>110</td>
<td>112</td>
<td>114</td>
<td>116</td>
<td>118</td>
<td>120</td>
<td>122</td>
<td>124</td>
<td>126</td>
<td>128</td>
<td>130</td>
</tr>
<tr>
<td>10</td>
<td>120</td>
<td>122</td>
<td>124</td>
<td>126</td>
<td>128</td>
<td>130</td>
<td>132</td>
<td>134</td>
<td>136</td>
<td>138</td>
<td>140</td>
<td>142</td>
<td>144</td>
<td>146</td>
</tr>
<tr>
<td>20</td>
<td>130</td>
<td>132</td>
<td>134</td>
<td>136</td>
<td>138</td>
<td>140</td>
<td>142</td>
<td>144</td>
<td>146</td>
<td>148</td>
<td>150</td>
<td>152</td>
<td>154</td>
<td>156</td>
</tr>
<tr>
<td>30</td>
<td>140</td>
<td>142</td>
<td>144</td>
<td>146</td>
<td>148</td>
<td>150</td>
<td>152</td>
<td>154</td>
<td>156</td>
<td>158</td>
<td>160</td>
<td>162</td>
<td>164</td>
<td>166</td>
</tr>
<tr>
<td>40</td>
<td>150</td>
<td>152</td>
<td>154</td>
<td>156</td>
<td>158</td>
<td>160</td>
<td>162</td>
<td>164</td>
<td>166</td>
<td>168</td>
<td>170</td>
<td>172</td>
<td>174</td>
<td>176</td>
</tr>
</tbody>
</table>