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SAMPLE PERMIT APPLICATION PACKAGE

SUNSOURCE® HOME ENERGY SYSTEM SAMPLE PERMIT APPLICATION PACKAGE

SUNSOURCE®
Home Energy System



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Application

This document is provided as guidance. Installation of a utility-interactive solar photovoltaic system generally requires a permit from the local authority having jurisdiction (AHJ). This document provides a typical format for a residential permit application to install a SunSource® Home Energy System.

A1 — System Summary

Project Report

For Construction: March 15, 2013

Project #: 412

Client: Mr. Jeff Bailey

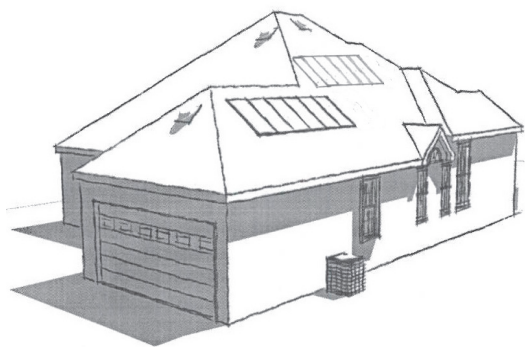
Address: Corsicana, TX

System Size: 3.180 kW

Module: Solar World SW-265

Microinverter: Enphase

Utility: United Cooperative Service

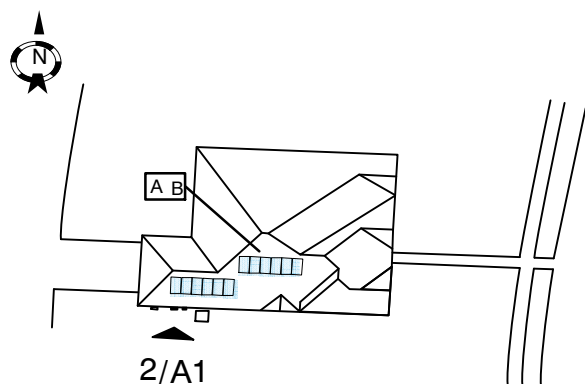


The following design describes a Solar PV system with a peak STC DC size of 3.180 kW and an estimated electrical generation of 4828 kWh per year.

The modules are mounted on the south facing roof with an 185° azimuth at a 32° tilt. The solar PV AC array consists of (12) SW-265 solar modules with each solar module in the array connected to an Enphase M215 microinverter. They have 96% CEC efficiency rating

From each module, DC power is connected directly to an Enphase microinverter mounted below each module. 240VAC power from the microinverter passes through a renewable energy credit meter; next, through a disconnect switch and then ties into solar source breaker located in the Lennox SunSource® XC21-060 (5-Ton) air conditioner.

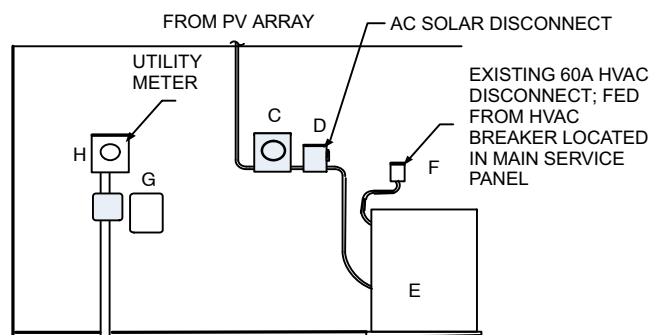
A2 — Site Plan



SCHEDULE OF COMPONENTS

- A Photovoltaic array
- B Microinverters
- C Renewable energy credit meter (if requested by electric utility)
- D AC utility disconnect
- E HVAC unit (existing)
- F HVAC disconnect (existing)
- G Main service panel (existing)
- H Utility meter (existing)

① **Site Plan**
NTS

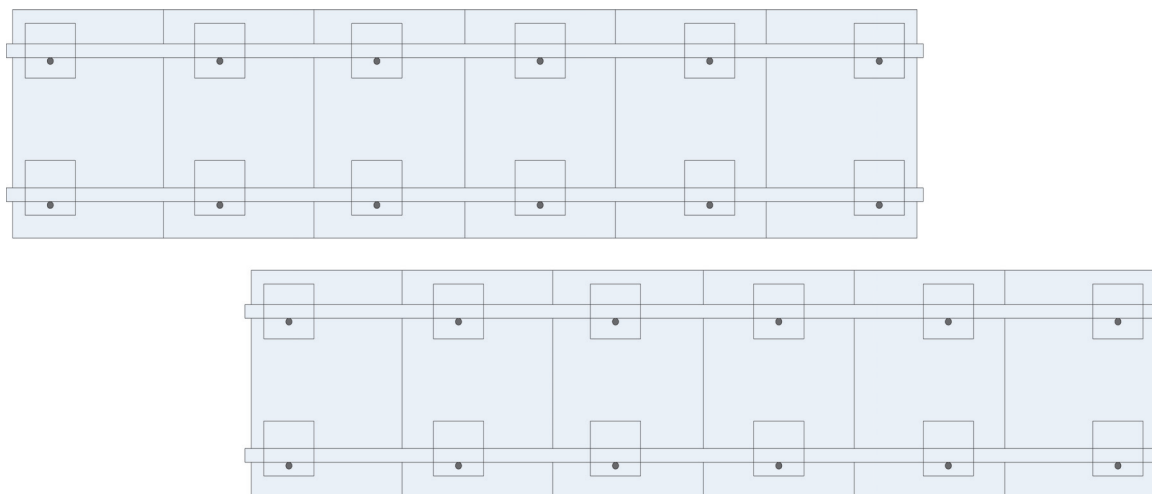


② **Elevation @ Utility Meter**

SCALE 1/2" = 1' - 0"

1 **Module Layout**

SCALE: 1/8" = 1'-0"



SOUTH FACING ROOF: 3.18 KW PV ARRAY DETAILS

- (12) SW-265 solar PV AC modules in one AC circuit.
- (12) Enphase M215-60-2LL-S22 (240)
- 90MPH designed wind speed and exposure category B.
- Composition shingle roof on 1/2" OSB decking with 2" x 6" at 24" O. C.

System Schematic
Installation - Wiring

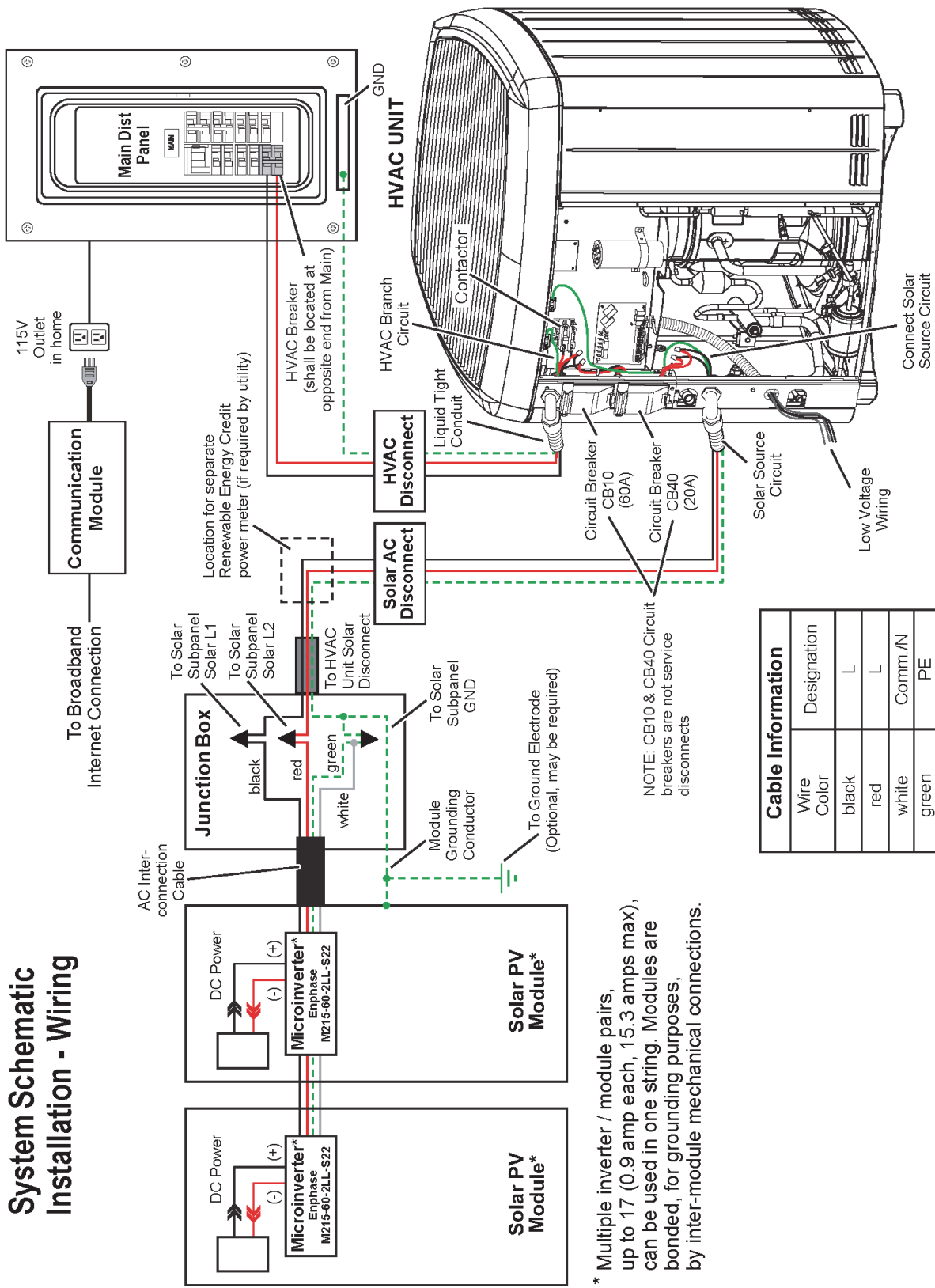
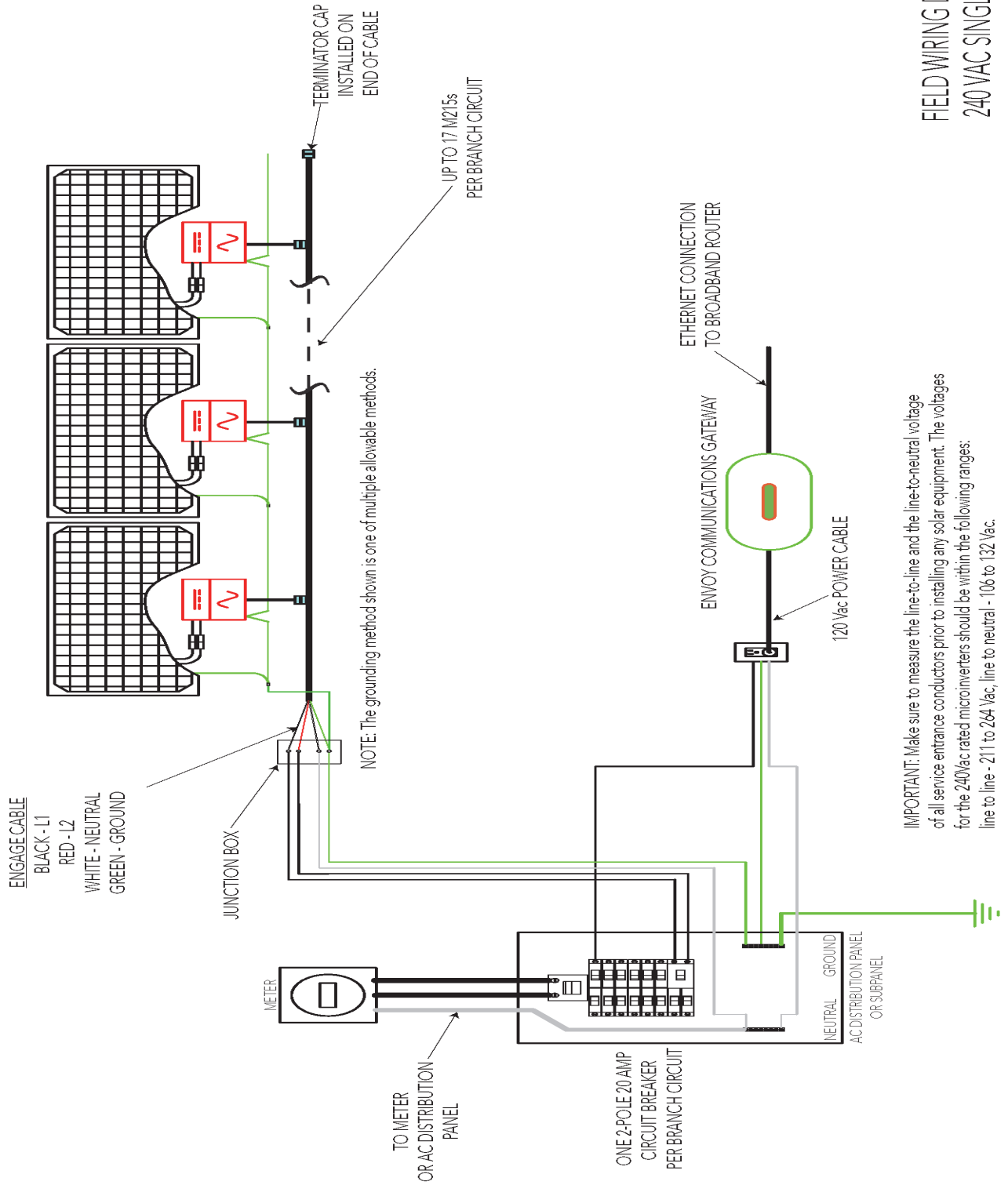


Figure 1. SunSource® Home Energy System Electrical Layout

B1 — Alternate Wiring Diagram

FIELD WIRING DIAGRAM 240 VAC SINGLE PHASE



B2 — Wire Calculations

AC Wire Sizing			
Description	AC run from inverter through ACV disconnect to solar source breaker.		
1. Design Current			
• Microinverter Maximum Current	15 A AC	Maximum Current	15 A AC
2. Wire Size			
• Maximum average ambient temperature	115°F (46°C)	Temperature De-rate Factor	0.87
• Number of current wires	2 per conduit	Conduit de-rate factor	1
• Maximum wire temperature allowed	167°F (75°C)		
• Selected wire size	10 AWG		
• Insulation type	THHN/THWNN-2	Specified wire ampacity	30.45 amps
3. Conduit size			
• Conduit specified	¾"		
• Conduit type	EMT		
4. Breaker size			
• AC over-current protection device (OCPD) size specified	20 A AC	Minimum breaker size	20 A AC
• Voltage rating of OCPD	240 VAC	Maximum breaker size	30
5. Voltage drop			
• Vnom	240 VAC	Voltage drop	.96 VAC
• Inom	12.0 A AC	Voltage loss percent-age	0.4%
• Wire distance	45 feet (13.7 meters)	Power loss	11 watts



AC Energy
&
Cost Savings



12 Panel PV System: Solar World 265W Panels.

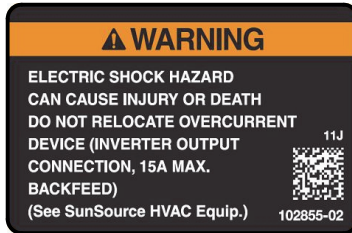
Station Identification	
City:	Fort Worth
State:	Texas
Latitude:	32.83° N
Longitude:	97.05° W
Elevation:	164 m
PV System Specifications	
DC Rating:	3.2 kW
DC to AC Derate Factor:	0.832
AC Rating:	2.6 kW
Array Type:	Fixed Tilt
Array Tilt:	32.8°
Array Azimuth:	185.0°
Energy Specifications	
Cost of Electricity:	12.0 ¢/kWh

Results			
Month	Solar Radiation (kWh/m ² /day)	AC Energy (kWh)	Energy Value (\$)
1	4.31	345	41.40
2	4.76	342	41.04
3	5.50	426	51.12
4	6.00	441	52.92
5	6.02	449	53.88
6	6.28	440	52.80
7	6.39	453	54.36
8	6.31	447	53.64
9	5.82	407	48.84
10	5.56	416	49.92
11	4.42	336	40.32
12	4.10	326	39.12
Year	5.46	4828	579.36

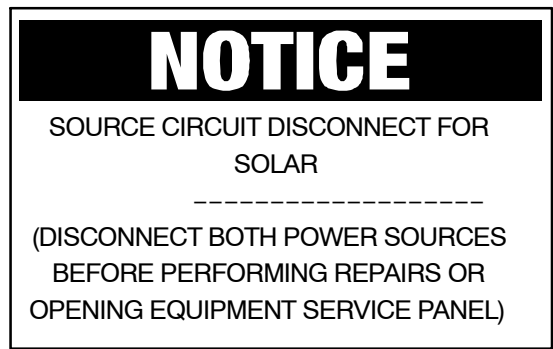
Calculator for Overall DC to AC Derate Factor

Component Derate Factors	Component Derate Values	Range of Acceptable Values
PV module nameplate DC rating	0.95	0.80 - 1.05
Inverter and Transformer	.96	0.88 - 0.98
Mismatch	.995	0.97 - 0.995
Diodes and connections	0.995	0.99 - 0.997
DC wiring	.99	0.97 - 0.99
AC wiring	0.99	0.98 - 0.993
Soiling	0.95	0.30 - 0.995
System availability	.99	0.00 - 0.995
Shading	1	0.00 - 1.00
Sun-tracking	1	0.95 - 1.00
Age	1	0.70 - 1.00
Overall DC to AC derate factor	0.832	

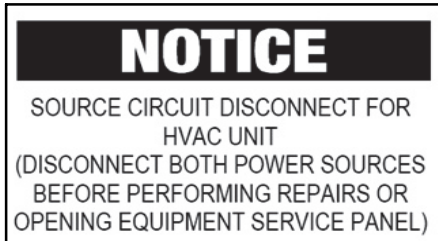
USED NEXT TO
CIRCUIT
BREAKER IN
MAIN PANEL.



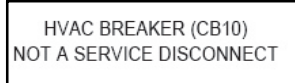
USED ON SOLAR
DISCONNECT
SWITCH



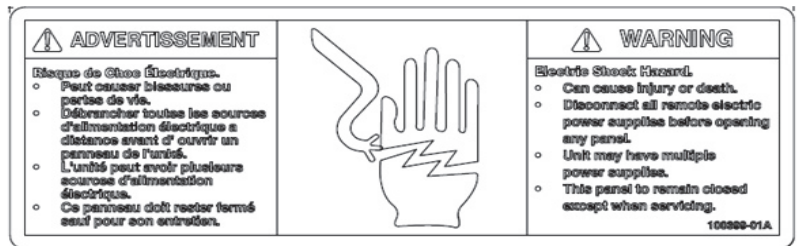
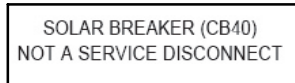
USED ON HVAC
DISCONNECT
SWITCH



USED ON UNIT
CB10 PLASTIC
COVER



USED ON UNIT
CB40 PLASTIC
COVER



E1 — Module Data Sheet

PERFORMANCE

		Performance Under ¹ Standard Testing Conditions	² Performance At 800 W/M ² , Normal Operating Cell Temperature (NOCT), AM 1.5
Maximum Power	P _{max}	265 Wp	187.6 Wp
Open Circuit Voltage	V _{oc}	38.1V	34.3V
Maximum Power Point Voltage	V _{mpp}	31.9V	28.7V
Short Circuit Current	I _{sc}	8.82A	7.12A
Maximum Power Point Current	I _{mpp}	8.33A	6.66A

¹ Standard Testing Conditions at 1000W/m², 25°C, AM 1.5

² Minor reduction in efficiency

COMPONENT MATERIALS

	265 Wp
Cells per module	60
Cell type	Mono crystalline
Cell dimensions	6.14 in. x 6.14 in.
Front	Tempered glass (EN 12150)
Frame	Clear anodized aluminum
Weight	47 lbs.

SYSTEM INTEGRATION PARAMETERS

Maximum system voltage SC II		1000V
Maximum system voltage USA NEC		600V
Maximum reverse currents		16A
Number of bypass diodes		3
UL Design Loads	Two rail system	113 psf downward, 64 psf upward
UL Design Loads	Three rail system	170 psf downward, 64 psf upward
IEC Design Loads	Two rail system	113 psf downward, 50 psf upward

ADDITIONAL DATA

THERMAL CHARACTERISTICS

	265 Wp
NOCT	115°F
TC _{Isc}	0.004%/K
TC _{Voc}	-0.30%/K
TCP _{MPP}	-0.45%/K
Operating Temp.	-40°F to 185°F

	265 Wp
Power Tolerance	-0 Wp / +5 Wp
J-Box	IP65
Connector	MC4
Module efficiency	15.81%
Fire rating UL (790)	Class C

DIMENSIONS – INCHES (MM)





How the Enphase Microinverter Works

The Enphase Microinverter maximizes energy production from the solar module array. Each Enphase Microinverter is individually installed on one solar module in the array.

This unique configuration means that an individual Maximum Peak Power Point Tracker (MPPT) controls each solar module. This ensures that the maximum power available from each solar module is exported to the utility grid regardless of the performance of the other solar modules in the array.

Even if individual solar modules in the array are affected by shading, soiling or orientation, the Enphase Microinverter ensures optimum performance for each associated solar module. The result is maximum energy production from the SunSource® Energy System.

Enphase Microinverters for 3-Phase Applications

Each Enphase Microinverter automatically connects to one phase of a 3-phase system. It senses the grid and synchronizes to that phase. When applied in groups of three it creates a balanced 3-phase system. If systems are installed in something other than multiples of three a small imbalance will be created across the phases. The maximum output of each inverter is 0.92A. This would be the maximum imbalance possible.

Enphase Microinverter Status LED Indications and Error Reporting

Startup LED Operation:

Six short green blinks when DC power is first applied to the Enphase Microinverter indicates a successful microinverter startup sequence.

Six short red blinks when DC power is first applied to the Enphase Microinverter indicates a failure during microinverter startup.

Post-Startup LED Operations:

Flashing Green Producing power and communicating with Envoy

Flashing Orange Producing power and not communicating with Envoy

Flashing Red Not producing power

GFDI Fault:

A solid red status LED when DC power has been cycled, indicates the Enphase Microinverter has detected a ground fault (GFDI) error. The LED will remain red and the fault will continue to be reported by the Envoy until the error has been cleared. The error can only be cleared via the Envoy after the ground fault condition has been remedied.

Other Faults:

All other faults are reported to the Envoy.

ENPHASE MICROINVERTER OPERATING PARAMETERS

INPUT DATA (DC)

Recommended Input Power (STC)	190–270W
Maximum Input DC Voltage	45V
Peak Power Tracking Voltage	22V – 36V
Operating Range	16V – 36V
Min./Max Start Voltage	22V / 45V
Max. DC Short Circuit Current	15A
Max. Input Current	10.5A

OUTPUT DATA (AC)

	208 VAC	240 VAC
Maximum Output Power	215W	215W
Nominal Output Current	1.0A (arms at nominal duration)	0.9A (arms at nominal duration)
Nominal Voltage / Range	208V / 183 – 229V	240V / 211 – 264V
Extended Voltage / Range	208V / 179 – 232V	240V / 206 – 269V
Nominal Frequency / Range	60.0 / 59.3 – 60.5 Hz	60.0 / 59.3 – 60.5 Hz
Extended Frequency / Range	60.0 / 59.2 – 60.6 Hz	60.0 / 59.2 – 60.6 Hz
Power Factor	>0.95	>0.95
Maximum Units Per 20A Branch Circuit	25 (3-phase)	17 (1-phase)
Maximum Output Fault Current	1.05 Arms, over 3 cycles; 25.2 A _{peak} , 1.74ms duration	

EFFICIENCY

CEC Weighted Efficiency	96%
Peak Inverter Efficiency	96.3%
Static MPPT Efficiency (weighted, reference EN50530)	99.3%
Night Time Power Consumption	46mW

MECHANICAL DATA

Ambient Temperature Range	–40°F to 149°F
Operating Temperature Range (Internal)	–40°F to 185°F
Dimensions (W x H x D)	6.8 in. x 6.45 in. x 1 in.
Weight	3.5 lbs.
Cooling	Natural Convection – No Fans
Enclosure Environmental Rating	Outdoor – NEMA 6

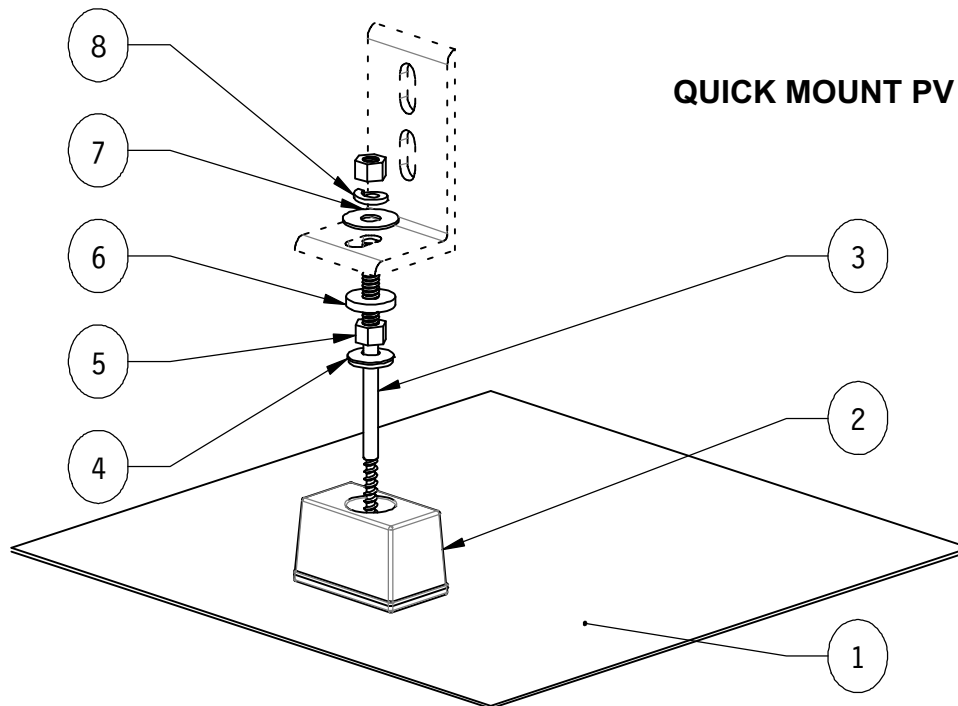
FEATURES

Compatibility	Pairs with most 60–cell PV Solar Modules
Communication	Power Line
Warranty	25–year Limited Warranty
Monitoring	Free Lifetime Monitoring via Enlighten Software
Compliance	UL1741/IEEE1547, FCC Part 15 Class B CAN/CSA–C22.2 NO. 0–M91, 0.4–04, and 107.1–01

VOLTAGE AND FREQUENCY LIMITS FOR UTILITY INTERACTION

Condition	Simulated utility source		Maximum time (sec) (cycles) at 60 Hz before cessation of current to the simulated utility
	Voltage (V)	Frequency (Hz)	
A	< 0.50 V _{Typical}	Rated	0.16
B	0.50 V _{Typical} ∇ < 0.88 V _{Typical}	Rated	2
C	1.10 V _{Typical} < V < 1.20 V _{Typical}	Rated	1
D	1.20 V _{Typical} ∇	Rated	0.16
E	Rated	f > 60.5	0.16
F	Rated	f < (59.8 – 57.0)	0.16 – 300

E3 — Module Attachment Hardware



NOTE — Check with local building department to identify any unique wind or snow load requirements that pertain to your jurisdiction. A combination of shortening the maximum span between roof attachments and increasing the length of your lags will enhance the wind load rating of PV System. When the proper number of attachment points are included, PV System panels are rated for coastal conditions in Florida.

Install the flashing below the upper shingle to allow water to run around the raised penetration point. Seal the penetration and lag screws with appropriate roofing sealant.

ITEM NO.	DESCRIPTION	QTY.
1	FLASHING, 12" X 12" X .050", 5052, MILL	1
2	QBLOCK, CLASSIC, A360.1 CAST AL, MILL	1
3	HANGER BOLT, 5/16" x 6", 18-8 SS	1
4	WASHER, SEALING, 5/16" ID X 3/4" OD, EPDM BONDED SS	1
5	NUT, HEX, 5/16-18, UNC-2, 18-8 SS	2
6	WASHER, FLAT, 19/64" ID x 7/8" OD x 1/8" EPDM	1
7	WASHER, FENDER, 5/16" ID X 1" OD, 18-8 SS	1
8	WASHER, SPLIT-LOCK, 5/16" ID, 18-8 SS	1

QUICK MOUNT PV (CONTINUED)

- ❶ Sunfix plus rail 2 modules = 82", 3 modules = 122", 4 modules = 162"
- ❷ Top-clamp assembly for 31 mm frame - M8 bolt with channel nut with bolt positioning retainer
- ❸ End clamp aluminum spacer - 31 mm
- ❹ Rail splice bar; joins rails together
- ❺ L-bracket with dual adjustment slots & mating serrations
- ❻ T-bolt M8 x 20 stainless steel with serrated flange hex nut
- ❼ Rail splice ground jumper WEEB 8.0 pre-assembled with T-bolts
- ❽ Rail-equipment ground WEEB-lug 8.0 with T-bolt assembly
- ❾ Roof attachment/flushing - Quick Mount PV[®]

