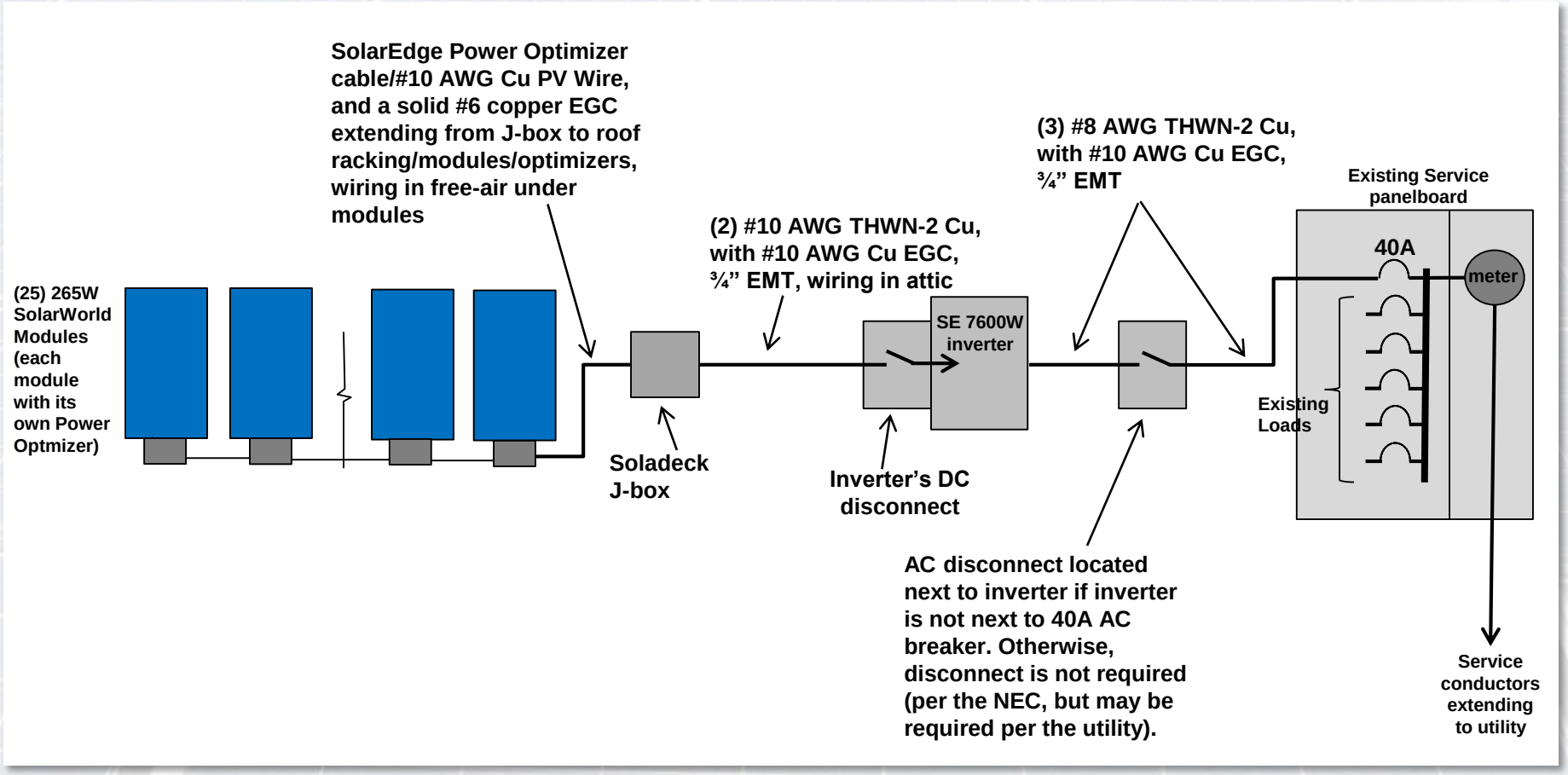
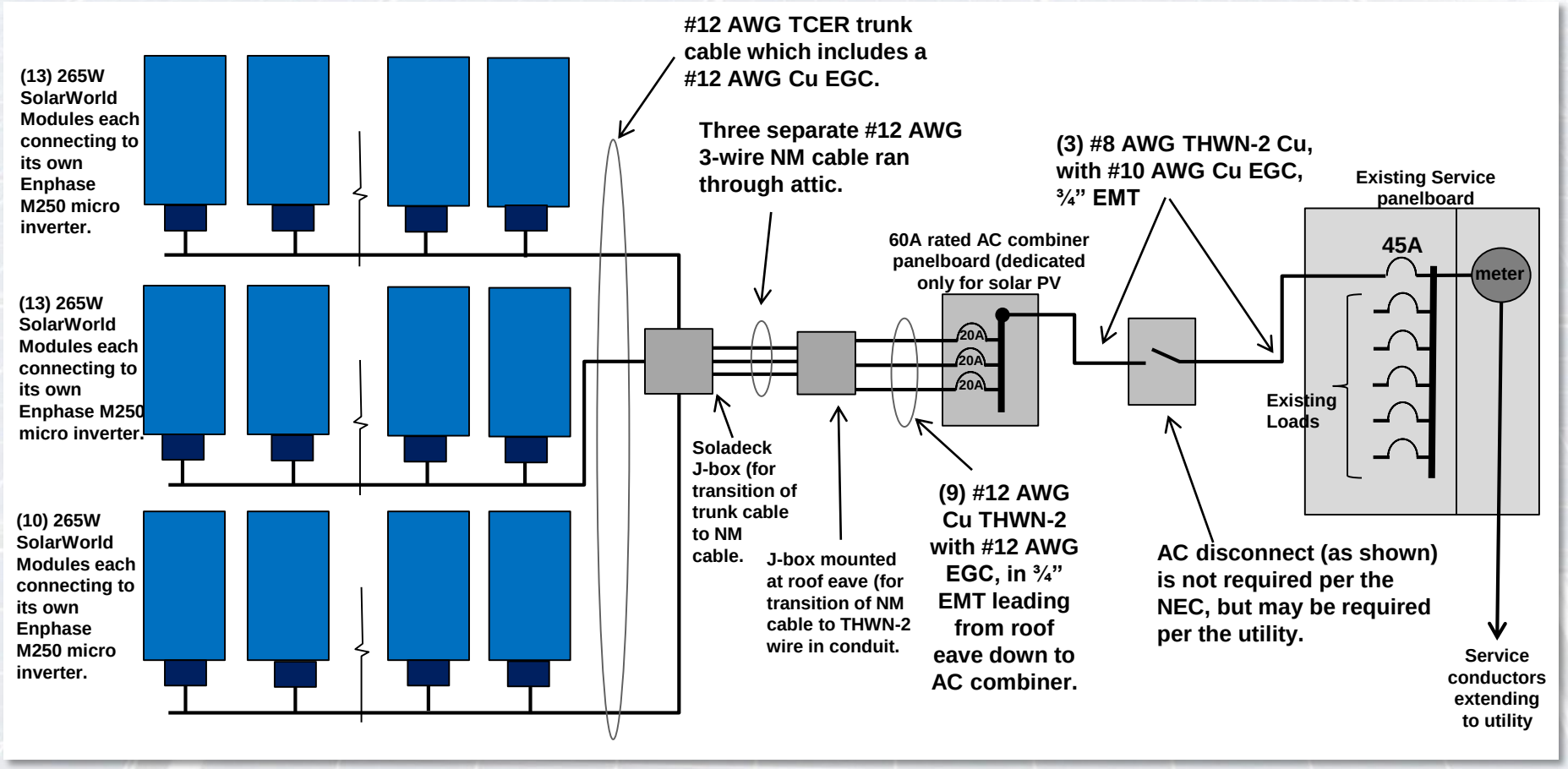
Example Single-Line Diagram for a SolarEdge® string inverter system (with power optimizers)



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

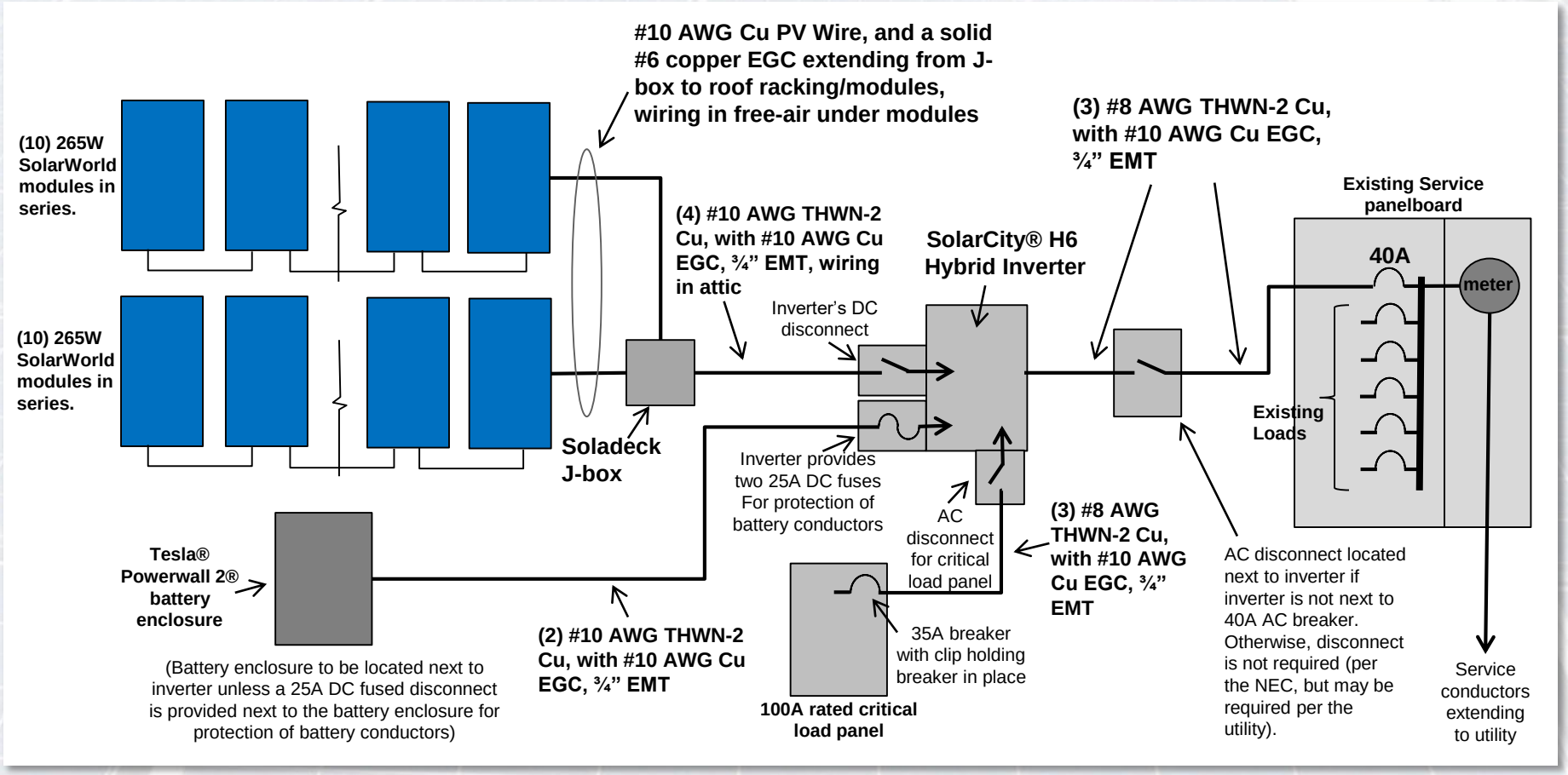
Example Single-Line Diagram (for a micro inverter system)



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

Grid-tied PV System With Battery Backup (example diagram)

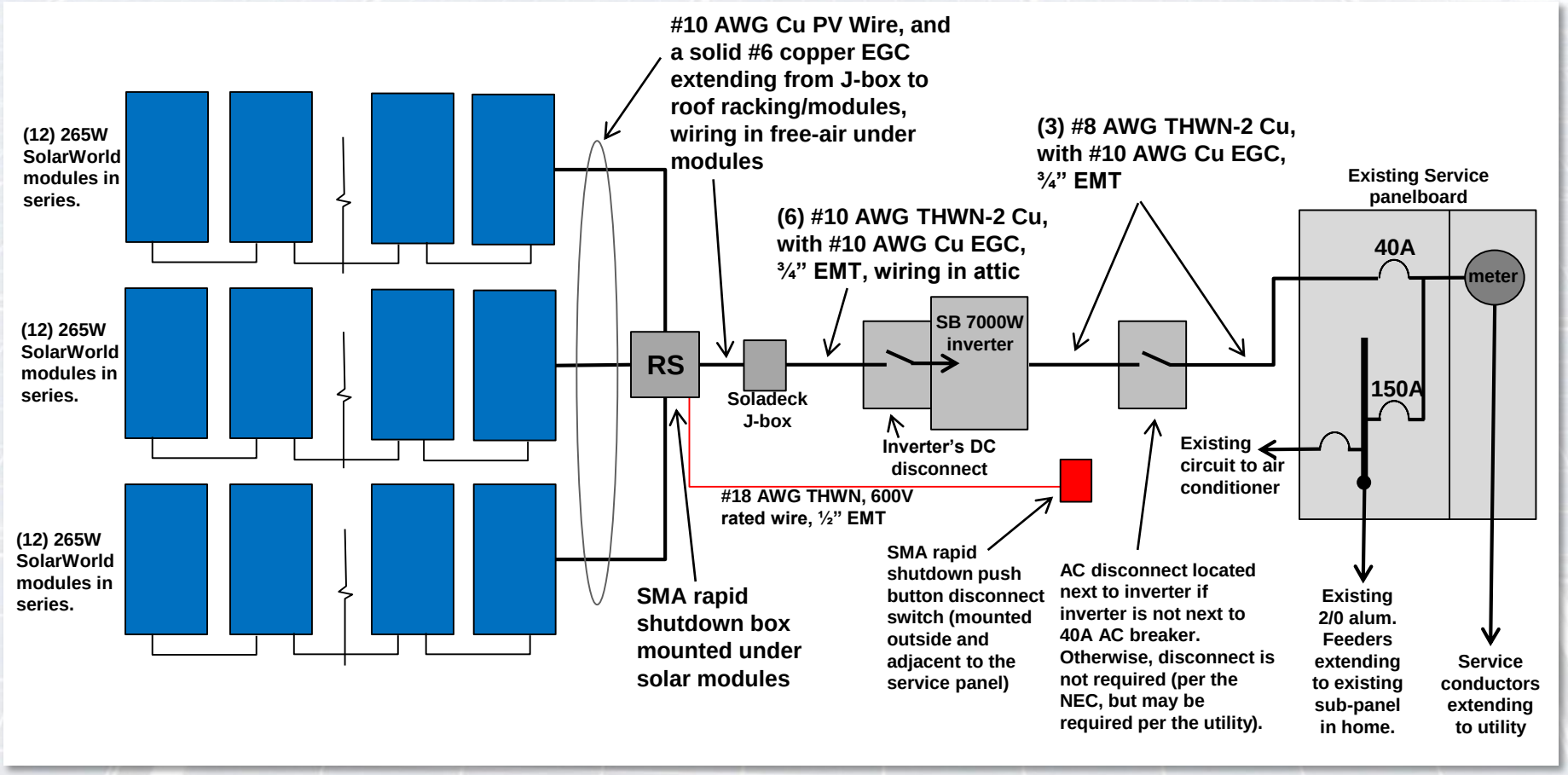
Note: this wiring diagram is simply an example. Diagrams may vary.



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)

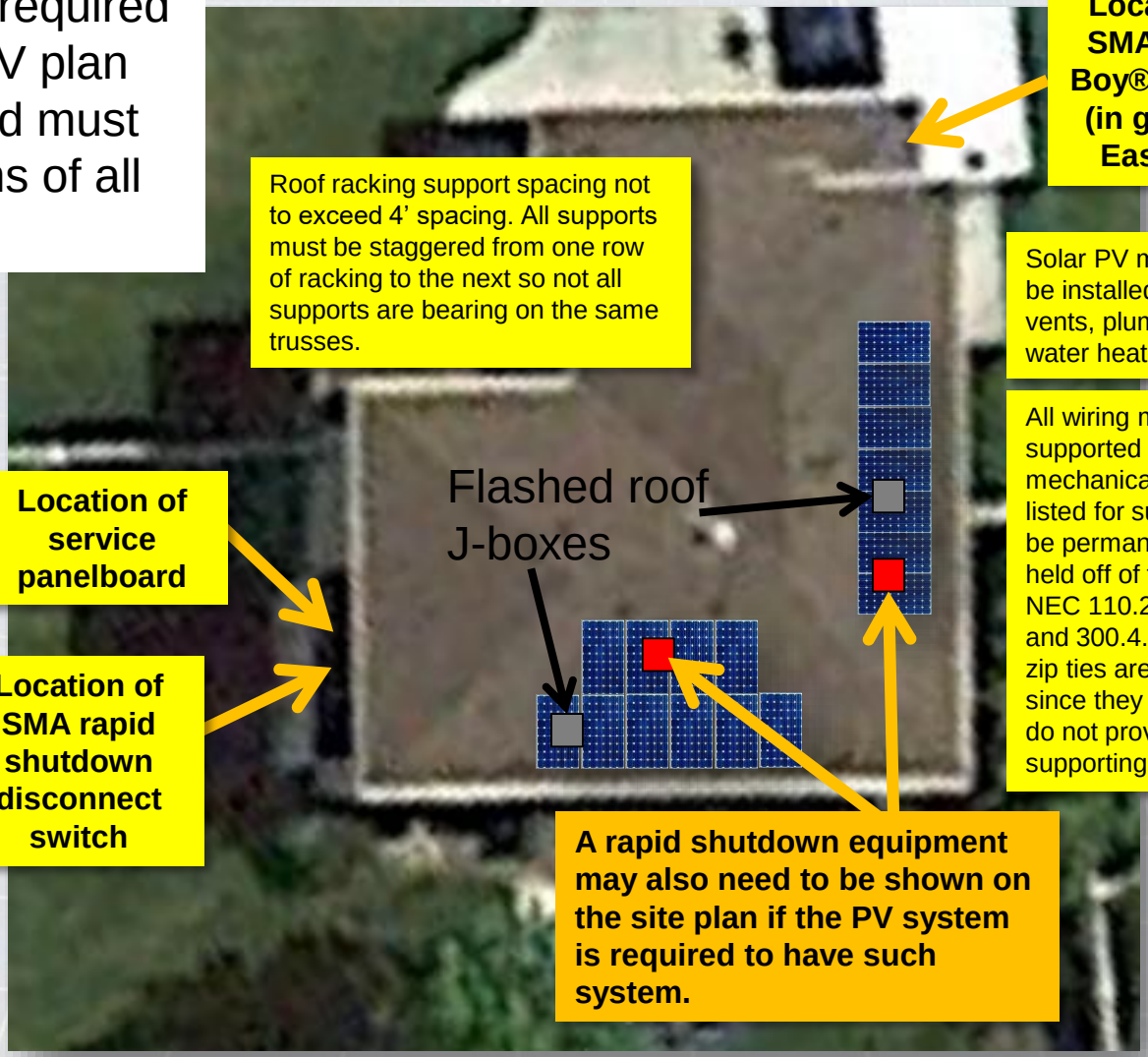
Note: this wiring diagram is simply an example. Diagrams may vary.



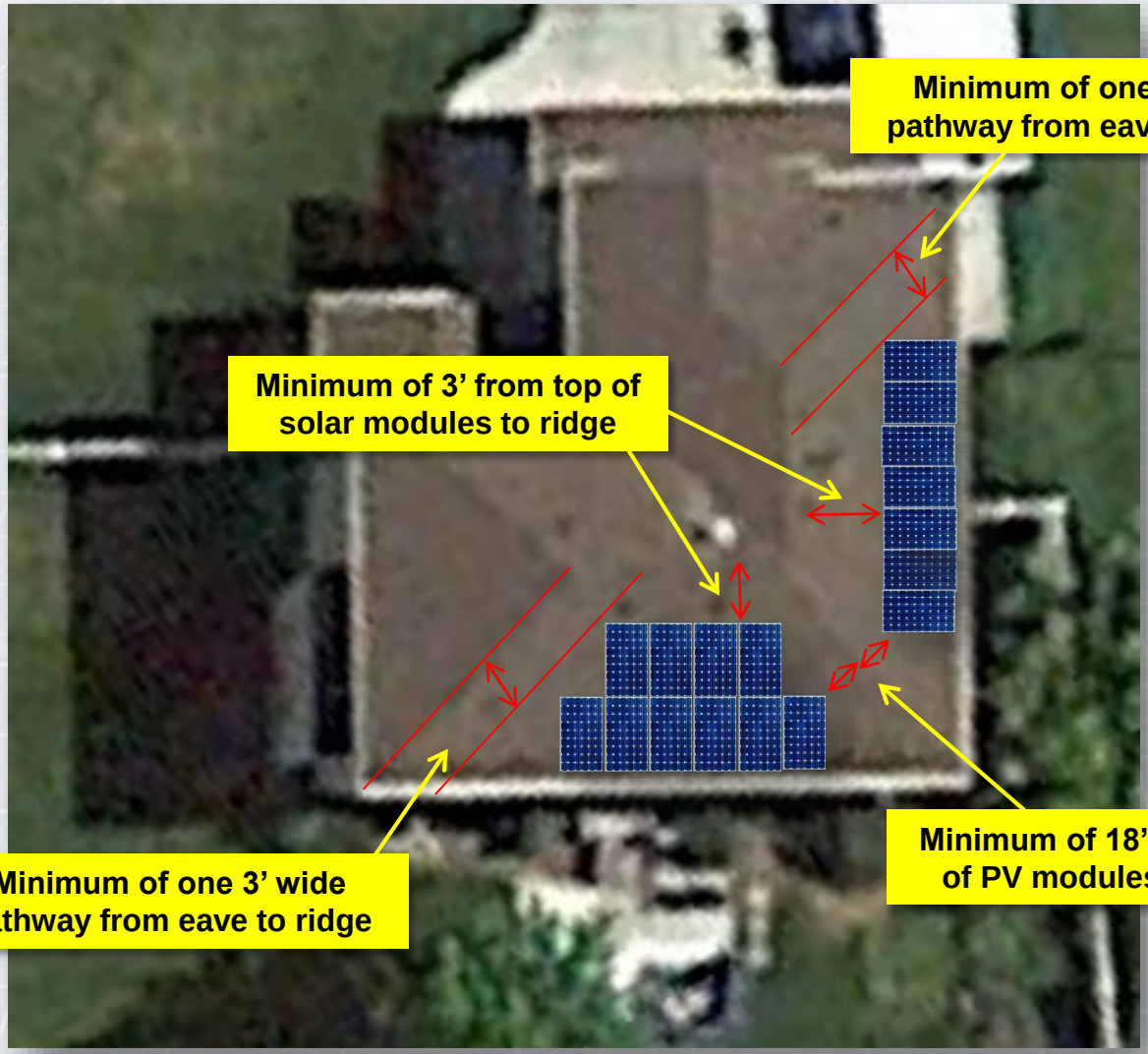
Site plan example (for an SMA Sunny Boy® inverter system)

A site plan is required for all solar PV plan submittals and must show locations of all equipment.

This site plan is an example ONLY and site plans may vary.



Hipped Roof Access – *IFC* 605.11.3.2.3 (continued)



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.

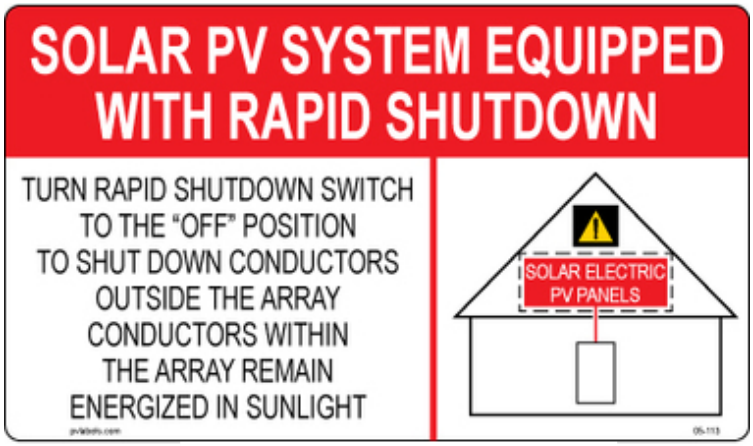
G. A sign is required at the inverter noting the total DC system STC rated max current (Impp), the rated max DC voltage (Vmpp), the DC open circuit voltage (Voc) which has been increased for coldest possible outside temperature, and DC short circuit current (Isc). NEC 690.53.

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).

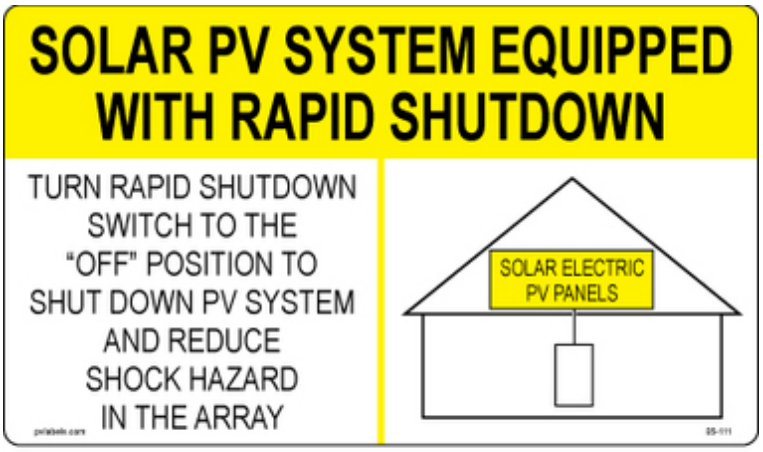
I. There must be a sign located at the service equipment which notes the following: "PHOTOVOLTAIC SYSTEM EQUIPPED WITH RAPID SHUTDOWN." The sign must be reflective, with all letters capitalized, and letters are at least 3/8" in height. Wording must also be white on a red background. Please specify this 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.



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



solaredge

INVERTERS

SolarEdge Single Phase Inverters

For North America

SE3000A-US / SE3800A-US / SE5000A-US / SE6000A-US /
SE7600A-US / SE10000A-US / SE11400A-US

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

SE3000A-US / SE3800A-US / SE5000A-US / SE6000A-US / SE7600A-US / SE10000A-US / SE11400A-US

	SE3000A-US	SE3800A-US	SE5000A-US	SE6000A-US	SE7600A-US	SE10000A- US	SE11400A-US	
OUTPUT								
Nominal AC Power Output	3000	3800	5000	6000	7600	9980 @ 208V 10000 @240V	11400	VA
Max. AC Power Output	3300	4150	5400 @ 208V 5450 @240V	6000	8350	10800 @ 208V 10950 @240V	12000	VA
AC Output Voltage Min.-Nom.-Max.[1] 183 - 208 - 229 Vac	-	-	✓	-	-	✓	-	
AC Output Voltage Min.-Nom.-Max.[1] 211 - 240 - 264 Vac	✓	✓	✓	✓	✓	✓	✓	
AC Frequency Min.-Nom.-Max.[1]	59.3 - 60 - 60.5 (with HI country setting 57 - 60 - 60.5)							Hz
Max. Continuous Output Current	12.5	16	24 @ 208V 21 @ 240V	25	32	48 @ 208V 42 @ 240V	47.5	A
GFDI Threshold	1							A
Utility Monitoring, Islanding Protection, Country Configurable Thresholds	Yes							Yes
INPUT								
Maximum DC Power (STC)	4050	5100	6750	8100	10250	13500	15350	W
Transformer-less, Ungrounded	Yes							
Max. Input Voltage	500							Vdc
Nom. DC Input Voltage	325 @ 208V / 350 @ 240V							Vdc
Max. Input Current[2]	9.5	13	16.5 @ 208V 15.5 @ 240V	18	23	33 @ 208V 30.5 @ 240V	34.5	Adc
Max. Input Short Circuit Current	45							Adc
Reverse-Polarity Protection	Yes							
Ground-Fault Isolation Detection	600kΩ Sensitivity							
Maximum Inverter Efficiency	97.7	98.2	98.3	98.3	98	98	98	%
CEC Weighted Efficiency	97.5	98	97.5 @ 208V 98 @ 240V	97.5	97.5	97 @ 208V 97.5 @ 240V	97.5	%
Nighttime Power Consumption	< 2.5					< 4		W
ADDITIONAL FEATURES								
Supported Communication Interfaces	RS485, RS232, Ethernet, ZigBee (optional)							
Revenue Grade Data, ANSI C12.1	Optional[3]							
Rapid Shutdown – NEC 2014 690.12	Functionality enabled when SolarEdge rapid shutdown kit is installed[4]							
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					3/4" minimum / 8-3 AWG		
DC input conduit size / # of strings / AWG range	3/4" minimum / 1-2 strings / 16-6 AWG					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					30.5 x 12.5 x 10.5 / 775 x 315 x 260		in / mm
Weight with Safety Switch	51.2 / 23.2		54.7 / 24.7			88 .4 / 40.1		lb / kg
Cooling	Natural Convection				Natural convection and internal fan (user replaceable)	Fans (user replaceable)		
Noise	< 25					< 50		dBA
Min.-Max. Operating Temperature Range	-13 to +140 / -25 to +60 (-40 to +60 version available[5])							˚F / ˚C
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.
(3) Revenue grade inverter P/N: SExxxxA-US000NNR2 (for 7600W inverter:SE7600A-US002NNR2).
(4) Rapid shutdown kit P/N: SE1000-RSD-S1.
(5) -40 version P/N: SExxxxA-US000NNU4 (for 7600W inverter:SE7600A-US002NNU4).

SUNSPEC ALLIANCE RoHS

solaredge

SolarEdge Power Optimizer

Module Add-On For North America

P300 / P320 / P400 / P405

POWER OPTIMIZER

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

	P300 (for 60-cell modules)	P320 (for high-power 60-cell modules)	P400 (for 72 & 96-cell modules)	P405 (for thin film modules)	
INPUT					
Rated Input DC Power[1]	300	320	400	405	W
Absolute Maximum Input Voltage (Voc at lowest temperature)	48		80	125	Vdc
MPPT Operating Range	8 - 48		8 - 80	12.5 - 105	Vdc
Maximum Short Circuit Current (Isc)	10	11	10		Adc
Maximum DC Input Current	12.5	13.75	12.5		Adc
Maximum Efficiency	99.5				%
Weighted Efficiency	98.8				%
Overvoltage Category	II				
OUTPUT DURING OPERATION (POWER OPTIMIZER CONNECTED TO OPERATING SOLAREDGE INVERTER)					
Maximum Output Current	15				Adc
Maximum Output Voltage	60			85	Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM SOLAREDGE INVERTER OR SOLAREDGE INVERTER OFF)					
Safety Output Voltage per Power Optimizer	1				Vdc
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 / 5 x 5.97 x 1.08		128 x 152 x 35 / 5 x 5.97 x 1.37	128 x 152 x 48 / 5 x 5.97 x 1.89	mm / in
Weight (including cables)	770 / 1.7		930 / 2.05	930 / 2.05	gr / lb
Input Connector	MC4 Compatible				
Output Wire Type / Connector	Double Insulated; MC4 Compatible				
Output Wire Length	0.95 / 3.0		1.2 / 3.9		m / ft
Operating Temperature Range	-40 - +85 / -40 - +185				˚C / ˚F
Protection Rating	IP68 / NEMA6P				
Relative Humidity	0 - 100				%

[1] Rated STC power of the module. Module of up to +5% power tolerance allowed.

PV SYSTEM DESIGN USING A SOLAREDGE INVERTER[2]	SINGLE PHASE	THREE PHASE 208V	THREE PHASE 480V	
Minimum String Length (Power Optimizers)	8	10	18	
Maximum String Length (Power Optimizers)	25	25	50	
Maximum Power per String	5250	6000	12750	W
Parallel Strings of Different Lengths or Orientations	Yes			

[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.

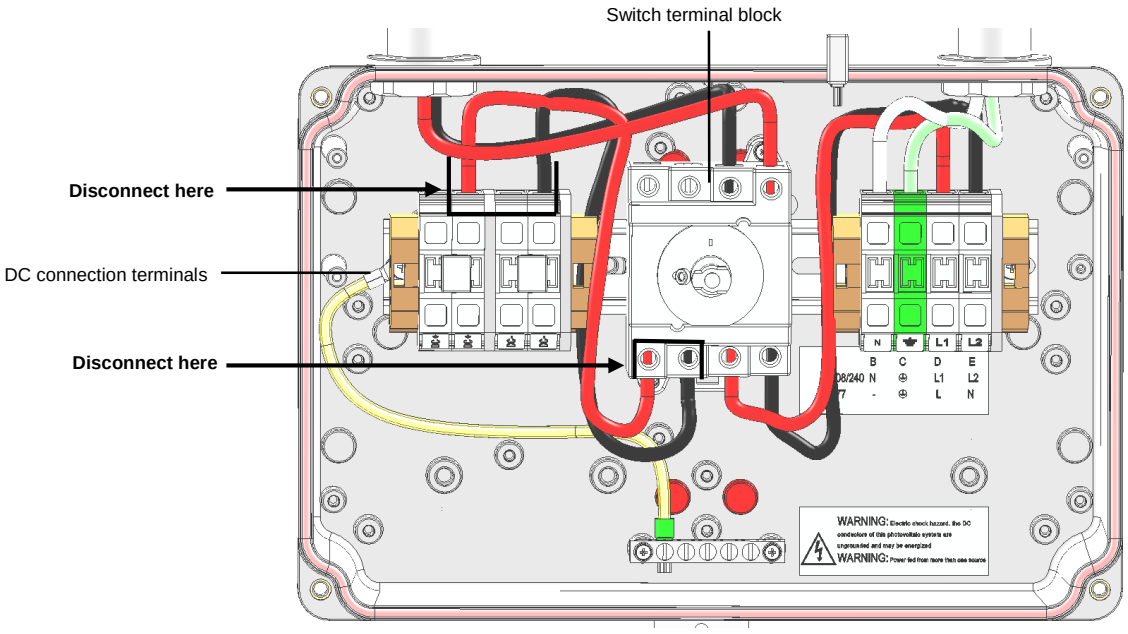


Figure 1: Inside the AC/DC Safety Switch

[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.

5 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.

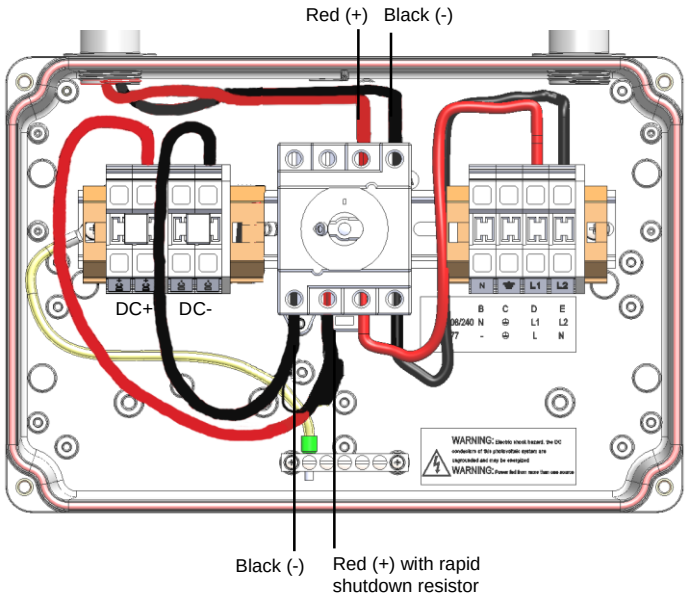


Figure 2: Rapid shutdown cable connected – option 1

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

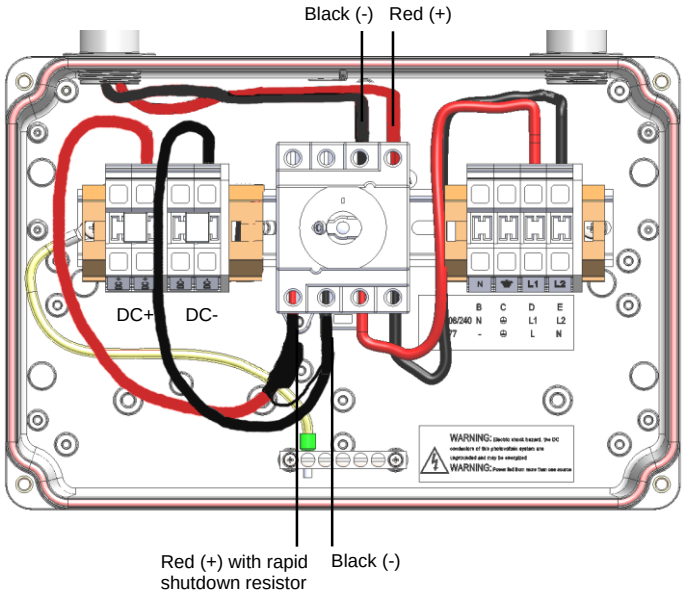


Figure 3: Rapid shutdown cable connected – option 2

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

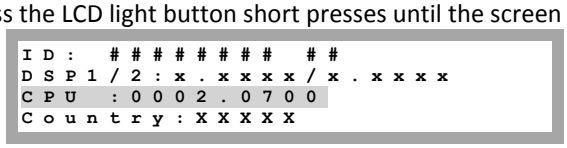
Perform this procedure after activating the inverter [Step 1 in Chapter 5: Commissioning the Installation of the *SolarEdge Installation Guide*], and before pairing (Step 2 in Chapter 5 of the *SolarEdge Installation Guide*).

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.



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. Verity 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 adaptor 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.
3. Perform Pairing as described in Step 2: Pairing, of Chapter 5: Commissioning of the *SolarEdge Installation Guide*.

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.
3. Select **Maintenance ➔ Optimizer Conf. ➔ Set Rapid Shutdown**.

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).

Certified
- UL 1741 and 1699B compliant
- Integrated AFCI meets the requirements of NEC 2011 690.11

Innovative
- Secure Power Supply provides daytime power in case of grid outage

Powerful
- 97.2% maximum efficiency
- Wide input voltage range
- Shade management with OptiTrac Global Peak MPP tracking

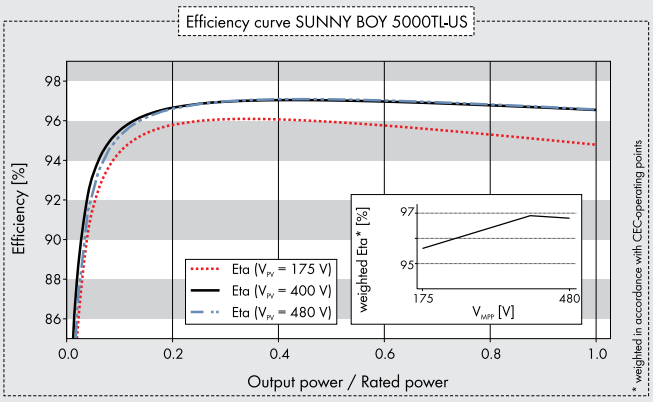
Flexible
- Two MPP trackers provide numerous design options
- Extended operating temperature range

SUNNY BOY 3000TL-US / 4000TL-US / 5000TL-US

Setting new heights in residential inverter performance

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	Sunny Boy 3000TL-US		Sunny Boy 4000TL-US		Sunny Boy 5000TL-US	
	208 V AC	240 V AC	208 V AC	240 V AC	208 V AC	240 V AC
Input (DC)						
Max. DC power (@ cos φ = 1)	3200 W		4200 W		5300 W	
Max. DC voltage	600 V		600 V		600 V	
MPP voltage range	175 – 480 V		175 – 480 V		175 – 480 V	
Min. DC voltage / start voltage	125 / 150 V		125 / 150 V		125 / 150 V	
Max. input current / per MPP tracker	18 A / 15 A		24 A / 15 A		30 A / 15 A	
Number of MPP trackers / strings per MPP tracker	2 / 2					
Output (AC)						
AC nominal power	3000 W		4000 W		4550 W	5000 W
Max. AC apparent power	3000 VA		4000 VA		4550 VA	5000 VA
Nominal AC voltage / adjustable	208 V / ●	240 V / ●	208 V / ●	240 V / ●	208 V / ●	240 V / ●
AC voltage range	183 – 229 V	211 – 264 V	183 – 229 V	211 – 264 V	183 – 229 V	211 – 264 V
AC grid frequency; range	60 Hz / 59.3 – 60.5 Hz		60 Hz / 59.3 – 60.5 Hz		60 Hz / 59.3 – 60.5 Hz	
Max. output current	15 A		20 A		22 A	
Power factor (cos φ)	1		1		1	
Output phases / line connections	1 / 2		1 / 2		1 / 2	
Harmonics	< 4%		< 4%		< 4%	
Efficiency						
Max. efficiency	96.8%	97.1%	96.8%	97.2%	96.8%	97.1%
CEC efficiency	96%	96.5%	96%	96.5%	96%	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)	490 / 519 / 185 (19.3 / 20.5 / 7.3)					
DC Disconnect dimensions (W / H / D) in mm (in)	187 / 297 / 190 (7.4 / 11.7 / 7.5)					
Packing dimensions (W / H / D) in mm (in)	617 / 597 / 266 (24.3 / 23.5 / 10.5)					
DC Disconnect packing dimensions (W / H / D) in mm (in)	370 / 240 / 280 (14.6 / 9.4 / 11.0)					
Weight / DC Disconnect weight	24 kg (53 lb) / 3.5 kg (8 lb)					
Packing weight / DC Disconnect packing weight	27 kg (60 lb) / 3.5 kg (8 lb)					
Operating temperature range	–40 °C ... +60 °C (–40 °F ... +140 °F)					
Noise emission (typical)	≤ 25 dB(A)		< 25 dB(A)		< 29 dB(A)	
Internal consumption at night	< 1 W		< 1 W		< 1 W	
Topology	Transformerless		Transformerless		Transformerless	
Cooling concept	Convection		Convection		Convection	
Electronics protection rating	NEMA 3R		NEMA 3R		NEMA 3R	
Features						
Secure Power Supply	●		●		●	
Display: graphic	●		●		●	
Interfaces: RS485 / Webconnect	o/o		o/o		o/o	
Interface: ZigBee	o		o		o	
Warranty: 10 / 15 / 20 years	●/o/o		●/o/o		●/o/o	
Certificates and permits (more available on request)	UL 1741, UL 1998, UL 1699B, IEEE1547, FCC Part 15 (Class A & B), CAN/CSA C22.2 107.1-1					
NOTE: US inverters ship with gray lids						
Type designation	SB 3000TL-US-22		SB 4000TL-US-22		SB 5000TL-US-22	



Accessories

Speedwire/Webconnect interface
SWDM-US-10

RS485 interface
DM-485CB-US-10

Fan kit
FANKIT02-10

● Standard feature o Optional feature – Not available
Data at nominal conditions

RSB-2S-US-10 & RSC-1X-US-10

IMAGE OF RAPID SHUTDOWN CONTROLLER FOR ILLUSTRATIVE PURPOSES ONLY

Reliable

- Optimal system reliability with hybrid switches for disconnecting
- Automatic self-test upon startup to ensure functionality

Perfect alignment

- Engineered for Sunny Boy-US and Sunny Boy TL-US inverter lines with multiple MPP tracking channels
- Compatible with Secure Power Supply

Code compliant

- UL-Certified and compliant with 2014 NEC 690.12 Rapid Shutdown
- No interference with AFCI function of Sunny Boy inverters

Cost effective

- Incorporated junction box reduces equipment and speeds installation time
- Pre-wired MC4 connectors and snap terminals reduce materials and installation time

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

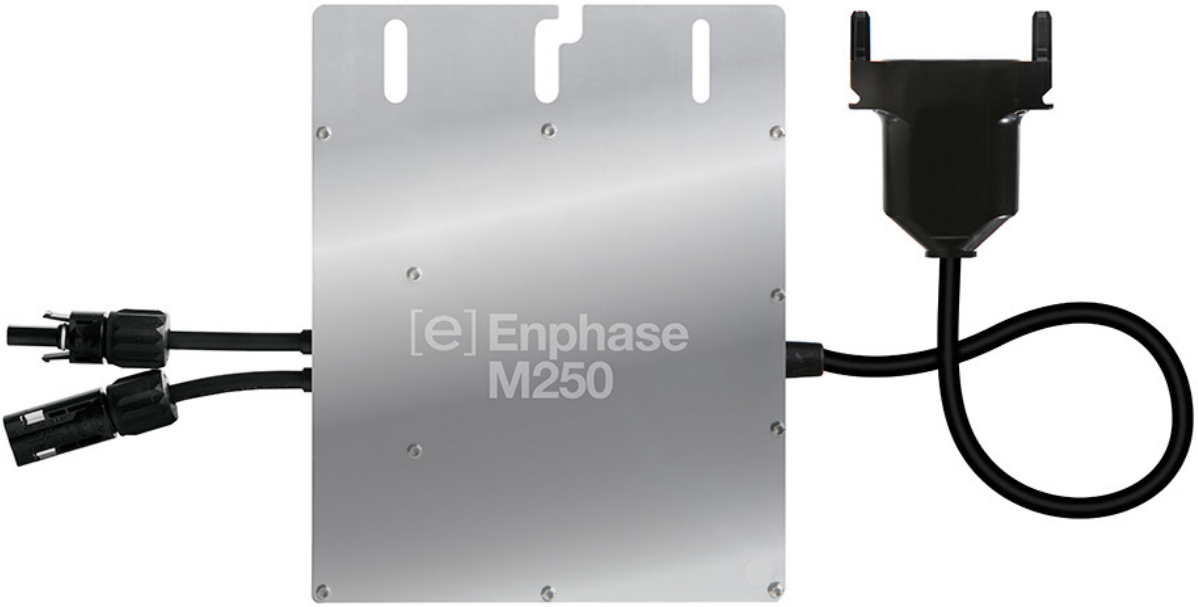
Technical data	Rapid Shutdown Controller
General data	
Status indicator	2 LEDs
Dimensions (W x H x D)	80 x 153 x 104 mm / 3.15 x 6.02 x 4.1 in
Weight	0.3 kg / 0.72 lb
Ambient temperature range	-25°C to +70°C
Enclosure rating	Type 4X
Enclosure finish	Polycarbonate
Type designation	RSC-1X-US-10

Toll Free +1 888 4 SMA USA
www.SMA-America.com

SMA America, LLC

Enphase® **Microinverters**

Enphase® **M250**



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

enphase® ENERGY

C US

INPUT DATA (DC)	**M250-60-2LL-S22, M250-60-2LL-S25**	
Recommended input power (STC)	210 - 310 W	
Maximum input DC voltage	48 V	
Peak power tracking voltage	27 V - 39 V	
Operating range	16 V - 48 V	
Min/Max start voltage	22 V / 48 V	
Max DC short circuit current	15 A	
OUTPUT DATA (AC)	**@208 VAC**	**@240 VAC**
Peak output power	250 W	250 W
Rated (continuous) output power	240 W	240 W
Nominal output current	1.15 A (A rms at nominal duration)	1.0 A (A rms at nominal duration)
Nominal voltage/range	208 V / 183-229 V	240 V / 211-264 V
Nominal frequency/range	60.0 / 57-61 Hz	60.0 / 57-61 Hz
Extended frequency range*	57-62.5 Hz	57-62.5 Hz
Power factor	>0.95	>0.95
Maximum units per 20 A branch circuit	24 (three phase)	16 (single phase)
Maximum output fault current	850 mA rms for 6 cycles	850 mA rms for 6 cycles
EFFICIENCY		
CEC weighted efficiency	96.5%	
Peak inverter efficiency	96.5%	
Static MPPT efficiency (weighted, reference EN50530)	99.4 %	
Night time power consumption	65 mW max	
MECHANICAL DATA		
Ambient temperature range	-40°C to +65°C	
Dimensions (WxHxD)	171 mm x 173 mm x 30 mm (without mounting bracket)	
Weight	1.6 kg (3.4 lbs)	
Cooling	Natural convection - No fans	
Enclosure environmental rating	Outdoor - NEMA 6	
Connector type	M250-60-2LL-S22: MC4 M250-60-2LL-S25: Amphenol H4	
FEATURES		
Compatibility	Compatible with 60-cell PV modules	
Communication	Power line	
Integrated ground	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.	
Monitoring	Enlighten Manager and MyEnlighten monitoring options	
Compliance	UL1741/IEEE1547, FCC Part 15 Class B, CAN/CSA-C22.2 NO. 0-M91, 0.4-04, and 107.1-01	

* Frequency ranges can be extended beyond nominal if required by the utility

To learn more about Enphase Microinverter technology, visit **enphase.com**

enphase® ENERGY

Sunmodule® Plus
SW 280 MONO

SOLARWORLD
REAL VALUE

TUV Power controlled:
Lowest measuring tolerance in industry

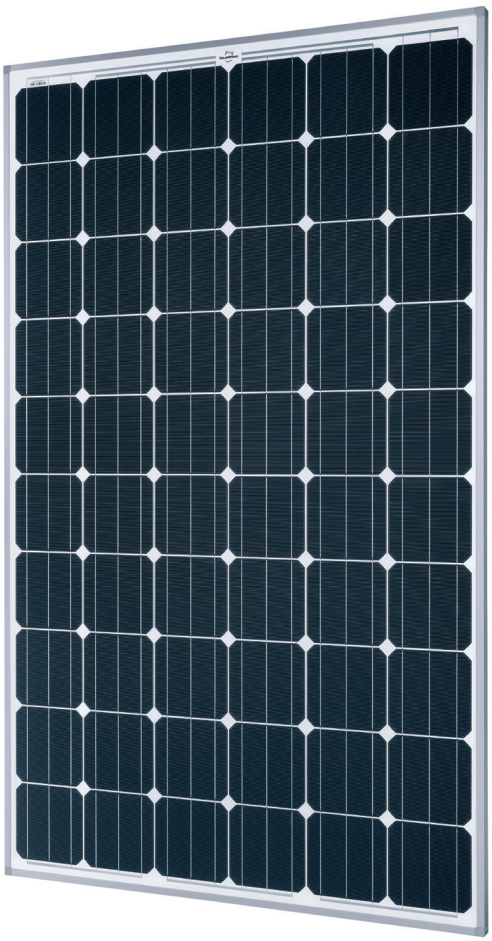
Every component is tested to meet
3 times IEC requirements

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

• Qualified, IEC 61215
• Safety tested, IEC 61730
• Periodic Inspection
• Blowing sand resistant

• Ammonia resistance tested
• Periodic Inspection
• Power Controlled

PERFORMANCE TESTED
SALT MIST RESISTANT
PHOTOVOLTAIC PRODUCT

UL 1703

ISO 9001
ISO 14001
Certified

MADE IN USA OF US
AND IMPORTED PARTS

solarworld.com

Sunmodule® Plus
SW 280 MONO

SOLARWORLD
REAL VALUE

PERFORMANCE UNDER STANDARD TEST CONDITIONS (STC)*

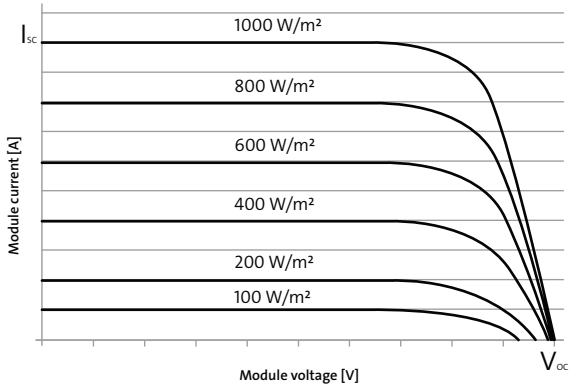
Maximum power	P_{max}	280 Wp
Open circuit voltage	V_{oc}	39.5 V
Maximum power point voltage	V_{mpp}	31.2 V
Short circuit current	I_{sc}	9.71 A
Maximum power point current	I_{mpp}	9.07 A
Module efficiency	η_m	16.70 %

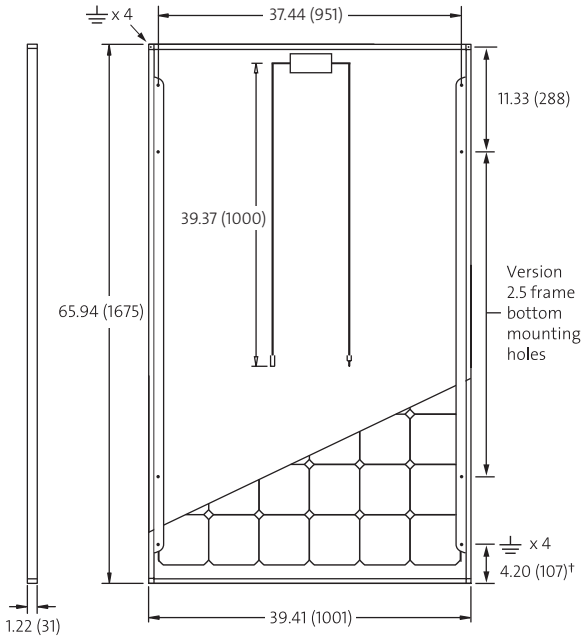
*STC: 1000 W/m², 25°C, AM 1.5

1) Measuring tolerance (P_{max}) traceable to TUV Rheinland: +/- 2% (TUV Power Controlled).

THERMAL CHARACTERISTICS

NOCT	46 °C
TC I_{sc}	0.04 %/°C
TC V_{oc}	-0.30 %/°C
TC P_{mpp}	-0.41 %/°C
Operating temperature	-40°C to 85°C





PERFORMANCE AT 800 W/m², NOCT, AM 1.5

Maximum power	P_{max}	209.2 Wp
Open circuit voltage	V_{oc}	36.1 V
Maximum power point voltage	V_{mpp}	28.5 V
Short circuit current	I_{sc}	7.85 A
Maximum power point current	I_{mpp}	7.33 A

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

Cells per module	60
Cell type	Mono crystalline
Cell dimensions	6.14 in x 6.14 in (156 mm x 156 mm)
Front	Tempered glass (EN 12150)
Frame	Clear anodized aluminum
Weight	39.5 lbs (17.9 kg)

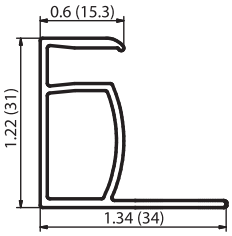
SYSTEM INTEGRATION PARAMETERS

Maximum system voltage SC II / NEC		1000 V
Maximum reverse current		16 A
Number of bypass diodes		3
*Design Loads**	*Two rail system*	113 psf downward 64 psf upward
*Design Loads**	*Three rail system*	170 psf downward 71 psf upward
*Design Loads**	*Edge mounting*	30 psf downward 30 psf upward

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

ADDITIONAL DATA

Power sorting[1]	-0 Wp / +5 Wp
J-Box	IP65
Module leads	PV wire per UL4703 with H4 connectors
Module type (UL 1703)	1
Glass	Low iron tempered with ARC



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.

SnapNrack™
Solar Mounting Solutions

snapnrack.com

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

No Cutting or Drilling

Integrated Wire Management

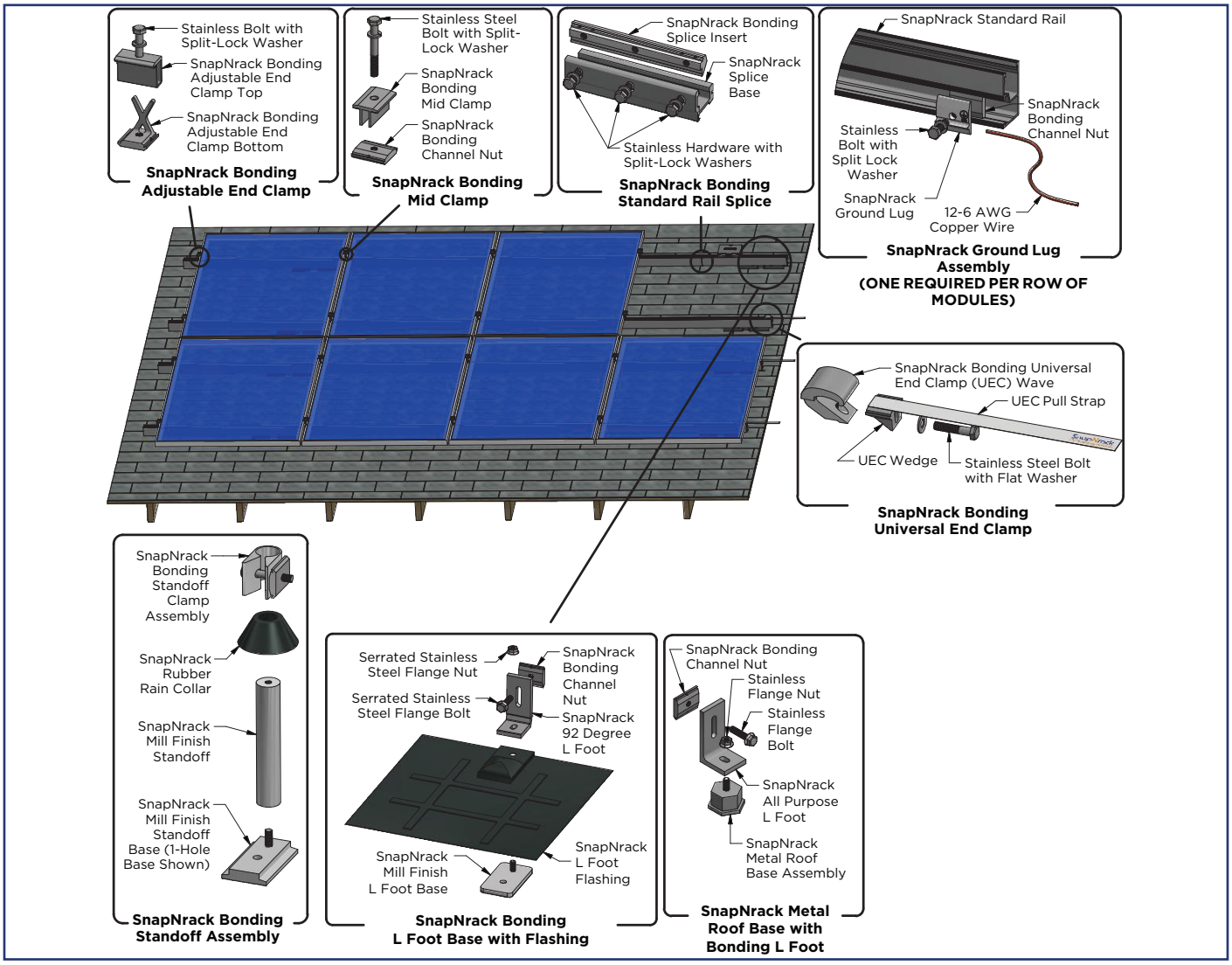
Preassembled hardware

Integrated bonding

UL 2703 Certified

SnapNrack™
Solar Mounting Solutions

snapnrack.com



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

877-732-2860 | **www.snapnrack.com** | **contact@snapnrack.com**

0-30 ft. Roof Height

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

Wind Load																
Ground Snow Load (psf)	Vult		110	115	120	125	130	135	140	145	150	155	160	170	180	190
	q_h		15.5	16.9	18.4	20.0	21.6	23.3	25.1	26.9	28.8	30.7	32.8	37.0	41.5	46.2
	P_g	P_s	-6.7	-7.3	-7.9	-8.6	-9.3	-10.0	-10.8	-11.6	-12.4	-13.2	-14.1	-15.9	-17.8	-19.9
	0	0	120	120	120	120	120	120	116	111	106	102	98	91	85	80
	10	8	112	111	110	109	108	107	105	104	103	102	98	91	85	80
	20	15	89	89	89	89	89	89	88	88	87	87	86	85	83	80
	30	23	75	75	75	75	75	75	75	75	75	75	75	75	74	73
	40	31	66	66	66	66	66	66	66	66	66	66	66	66	66	66
	50	39	60	60	60	60	60	60	60	60	60	60	60	60	60	60
	60	46	55	55	55	55	55	55	55	55	55	55	55	55	55	55
	70	54	51	51	51	51	51	51	51	51	51	51	51	51	51	51
	80	62	48	48	48	48	48	48	48	48	48	48	48	48	48	48
	100	77	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	120	92	40	40	40	40	40	40	40	40	40	40	40	40	40	40

0-30 ft. Roof Height

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

Wind Load																
Ground Snow Load (psf)	Vult		110	115	120	125	130	135	140	145	150	155	160	170	180	190
	q_h		15.5	16.9	18.4	20.0	21.6	23.3	25.1	26.9	28.8	30.7	32.8	37.0	41.5	46.2
	P_g	P_s	-6.3	-6.9	-7.6	-8.2	-8.9	-9.6	-10.3	-11.0	-11.8	-12.6	-13.4	-15.2	-17.0	-18.9
	0	0	120	120	120	120	118	115	113	110	107	105	101	94	88	82
	10	8	106	105	104	102	101	100	98	97	96	94	93	90	88	82
	20	15	89	88	87	87	86	85	84	83	82	82	81	79	77	76
	30	23	75	75	75	75	75	75	75	74	74	73	72	71	70	69
	40	31	66	66	66	66	66	66	66	66	66	66	66	65	64	63
	50	39	60	60	60	60	60	60	60	60	60	60	60	60	60	59
	60	46	55	55	55	55	55	55	55	55	55	55	55	55	55	55
	70	54	51	51	51	51	51	51	51	51	51	51	51	51	51	51
	80	62	48	48	48	48	48	48	48	48	48	48	48	48	48	48
	100	77	43	43	43	43	43	43	43	43	43	43	43	43	43	43
	120	92	40	40	40	40	40	40	40	40	40	40	40	40	40	40