

# HERNANDEZ RESIDENCE

## 14.800 kW PV SYSTEM

6021 SW STATE RD 247,  
LAKE CITY FL 32024



**CASTILLO ENGINEERING SERVICES, LLC**  
COA # 28345  
620 N. WYMORE ROAD, SUITE 250,  
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TEL: (407) 289-2575  
ERMOCRATES E. CASTILLO - FL PE 52590

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REVISIONS		
DESCRIPTION	DATE	REV

PROJECT INSTALLER



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Date: 2022.08.03 13:43:19

PROJECT NAME

**HERNANDEZ RESIDENCE**  
6021 SW STATE RD 247,  
LAKE CITY FL 32024

SHEET NAME

COVER SHEET

SHEET SIZE  
**ANSI B**  
11" X 17"

SHEET NUMBER  
**G-01**

### PROJECT DESCRIPTION:

37x400 HANWHA: Q.PEAK DUO BLK ML-G10+ (400W) MODULES  
ROOF MOUNTED SOLAR PHOTOVOLTAIC MODULES  
SYSTEM SIZE: 14.800 kW DC STC  
ARRAY AREA #1: 781.47 SQ. FT.

#### EQUIPMENT SUMMARY

37 HANWHA: Q.PEAK DUO BLK ML-G10+ (400W) MODULES  
37 ENPHASE: IQ8PLUS-72-2-US MICROINVERTERS

RACKING: IRONRIDGE XR10  
ATTACHMENT: S-5 PROTEA

DESIGN CRITERIA:  
WIND SPEED (ULT): 120 MPH  
WIND SPEED (ASD): 93 MPH  
RISK CATEGORY: II  
EXPOSURE: B

### CODES AND STANDARDS

GOVERNING CODES :  
FLORIDA RESIDENTIAL CODE, 7TH EDITION 2020 (FRC)  
FLORIDA PLUMBING CODE, 7TH EDITION 2020 (FPC)  
FLORIDA BUILDING CODE, 7TH EDITION 2020 (FBC)  
FLORIDA MECHANICAL CODE, 7TH EDITION 2020 (FMC)  
NATIONAL ELECTRICAL CODE 2017 (NEC)  
ASCE 7-16  
FLORIDA FIRE PREVENTION CODE, 7TH EDITION 2020 (FFPC)

### OWNER

HERNANDEZ, JOSE

### INSTALLER

SUNSMART AMERICA  
1404 HAMLIN AVE UNIT L,  
ST CLOUD FL 34771  
(407) 904-0441.

### ENGINEER

Castillo Engineering Services LLC  
620 N. Wymore Road, Suite 250, Maitland, FL 32751  
TEL: (407) 289-2575  
Ermocrates E. Castillo  
License#: FL PE 52590

### SHEET INDEX

SHEET #	SHEET DESCRIPTION
G-01	COVER SHEET
A-00	NOTES AND DESCRIPTION
A-01	ROOF PLAN
S-01	MODULE LAYOUT
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S-02	ATTACHMENT DETAIL
S-02.1	STRUCTURE CALCULATION
E-01	ELECTRICAL LINE DIAGRAM
E-02	WIRING CALCULATIONS
E-03	SYSTEM LABELING
DS-01-06	DATA SHEETS

### HOUSE PHOTO



### VICINITY MAP



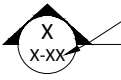
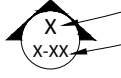














### STRUCTURAL CERTIFICATION:

I ERMOCRATES CASTILLO PE# 52590 AN ENGINEER LICENSED PURSUANT TO CHAPTER 471, CERTIFY THAT THE INSTALLATION OF THE MODULES IS IN COMPLIANCE WITH FBC: RESIDENTIAL 2020 7th ED., CHAPTER 3. BUILDING STRUCTURE WILL SAFELY ACCOMMODATE WIND LATERAL AND UPLIFT FORCES, AND EQUIPMENT DEAD LOADS.

### ELECTRICAL CERTIFICATION:

I ERMOCRATES CASTILLO PE# 52590 AN ENGINEER LICENSED PURSUANT TO CHAPTER 471, CERTIFY THAT THE PV ELECTRICAL SYSTEM AND ELECTRICAL COMPONENTS ARE DESIGNED AND APPROVED USING THE STANDARDS CONTAINED IN THE MOST RECENT VERSION OF THE FLORIDA BUILDING CODE. FBC 107, THE NEC 2017, AND THOSE SET FORTH BY THE FLORIDA SOLAR ENERGY CENTER CERTIFICATION.

**Symbols:**

- Section.....  Sheet where section is located
- Elevation .....  Detail ID Letter  
Sheet where section is located
- Detail .....  Detail ID Letter  
Sheet where section is located
- Detail .....  Detail ID Letter  
(Enlarged Plan) ← Area to be enlarged  
Sheet where section is located
- Keyed Notes ..... 1 Keyed note designation on applicable sheet
- Ground Terminal ..... 
- Grounding Point/rod.... 
- Solar Panel .....  or 00 ← Module with Source Circuit number
- Combiner Box ..... CB
- AC Disconnect ..... ACD
- Main Distribution Panel ..... MDP
- Fuse ..... 
- Overcurrent Breaker .. 
- Inverter ..... 
- Transformer ..... 
- Automatic ..... ATS  
Transfer Switch
- Vent, Attic fan (Roof obstruction) 
- PV Roof Attachment 
- Trusses 
- Conduit 
- Fire Access 

**Abbreviations:**

- AC Alternating Current
- ACD AC Disconnect
- APPROX Approximate
- AWG American Wire Gauge
- BAT Battery
- CB Combiner Box
- DC Direct Current
- DISC Disconnect
- (E) Existing
- EL Elevation
- EQ Equal
- GP Generation Panel
- JB Junction Box
- MCB Main Combiner Box
- MFR Manufacturer
- MID MICROGRID INTERCONNECTION
- MIN Minimum
- MISC Miscellaneous
- MDP Main Distribution Panel
- (N) New
- NAVD North American Vertical datum
- OCPD OverCurrent Protection Device
- POCC Point Of Common Coupling
- PV Photovoltaic
- SF Squarefoot/feet
- STC Standard Test Conditions
- SD Soladeck
- TBD To Be Determined
- TYP Typical
- UNO Unless Noted Otherwise
- UM Utility meter
- VIF Verify In Field
- WP Weather Proof

**System Description**

This system is a grid-tied, PV system, with PV generation consisting of 37x400 HANWHA: Q.PEAK DUO BLK ML-G10+ (400W) Modules with a combined STC rated dc output power of 14.800W. The modules are connected into 37 ENPHASE: IQ8PLUS-72-2-US Microinverters. The inverter has electronic maximum power point tracking to maximize energy captured by the PV modules. The inverter also has an internal ground fault detection and interruption device that is set to disconnect the array in the event that a ground fault that exceeds one ampere should occur. The inverter has DC and AC disconnect integrated system and labels are provided as required by the *National Electrical Code*.

When the sun is shining, power from the PV array is fed into the inverter, where it is converted from DC to AC. The inverter output is then used to contribute to the power requirements of the occupancy. If PV power meets the requirements of the loads of the occupancy, any remaining PV power is sold back to the utility. When utility power is available, but PV power is not available, building loads are supplied by the utility.

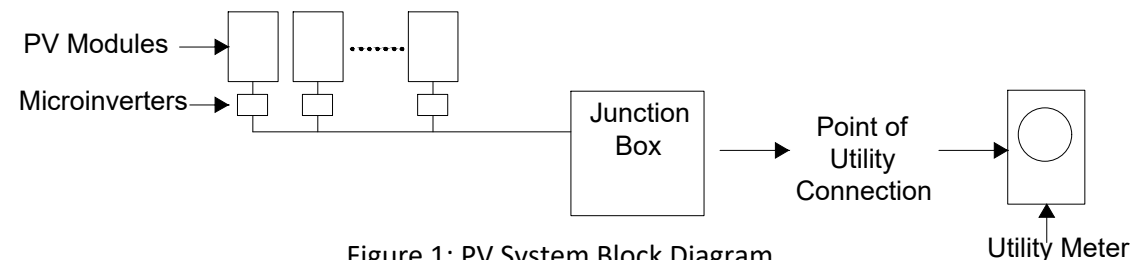


Figure 1: PV System Block Diagram

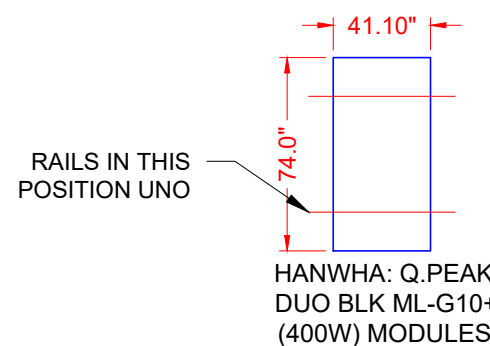
The inverter meets the requirements of IEEE 1547 and UL 1741.

**FALL PROTECTION:**  
ANCHORAGES USED FOR ATTACHMENT OF PERSONAL FALL ARREST EQUIPMENT MUST BE INDEPENDENT OF ANY ANCHORAGE BEING USED TO SUPPORT OR SUSPEND PLATFORMS, AND CAPABLE OF SUPPORTING AT LEAST 5,000 POUNDS PER EMPLOYEE ATTACHED, OR MUST BE DESIGNED AND USED AS FOLLOWS:

- AS PART OF A COMPLETE PERSONAL FALL ARREST SYSTEM WHICH MAINTAINS A SAFETY FACTOR OF AT LEAST TWO.
- UNDER THE SUPERVISION OF A QUALIFIED PERSON

**ADDITIONAL INFORMATION**

- 29 CFR 1926 SUBPART M, FALL PROTECTION. OSHA STANDARD.
- 1926.502, FALL PROTECTION SYSTEMS CRITERIA AND PRACTICES
- 1926.502(D)(15)



ALLOWABLE/DESIGN PRESSURE	PSF
DOWN PRESSURE	75
UPLIFT PRESSURE, 2 RAILS	55

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6021 SW STATE RD 247,  
LAKE CITY FL 32024

SHEET NAME

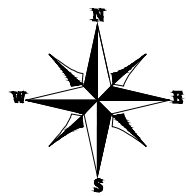
NOTES AND DESCRIPTION

SHEET SIZE

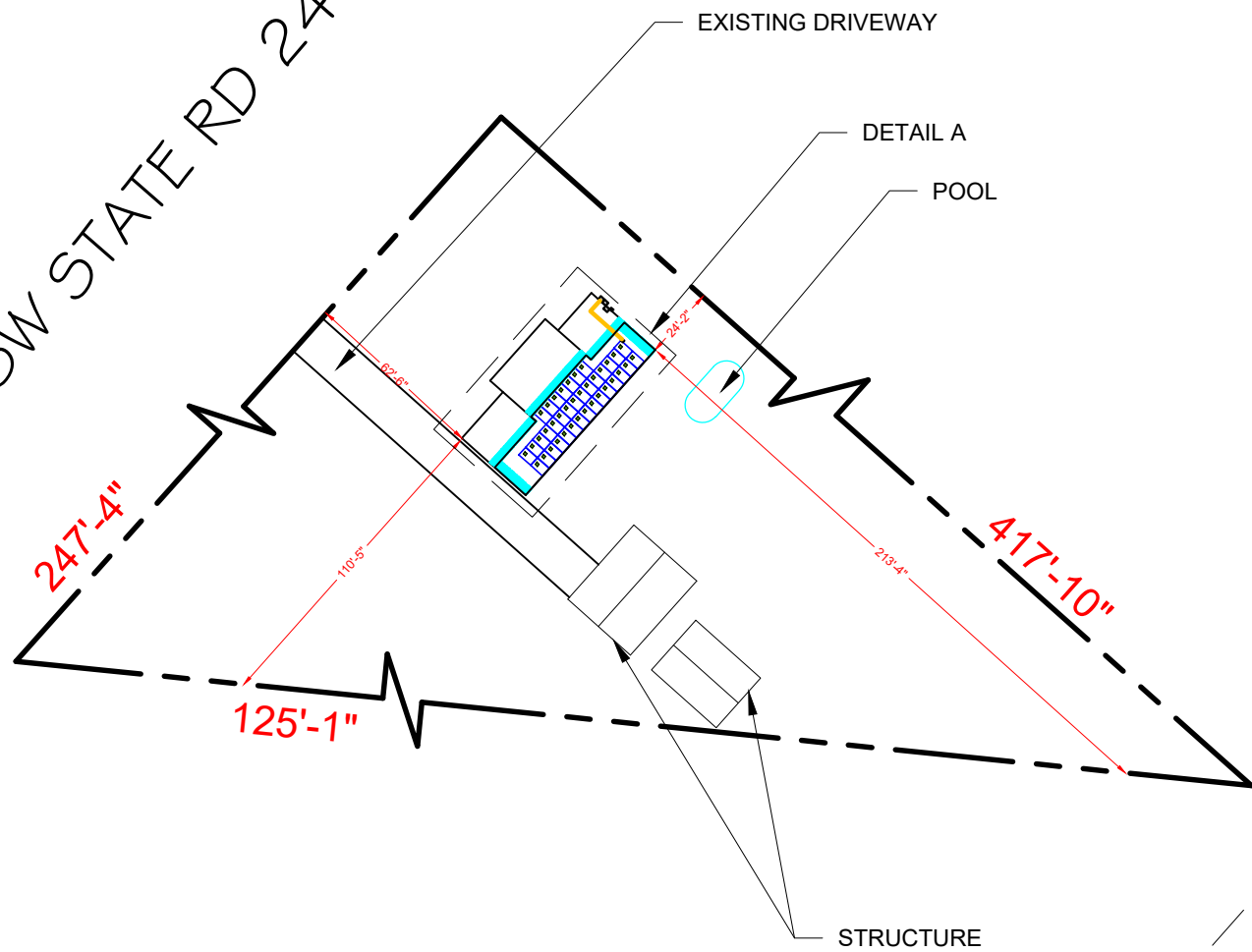
**ANSI B**  
11" X 17"

SHEET NUMBER

**A-00**

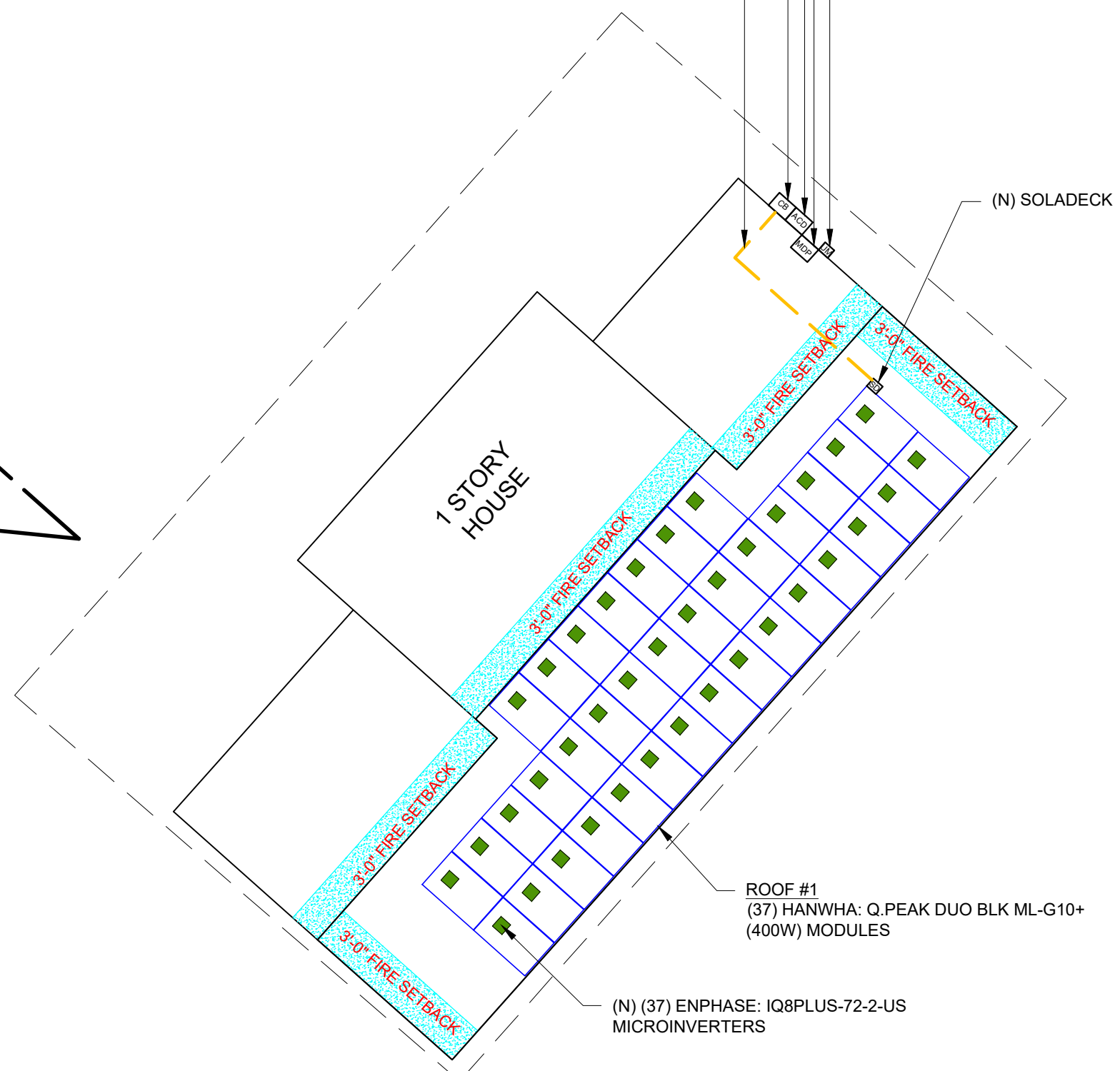


SW STATE RD 247,



- (N) ENPHASE IQ COMBINER BOX
- (E) MAIN SERVICE DISCONNECT / MAIN DISTRIBUTION PANEL
- (N) ALTERNATE POWER SOURCE AC DISCONNECT/RAPID SHUTDOWN
- (E) SERVICE POINT AND UTILITY METERING

3/4" IMC, RMC, FMC, LFMC, EMT OR EQUIVALENT CONDUIT RUN



(N) (37) ENPHASE: IQ8PLUS-72-2-US MICROINVERTERS

**1** ROOF PLAN WITH PROPERTY LINES

A-01

SCALE: 1/64" = 1'-0"

**2** DETAIL A

A-01

SCALE: 3/32" = 1'-0"

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SHEET NAME

ROOF PLAN

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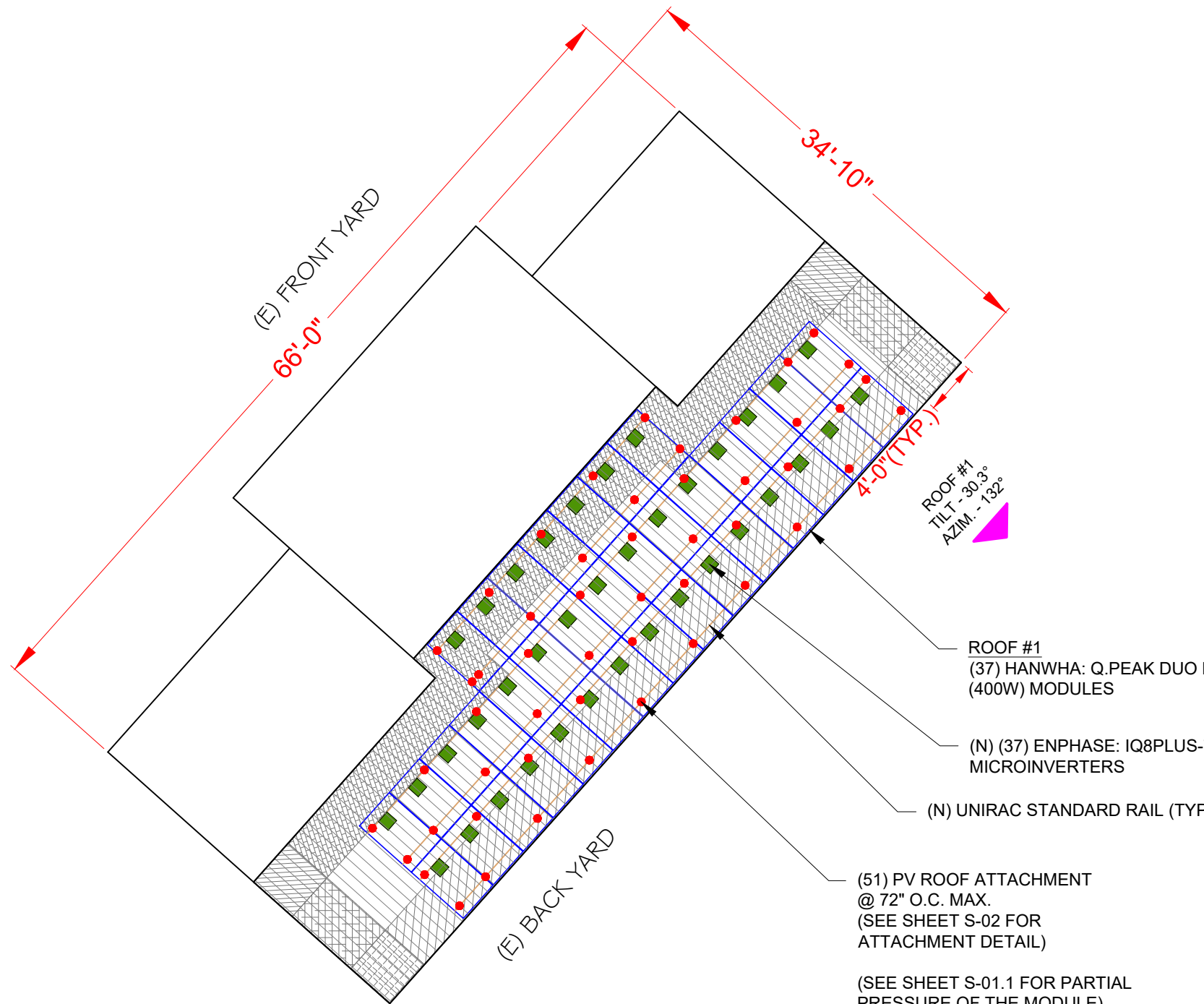
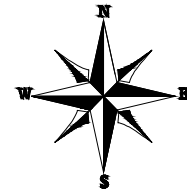
SHEET NUMBER

A-01

**MODULE TYPE, DIMENSIONS & WEIGHT**

NUMBER OF MODULES = 37 MODULES  
 MODULE TYPE = HANWHA: Q.PEAK DUO BLK ML-G10+ (400W) MODULES  
 MODULE WEIGHT = 48.50 LBS / 22.0 KG.  
 MODULE DIMENSIONS = 74.0" x 41.10" = 21.12 SF  
 UNIT WEIGHT OF ARRAY = 2.30 PSF

ARRAY AREA & ROOF AREA CALC'S								
ROOF	ROOF TYPE	ARRAY AREA (sq.Ft.)	ROOF AREA (Sq. Ft.)	ROOF AREA COVERED BY ARRAY (%)	TILT	AZIMUTH	TRUSS SIZE	TRUSS SPACING
#1	METAL	781.47	988.75	79.04	30.3	132°	2"X4"	9" o.c.
	TOTAL PLAN VIEW	781.47	2078.36	37.60				



**GENERAL INSTALLATION PLAN NOTES:**

1) ROOF ATTACHMENTS TO SEAM SHALL BE INSTALLED AS SHOWN IN SHEET S-02 AND AS FOLLOWS FOR EACH WIND ZONE:

WIND ZONES	NON - EXPOSED MODULES		EDGE / EXPOSED MODULES	
	SPAN	CANTILEVER	SPAN	CANTILEVER
ZONE 1	6' - 0"	2' - 0"	6' - 0"	2' - 0"
ZONE 1'	X	X	X	X
ZONE 2e	6' - 0"	2' - 0"	6' - 0"	2' - 0"
ZONE 2n	6' - 0"	2' - 0"	6' - 0"	2' - 0"
ZONE 2r	6' - 0"	2' - 0"	6' - 0"	2' - 0"
ZONE 3e	6' - 0"	2' - 0"	5' - 3"	1' - 4"
ZONE 3r	6' - 0"	2' - 0"	5' - 3"	1' - 4"

SEE SHEET S-02.1 FOR SUPPORTING CALCULATIONS.

2) EXISTING RESIDENTIAL BUILDING HAVE 2"X4" SYP TRUSSES SPACED @ 24" O.C. AND METAL ROOF DECKS WITH A MEAN ROOF HEIGHT OF 15 FT WITH SEAMS SPACED 9" O.C. EXISTING ROOF SLOPE FOR THE SOLAR RETROFIT IS 30.3 DEGREES. CONTRACTOR TO FIELD VERIFY AND SHALL REPORT TO THE ENGINEER IF ANY DISCREPANCIES EXIST BETWEEN PLANS AND IN FIELD CONDITIONS.

3) FIRE SETBACK TO BE 3' FROM RIDGES AND EDGES, AND 18" EACH WAY FROM HIPPS AND VALLEYS PER NFPA 1, 11.12.2.

4) THE EXISTING ROOF AND STRUCTURE WILL NOT BE ADVERSLY AFFECTED BY THE ADDITIONAL LOADS IMPOSED BY THE SOLAR SYSTEM.

\* I CERTIFY THAT THE INSTALLATION OF THE MODULES IS IN COMPLIANCE WITH FBC: RESIDENTIAL 2020 7TH ED., CHAPTER 3. BUILDING STRUCTURE WILL SAFELY ACCOMMODATE WIND LATERAL AND UPLIFT FORCES AND EQUIPMENT DEAD LOADS. \*

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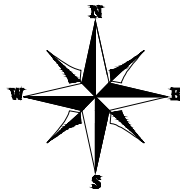
SHEET NAME  
 MODULE LAYOUT

SHEET SIZE  
**ANSI B**  
 11" X 17"

SHEET NUMBER  
**S-01**

**LEGEND**

	- WIND ZONE 1 (TYP)
	- WIND ZONE 2e (TYP)
	- WIND ZONE 2n (TYP)
	- WIND ZONE 2r (TYP)
	- WIND ZONE 3r (TYP)
	- WIND ZONE 3e (TYP)



2h<sub>2</sub> DISTANCE : 0' - 10"  
 0.5h DISTANCE : 7' - 6"

NOTE : PARTIAL PRESSURES OF THE WIND ZONES ON ALL MODULES HAVE BEEN VERIFIED AND ARE WITHIN THE ALLOWABLE PER THE MANUFACTURER SPECIFICATION, INSTALLER SHOULD FOLLOW THE LAYOUT TO AVOID HIGHER ZONAL PARTIAL PRESSURES. ANY CHANGES IN LAYOUT SHOULD BE REPORTED BACK TO THE ENGINEER OF RECORD.

FOR EXPOSED MODULES

1	1'	2e	2n	2r	3e	3r
16	0	16	18.9	16	23.4	16

Module Size 21.12 Sq. ft.

	1	1'	2e	2n	2r	3e	3r	Partial Pressure
P1	17.98	0	0	0	3.14	0	0	16.00
P2	1.52	0	0	0	19.60	0	0	16.00
P3	2.79	0	0	0	18.33	0	0	16.00
P4	5.76	0	15.36	0	0	0	0	16.00

FOR - NON- EXPOSED MODULES

1	1'	2e	2n	2r	3e	3r
16	0	16	16	16	16	16

Module Size 21.12 Sq. ft.

	1	1'	2e	2n	2r	3e	3r	Partial Pressure
P5	17.98	0	0	0	3.14	0	0	16.00
P6	18.83	0	0	0	2.29	0	0	16.00
P7	21.12	0	0	0	0	0	0	16.00
P8	19.54	0	0	0	1.58	0	0	16.00

FOR EDGEMODULES

1	1'	2e	2n	2r	3e	3r
16	0	16	18.9	16	23.4	16

Module Size 21.12 Sq. ft.

	1	1'	2e	2n	2r	3e	3r	Partial Pressure
P9	5.76	0	15.36	0	0	0	0	16.00
P10	5.63	0	0	0	15.49	0	0	16.00

ALLOWABLE MODULE UPLIFT PRESSURE 2 RAILS: 55 PSF

LEGEND

- EXPOSED MODULE
- EDGE MODULE
- NON- EXPOSED MODULE
- MISSING MODULE
- MIN. MODULE EDGE DISTANCE LINE
- MODULE EXPOSURE LINE
- WIND ZONE 1 (TYP)
- WIND ZONE 2e (TYP)
- WIND ZONE 2n (TYP)
- WIND ZONE 2r (TYP)
- WIND ZONE 3r (TYP)
- WIND ZONE 3e (TYP)



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SHEET NAME

PARTIAL PRESSURE AND MODULES EXPOSURE

SHEET SIZE

**ANSI B**  
 11" X 17"

SHEET NUMBER

**S-01.1**

REVISIONS

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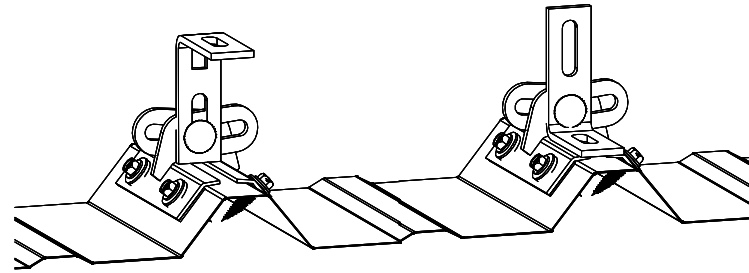
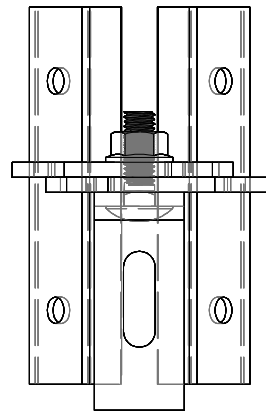
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SHEET SIZE

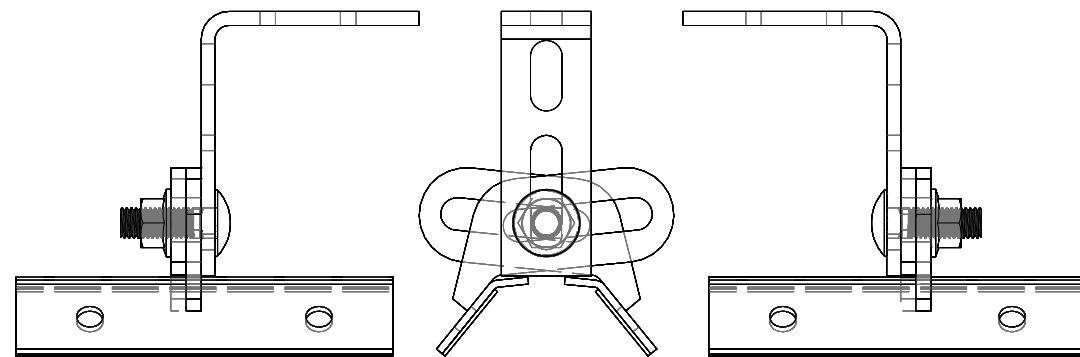
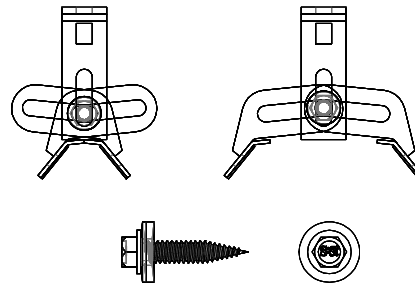
ANSI B  
11" X 17"

SHEET NUMBER

S-02



**ProteaBracket**



LEFT VIEW

FRONT VIEW

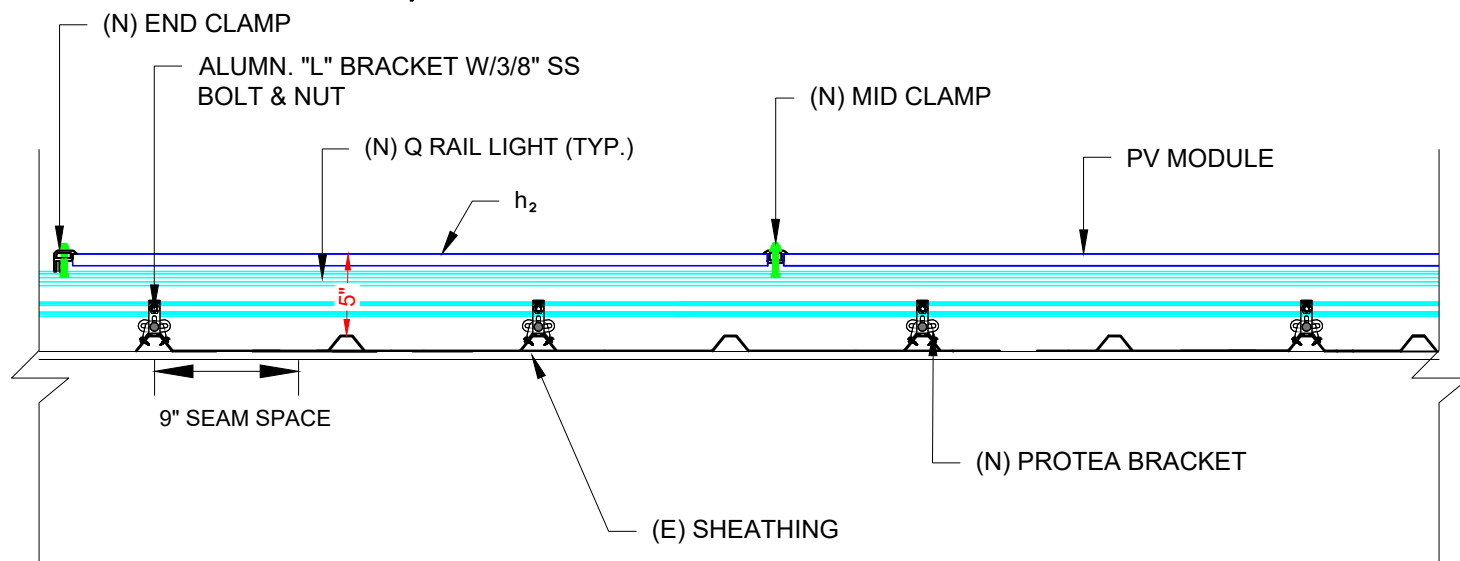
RIGHT VIEW

FOR STANDING SEAM SPECIFIC MECHANICAL LOAD TEST INFORMATION AND CLAMP INSTALLATION INFORMATION PLEASE VISIT: [WWW.S-5.COM](http://WWW.S-5.COM)

**1 ATTACHMENT DETAIL**

S-02

SCALE: NTS



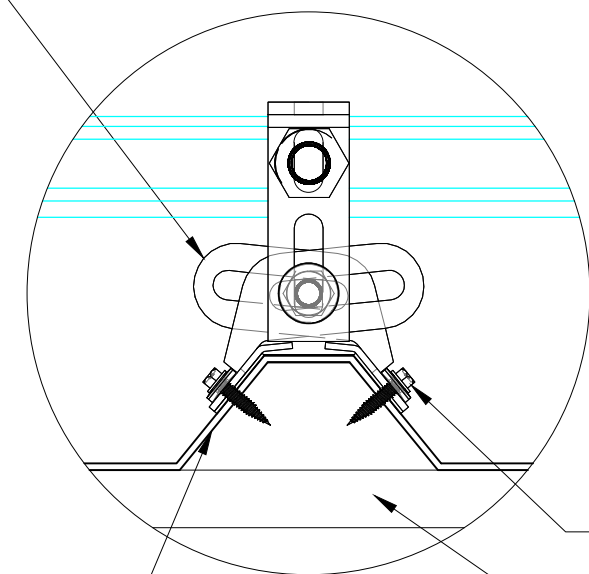
**2 ATTACHMENT DETAIL & ENLARGED VIEW**

S-02

SCALE: 1" = 1'-0"

(N) PROTEA BRACKET

(E) STANDING SEAM



(N) STAINLESS STEEL SCREWS  
(E) SHEATHING

**3 ENLARGED VIEW**

S-02

SCALE: 1" = 1'-0"

REVISIONS

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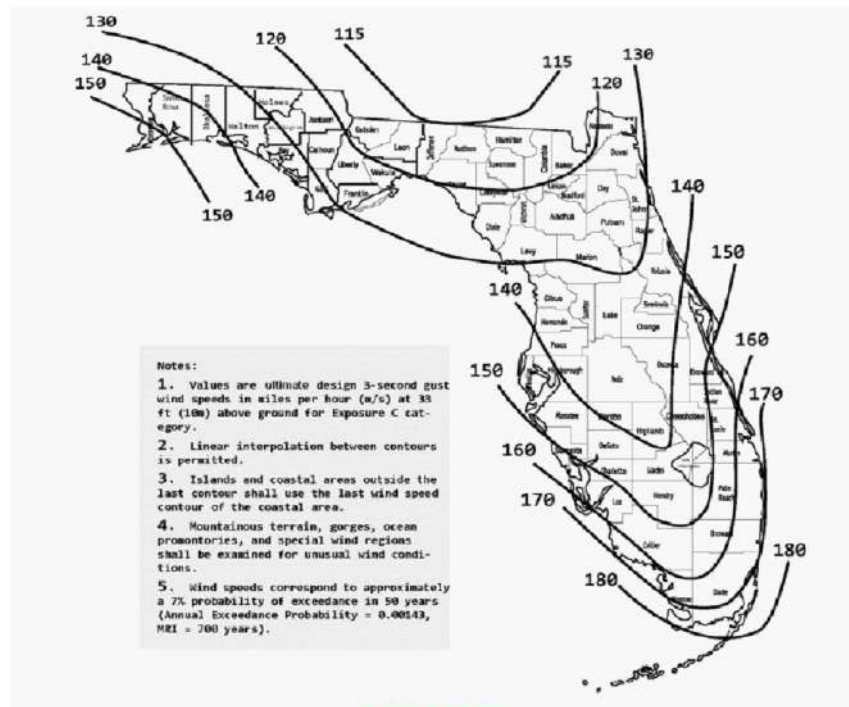
STRUCTURE CALCULATION

SHEET SIZE

**ANSI B**  
11" X 17"

SHEET NUMBER

**S-02.1**



**FIGURE 1609.3(1)**  
**ULTIMATE DESIGN WIND SPEEDS,  $V_{ULT}$ , FOR RISK CATEGORY II BUILDINGS AND OTHER STRUCTURES**

- Notes:
1. Values are ultimate design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10m) above ground for Exposure C category.
  2. Linear interpolation between contours is permitted.
  3. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
  4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
  5. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, REI = 700 years).

**WIND LOAD CALCULATIONS FOR MODULES INSTALLED ON ROOFS WITH A HEIGHT LESS THAN 60'**

SITE INFORMATION			
FBC VERSION	2020	RISK CATEGORY	II
MEAN ROOF HEIGHT (ft)	15.0	EXPOSURE CATEGORY	B
ROOF LENGTH (ft)	68.0	ROOF SLOPE	7 / 12
ROOF WIDTH (ft)	34.1	ROOF SLOPE (°)	30.3
PARAPET HEIGHT (ft)	0.0	ROOF TYPE	GABLE
MODULE LENGTH (in)	74	ULTIMATE WIND SPEED	120 mph
MODULE WIDTH (in)	41.10	NOMINAL WIND SPEED	93 mph
MODULE ORIENTATION	PORTRAIT	EXPOSURE FACTOR ( $C_e$ )	1.000
MODULE AREA (sq. ft)	21.12	TEMPERATURE FACTOR ( $C_t$ )	1.000
GROUND SNOW LOAD (psf)	0.0	IMPORTANCE FACTOR ( $I_s$ )	1.000
DEAD LOAD (psf)	3.0	SLOPE FACTOR ( $C_s$ )	0.910
SLOPED ROOF SNOWLOAD (psf)	0.0	$K_D$	0.850
EFFECTIVE WIND AREA (ft <sup>2</sup> )	21.1	$K_{ZT}$	1.000
GROUND ELEVATION (ft)	95.0	$K_e$	0.997
HVHZ	NO	$K_z$	0.575

DESIGN CALCULATIONS			
VELOCITY PRESSURE ( $q$ ) = $.00256 \cdot K_e \cdot K_{ZT} \cdot K_D \cdot V^2$			
VELOCITY PRESSURE (ASD) 10.8 psf			
WIDTH OF PRESSURE COEFFICIENT	34.1' * 10% = 3.41'	ZONE WIDTH A	4 FT
	15' * 40% = 6'	ZONE 2 WIDTH	N/A (FOR (°) < 7°)
		ZONE 3 WIDTH	N/A (FOR (°) < 7°)
EXTERNAL PRESSURE COEFFICIENT	ZONE 1	0.770	-1.475
	ZONE 1'	X	X
	ZONE 2e	0.770	-1.475
	ZONE 2n	0.770	-1.750
	ZONE 2r	0.770	-1.475
	ZONE 3e	0.770	-2.165
	ZONE 3r	0.770	-1.101
INTERNAL PRESSURE COEFFICIENT (+/-)	0		

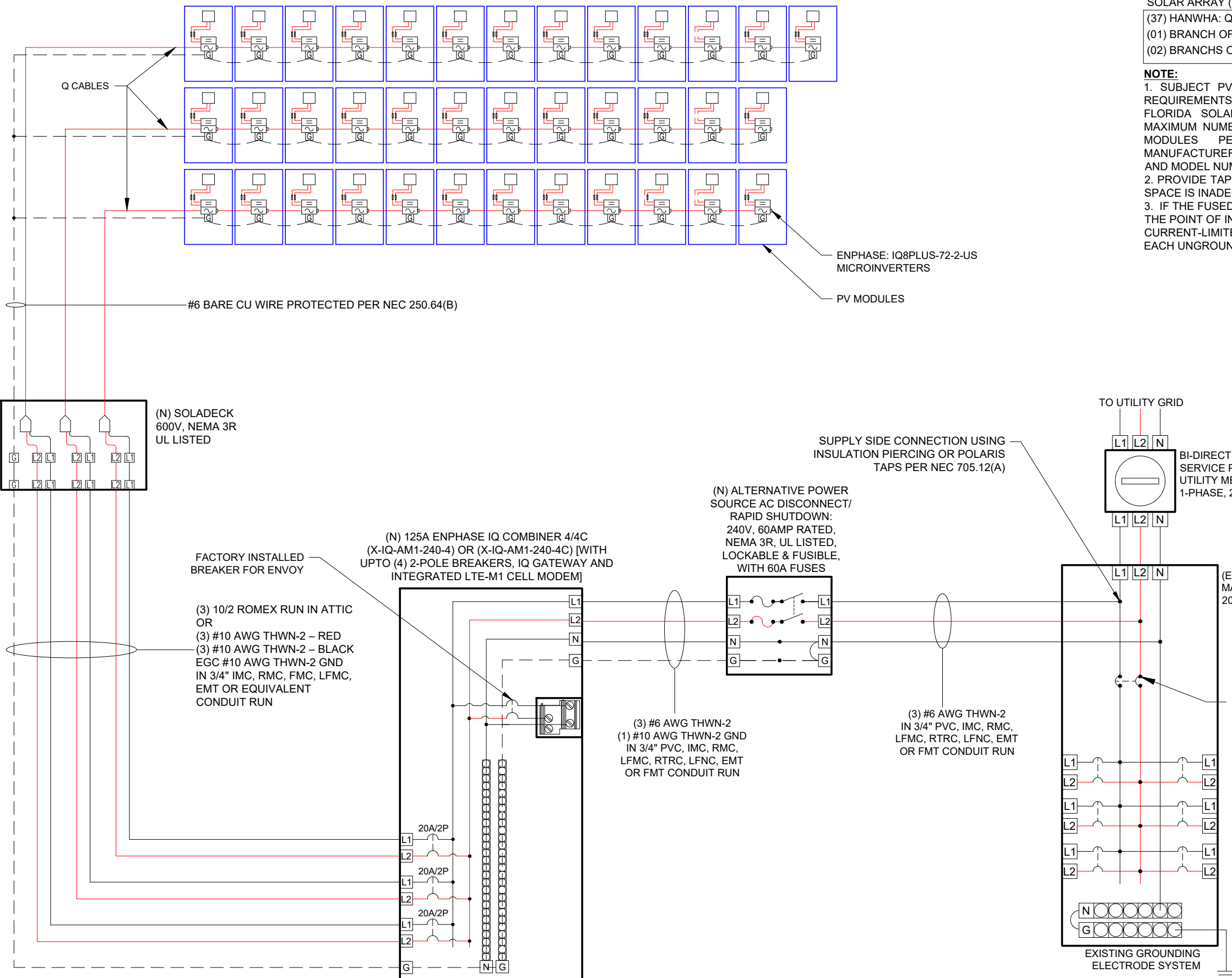
DESIGN PRESSURES					
ROOF ZONE	DOWN	UP			
1	16.0	-15.9	psf		
1'	X	X	psf		
2e	16.0	-15.9	psf	Module allowable uplift pressure	55 psf
2n	16.0	-18.8	psf	Module allowable down pressure	75 psf
2r	16.0	-15.9	psf		
3e	16.0	-23.3	psf		
3r	16.0	-11.9	psf		

ARRAY FACTORS			
ARRAY EDGE FACTOR (EXPOSED)	1.5	SOLAR PANEL PRESSURE	0.67012
ARRAY EDGE FACTOR (NON-EXPOSED)	1	EQUALIZATION FACTOR	

ADJUSTED DESIGN PRESSURES				
ROOF ZONE	DOWN	UP (Exposed)	UP (N. Exposed)	
1	16.0	-16.0	-16.0	psf
1'	X	X	X	psf
2e	16.0	-16.0	-16.0	psf
2n	16.0	-18.9	-16.0	psf
2r	16.0	-16.0	-16.0	psf
3e	16.0	-23.4	-16.0	psf
3r	16.0	-16.0	-16.0	psf

ATTACHMENTS USED		
ATTACHMENT MODEL	S-5 prolea	
ATTACHMENT STRENGTH	422	lbs

MAX DESIGN LOADS ALLOWABLE						
LIMIT MAX SPAN TO		N/A		in		
RAFTER/SEAM SPACING		9		in		
ROOF ZONE	DOWN	UP (Exposed)	UP (N. Exposed)	SPANS (E)	SPANS (N E)	
1	296.0	296.0	296.0	72 in	72 in	
1'	X	X	X	X in	X in	
2e	296.0	296.0	296.0	72 in	72 in	
2n	296.0	350.5	296.0	72 in	72 in	
2r	296.0	296.0	296.0	72 in	72 in	
3e	296.0	379.3	296.0	63 in	72 in	
3r	296.0	259.0	296.0	63 in	72 in	



SOLAR ARRAY (14.800 kW-DC STC)  
 (37) HANWHA: Q.PEAK DUO BLK ML-G10+ (400W) MODULES  
 (01) BRANCH OF 13 MODULES &  
 (02) BRANCHES OF 12 MODULES

**NOTE:**  
 1. SUBJECT PV SYSTEMS HAS BEEN DESIGNED TO MEET THE REQUIREMENTS OF THE NEC 2017, AND THOSE SET FORTH BY THE FLORIDA SOLAR ENERGY CENTER CERTIFICATION, INCLUDING MAXIMUM NUMBER OF MODULE STRINGS, MAXIMUM NUMBER OF MODULES PER STRING, MAXIMUM OUTPUT, MODULE MANUFACTURER AND MODEL NUMBER, INVERTER MANUFACTURER AND MODEL NUMBER, AS APPLICABLE.  
 2. PROVIDE TAP BOX IN COMPLIANCE WITH 312.8 IF PANEL GUTTER SPACE IS INADEQUATE.  
 3. IF THE FUSED AC DISCONNECT WIRE RUN EXCEEDS 10 FT FROM THE POINT OF INTERCONNECTION, CABLE LIMITERS OR CURRENT-LIMITED CIRCUIT BREAKERS MUST BE INSTALLED FOR EACH UNGROUNDED CONDUCTOR PER NEC 705.31.

ENPHASE: IQ8PLUS-72-2-US MICROINVERTERS  
 PV MODULES

#6 BARE CU WIRE PROTECTED PER NEC 250.64(B)

(N) SOLADECK 600V, NEMA 3R UL LISTED

SUPPLY SIDE CONNECTION USING INSULATION PIERCING OR POLARIS TAPS PER NEC 705.12(A)

(N) ALTERNATIVE POWER SOURCE AC DISCONNECT/ RAPID SHUTDOWN: 240V, 60AMP RATED, NEMA 3R, UL LISTED, LOCKABLE & FUSIBLE, WITH 60A FUSES

TO UTILITY GRID  
 BI-DIRECTIONAL SERVICE POINT AND UTILITY METERING 1-PHASE, 240V

FACTORY INSTALLED BREAKER FOR ENVOY

(N) 125A ENPHASE IQ COMBINER 4/4C (X-IQ-AM1-240-4) OR (X-IQ-AM1-240-4C) [WITH UPTO (4) 2-POLE BREAKERS, IQ GATEWAY AND INTEGRATED LTE-M1 CELL MODEM]

(3) 10/2 ROMEX RUN IN ATTIC OR  
 (3) #10 AWG THWN-2 - RED  
 (3) #10 AWG THWN-2 - BLACK  
 EGC #10 AWG THWN-2 GND IN 3/4" IMC, RMC, FMC, LFMC, EMT OR EQUIVALENT CONDUIT RUN

(3) #6 AWG THWN-2  
 (1) #10 AWG THWN-2 GND IN 3/4" PVC, IMC, RMC, LFMC, RTRC, LFNC, EMT OR FMT CONDUIT RUN

(3) #6 AWG THWN-2 IN 3/4" PVC, IMC, RMC, LFMC, RTRC, LFNC, EMT OR FMT CONDUIT RUN

(E) MAIN SERVICE DISCONNECT/ MAIN DISTRIBUTION PANEL, 200A RATED, 240V.

(E) MAIN BREAKER 200A/2P, 240V

EXISTING GROUNDING ELECTRODE SYSTEM

**1 | ELECTRICAL LINE DIAGRAM**  
 E-01 | SCALE: NTS



**CASTILLO ENGINEERING SERVICES, LLC**  
 COA # 28345  
 620 N. WYMORE ROAD, SUITE 250,  
 MAITLAND, FL 32751  
 TEL: (407) 289-2575  
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REVISIONS		
DESCRIPTION	DATE	REV

PROJECT INSTALLER



Digitally signed by: Ermocrates E Castillo  
 Date: 2022.08.03 13:43:22

PROJECT NAME

**HERNANDEZ RESIDENCE**  
 6021 SW STATE RD 247,  
 LAKE CITY FL 32024

SHEET NAME  
 ELECTRICAL LINE DIAGRAM

SHEET SIZE  
 ANSI B  
 11" X 17"

SHEET NUMBER  
**E-01**

# ELECTRICAL CALCULATION

MODULE MANUFACTURER	HANWHA
MODULE MODEL	Q PEAK DUO-G10+ 400
INVERTER MANUFACTURER	ENPHASE
INVERTER MODEL	ENPHASE IQ 6 PLUS
MODULES/BRANCH CIRCUIT 1	13
MODULES/BRANCH CIRCUIT 2	12
MODULES/BRANCH CIRCUIT 3	12
TOTAL ARRAY POWER (KW)	14.800
SYSTEM AC VOLTAGE	240V 1-PHASE

DESIGN TEMPERATURE	
MIN. AMBIENT TEMP. °F	32
MAX. AMBIENT TEMP. °F	117
CALCULATED MAX. V <sub>OC</sub>	49
CALCULATED MIN V <sub>MP</sub>	29
CONDUIT FILL	
NUMBER OF CONDUITS	1

AMPACITY CALCULATIONS											
CIRCUIT	MAX AMPS	1.25 x MAX AMPS	AWG	90 °C AMPACITY	AMBIENT TEMP °F	TEMP DERATE	CONDUIT FILL	FILL DERATE	DERATED AMPACITY	MAXIMUM CIRCUIT BREAKER	
CIRCUIT 1	15.7	19.6	#10	40	130	0.76	6	0.8	24.32	20 A	
CIRCUIT 2	14.5	18.1	#10	40	130	0.76	6	0.8	24.32	20 A	
CIRCUIT 3	14.5	18.2	#10	40	130	0.76	6	0.8	24.32	20 A	
AC COMBINER PANEL OUTPUT	44.80	56.0	#6	75	95	0.96	3	1	72	60 A	

MAXIMUM CIRCUIT VOLTAGE DROP	2%
------------------------------	----

VOLTAGE DROP CALCULATIONS					
CIRCUIT	AWG	CIRCULAR MILLS	I	V	MAX LENGTH
CIRCUIT 1	#10	10380	15.7	240	123 FEET
CIRCUIT 2	#10	10380	14.5	240	133 FEET
CIRCUIT 3	#10	10380	14.5	240	133 FEET
AC COMBINER PANEL OUTPUT	#6	26240	44.8	240	109 FEET

NOTES	
TEMP DERATE BASED ON NEC TABLE 310.15(B)(2)(A)	
CONDUIT FILL DERATE BASED ON NEC TABLE 310.15(B)(3)(A)	
MAXIMUM V <sub>OC</sub> CALCULATED USING MODULE MANUFACTURE TEMPERATURE COEFFICIENTS PER NEC 690.7(A)	
UNLESS OTHERWISE SPECIFIED, ALL WIRING MUST BE THHN OR THWN-2 COPPER	
ALL WIRE SIZES LISTED ARE THE MINIMUM ALLOWABLE	
<span style="background-color: #90EE90;"> </span> IN ANY CELL INDICATES THAT THE SYSTEM IS SAFE AND COMPLIES WITH NEC REQUIREMENTS	
<span style="background-color: #FF0000;"> </span> IN ANY CELL INDICATES A POTENTIALLY UNSAFE CONDITION	
<span style="background-color: #FFFF00;"> </span> INFORMATION INPUT BY SYSTEM DESIGNER	
<span style="background-color: #ADD8E6;"> </span> INFORMATION OBTAINED FROM MANUFACTURER DATASHEETS	

# ELECTRICAL NOTES

- ALL EQUIPMENT TO BE LISTED BY UL OR OTHER NRTL, AND LABELED FOR ITS APPLICATION.
- ALL CONDUCTORS SHALL BE COPPER, RATED FOR 600 V AND 90 DEGREE C WET ENVIRONMENT. THE TERMINALS ARE RATED FOR 75 DEGREE C.
- THE WIRES ARE SIZED ACCORDING TO NEC 110.14.
- WIRING, CONDUIT, AND RACEWAYS MOUNTED ON ROOFTOPS SHALL BE ROUTED DIRECTLY TO, AND LOCATED AS CLOSE AS POSSIBLE TO THE NEAREST RIDGE, HIP, OR VALLEY.
- WORKING CLEARANCES AROUND ALL NEW AND EXISTING ELECTRICAL EQUIPMENT SHALL COMPLY WITH NEC 110.26.
- DRAWINGS INDICATE THE GENERAL ARRANGEMENT OF SYSTEMS. CONTRACTOR SHALL FURNISH ALL NECESSARY OUTLETS, SUPPORTS, FITTINGS AND ACCESSORIES TO FULFILL APPLICABLE CODES AND STANDARDS.
- WHERE SIZES OF JUNCTION BOXES, RACEWAYS, AND CONDUITS ARE NOT SPECIFIED, THE CONTRACTOR SHALL SIZE THEM ACCORDINGLY.
- ALL WIRE TERMINATIONS SHALL BE APPROPRIATELY LABELED AND READILY VISIBLE.
- MODULE GROUNDING CLIPS TO BE INSTALLED BETWEEN MODULE FRAME AND MODULE SUPPORT RAIL, PER THE GROUNDING CLIP MANUFACTURER'S INSTRUCTION.
- MODULE SUPPORT RAIL TO BE BONDED TO CONTINUOUS COPPER G.E.C. VIA WEBB LUG OR ILSCO GBL-4DBT LAY-IN LUG.
- THE POLARITY OF THE GROUNDED CONDUCTORS IS NEGATIVE .
- UTILITY HAS 24-HR UNRESTRICTED ACCESS TO ALL PHOTOVOLTAIC SYSTEM COMPONENTS LOCATED AT THE SERVICE ENTRANCE.
- MODULES CONFORM TO AND ARE LISTED UNDER UL 1703.
- RACKING CONFORMS TO AND IS LISTED UNDER UL 2703.
- CONDUCTORS EXPOSED TO SUNLIGHT SHALL BE LISTED AS SUNLIGHT RESISTANT PER NEC ARTICLE 300.6 (C) (1) AND ARTICLE 310.10 (D).
- CONDUCTORS EXPOSED TO WET LOCATIONS SHALL BE SUITABLE FOR USE IN WET LOCATIONS PER NEC ARTICLE 310.10 (C).
- THIS SYSTEM IS EQUIPPED WITH RAPID SHUTDOWN OF PV CONDUCTORS IN COMPLIANCE WITH NEC 690.12.
- LABELING IN COMPLIANCE WITH NEC 690.12 AND 690.56(C) IS SHOWN ON SHEET E-03.
- ALL CONDUITS TO BE INSTALLED A MIN OF 7/8" ABOVE THE ROOF SURFACE.

MODULE PROPERTIES			
V <sub>OC</sub>	45.3	I <sub>SC</sub>	11.14
V <sub>MPP</sub>	37.13	I <sub>MP</sub>	10.77
TC V <sub>OC</sub>	-0.27%/°K	TC V <sub>MP</sub>	-0.35%/°K
F <sub>MP</sub>	400.0	NOCT	45 °C

INVERTER PROPERTIES	
OUTPUT VOLTAGE	240 L-L 1-PH
MAX INPUT DC VOLTAGE	60 V <sub>DC</sub>
OPERATING RANGE	16 - 60 V <sub>DC</sub>
MPPT VOLTAGE RANGE	29 - 45 V <sub>DC</sub>
START VOLTAGE	22 V <sub>DC</sub>
MAX INPUT POWER	440 W <sub>DC</sub>
CONTINUOUS AC POWER	290 VA

I ERMOCRATES CASTILLO PE# 52590 AN ENGINEER LICENSED PURSUANT TO CHAPTER 471, CERTIFY THAT THE PV ELECTRICAL SYSTEM AND ELECTRICAL COMPONENTS ARE DESIGNED AND APPROVED USING THE STANDARDS CONTAINED IN THE MOST RECENT VERSION OF THE FLORIDA BUILDING CODE. FBC 107, THE NEC 2017, AND THOSE SET FORTH BY THE FLORIDA SOLAR ENERGY CENTER CERTIFICATION.



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REVISIONS		
DESCRIPTION	DATE	REV

PROJECT INSTALLER



Digitally signed by: Ermocrates E Castillo  
 Date: 2022.08.03 13:43:22

PROJECT NAME

**HERNANDEZ RESIDENCE**  
 6021 SW STATE RD 247,  
 LAKE CITY FL 32024

SHEET NAME

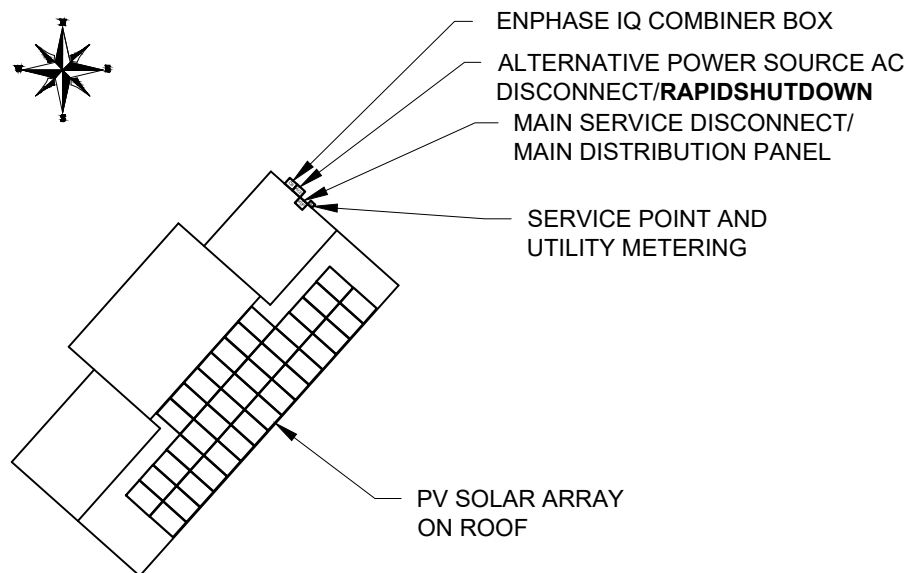
WIRING CALCULATIONS

SHEET SIZE  
**ANSI B**  
 11" X 17"

SHEET NUMBER  
**E-02**

# CAUTION!

POWER TO THIS BUILDING  
SUPPLIED FROM MULTIPLE SOURCES



6021 SW STATE RD 247, LAKE CITY FL 32024

LABEL LOCATION:  
MAIN SERVICE DISCONNECT / MAIN DISTRIBUTION PANEL, PV DISCONNECT  
LOCATED NO MORE THAN 3FT (1M) FROM THE SERVICE DISCONNECT  
(TEXT HEIGHT SHOULD BE A MINIMUM OF 3/8")  
PER CODE NEC 705.10

## PHOTOVOLTAIC SYSTEM AC DISCONNECT RATED AC OPERATING CURRENT 44.80 AMPS AC NOMINAL OPERATING VOLTAGE 240 VOLTS

LABEL LOCATION:  
AC DISCONNECT, POINT OF INTERCONNECTION  
(PER CODE: NEC690.54)

### WARNING: POWER SOURCE OUTPUT CONNECTION DO NOT RELOCATE THIS OVERCURRENT DEVICE

LABEL LOCATION:  
POINT OF INTERCONNECTION  
(PER CODE: NEC 705.12(B)(2)(3)(b))

DATA PER PANEL

NOMINAL OPERATING AC VOLTAGE -	240	V
NOMINAL OPERATING AC FREQUENCY-	60	Hz
MAXIMUM AC POWER-	349	VA
MAXIMUM AC CURRENT-	1.21	A
MAXIMUM OVERCURRENT DEVICE RATING FOR AC MODULE PROTECTION PER CIRCUIT-	20	A

LABEL LOCATION:  
COMBINER BOX  
(PER CODE: NEC690.52)

### RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

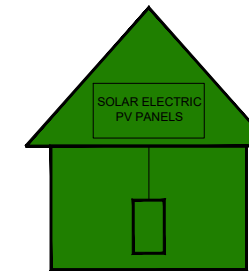
LABEL LOCATION:  
AC DISCONNECT  
(PER CODE: NEC690.56(C)(3))

## EMERGENCY RESPONDER THIS SOLAR PV SYSTEM IS EQUIPPED WITH RAPID SHUTDOWN.

TURN RAPID  
SHUTDOWN SWITCH  
TO THE "OFF" POSITION  
TO SHUT DOWN ENTIRE  
PV SYSTEM

- SECTIONS OF THE PV SYSTEM THAT  
ARE SHUT DOWN WHEN THE RAPID  
SHUTDOWN SWITCH IS OPERATED.

- SECTIONS OF THE PV SYSTEM THAT  
ARE NOT SHUT DOWN WHEN THE RAPID  
SHUTDOWN SWITCH IS OPERATED.



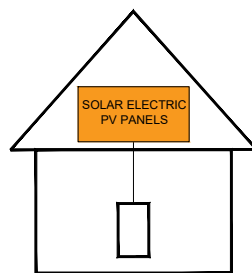
LABEL LOCATION:  
AC DISCONNECT  
(TEXT HEIGHT SHOULD BE A MINIMUM OF 3/8")  
(PER CODE: NFPA 1,11.12.2.1.1)

**SUN SMART AMERICA**  
EMERGENCY CONTACT:  
PH. NO. : (407) 904-0441

LABEL LOCATION:  
MAIN DISCONNECT  
(PER CODE: NFPA - 1, 11.12.2.1.5)

## 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



LABEL LOCATION:  
AC DISCONNECT, POINT OF INTERCONNECTION  
(PER CODE: NEC 690.56(C)(1)(a), IFC 1204.5.1)

### WARNING

**ELECTRIC SHOCK HAZARD**  
TERMINALS ON BOTH LINE AND  
LOAD SIDES MAY BE ENERGIZED  
IN THE OPEN POSITION

LABEL LOCATION:  
AC DISCONNECT, POINT OF INTERCONNECTION  
(PER CODE: NEC 690.13(B))

### WARNING DUAL POWER SOURCE SECOND SOURCE IS PHOTOVOLTAIC SYSTEM

LABEL LOCATION:  
POINT OF INTERCONNECTION  
(PER CODE: NEC 705.12(B)(2)(3)(b))

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#### REVISIONS

DESCRIPTION	DATE	REV

#### PROJECT INSTALLER



Signature with Digitally signed by:  
Ermocrates E Castillo  
Date: 2022.08.03  
13:43:23

#### PROJECT NAME

**HERNANDEZ RESIDENCE**  
6021 SW STATE RD 247,  
LAKE CITY FL 32024

#### SHEET NAME

SYSTEM LABELING

#### SHEET SIZE

ANSI B  
11" X 17"

#### SHEET NUMBER

E-03

#### ADHESIVE FASTENED SIGNS:

- THE LABEL SHALL BE VISIBLE, REFLECTIVE AND SUITABLE FOR THE ENVIRONMENT WHERE IT IS INSTALLED [NFPA 1, 11.12.2.1]
- WHERE REQUIRED ELSEWHERE IN THIS CODE, ALL FIELD APPLIED LABELS, WARNINGS, AND MARKINGS SHOULD COMPLY WITH ANSI Z535.4 [NEC 110.21(B) FIELD MARKING].
- ADHESIVE FASTENED SIGNS MAY BE ACCEPTABLE IF PROPERLY ADHERED. VINYL SIGNS SHALL BE WEATHER RESISTANT [IFC 605.11.1.3]



powered by  
**Q.ANTUM DUO Z**

# Q.PEAK DUO BLK ML-G10+ 385-405

ENDURING HIGH  
PERFORMANCE



- BREAKING THE 20% EFFICIENCY BARRIER**  
Q.ANTUM DUO Z Technology with zero gap cell layout boosts module efficiency up to 20.9%.
- THE MOST THOROUGH TESTING PROGRAMME IN THE INDUSTRY**  
Q CELLS is the first solar module manufacturer to pass the most comprehensive quality programme in the industry: The new "Quality Controlled PV" of the independent certification institute TÜV Rheinland.
- INNOVATIVE ALL-WEATHER TECHNOLOGY**  
Optimal yields, whatever the weather with excellent low-light and temperature behavior.
- ENDURING HIGH PERFORMANCE**  
Long-term yield security with Anti LID Technology, Anti PID Technology<sup>1</sup>, Hot-Spot Protect and Traceable Quality Tra.Q™.
- EXTREME WEATHER RATING**  
High-tech aluminum alloy frame, certified for high snow (5400Pa) and wind loads (4000Pa).
- A RELIABLE INVESTMENT**  
Inclusive 25-year product warranty and 25-year linear performance warranty<sup>2</sup>.

<sup>1</sup> APT test conditions according to IEC/TS 62804-1:2015, method A (-1500V, 96h)  
<sup>2</sup> See data sheet on rear for further information.

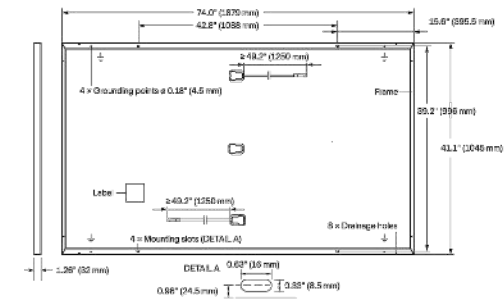
**THE IDEAL SOLUTION FOR:**  
Rooftop arrays on residential buildings

Engineered in Germany



### MECHANICAL SPECIFICATION

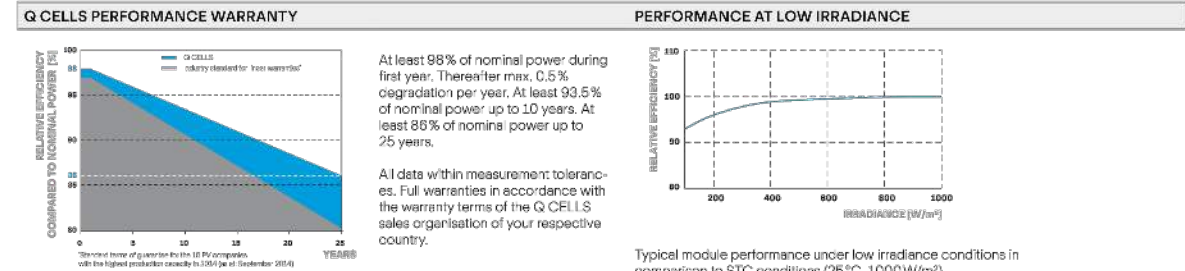
Format	74.0 in × 41.1 in × 1.26 in (including frame) (1879 mm × 1045 mm × 32 mm)
Weight	48.5 lbs (22.0 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	Composite film
Frame	Black anodized aluminum
Cell	6 × 22 monocrystalline Q.ANTUM solar half cells
Junction Box	2.09-3.98 in × 1.26-2.36 in × 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), IP67, with bypass diodes
Cable	4 mm <sup>2</sup> Solar cable; (+) ≥ 49.2 in (1250 mm), (-) ≥ 49.2 in (1250 mm)
Connector	Stäubli MC4; IP68



### ELECTRICAL CHARACTERISTICS

POWER CLASS	385	390	395	400	405	
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC <sup>1</sup> (POWER TOLERANCE +5W / -0W)						
Power at MPP <sup>1</sup>	P <sub>MPP</sub> [W]	385	390	395	400	405
Short Circuit Current <sup>1</sup>	I <sub>SC</sub> [A]	11.04	11.07	11.10	11.14	11.17
Open Circuit Voltage <sup>1</sup>	V <sub>OC</sub> [V]	45.19	45.23	45.27	45.30	45.34
Current at MPP	I <sub>MPP</sub> [A]	10.59	10.65	10.71	10.77	10.83
Voltage at MPP	V <sub>MPP</sub> [V]	36.36	36.62	36.88	37.13	37.39
Efficiency <sup>1</sup>	η [%]	≥19.6	≥19.9	≥20.1	≥20.4	≥20.6
MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT <sup>2</sup>						
Power at MPP	P <sub>MPP</sub> [W]	289.8	292.6	296.3	300.1	303.8
Short Circuit Current	I <sub>SC</sub> [A]	8.90	8.92	8.95	8.97	9.00
Open Circuit Voltage	V <sub>OC</sub> [V]	42.62	42.65	42.69	42.72	42.76
Current at MPP	I <sub>MPP</sub> [A]	8.35	8.41	8.46	8.51	8.57
Voltage at MPP	V <sub>MPP</sub> [V]	34.59	34.81	35.03	35.25	35.46

<sup>1</sup>Measurement tolerances P<sub>MPP</sub> ±3%; I<sub>SC</sub> ±5% at STC: 1000 W/m<sup>2</sup>, 25±2°C, AM 1.5 according to IEC 60904-3 • 800 W/m<sup>2</sup>, NMOT, spectrum AM 1.5



### TEMPERATURE COEFFICIENTS

Temperature Coefficient of I <sub>SC</sub>	α [%/K]	+0.04	Temperature Coefficient of V <sub>OC</sub>	β [%/K]	-0.27
Temperature Coefficient of P <sub>MPP</sub>	γ [%/K]	-0.34	Nominal Module Operating Temperature	NMOT [°F]	109±5.4 (43±3°C)

### PROPERTIES FOR SYSTEM DESIGN

Maximum System Voltage V <sub>sys</sub> [V]	1000 (IEC)/1000 (UL)	PV module classification	Class II
Maximum Series Fuse Rating [A DC]	20	Fire Rating based on ANSI / UL 61730	TYPE 2
Max. Design Load, Push / Pull <sup>1</sup> [lbs/ft <sup>2</sup> ]	75 (3600Pa) / 55 (2660Pa)	Permitted Module Temperature on Continuous Duty	-40°F up to +185°F (-40°C up to +85°C)
Max. Test Load, Push / Pull <sup>2</sup> [lbs/ft <sup>2</sup> ]	113 (5400Pa) / 84 (4000Pa)		

<sup>1</sup> See Installation Manual

### QUALIFICATIONS AND CERTIFICATES

UL 61730, CE-compliant, Quality Controlled PV - TÜV Rheinland, IEC 61215-2016, IEC 61730-2016, U.S. Patent No. 9,893,215 (solar cells), GCPV Certification ongoing.

### PACKAGING INFORMATION

Horizontal packaging	76.4 in 1940 mm	43.3 in 1100 mm	48.0 in 1220 mm	1656 lbs 751 kg	24 pallets	24 pallets	32 modules
----------------------	--------------------	--------------------	--------------------	--------------------	------------	------------	------------

**Note:** Installation instructions must be followed. See the installation and operating manual or contact our technical service department for further information on approved installation end use of this product.

Hanwha Q CELLS America Inc.  
400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | TEL: +1 949 748 59 96 | EMAIL: inquiry@us.q-cells.com | WEB: www.q-cells.us



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### REVISIONS

DESCRIPTION	DATE	REV

PROJECT INSTALLER



Digitally signed by:  
Ermocrates E Castillo  
Date: 2022.08.03 13:43:23

PROJECT NAME

**HERNANDEZ RESIDENCE**  
6021 SW STATE RD 247,  
LAKE CITY FL 32024

SHEET NAME  
DATA SHEET

SHEET SIZE  
ANSI B  
11" X 17"

SHEET NUMBER  
DS-01

Specifications subject to technical changes © Q CELLS Q.PEAK DUO BLK ML-G10+ 385-405\_2022-08\_Rev01\_NA



## IQ8 and IQ8+ Microinverters

Our newest IQ8 Microinverters are the industry's first microgrid-forming, software-defined microinverters with split-phase power conversion capability to convert DC power to AC power efficiently. The brain of the semiconductor-based microinverter is our proprietary application-specific integrated circuit (ASIC) which enables the microinverter to operate in grid-tied or off-grid modes. This chip is built in advanced 55nm technology with high speed digital logic and has super-fast response times to changing loads and grid events, alleviating constraints on battery sizing for home energy systems.



Part of the Enphase Energy System, IQ8 Series Microinverters integrate with the Enphase IQ Battery, Enphase IQ Gateway, and the Enphase App monitoring and analysis software.



IQ8 Series Microinverters redefine reliability standards with more than one million cumulative hours of power-on testing, enabling an industry-leading limited warranty of up to 25 years.



Connect PV modules quickly and easily to IQ8 Series Microinverters using the included Q-DCC-2 adapter cable with plug-n-play MC4 connectors.



IQ8 Series Microinverters are UL Listed as PV Rapid Shut Down Equipment and conform with various regulations, when installed according to manufacturer's instructions.

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IQ8SP-DS-0002-01-EN-US-2021-10-19

### Easy to install

- Lightweight and compact with plug-n-play connectors
- Power Line Communication (PLC) between components
- Faster installation with simple two-wire cabling

### High productivity and reliability

- Produce power even when the grid is down
- More than one million cumulative hours of testing
- Class II double-insulated enclosure
- Optimized for the latest high-powered PV modules

### Microgrid-forming

- Complies with the latest advanced grid support
- Remote automatic updates for the latest grid requirements
- Configurable to support a wide range of grid profiles
- Meets CA Rule 21 (UL 1741-SA) requirements

## IQ8 and IQ8+ Microinverters

INPUT DATA [DC]		IQ8-60-2-US	IQ8PLUS-72-2-US
Commonly used module pairings <sup>1</sup>	W	235 – 350	235 – 440
Module compatibility		60-cell/120 half-cell	60-cell/120 half-cell and 72-cell/144 half-cell
MPPT voltage range	V	27 – 37	29 – 45
Operating range	V	25 – 48	25 – 58
Min/max start voltage	V	30 / 48	30 / 58
Max input DC voltage	V	50	60
Max DC current <sup>2</sup> [module Isc]	A		15
Overvoltage class DC port			II
DC port backfeed current	mA		0
PV array configuration		1x1 Ungrounded array; No additional DC side protection required; AC side protection requires max 20A per branch circuit	
OUTPUT DATA [AC]		IQ8-60-2-US	IQ8PLUS-72-2-US
Peak output power	VA	245	300
Max continuous output power	VA	240	290
Nominal (L-L) voltage/range <sup>3</sup>	V	240 / 211 – 264	
Max continuous output current	A	1.0	1.21
Nominal frequency	Hz	60	
Extended frequency range	Hz	50 – 68	
Max units per 20 A (L-L) branch circuit <sup>4</sup>		16	13
Total harmonic distortion		<5%	
Overvoltage class AC port		III	
AC port backfeed current	mA	30	
Power factor setting		1.0	
Grid-tied power factor (adjustable)		0.85 leading – 0.85 lagging	
Peak efficiency	%	97.5	97.6
CEC weighted efficiency	%	97	97
Night-time power consumption	mW	60	
MECHANICAL DATA			
Ambient temperature range		-40°C to +60°C (-40°F to +140°F)	
Relative humidity range		4% to 100% (condensing)	
DC Connector type		MC4	
Dimensions (HxWxD)		212 mm (8.3") x 175 mm (6.9") x 30.2 mm (1.2")	
Weight		1.08 kg (2.38 lbs)	
Cooling		Natural convection – no fans	
Approved for wet locations		Yes	
Acoustic noise at 1 m		<60 dBA	
Pollution degree		PD3	
Enclosure		Class II double-insulated, corrosion resistant polymeric enclosure	
Environ. category / UV exposure rating		NEMA Type 6 / outdoor	
COMPLIANCE			
Certifications		CA Rule 21 (UL 1741-SA), UL 62109-1, UL1741/IEEE1547, FCC Part 15 Class B, ICES-0003 Class B, CAN/CSA-C22.2 NO. 107.1-01	
		This product is UL Listed as PV Rapid Shut Down Equipment and conforms with NEC 2014, NEC 2017, and NEC 2020 section 690.12 and C22.1-2018 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according to manufacturer's instructions.	

(1) No enforced DC/AC ratio. See the compatibility calculator at <https://link.enphase.com/module-compatibility> (2) Maximum continuous input DC current is 10.6A (3) Nominal voltage range can be extended beyond nominal if required by the utility. (4) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.

IQ8SP-DS-0002-01-EN-US-2021-10-19

REVISIONS		
DESCRIPTION	DATE	REV

### PROJECT INSTALLER



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### PROJECT NAME

**HERNANDEZ RESIDENCE**  
6021 SW STATE RD 247,  
LAKE CITY FL 32024

SHEET NAME  
DATA SHEET

SHEET SIZE  
ANSI B  
11" X 17"

SHEET NUMBER  
DS-02

# Enphase IQ Combiner 4/4C

X-IQ-AM1-240-4  
X-IQ-AM1-240-4C



X-IQ-AM1-240-4C

X-IQ-AM1-240-4



To learn more about Enphase offerings, visit [enphase.com](http://enphase.com)

The **Enphase IQ Combiner 4/4C** with Enphase IQ Gateway and integrated LTE-M1 cell modem (included only with IQ Combiner 4C) consolidates interconnection equipment into a single enclosure and streamlines IQ microinverters and storage installations by providing a consistent, pre-wired solution for residential applications. It offers up to four 2-pole input circuits and Eaton BR series busbar assembly.

### Smart

- Includes IQ Gateway for communication and control
- Includes Enphase Mobile Connect cellular modem (CELLMODEM-M1-06-SP-05), included only with IQ Combiner 4C
- Includes solar shield to match Enphase IQ Battery aesthetics and deflect heat
- Flexible networking supports Wi-Fi, Ethernet, or cellular
- Optional AC receptacle available for PLC bridge
- Provides production metering and consumption monitoring

### Simple

- Centered mounting brackets support single stud mounting
- Supports bottom, back and side conduit entry
- Up to four 2-pole branch circuits for 240 VAC plug-in breakers (not included)
- 80A total PV or storage branch circuits

### Reliable

- Durable NRTL-certified NEMA type 3R enclosure
- Five-year limited warranty
- Two years labor reimbursement program coverage included for both the IQ Combiner SKU's
- UL listed



## Enphase IQ Combiner 4/4C

MODEL NUMBER	
IQ Combiner 4 (X-IQ-AM1-240-4)	IQ Combiner 4 with Enphase IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and consumption monitoring (+/- 2.5%). Includes a silver solar shield to match the IQ Battery system and IQ System Controller 2 and to deflect heat.
IQ Combiner 4C (X-IQ-AM1-240-4C)	IQ Combiner 4C with Enphase IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and consumption monitoring (+/- 2.5%). Includes Enphase Mobile Connect cellular modem (CELLMODEM-M1-06-SP-05), a plug-and-play industrial-grade cell modem for systems up to 60 microinverters. (Available in the US, Canada, Mexico, Puerto Rico, and the US Virgin Islands, where there is adequate cellular service in the installation area.) Includes a silver solar shield to match the IQ Battery and IQ System Controller and to deflect heat.
ACCESSORIES AND REPLACEMENT PARTS (not included, order separately)	
Ensemble Communications Kit COMMS-CELLMODEM-M1-06 CELLMODEM-M1-06-SP-05 CELLMODEM-M1-06-AT-05	- Includes COMMS-KIT-01 and CELLMODEM-M1-06-SP-05 with 5-year Sprint data plan for Ensemble sites - 4G based LTE-M1 cellular modem with 5-year Sprint data plan - 4G based LTE-M1 cellular modem with 5-year AT&T data plan
Circuit Breakers BRK-10A-2-240V BRK-15A-2-240V BRK-20A-2P-240V BRK-15A-2P-240V-B BRK-20A-2P-240V-B	Supports Eaton BR210, BR215, BR220, BR230, BR240, BR250, and BR260 circuit breakers. Circuit breaker, 2 pole, 10A, Eaton BR210 Circuit breaker, 2 pole, 15A, Eaton BR215 Circuit breaker, 2 pole, 20A, Eaton BR220 Circuit breaker, 2 pole, 15A, Eaton BR215B with hold down kit support Circuit breaker, 2 pole, 20A, Eaton BR220B with hold down kit support
EPLC-01	Power line carrier (communication bridge pair), quantity - one pair
XA-SOLARSHIELD-ES	Replacement solar shield for IQ Combiner 4/4C
XA-PLUG-120-3	Accessory receptacle for Power Line Carrier in IQ Combiner 4/4C (required for EPLC-01)
XA-ENV-PCBA-3	Replacement IQ Gateway printed circuit board (PCB) for Combiner 4/4C
X-IQ-NA-HD-125A	Hold down kit for Eaton circuit breaker with screws.
ELECTRICAL SPECIFICATIONS	
Rating	Continuous duty
System voltage	120/240 VAC, 60 Hz
Eaton BR series busbar rating	125 A
Max. continuous current rating	65 A
Max. continuous current rating (input from PV/storage)	64 A
Max. fuse/circuit rating (output)	90 A
Branch circuits (solar and/or storage)	Up to four 2-pole Eaton BR series Distributed Generation (DG) breakers only (not included)
Max. total branch circuit breaker rating (input)	80A of distributed generation / 95A with IQ Gateway breaker included
Production metering CT	200 A solid core pre-installed and wired to IQ Gateway
Consumption monitoring CT (CT-200-SPLIT)	A pair of 200 A split core current transformers
MECHANICAL DATA	
Dimensions (WxHxD)	37.5 x 49.5 x 16.8 cm (14.75" x 19.5" x 6.63"). Height is 21.06" (53.5 cm) with mounting brackets.
Weight	7.5 kg (16.5 lbs)
Ambient temperature range	-40° C to +46° C (-40° to 115° F)
Cooling	Natural convection, plus heat shield
Enclosure environmental rating	Outdoor, NRTL-certified, NEMA type 3R, polycarbonate construction
Wire sizes	• 20 A to 50 A breaker inputs: 14 to 4 AWG copper conductors • 60 A breaker branch input: 4 to 1/0 AWG copper conductors • Main lug combined output: 10 to 2/0 AWG copper conductors • Neutral and ground: 14 to 1/0 copper conductors Always follow local code requirements for conductor sizing.
Altitude	To 2000 meters (6,560 feet)
INTERNET CONNECTION OPTIONS	
Integrated Wi-Fi	802.11b/g/n
Cellular	CELLMODEM-M1-06-SP-05, CELLMODEM-M1-06-AT-05 (4G based LTE-M1 cellular modem). Note that an Enphase Mobile Connect cellular modem is required for all Ensemble installations.
Ethernet	Optional, 802.3, Cat5E (or Cat 6) UTP Ethernet cable (not included)
COMPLIANCE	
Compliance, IQ Combiner	UL 1741, CAN/CSA C22.2 No. 107.1, 47 CFR, Part 15, Class B, ICES 003 Production metering: ANSI C12.20 accuracy class 0.5 (PV production) Consumption metering: accuracy class 2.5
Compliance, IQ Gateway	UL 60601-1/CANCSA 22.2 No. 61010-1

To learn more about Enphase offerings, visit [enphase.com](http://enphase.com)

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REVISIONS		
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### PROJECT INSTALLER



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### PROJECT NAME

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6021 SW STATE RD 247,  
LAKE CITY FL 32024

SHEET NAME  
DATA SHEET

SHEET SIZE  
ANSI B  
11" X 17"

SHEET NUMBER  
DS-03



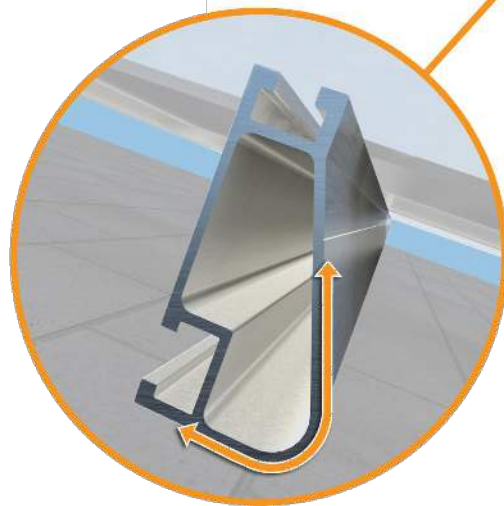
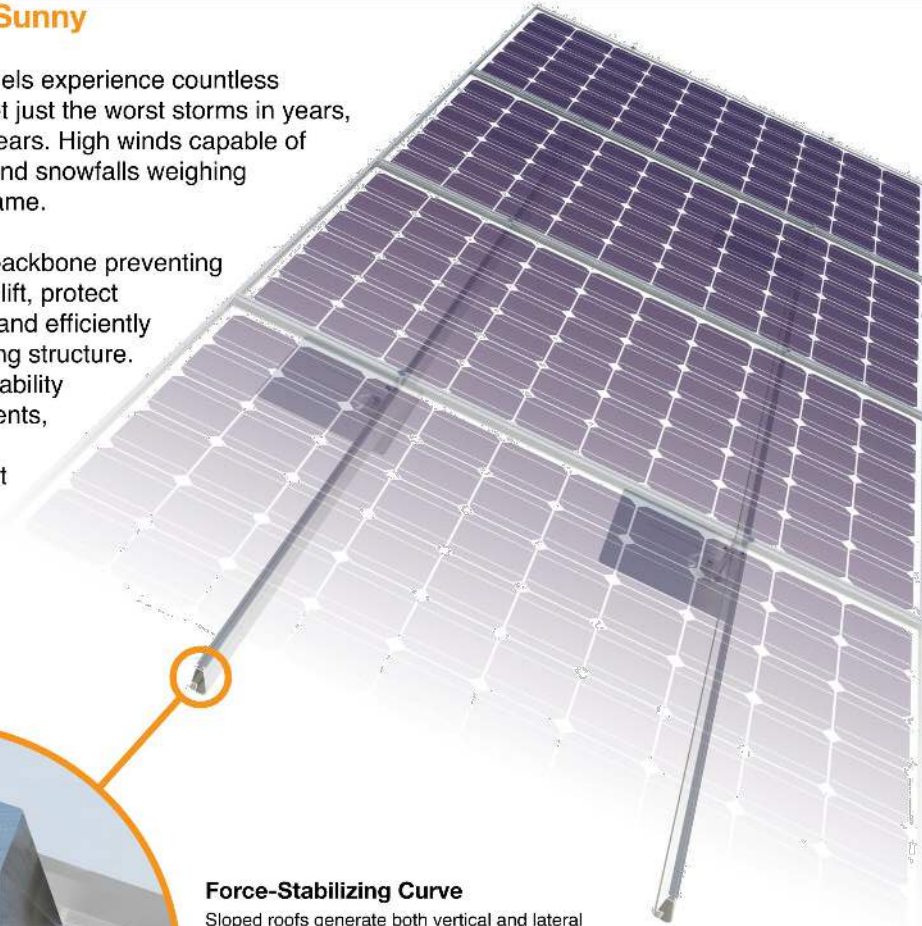
Tech Brief

## XR Rail Family

### Solar Is Not Always Sunny

Over their lifetime, solar panels experience countless extreme weather events. Not just the worst storms in years, but the worst storms in 40 years. High winds capable of ripping panels from a roof, and snowfalls weighing enough to buckle a panel frame.

XR Rails are the structural backbone preventing these results. They resist uplift, protect against buckling and safely and efficiently transfer loads into the building structure. Their superior spanning capability requires fewer roof attachments, reducing the number of roof penetrations and the amount of installation time.



#### Force-Stabilizing Curve

Sloped roofs generate both vertical and lateral forces on mounting rails which can cause them to bend and twist. The curved shape of XR Rails is specially designed to increase strength in both directions while resisting the twisting. This unique feature ensures greater security during extreme weather and a longer system lifetime.

#### Compatible with Flat & Pitched Roofs



XR Rails are compatible with FlashFoot and other pitched roof attachments.



IronRidge offers a range of tilt leg options for flat roof mounting applications.

#### Corrosion-Resistant Materials

All XR Rails are made of 6000-series aluminum alloy, then protected with an anodized finish. Anodizing prevents surface and structural corrosion, while also providing a more attractive appearance.



## XR Rail Family

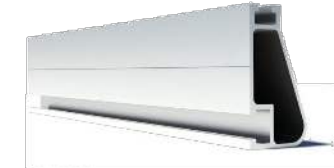
The XR Rail Family offers the strength of a curved rail in three targeted sizes. Each size supports specific design loads, while minimizing material costs. Depending on your location, there is an XR Rail to match.



**XR10**

XR10 is a sleek, low-profile mounting rail, designed for regions with light or no snow. It achieves spans up to 6 feet, while remaining light and economical.

- 6' spanning capability
- Moderate load capability
- Clear & black anodized finish
- Internal splices available



**XR100**

XR100 is the ultimate residential mounting rail. It supports a range of wind and snow conditions, while also maximizing spans up to 10 feet.

- 10' spanning capability
- Heavy load capability
- Clear & black anodized finish
- Internal splices available



**XR1000**

XR1000 is a heavyweight among solar mounting rails. It's built to handle extreme climates and spans up to 12 feet for commercial applications.

- 12' spanning capability
- Extreme load capability
- Clear anodized finish
- Internal splices available

## Rail Selection

The table below was prepared in compliance with applicable engineering codes and standards.\* Values are based on the following criteria: ASCE 7-16, Gable Roof Flush Mount, Roof Zones 1 & 2e, Exposure B, Roof Slope of 8 to 20 degrees and Mean Building Height of 30 ft. Visit IronRidge.com for detailed certification letters.

Load		Rail Span					
Snow (PSF)	Wind (MPH)	4'	5' 4"	6'	8'	10'	12'
None	90						
	120						
	140	XR10		XR100		XR1000	
	160						
20	90						
	120						
	140						
	160						
30	90						
	160						
40	90						
	160						
80	160						
120	160						

\*Table is meant to be a simplified span chart for conveying general rail capabilities. Use approved certification letters for actual design guidance.

Tech Brief



CASTILLO ENGINEERING SERVICES, LLC  
COA # 28345  
620 N. WYMORE ROAD, SUITE 250,  
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6021 SW STATE RD 247,  
LAKE CITY FL 32024

SHEET NAME

DATA SHEET

SHEET SIZE

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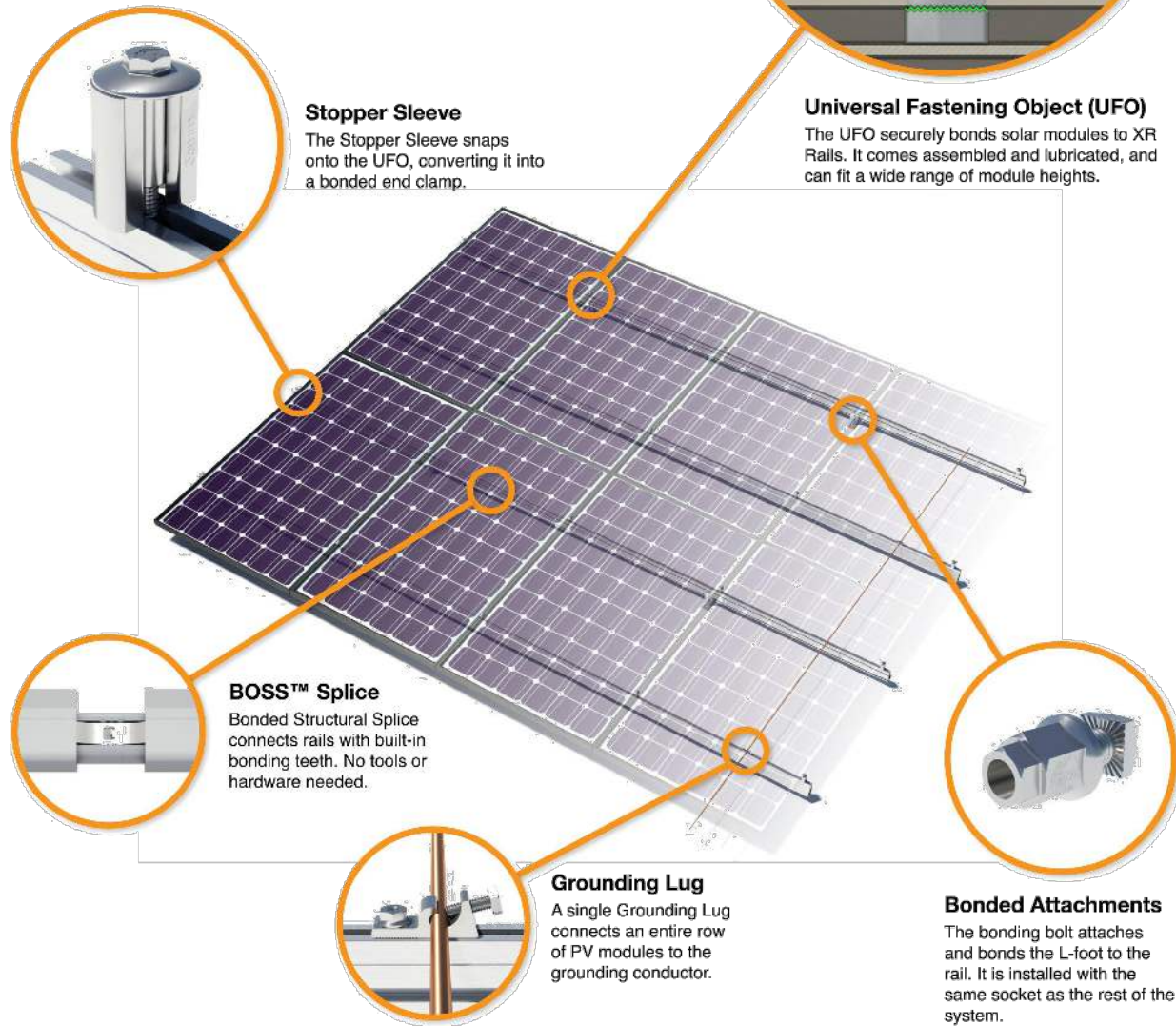
SHEET NUMBER

DS-04

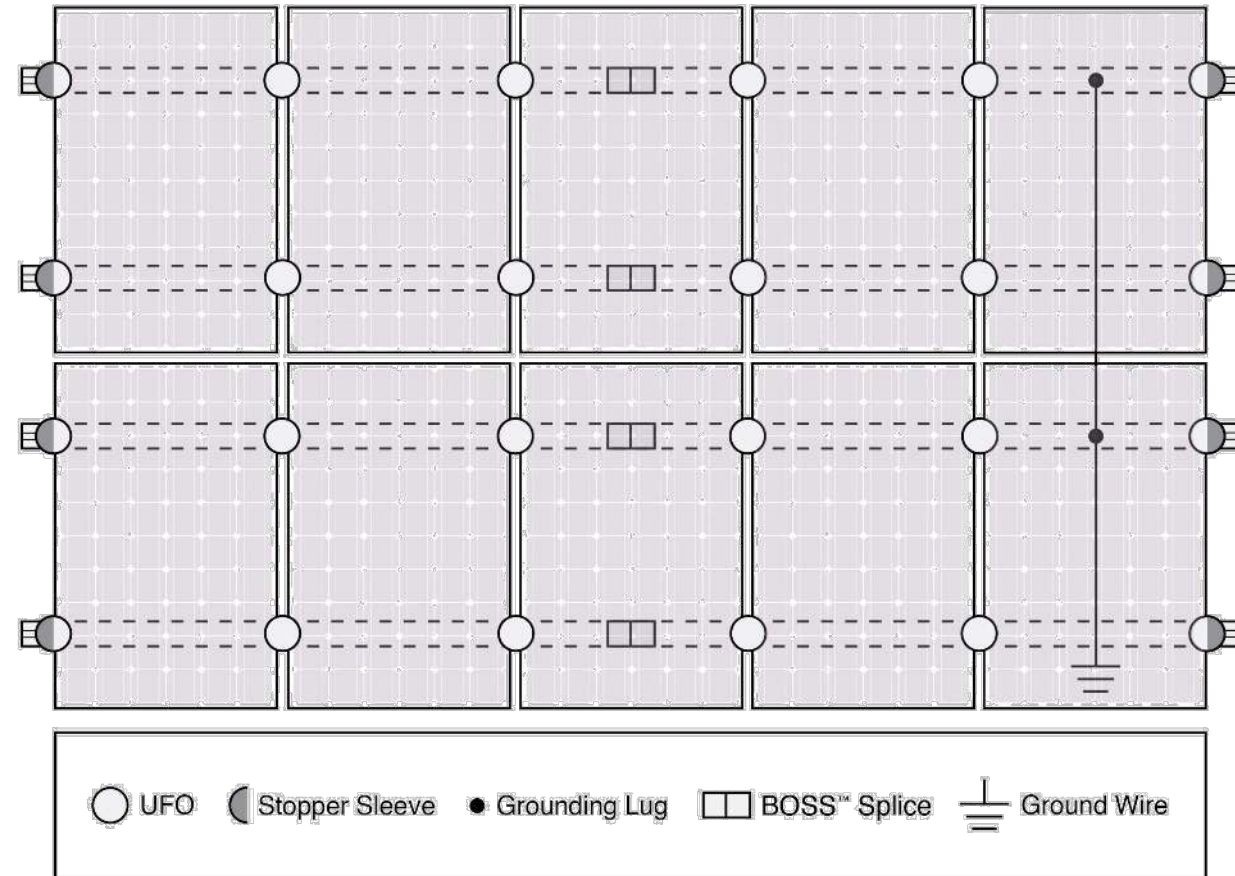
## Simplified Grounding for Every Application

The UFO family of components eliminates the need for separate grounding hardware by bonding solar modules directly to IronRidge XR Rails. All system types that feature the UFO family—Flush Mount, Tilt Mount and Ground Mount—are fully listed to the UL 2703 standard.

UFO hardware forms secure electrical bonds with both the module and the rail, resulting in many parallel grounding paths throughout the system. This leads to safer and more reliable installations.



## System Diagram



Approved Enphase microinverters can provide equipment grounding of IronRidge systems, eliminating the need for grounding lugs and field installed equipment ground conductors (EGC). A minimum of two microinverters mounted to the same rail and connected to the same Engage cable is required. Refer to installation manuals for additional details.

## UL Certification

The IronRidge Flush Mount, Tilt Mount, and Ground Mount Systems have been listed to UL 2703 by Intertek Group plc.

UL 2703 is the standard for evaluating solar mounting systems. It ensures these devices will maintain strong electrical and mechanical connections over an extended period of time in extreme outdoor environments.

[Go to IronRidge.com/UFO](http://Go to IronRidge.com/UFO)

Feature	Cross-System Compatibility		
	Flush Mount	Tilt Mount	Ground Mount
<b>XR Rails</b>	✓	✓	XR1000 Only
<b>UFO/Stopper</b>	✓	✓	✓
<b>BOSS™ Splice</b>	✓	✓	N/A
<b>Grounding Lugs</b>	1 per Row	1 per Row	1 per Array
<b>Microinverters &amp; Power Optimizers</b>	Compatible with most MLPE manufacturers. Refer to system installation manual.		
<b>Fire Rating</b>	Class A	Class A	N/A
<b>Modules</b>	Tested or Evaluated with over 400 Framed Modules Refer to installation manuals for a detailed list.		

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DATA SHEET

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ANSI B  
11" X 17"

SHEET NUMBER

DS-05

# S-5!<sup>®</sup>

## The Right Way!<sup>™</sup>

**NEW**

**NOW AVAILABLE  
IN ALUMINUM**

ProteaBracket<sup>™</sup>

### ProteaBracket<sup>™</sup>

A versatile bracket for mounting solar PV to trapezoidal roof profiles

ProteaBracket<sup>™</sup> is now made in aluminum. Still the most versatile trapezoidal metal roof attachment solution on the market, the S-5! ProteaBracket just got better!

The bracket features an adjustable attachment base and module attachment options to accommodate different roof profile dimensions and mounting options.

Our pre-applied EPDM gasket with peel and stick adhesive makes installation a snap, ensuring accurate and secure placement the first time.

With no messy sealants, faster installation, and a weather-proof fit, ProteaBracket offers you the most versatile solar attachment solution available.

ProteaBracket\* can be used for rail mounting or "direct-attach" with S-5! PVKIT<sup>™</sup>

### Features and Benefits

- 34% lighter - saves on shipping
- Stronger L-Foot<sup>™</sup>
- Load-tested for engineered application
- Corrosion-resistant materials
- Adjustable - Fits rib profiles up to 3"
- Peel-and-Stick prevents accidental shifting during installation
- Fully pre-assembled
- 25-year warranty\*

888-825-3432 | www.S-5.com | 

\*See www.S-5.com for details.

\*When ProteaBracket is used in conjunction with the S-5! PVKIT, an additional nut is required during installation.

The right way to attach solar PV to trapezoidal roof profiles!



# S-5!<sup>®</sup>

## The Right Way!<sup>™</sup>

ProteaBracket<sup>™</sup> is the perfect solar attachment solution for most trapezoidal rib, exposed-fastened metal roof profiles!

ProteaBracket<sup>™</sup> is compatible with common metal roofing materials and comes with a pre-applied EPDM gasket on the base.

**Note:** All four pre-punched holes must be used to achieve tested strength. Fasteners are provided.

For design assistance, ask your distributor, or visit [www.S-5.com](http://www.S-5.com) for the independent lab test data that can be used for load-critical designs and applications. Also, please visit our website for more information including metallurgical compatibilities and specifications.

S-5!<sup>®</sup> holding strength is unmatched in the industry.

### Multiple Attachment Options:



Side Mount Rail

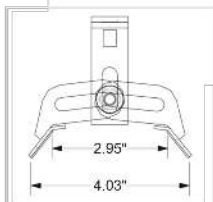
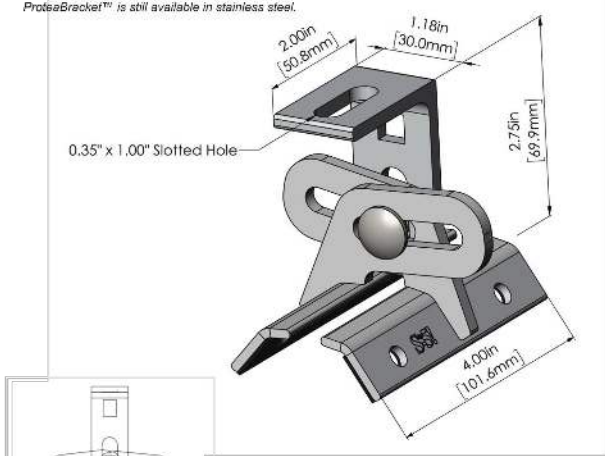


Bottom Mount Rail



w/ S-5! PVKIT<sup>™</sup> (rail-less)

### ProteaBracket<sup>™</sup>



ProteaBracket fits profiles up to 3 inches

**INSTALLATION:** No surface preparation needed. (1) Wipe away excess oil and debris. (2) Peel off adhesive release paper. (3) Align and mount bracket directly onto crown of panel. (4) Secure ProteaBracket through pre-punched holes, using piercing-point S-5! screws.



ProteaBracket<sup>™</sup> and the S-5! PVKIT<sup>™</sup> 2.0 mounted on a trapezoidal roof profile

**S-5! Warning! Please use this product responsibly!**  
Products are protected by multiple U.S. and foreign patents. For published data regarding holding strength, bolt torque, patents, and trademarks, visit the S-5! website at [www.S-5.com](http://www.S-5.com).  
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PROJECT NAME

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6021 SW STATE RD 247,  
LAKE CITY FL 32024

SHEET NAME

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SHEET SIZE  
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11" X 17"**

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**DS-06**