

# RESIDENTIAL ROOFTOP SOLAR PERMIT PACKAGE



**STEPHANIE RODGERS**  
 99 NECTAR LN  
 BUNNLEVEL, North Carolina 28323  
 14064371091



1403 N 630 E  
 Orem, Utah 84097  
 (800) 377-4480  
 BlueRavenSolar.com

**SCOPE OF WORK**  
 INSTALLATION OF ROOFTOP MOUNTED PHOTOVOLTAIC SOLAR SYSTEM



**SHEET INDEX**

- PV1 COVER SHEET
- PV2 SITE PLAN
- PV3 ROOF PLAN
- PV4 STRUCTURAL
- PV5 ELECTRICAL 3-LINE
- PV6 ELECTRICAL CALCULATIONS
- PV7 LABELS
- PV8 PLACARD
- SS SPEC SHEETS

NOTICE TO CONTRACTOR  
 All construction must comply with current NC Building Codes and is subject to field inspection and verification.

**APPROVED**  
Limited building only review  
 Permit holder responsible for full compliance with the code

11/19/2024

**REV1**

**TYPICAL STRUCTURAL INFORMATION**

- ROOF MATERIAL: Comp Shingle
- SHEATHING: OSB
- FRAMING: Manufactured Truss
- RACKING: UNIRAC SFM INFINITY
- ROOF ATTACHMENT: UNIRAC SFM INFINITY FLASHKIT
- TOTAL ATTACHMENTS: 18

A

**NEW PV SYSTEM INFORMATION**

- DC SYSTEM SIZE: 4.6 kW DC
- AC SYSTEM SIZE: 3.8 kW AC
- MODULE TYPE: (10) REC Solar REC460AA Pure-RX
- INVERTER TYPE: (10) Enphase IQ8X-80-M-US

<b>TOTAL PV DC SYSTEM SIZE</b>	<b>TOTAL PV AC SYSTEM SIZE</b>
4.600 kW DC	3.800 kW AC

**DESIGN CRITERIA**

- WIND SPEED: 115
- WIND EXPOSURE FACTOR: C
- RISK CATEGORY: II
- GROUND SNOW LOAD: 15
- ROOF SNOW LOAD: 10.5
- SEISMIC DESIGN CATEGORY: B

**WEATHER STATION DATA**

- WEATHER STATION: SEYMOUR-JOHNSON AFB
- HIGH TEMP 2% AVG: 35°C
- EXTREME MINIMUM TEMP: -10°C

**APPLICABLE CODES**

- \*2017 NATIONAL ELECTRIC CODE (NEC)
- \*2018 NORTH CAROLINA BUILDING CODE (NCBC)
- \*2018 NORTH CAROLINA RESIDENTIAL CODE (NCRC), PLUMBING CODE (NCPCL), AND ALL STATE AND LOCAL BUILDING, ELECTRICAL, AND PLUMBING CODES

**GENERAL NOTES**

**AHJ**  
 Harnett County

**UTILITY COMPANY**  
 Duke Energy

**CUSTOMER NAME:** STEPHANIE RODGERS  
 99 NECTAR LN  
 BUNNLEVEL, North Carolina 28323

**AHJ:** Harnett County

**UTILITY COMPANY:** Duke Energy

**PROJECT ID:** 1036248

**PV DC SYSTEM SIZE:** 4.600 kW DC

**PV AC SYSTEM SIZE:** 3.800 kW AC

**REVISIONS:**

A	10/09/2024
B	11/13/2024
C	---
D	---

**DRAWN BY:** Brendan Fillmore

**PLOT DATE:** November 14, 2024

**DRAWING TITLE:** Cover Sheet

**DRAWING NUMBER:** PV1

**CUSTOMER NAME:** **STEPHANIE RODGERS**  
99 NECTAR LN  
BUNNLEVEL, North Carolina 28323

**AHJ:** Harnett County  
**UTILITY COMPANY:** Duke Energy

**PROJECT ID:**  
**1036248**

**PV DC SYSTEM SIZE:**  
4.600 kW DC

**PV AC SYSTEM SIZE:**  
3.800 kW AC

**REVISIONS:**

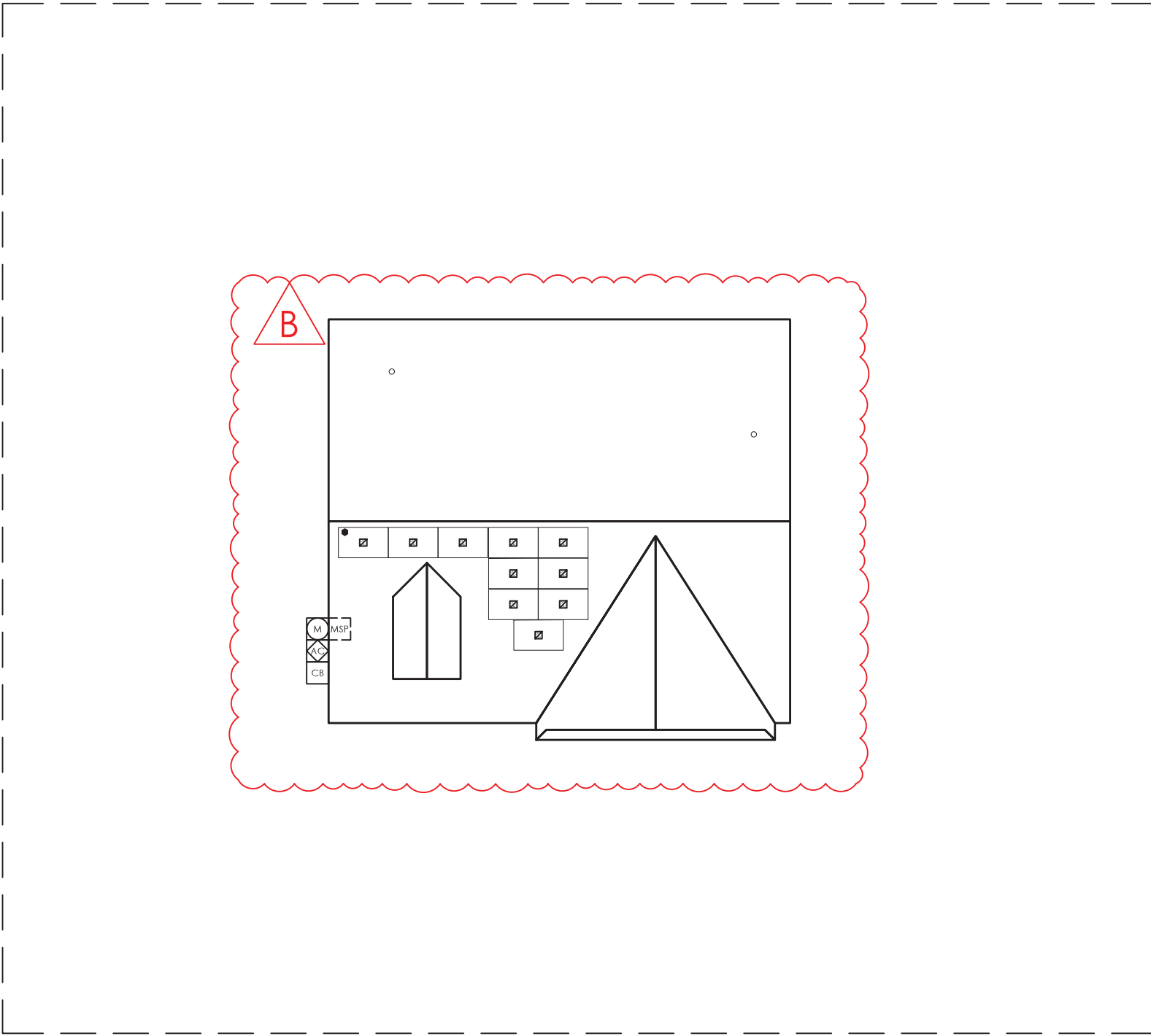
A	10/09/2024
B	11/13/2024
C	---
D	---

**DRAWN BY:**  
Brendan Fillmore

**PLOT DATE:**  
November 14, 2024

**DRAWING TITLE:**  
Site Plan

**DRAWING NUMBER:**  
**PV2**



**FRONT OF HOME**  
99 NECTAR LN

**SITE PLAN**  
SCALE: 1/16" = 1'-0"

**LEGEND**

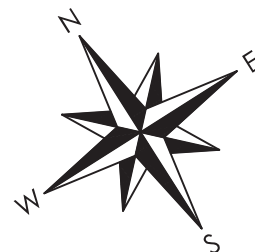
UTILITY METER	BREAKER ENCLOSURE	ESS - BATTERY	FIRE SETBACK HATCH	TRENCH OR OVERHEAD
MAIN SERVICE PANEL	AC DISCONNECT	ESS - CONTROLLER	MICROINVERTER	PROPERTY LINE
SUBPANEL	PV PRODUCTION METER	REMOTE POWER OFF SWITCH	ROOF TOP JUNCTION BOX	<i>ICONS WITH DOTTED OUTLINE INDICATE INTERIOR LOCATION</i>
UTILITY METER CT CABINET	COMBINER BOX	GENERATOR ATS PANEL	INVERTER	

**PV SYSTEM SPECIFICATIONS**

*NEW PV SYSTEM INFORMATION*

**PV MODULE:** (10) REC Solar REC460AA Pure-RX, **POWER RATING:** 460 W  
**INVERTER:** (10) Enphase IQ8X-80-M-US, **POWER RATING:** 380 W

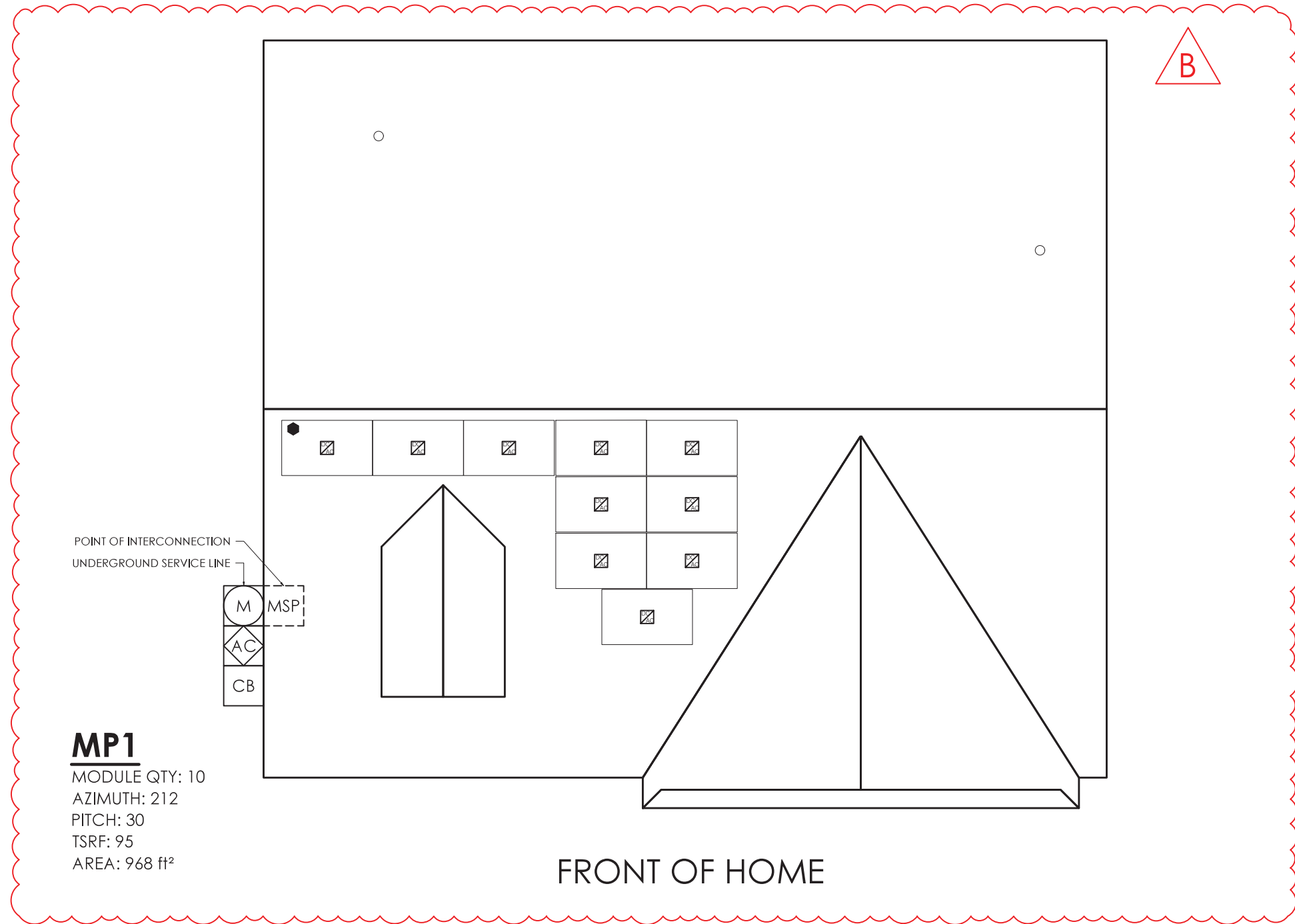
**COMPASS**



DC SYSTEM SIZE: 4.6 KW DCMODULE: REC 460INVERTER(S): Enphase IQ8X Microinverters



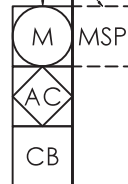
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**MP1**

MODULE QTY: 10  
AZIMUTH: 212  
PITCH: 30  
TSRF: 95  
AREA: 968 ft<sup>2</sup>

POINT OF INTERCONNECTION  
UNDERGROUND SERVICE LINE



FRONT OF HOME

**ROOF PLAN**

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

**STEPHANIE RODGERS**

99 NECTAR LN  
BUNNLEVEL, North Carolina 28323

Harnett County

Duke Energy

CUSTOMER NAME:  
AHJ:

PROJECT ID:

**1036248**

PV DC SYSTEM SIZE:

4.600 kW DC

PV AC SYSTEM SIZE:

3.800 kW AC

REVISIONS:

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NEW PV SYSTEM

**LEGEND**

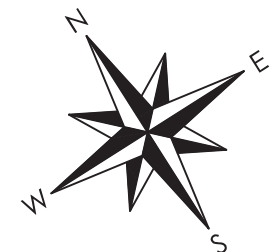
UTILITY METER	BREAKER ENCLOSURE	ESS - BATTERY	FIRE SETBACK HATCH	TRENCH OR OVERHEAD
MAIN SERVICE PANEL	AC DISCONNECT	ESS - CONTROLLER	MICROINVERTER	PROPERTY LINE
SUBPANEL	PV PRODUCTION METER	REMOTE POWER OFF SWITCH	ROOF TOP JUNCTION BOX	
UTILITY METER CT CABINET	COMBINER BOX	GENERATOR ATS PANEL	INVERTER	<b>ICONS WITH DOTTED OUTLINE INDICATE INTERIOR LOCATION</b>

**PV SYSTEM SPECIFICATIONS**

NEW PV SYSTEM INFORMATION

**PV MODULE:** (10) REC Solar REC460AA Pure-RX, **POWER RATING:** 460 W  
**INVERTER:** (10) Enphase IQ8X-80-M-US, **POWER RATING:** 380 W

**COMPASS**



DRAWN BY:

Brendan Fillmore

PLOT DATE:

November 14, 2024

DRAWING TITLE:

Roof Plan

DRAWING NUMBER:

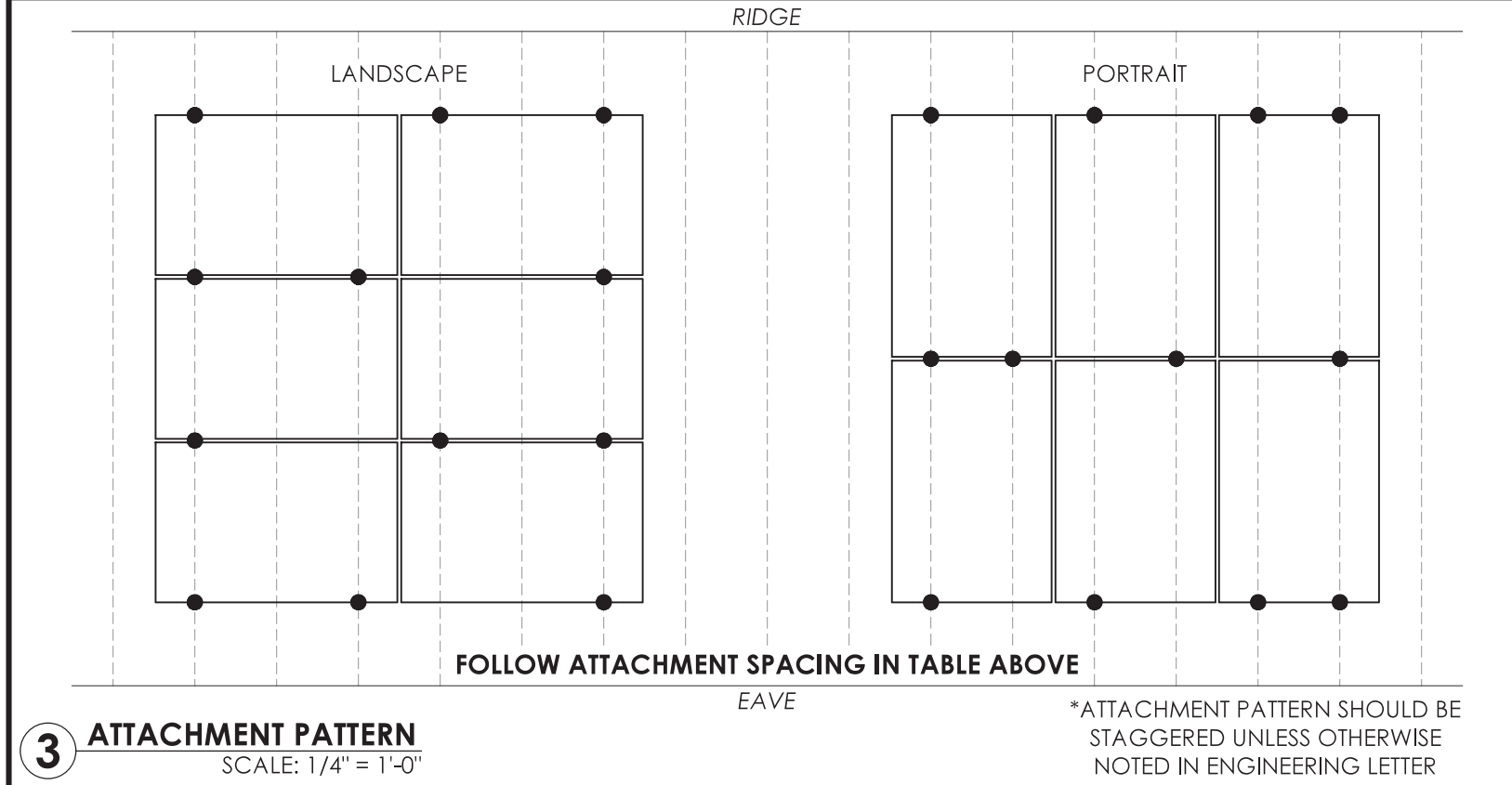
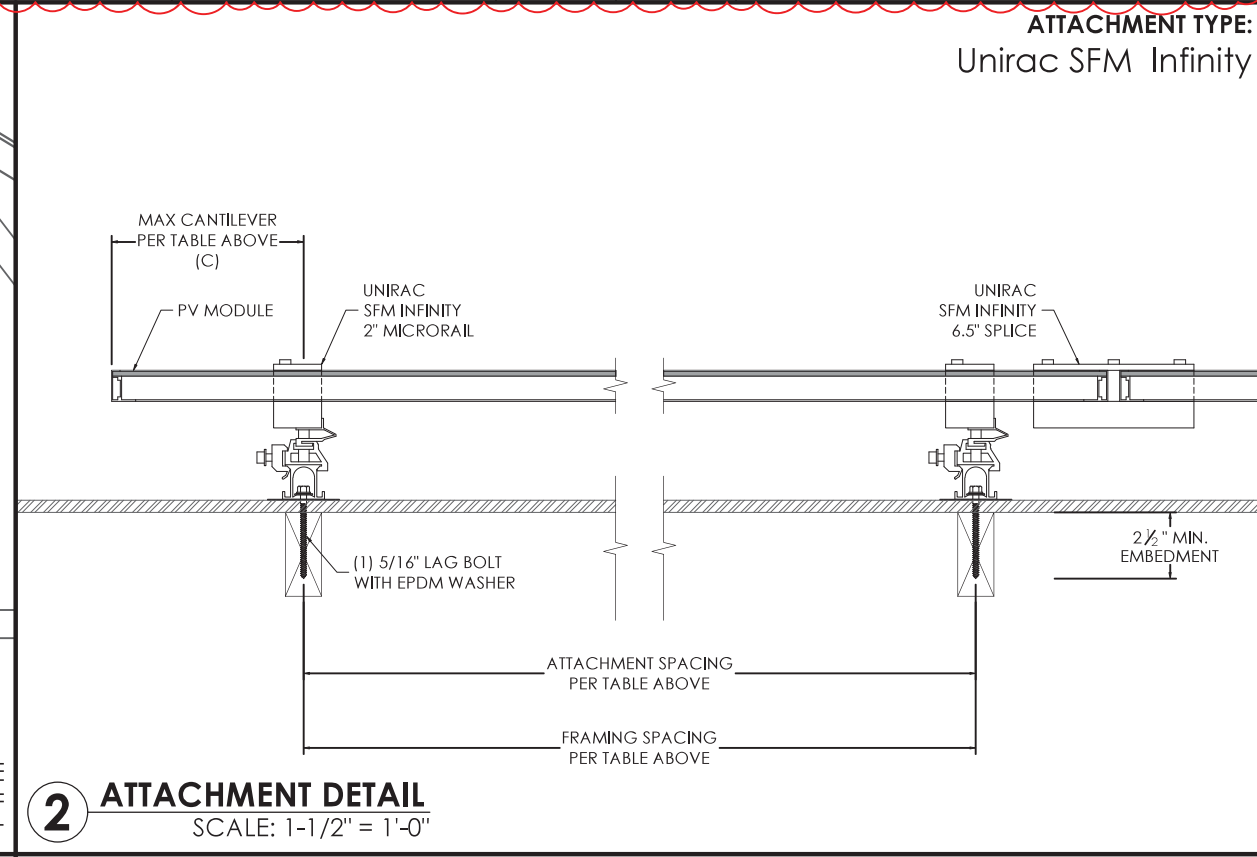
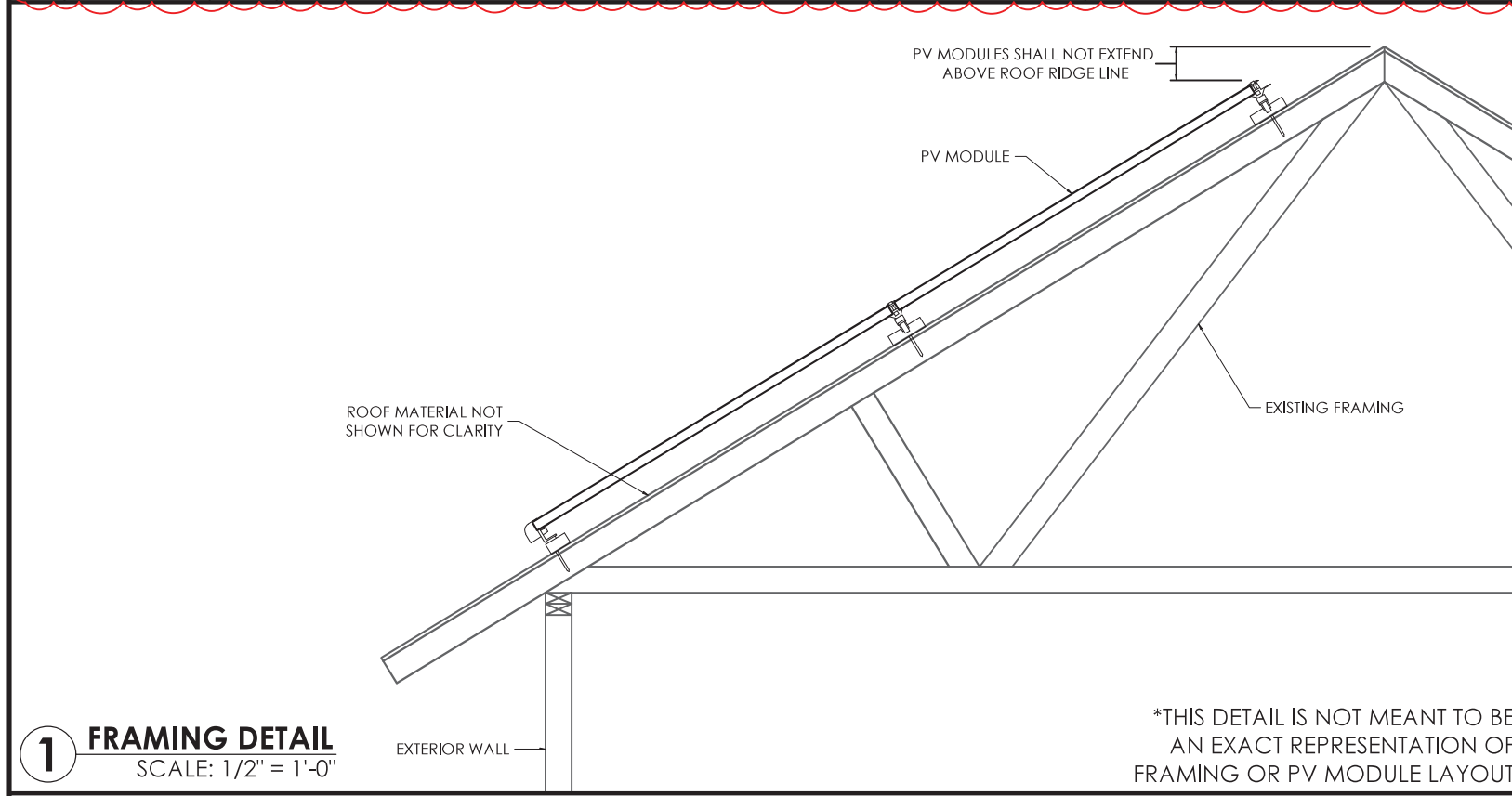
**PV3**

PANEL COUNT	AZIMUTH (DEG)	PITCH (DEG)	TSRF (%)	AREA (#²)	ROOF MATERIAL	SHEATHING TYPE	FRAMING TYPE	FRAMING SIZE AND SPACING	CEILING JOIST/PURLINS SIZE AND SPACING	RACKING TYPE	ATTACHMENT TYPE	MAXIMUM ATTACHMENT SPACING (S)	MAXIMUM CANTILEVER (C)	
MP1	10	212	30	95	968	Comp Shingle	OSB	Manufactured Truss	2x4 @ 24 in OC	2x4 @ 24 in OC	UNIRAC SFM INFINITY	UNIRAC SFM INFINITY FLASHKIT	72"L / 48"P	24"L / 16"P
MP2	0													
MP3	0													
MP4	0													
MP5	0													
MP6	0													
MP7	0													
MP8	0													
MP9	0													
MP10	0													

TOTAL PV ARRAY AREA (#²)	224.16
TOTAL ROOF AREA (#²)	2942
DISTRIBUTED LOAD (psf)	2.23
ROOF COVERAGE (%)	7.62
TOTAL PV ARRAY WEIGHT (lbs)	500
TOTAL PV ATTACHMENTS	18
POINT LOAD (lbs/att.)	27.8



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NOTES

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PROJECT ID: **1036248**

PV DC SYSTEM SIZE: 4.600 kW DC

PV AC SYSTEM SIZE: 3.800 kW AC

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DRAWN BY: Brendan Fillmore

PLOT DATE: November 14, 2024

DRAWING TITLE: Structural

DRAWING NUMBER: **PV4**

<b>4</b>	L1 (1) 10 AWG THHN/THWN-2 CU BLACK	<b>3/4 INCH EMT</b>	<b>Exterior</b>
	L2 (1) 10 AWG THHN/THWN-2 CU RED		
	N (1) 10 AWG THHN/THWN-2 CU WHITE		
	G (1) 10 AWG THHN/THWN-2 CU GREEN		

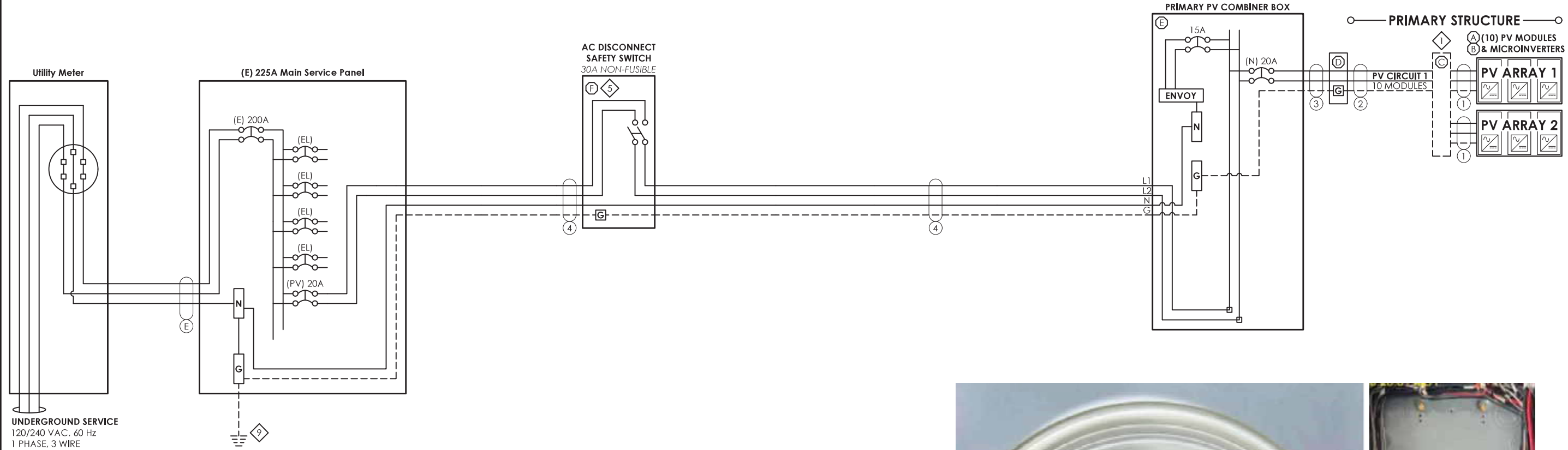
<b>3</b>	L1 (1) 10 AWG THHN/THWN-2 CU BLACK	<b>3/4 INCH EMT*</b>
	L2 (1) 10 AWG THHN/THWN-2 CU RED	
	G (1) 10 AWG THHN/THWN-2 CU GREEN	
	*TYPE UF CABLE MAY BE SUBSTITUTED FOR USE IN CONDUIT WHERE NEC CODE PERMITS	

<b>2</b>	L1 (1) 10 AWG THHN/THWN-2 CU BLACK	<b>3/4 INCH *</b>
	L2 (1) 10 AWG THHN/THWN-2 CU RED	
	G (1) 10 AWG THHN/THWN-2 CU GREEN	
	*TYPE NM (ROMEX) OR UF CABLE IS PERMITTED FOR INTERIOR OR ATTIC RUNS AND SHALL BE USED WHEN NEC CODE PERMITS	

<b>1</b>	L1 (1) 12 AWG THHN/THWN-2 CU BLACK	<b>ENPHASE Q-CABLE, 2-WIRE, FREE AIR</b>	<b>Exterior</b>
	L2 (1) 12 AWG THHN/THWN-2 CU RED		
	G (1) 6 AWG BARE, CU		



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**INTERCONNECTION NOTES**

Utility Meter Number: 325180472

Load Side Breaker in MSP, Interior POI

**LEGEND**

(E) EXISTING	(PV) PV BREAKER
(N) NEW	(FIB) FACTORY INSTALLED BREAKER
(EL) EXISTING LOADS	SPD SURGE PROTECTIVE DEVICE
(RL) RELOCATED LOADS	MI MECHANICAL INTERLOCK

**EQUIPMENT NOTES**

1 FINAL CONFIGURATION OF PV CIRCUITS TO BE DECIDED BY INSTALLER. MUST COMPLY WITH MAX MICROINVERTERS PER CIRCUIT AS LISTED ON ATTACHED SPEC SHEET.

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9 GROUNDING ELECTRODE SYSTEM SHALL BE IN ACCORDANCE WITH NEC 250.53.

10

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12

**EQUIPMENT DESCRIPTIONS**

(A) PV MODULE: REC Solar REC460AA Pure-RX, 460 W DC, UL 1703 / UL 61730 COMPLIANT

(B) MICROINVERTER: ENPHASE IQ8X-80-M-US, 380 W AC (0.380 kW), 1 PHASE, UL 1741 COMPLIANT

(C) ROOFTOP JUNCTION BOX: EZ SOLAR JB-1.2 JUNCTION BOX

(D) JUNCTION BOX: PVC 4 X 4 JUNCTION BOX

(E) PV COMBINER BOX: ENPHASE COMBINER 5 (X-IQ-AM1-240-5)

(F) SQUARE-D SAFETY SWITCH 30A, 2P, 240VAC, NON-FUSIBLE (DU221RB)

(G)

(H)

(I)

(J)

(K)

(L)

(M)

(N)

(O)

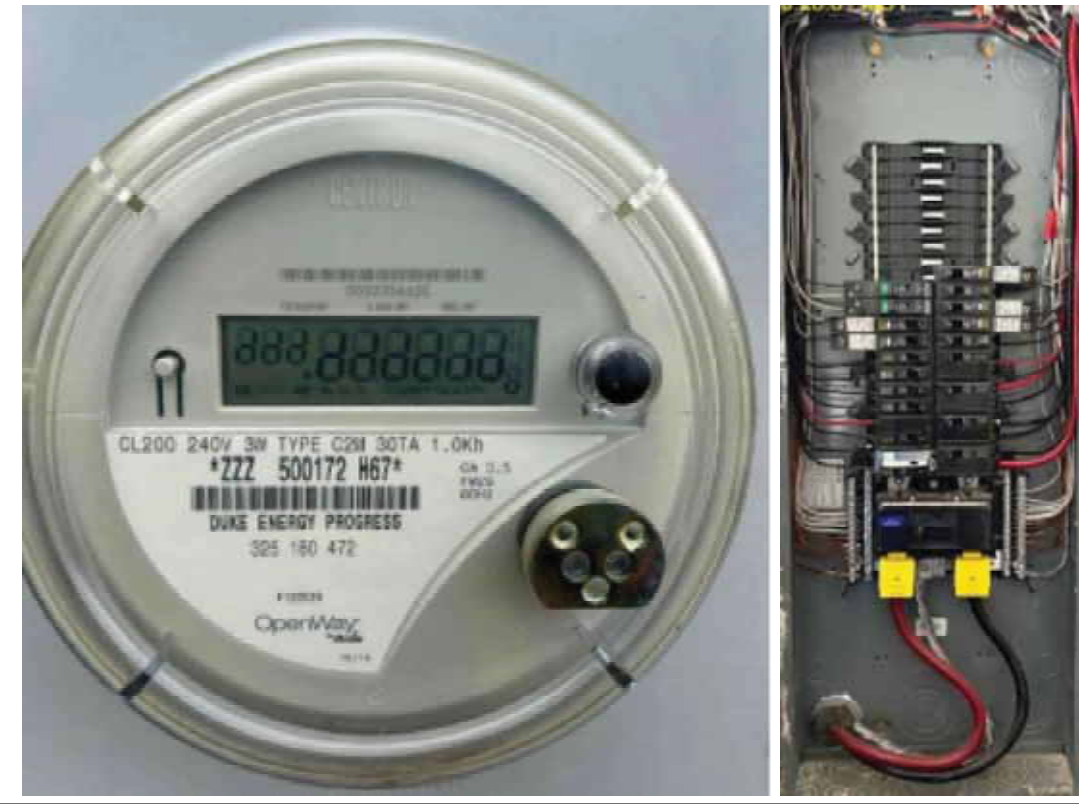
(P)

(Q)

(R)

(S)

(T)



**OTHER NOTES**

10 MICROINVERTERS X 380 W AC = 3.8 KW AC; PANEL WATTAGE = 460 W DC

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Duke Energy

**PROJECT ID:** 1036248

**PV DC SYSTEM SIZE:** 4.600 kW DC

**PV AC SYSTEM SIZE:** 3.800 kW AC

**REVISIONS:**

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**DRAWN BY:** Brendan Fillmore

**PLOT DATE:** November 14, 2024

**DRAWING TITLE:** Electrical 3-Line

**DRAWING NUMBER:** PV5

ELECTRICAL INFORMATION	
UTILITY ELECTRICAL SYSTEM	
1-Phase, 3-Wire, 60Hz, 120/240V	
NEW PV SYSTEM	
1-Phase, 3-Wire, 60Hz, 120/240V	
AC SYSTEM SIZE	3.8kW AC
DC SYSTEM SIZE	4.6kW DC
PV MODULES	
QUANTITY	10
TYPE	REC Solar REC460AA Pure-RX
WATTAGE	460W DC
MICROINVERTERS	
TYPE	Enphase IQ8X-80-M-US
OUTPUT CURRENT	1.58A AC
NOMINAL VOLTAGE	240V AC
OUTPUT POWER	380W AC

PV BREAKER BACKFEED CALCULATIONS			
NEC 705.12(B) -- "120% RULE"			
(BUSBAR RATING * 120%) - OCPD RATING = AVAILABLE BACKFEED			
	MAIN SERVICE PANEL	SUBPANEL 1	SUBPANEL 2
BUSBAR RATING	225A	---A	---A
PANEL OCPD RATING	200A	---A	---A
AVAILABLE BACKFEED (120% RULE)	70A	##A	##A
PV BREAKER RATING	20A	20A	20A
*THESE CALCULATIONS ARE ONLY APPLICABLE IF PV INTERCONNECTION IS A LOAD SIDE BREAKER. *PV BREAKER MUST BE RATED LESS THAN OR EQUAL TO AVAILABLE BACKFEED FOR CODE COMPLIANCE*			

DESIGN LOCATION AND TEMPERATURES	
DATA SOURCE	ASHRAE Weather Station Data
STATE	North Carolina
CITY	BUNNLEVEL
WEATHER STATION	SEYMOUR-JOHNSON AFB
HIGH TEMP 2% AVG	35°C
EXTREME MINIMUM TEMP	-10°C

WIRE SIZE SPECIFICATIONS										
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
MINIMUM CONDUCTOR AMPACITY	19.75A AC	19.75A AC	19.75A AC	19.75A AC	---A AC	---A AC	---A AC	---A AC	---A AC	---A AC
CONDUCTOR MATERIAL	CU	CU	CU	CU	---	---	---	---	---	---
CONDUCTOR TYPE	THHN/THWN-2	THHN/THWN-2	THHN/THWN-2	THHN/THWN-2	---	---	---	---	---	---
CONDUCTOR SIZE	12 AWG	10 AWG	10 AWG	10 AWG	---	---	---	---	---	---
CONDUCTOR AMPACITY	30A	40A	40A	40A	---A	---A	---A	---A	---A	---A
AMBIENT TEMPERATURE ADJUSTMENT FACTOR	0.96	0.96	0.96	0.96	---	---	---	---	---	---
CONDUIT FILL ADJUSTMENT FACTOR	1	1	1	1	---	---	---	---	---	---
ADJUSTED CONDUCTOR AMPACITY	28.8A	38.4A	38.4A	38.4A	---A	---A	---A	---A	---A	---A
WIRE RUN DISTANCE (FT)	66	55	20	5	---	---	---	---	---	---
CALCULATED VOLTAGE DROP	0.94%	0.9%	0.33%	0.08%	0%	0%	0%	0%	0%	0%

PV CIRCUIT SPECIFICATIONS													
	PRIMARY STRUCTURE								DETACHED STRUCTURE				
	CIRCUIT 1	CIRCUIT 2	CIRCUIT 3	CIRCUIT 4	CIRCUIT 5	CIRCUIT 6	CIRCUIT 7	CIRCUIT 8	CIRCUIT 1	CIRCUIT 2	CIRCUIT 3	CIRCUIT 4	CIRCUIT 5
NUMBER OF MODULES PER CIRCUIT	10	0	0	0	0	0	0	0	0	0	0	0	0
RATED AC OUTPUT CURRENT (I <sub>out</sub> )	15.8A	0.0A	0.0A	0.0A	0.0A	0.0A	0.0A	0.0A	0.0A	0.0A	0.0A	0.0A	0.0A
MINIMUM AMPACITY (I <sub>out</sub> x 125%)	19.8A	0.0A	0.0A	0.0A	0.0A	0.0A	0.0A	0.0A	0.0A	0.0A	0.0A	0.0A	0.0A
OVERCURRENT PROTECTION RATING	20A	20A	20A	20A	20A	20A	20A	20A	20A	20A	20A	20A	20A
COMBINED AC OUTPUT CURRENT (C <sub>out</sub> )	15.8A								0.0A				
MINIMUM AMPACITY (C <sub>out</sub> x 125%)	19.8A								0.0A				
COMBINED PV BREAKER RATING	20AA								0AA				

TOTAL VOLTAGE DROP	
WIRE TAG #	VOLTAGE DROP
WIRE TAG #1	0.94%
WIRE TAG #2	0.9%
WIRE TAG #3	0.33%
WIRE TAG #4	0.08%
WIRE TAG #5	0%
WIRE TAG #6	0%
TOTAL	2.250000%



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PROJECT ID:  
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PV DC SYSTEM SIZE:  
4.600 kW DC

PV AC SYSTEM SIZE:  
3.800 kW AC

REVISIONS:	
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DRAWN BY:  
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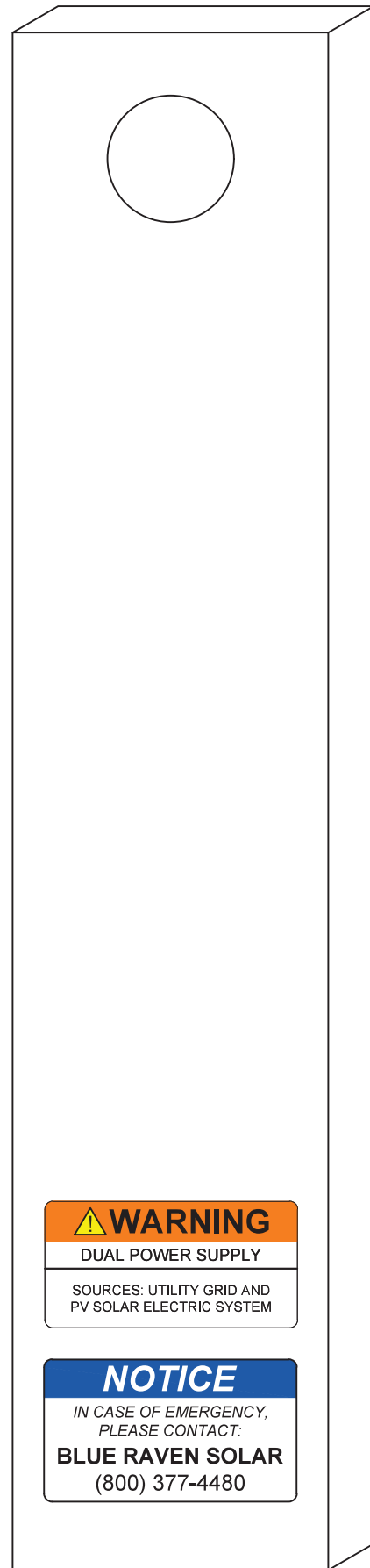
PLOT DATE:  
November 14, 2024

DRAWING TITLE:  
Electrical Calculations

DRAWING NUMBER:  
**PV6**

# WARNING LABELS

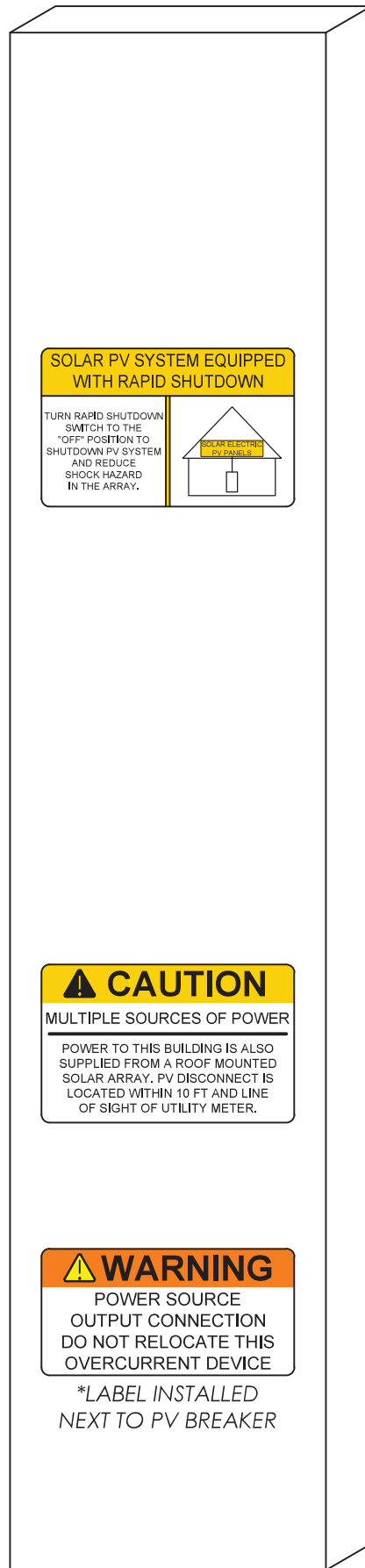
UTILITY METER



**WARNING**  
DUAL POWER SUPPLY  
SOURCES: UTILITY GRID AND PV SOLAR ELECTRIC SYSTEM

**NOTICE**  
IN CASE OF EMERGENCY,  
PLEASE CONTACT:  
**BLUE RAVEN SOLAR**  
(800) 377-4480

MAIN SERVICE PANEL

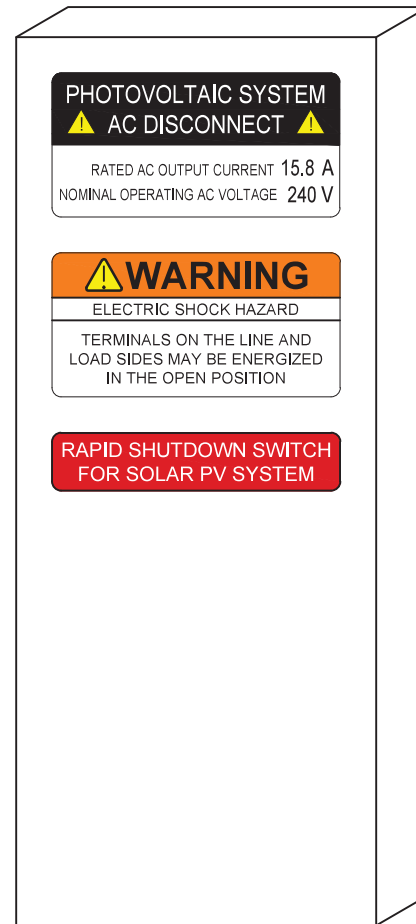


**SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN**  
TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUTDOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN THE ARRAY.

**CAUTION**  
MULTIPLE SOURCES OF POWER  
POWER TO THIS BUILDING IS ALSO SUPPLIED FROM A ROOF MOUNTED SOLAR ARRAY. PV DISCONNECT IS LOCATED WITHIN 10 FT AND LINE OF SIGHT OF UTILITY METER.

**WARNING**  
POWER SOURCE OUTPUT CONNECTION DO NOT RELOCATE THIS OVERCURRENT DEVICE  
\*LABEL INSTALLED NEXT TO PV BREAKER

PV AC DISCONNECT



**PHOTOVOLTAIC SYSTEM AC DISCONNECT**  
RATED AC OUTPUT CURRENT 15.8 A  
NOMINAL OPERATING AC VOLTAGE 240 V

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

**RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM**

PV COMBINER BOX



**PHOTOVOLTAIC SYSTEM COMBINER PANEL**  
**WARNING**  
**AUTHORIZED PERSONNEL ONLY**  
DO NOT ADD LOADS  
NO DC WIRES PRESENT  
RAPID SHUTDOWN TEST NOT REQUIRED



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**DRAWN BY:** Brendan Fillmore

**PLOT DATE:** November 14, 2024

**DRAWING TITLE:** Warning Labels

**DRAWING NUMBER:** PV7

# REC ALPHA<sup>®</sup> PURE-RX SERIES

## DATASHEET

470 W<sub>P</sub>  
22.6% EFFICIENCY  
226 W/M<sup>2</sup>



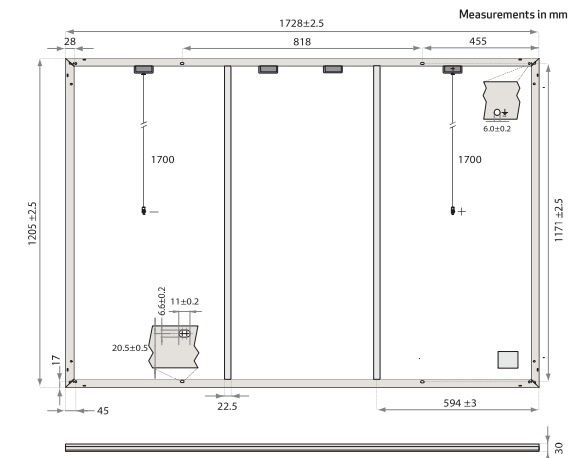
9 A MODULE CURRENT  
COMPATIBLE WITH MLPE



# REC ALPHA<sup>®</sup> PURE-RX SERIES

## DATASHEET

GENERAL DATA	
Cell Type	88 half-cut bifacial REC heterojunction cells, with gapless technology
Glass	3.2 mm solar glass with anti-reflective surface treatment in accordance with EN12150
Backsheet	Highly resistant polymer (Black)
Frame	Anodized aluminum (Black)
Junction Box	4-part, 4 bypass diodes, IP68 rated, in accordance with IEC 62790
Connectors	Stäubli MC4 PV-KBT4/KST4 (4 mm <sup>2</sup> ) in accordance with IEC 62852, IP68 only when connected
Cable	4 mm <sup>2</sup> solar cable, 1.7 m + 1.7 m in accordance with EN50618
Dimensions	1728 x 1205 x 30 mm (2.08 m <sup>2</sup> )
Weight	22.7 kg
Origin	Made in Singapore



ELECTRICAL DATA		PRODUCT CODE*: RECxxxAA Pure-RX			
STC	Power Output - P <sub>MAX</sub> (W <sub>p</sub> )	450	460	470	
	Watt Class Sorting - (W)	0/+10	0/ .0	0/+10	
	Nominal Power Voltage - V <sub>MPP</sub> (V)	54.3	54.9	55.4	
	Nominal Power Current - I <sub>MPP</sub> (A)	8.29	8.38	8.49	
	Open Circuit Voltage - V <sub>OC</sub> (V)	65.1	65.3	65.6	
	Short Circuit Current - I <sub>SC</sub> (A)	8.81	8.88	8.95	
	Power Density (W/m <sup>2</sup> )	216	221	226	
	Panel Efficiency (%)	21.6	22.1	22.6	
	NMOT	Power Output - P <sub>MAX</sub> (W <sub>p</sub> )	343	350	358
		Nominal Power Voltage - V <sub>MPP</sub> (V)	51.2	51.7	52.2
Nominal Power Current - I <sub>MPP</sub> (A)		6.70	6.77	6.86	
Open Circuit Voltage - V <sub>OC</sub> (V)		61.3	61.6	61.8	
Short Circuit Current - I <sub>SC</sub> (A)	7.11	7.17	7.23		

Values at standard test conditions (STC: air mass AM 1.5, irradiance 1000 W/m<sup>2</sup>, temperature 25°C), based on a production spread with a tolerance of P<sub>max</sub>, V<sub>oc</sub> & I<sub>sc</sub> ±3% within one watt class. Nominal module operating temperature (NMOT: air mass AM 1.5, irradiance 800 W/m<sup>2</sup>, temperature 20°C, windspeed 1 m/s). \* Where xxx indicates the nominal power class (P<sub>nom</sub>) at STC above.

MAXIMUM RATINGS*		TEMPERATURE RATINGS*	
Operational Temperature	-40 °C - 85 °C	Nominal Module Operating Temperature	44 °C ± 2°C
System Voltage	1000 V	Temperature coefficient of P <sub>MAX</sub>	-0.24% / °C
Maximum Test Load (front)	+7000 Pa (713 kg/m <sup>2</sup> )	Temperature coefficient of V <sub>OC</sub>	-0.24% / °C
Maximum Test Load (rear)	-4000 Pa (407 kg/m <sup>2</sup> )	Temperature coefficient of I <sub>SC</sub>	0.04% / °C
Max Series Fuse Rating	25 A	*The temperature coefficients stated are linear values	
Max Reverse Current	25 A		

DELIVERY INFORMATION	
Panels per Pallet	33
Panels per 40 ft GP/high cube container	594 (18 Pallets)
Panels per 13.6 m truck	660 (20 Pallets)

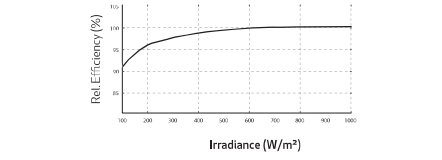
Available from:

CERTIFICATIONS	
IEC 61215:2011; IEC61730:2016; UL61730	
ISO 11925-2 Ignitability (EN 13501-1 Class E)	
IEC 62716 Ammonia Resistance	
IEC 61701 Salt Mist (SM6)	
IEC 61215:2016 Hailstone (35 mm)	
UL 61730 Fire Type 2	
ISO 14001; ISO9001; IEC45001; IEC62941	



	WARRANTY	
	Standard	REC ProTrust
Installed by an REC Certified Professional	No	Yes
System Size	All	<25 kW 25-500 kW
Product Warranty (yrs)	20	25
Power Warranty (yrs)	25	25
Labor Warranty (yrs)	0	25
Power in Year 1	98%	98%
Annual Degradation	0.25%	0.25%
Power in Year 25	92%	92%

**LOW LIGHT BEHAVIOUR**  
Typical low irradiance performance of module at STC:



Founded in 1996, REC Group is an international pioneering solar energy company dedicated to empowering consumers with clean, affordable solar power. As Solar's Most Trusted, REC is committed to high quality, innovation, and a low carbon footprint in the solar materials and solar panels it manufactures. Headquartered in Norway with operational headquarters in Singapore, REC also has regional hubs in North America, Europe, and Asia-Pacific.

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Specifications subject to change without notice.

Ref: PV-D5-12-06-Rev-4.4.5.2024





# IQ8X Microinverter

Our newest IQ8 Series 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 mode. This chip is built using advanced 55-nm technology with high-speed digital logic and superfast response times to changing loads and grid events, alleviating constraints on battery sizing for home energy systems.

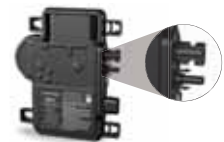
IQ8X Microinverter is the latest addition to this family, designed to support PV modules with high input DC voltage and cell counts, such as 80-half-cut cells, 88-half-cut cells and 96-cells.



Part of the Enphase Energy System, IQ8 Series Microinverters integrate with the IQ Battery, 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 the IQ8 Series Microinverters with integrated MC4 connectors.



IQ8 Series Microinverters are UL Listed as PV rapid shutdown equipment and conform with regulations when installed according to the manufacturer's instructions.

\*Meets UL 1741 only when installed with IQ System Controller 2 and 3.

### Easy to install

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

### High productivity and reliability

- Produces 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) and IEEE 1547:2018 (UL 1741-SB)

### NOTE:

- IQ8 Series Microinverters cannot be mixed with previous generations of Enphase microinverters (IQ7 Series, IQ6 Series, and so on) in the same system.
- IQ Gateway is required to change the default grid profile at the time of installation to meet local Authority Having Jurisdiction (AHJ) requirements.

INPUT DATA (DC)	UNIT	IQ8X-80-M-US
Commonly used module pairings <sup>1</sup>	W	320-540
Module compatibility	—	To meet compatibility, PV modules must be within the following maximum input DC voltage and maximum module I <sub>sc</sub> . Module compatibility can be checked at <a href="https://enphase.com/installers/microinverters/calculator">https://enphase.com/installers/microinverters/calculator</a>
MPPT voltage range	V	43-60
Operating range	V	25-79.5
Minimum and maximum start voltage	V	30-79.5
Maximum input DC voltage	V	79.5
Maximum continuous operating DC current	A	10
Maximum input DC short-circuit current	A	16
Maximum module I <sub>sc</sub>	A	13
Overvoltage class DC port	—	II
DC port backfeed current	mA	0
PV array configuration	—	Ungrounded array; no additional DC side protection required; AC side protection requires maximum 20 A per branch circuit

OUTPUT DATA (AC)	UNIT	IQ8X-80-M-US @240 VAC	IQ8X-80-M-US @208 VAC
Peak output power	VA	384	366
Maximum continuous output power	VA	380	360
Nominal grid voltage (L-L)	V	240, split-phase (L-L), 180°	208, single-phase (L-L), 120° <sup>4</sup>
Minimum and maximum grid voltage <sup>2</sup>	V	211-264	183-229
Max. continuous output current	A	1.58	1.73
Nominal frequency	Hz	60	
Extended frequency range	Hz	47-68	
AC short circuit fault current over three cycles	A <sub>rms</sub>	2.70	
Maximum units per 20 A (L-L) branch circuit <sup>3</sup>	—	10	9
Total harmonic distortion	%	<5	
Overvoltage class AC port	—	III	
AC port backfeed current	mA	18	
Power factor setting	—	1.0	
Grid-tied power factor (adjustable)	—	0.85 leading ... 0.85 lagging	
Peak efficiency	%	97.3	97.0
CEC weighted efficiency	%	96.5	96.5
Nighttime power consumption	mW	26	12

MECHANICAL DATA	
Ambient temperature range	-40°C to 65°C (-40°F to 149°F)
Relative humidity range	4% to 100% (condensing)
DC connector type	Stäubli MC4
Dimensions (H × W × D); Weight	212 mm (8.3") × 175 mm (6.9") × 30.2 mm (1.2"); 1.1 kg (2.43 lbs)
Cooling	Natural convection - no fans
Approved for wet locations; Pollution degree	Yes; PD3
Enclosure	Class II double-insulated, corrosion-resistant polymeric enclosure
Environmental category; UV exposure rating	NEMA Type 6; outdoor

COMPLIANCE	
Certifications	CA Rule 21 (UL 1741-SA), UL 62109-1, IEEE 1547:2018 (UL 1741-SB), 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 shutdown equipment and conforms with NEC 2014, NEC 2017, NEC 2020, and NEC 2023 section 690.12 and C22.1-2018 Rule 64-218 rapid shutdown of PV systems for AC and DC conductors when installed according to the manufacturer's instructions.

(1) No enforced DC/AC ratio.  
 (2) Nominal voltage range can be extended beyond nominal if required by the utility.  
 (3) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.  
 (4) IQ8X is not certified for use with Enphase Three Phase Network Protection Relay (NPR-3P-208-NA) and therefore designed for single-phase operation only. Check with the local utility requirements if you wish to install single phase inverter across three phases.

# Enphase Q Cable Accessories

The **Enphase Q Cable™** and accessories are part of the latest generation Enphase IQ System™. These accessories provide simplicity, reliability, and faster installation times.



### Enphase Q Cable

- Two-wire, double-insulated Enphase Q Cable is 50% lighter than the previous generation Enphase cable
- New cable numbering and plug and play connectors speed up installation and simplify wire management
- Link connectors eliminate cable waste

### Field-Wireable Connectors

- Easily connect Q cables on the roof without complex wiring
- Make connections from any open connector and center feed any section of cable within branch limits
- Available in male and female connector types

## Enphase Q Cable Accessories

### CONDUCTOR SPECIFICATIONS

Certification	UL3003 (raw cable), UL 9703 (cable assemblies), DG cable
Flame test rating	FT4
Compliance	RoHS, OIL RES I, CE, UV Resistant, combined UL for Canada and United States
Conductor type	THHN/THWN-2 dry/wet
Disconnecting means	The AC and DC bulkhead connectors have been evaluated and approved by UL for use as the load-break disconnect required by NEC 690.





### Q CABLE TYPES / ORDERING OPTIONS

Connectorized Models	Size / Max Nominal Voltage	Connector Spacing	PV Module Orientation	Connector Count per Box
Q-12-10-240	12 AWG / 277 VAC	1.3 m (4.2 ft)	Portrait	240
Q-12-17-240	12 AWG / 277 VAC	2.0 m (6.5 ft)	Landscape (60-cell)	240
Q-12-20-200	12 AWG / 277 VAC	2.3 m (7.5 ft)	Landscape (72-cell)	200

### ENPHASE Q CABLE ACCESSORIES

Name	Model Number	Description
Raw Q Cable	Q-12-RAW-300	300 meters of 12 AWG cable with no connectors
Field-wireable connector (male)	Q-CONN-10M	Make connections from any open connector
Field-wireable connector (female)	Q-CONN-10F	Make connections from any Q Cable open connector
Cable Clip	Q-CLIP-100	Used to fasten cabling to the racking or to secure looped cabling
Disconnect tool	Q-DISC-10	Disconnect tool for Q Cable connectors, DC connectors, and AC module mount
Q Cable sealing caps (female)	Q-SEAL-10	One needed to cover each unused connector on the cabling
Terminator	Q-TERM-10	Terminator cap for unused cable ends
Enphase EN4 to MC4 adaptor <sup>1</sup>	ECA-EN4-S22	Connect PV module using MC4 connectors to IQ micros with EN4 (TE PV4-S SOLARLOK). 150mm/5.9" to MC4.
Enphase EN4 non-terminated adaptor <sup>1</sup>	ECA-EN4-FW	For field wiring of UL certified DC connectors. EN4 (TE PV4-S SOLARLOK) to non-terminated cable. 150mm/5.9"
Enphase EN4 to MC4 adaptor (long) <sup>1</sup>	ECA-EN4-S22-L	Longer adapter cable for EN4 (TE PV4-S SOLARLOK) to MC4. Use with split cell modules or PV modules with short DC cable. 600mm/23.6"
Replacement DC Adaptor (MC4)	Q-DCC-2	DC adaptor to MC4 (max voltage 100 VDC)
Replacement DC Adaptor (UTX)	Q-DCC-5	DC adaptor to UTX (max voltage 100 VDC)

1. Qualified per UL subject 9703.

	<b>TERMINATOR</b> Terminator cap for unused cable ends, sold in packs of ten (Q-TERM-10)		<b>SEALING CAPS</b> Sealing caps for unused aggregator and cable connections (Q-BA-CAP-10 and Q-SEAL-10)
	<b>DISCONNECT TOOL</b> Plan to use at least one per installation, sold in packs of ten (Q-DISC-10)		<b>CABLE CLIP</b> Used to fasten cabling to the racking or to secure looped cabling, sold in packs of one hundred (Q-CLIP-100)

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

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 2020-06-26



DRAWING NUMBER:

SS



X-IQ-AM1-240-5  
X-IQ-AM1-240-5C

# IQ Combiner 5/5C

The IQ Combiner 5/5C consolidates interconnection equipment into a single enclosure and streamlines IQ Series Microinverters and IQ Gateway installation by providing a consistent, pre-wired solution for residential applications. IQ Combiner 5/5C uses wired control communication and is compatible with IQ System Controller 3/3G and IQ Battery 5P.

The IQ Combiner 5/5C, IQ Series Microinverters, IQ System Controller 3/3G, and IQ Battery 5P provide a complete grid-agnostic Enphase Energy System.



**IQ Series Microinverters**  
The high-powered smart grid-ready IQ Series Microinverters (IQ6, IQ7, and IQ8 Series) simplify the installation process.



**IQ System Controller 3/3G**  
Provides microgrid interconnection device (MID) functionality by automatically detecting grid failures and seamlessly transitioning the home energy system from grid power to backup power.



**IQ Battery 5P**  
Fully integrated AC battery system. Includes six field-replaceable IQ8D-BAT Microinverters.



**IQ Load Controller**  
Helps prioritize essential appliances during a grid outage to optimize energy consumption and prolong battery life.





5-year limited warranty

\*For country-specific warranty information, see the <https://enphase.com/installers/resources/warranty> page.

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### Smart

- Includes IQ Gateway for communication and control
- Includes Enphase Mobile Connect (CELLMODEM-M1-06-SP-05), only with IQ Combiner 5C
- Supports flexible networking: Wi-Fi, Ethernet, or cellular
- Provides production metering (revenue grade) and consumption monitoring

### Easy to install

- Mounts to one stud with centered brackets
- Supports bottom, back, and side conduit entries
- Supports up to four 2-pole branch circuits for 240 VAC plug-in breakers (not included)
- 80 A total PV branch circuits
- Bluetooth-based Wi-Fi provisioning for easy Wi-Fi setup

### Reliable

- Durable NRTL-certified NEMA type 3R enclosure
- 5-year limited warranty
- 2-year labor reimbursement program coverage included for both the IQ Combiner SKUs<sup>1</sup>
- UL1741 Listed

# IQ Combiner 5/5C

MODEL NUMBER	
IQ Combiner 5 (X-IQ-AM1-240-5)	IQ Combiner 5 with IQ Gateway printed circuit board for integrated revenue-grade PV production metering (ANSIC12.20 ±0.5%), consumption monitoring (± 2.5%), and IQ Battery monitoring (±2.5%). Includes a silver solar shield to deflect heat.
IQ Combiner 5C (X-IQ-AM1-240-5C)	IQ Combiner 5C with IQ Gateway printed circuit board for integrated revenue-grade PV production metering (ANSI C12.20 ±0.5%), consumption monitoring (±2.5%) and IQ Battery monitoring (±2.5%). Includes Enphase Mobile Connect cellular modem (CELLMODEM-M1-06-SP-05) <sup>1</sup> . Includes a silver solar shield to deflect heat.
WHAT'S IN THE BOX	
IQ Gateway printed circuit board	IQ Gateway is the platform for total energy management for comprehensive, remote maintenance, and management of the Enphase Energy System
Busbar	80 A busbar with support for 1 × IQ Gateway breaker and 4 × 20 A breaker for installing IQ Series Microinverters and IQ Battery 5P
IQ Gateway breaker	Circuit breaker, 2-pole, 10 A/15 A
Production CT	Pre-wired revenue-grade solid-core CT, accurate up to ±0.5%
Consumption CT	Two consumption metering clamp CTs, shipped with the box, accurate up to ±2.5%
IQ Battery CT	One battery metering clamp CT, shipped with the box, accurate up to ±2.5%
CTRL board	Control board for wired communication with IQ System Controller 3/3G and the IQ Battery 5P
Enphase Mobile Connect (only with IQ Combiner 5C)	4G-based LTE-M1 cellular modem (CELLMODEM-M1-06-SP-05) with a 5-year T-Mobile data plan
Accessories kit	Spare control headers for the COMMS-KIT-02 board
ACCESSORIES AND REPLACEMENT PARTS (NOT INCLUDED, ORDER SEPARATELY)	
CELLMODEM-M1-06-SP-05	4G-based LTE-M1 cellular modem with a 5-year T-Mobile data plan
CELLMODEM-M1-06-AT-05	4G-based LTE-M1 cellular modem with a 5-year AT&T data plan
Circuit breakers (off-the-shelf)	Supports Eaton BR2XX, Siemens Q2XX and GE/ABB THQL21XX Series circuit breakers (XX represents 10, 15, 20, 30, 40, 50, or 60). Also supports Eaton BR220B, BR230B, and BR240B circuit breakers compatible with the hold-down kit.
Circuit breakers (provided by Enphase)	BRK-10A-2-240V, BRK-15A-2-240V, BRK-20A-2P-240V, BRK-15A-2P-240V-B, and BRK-20A-2P-240V-B (more details in the "Accessories" section)
XA-SOLARSHIELD-ES	Replacement solar shield for IQ Combiner 5/5C
XA-ENV2-PCBA-5	IQ Gateway replacement printed circuit board (PCB) for IQ Combiner 5/5C
X-IQ-NA-HD-125A	Hold-down kit compatible with Eaton BR-B Series circuit breakers (with screws)
XA-COMMS2-PCBA-5	Replacement COMMS-KIT-02 printed circuit board (PCB) for IQ Combiner 5/5C
ELECTRICAL SPECIFICATIONS	
Rating	80 A
System voltage and frequency	120/240 VAC, 60 Hz
Busbar rating	125 A
Fault current rating	10 kAIC
Maximum continuous current rating (input from PV/storage)	64 A
Branch circuits (solar and/or storage)	Up to four 2-pole Eaton BR, Siemens Q, or GE/ABB THQL Series distributed generation (DG) breakers only (not included)
Maximum total branch circuit breaker rating (input)	80 A of distributed generation/95 A with IQ Gateway breaker included
IQ Gateway breaker	10 A or 15 A rating GE/Siemens/Eaton included
Production metering CT	200 A solid core pre-installed and wired to IQ Gateway
Consumption monitoring CT (CT-200-CLAMP)	A pair of 200 A clamp-style current transformers is included with the box
IQ Battery metering CT	200 A clamp-style current transformer for IQ Battery metering, included with the box

1. A plug-and-play industrial-grade cell modem for systems of up to 60 microinverters. Available in the United States, Canada, Mexico, Puerto Rico, and the US Virgin Islands, where there is adequate cellular service in the installation area.

MECHANICAL DATA		
Dimensions (W × H × D)	37.5 cm × 49.5 cm × 16.8 cm (14.75" × 19.5" × 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°F to 115°F)	
Cooling	Natural convection, plus heat shield	
Enclosure environmental rating	Outdoor, NRTL-certified, NEMA type 3R, polycarbonate construction	
Wire sizes	<ul style="list-style-type: none"> <li>• 20 A to 50 A breaker inputs: 14 to 4 AWG copper conductors</li> <li>• 60 A breaker branch input: 4 to 1/0 AWG copper conductors</li> <li>• Main lug combined output: 10 to 2/0 AWG copper conductors</li> <li>• Neutral and ground: 14 to 1/0 copper conductors</li> <li>• Always follow local code requirements for conductor sizing</li> </ul>	
Communication (in-premise connectivity)	Built-in CTRL board for wired communication with IQ Battery 5P and IQ System Controller 3/3G. Integrated power line communication for IQ Series Microinverters	
Altitude	Up to 2,600 meters (8,530 feet)	
COMMUNICATION INTERFACES		
Integrated Wi-Fi	802.11b/g/n (dual band 2.4 GHz/5 GHz), for connecting the Enphase Cloud through the internet	
Wi-Fi range (recommended)	10 m (32.8 feet)	
Bluetooth	BLE4.2, 10 m range to configure Wi-Fi SSID	
Ethernet	Optional, 802.3, Cat5E (or Cat 6) UTP Ethernet cable (not included), for connecting to the Enphase Cloud through the internet	
Cellular/Mobile Connect	CELLMODEM-M1-06-SP-05 or CELLMODEM-M1-06-AT-05 (included with IQ Combiner 5C)	
Digital I/O	Digital input/output for grid operator control	
USB 2.0	Mobile Connect, COMMS-KIT-01 for IQ Battery 3/3T/10/10T, COMMS-KIT-02 for IQ Battery 5P	
Access point (AP) mode	For connection between the IQ Gateway and a mobile device running the Enphase Installer App	
Metering ports	Up to two Consumption CTs, one IQ Battery CT, and one Production CT	
Power line communication	90–110 kHz	
Web API	See <a href="https://developer-v4.enphase.com">https://developer-v4.enphase.com</a>	
Local API	See <a href="#">guide for local API</a>	
COMPLIANCE		
IQ Combiner with IQ Gateway	UL 1741, CAN/CSA C22.2 No. 107.1, Title 47 CFR, Part 15, Class B, ICES 003, NOM-208-SCFI-2016, UL 60601-1/CANCSA 22.2 No. 61010-1, IEC 60335-1, IEC 60335-2-11, IEC 60335-2-12, IEC 60335-2-13, IEC 60335-2-14, IEC 60335-2-15, IEC 60335-2-16, IEC 60335-2-17, IEC 60335-2-18, IEC 60335-2-19, IEC 60335-2-20, IEC 60335-2-21, IEC 60335-2-22, IEC 60335-2-23, IEC 60335-2-24, IEC 60335-2-25, IEC 60335-2-26, IEC 60335-2-27, IEC 60335-2-28, IEC 60335-2-29, IEC 60335-2-30, IEC 60335-2-31, IEC 60335-2-32, IEC 60335-2-33, IEC 60335-2-34, IEC 60335-2-35, IEC 60335-2-36, IEC 60335-2-37, IEC 60335-2-38, IEC 60335-2-39, IEC 60335-2-40, IEC 60335-2-41, IEC 60335-2-42, IEC 60335-2-43, IEC 60335-2-44, IEC 60335-2-45, IEC 60335-2-46, IEC 60335-2-47, IEC 60335-2-48, IEC 60335-2-49, IEC 60335-2-50, IEC 60335-2-51, IEC 60335-2-52, IEC 60335-2-53, IEC 60335-2-54, IEC 60335-2-55, IEC 60335-2-56, IEC 60335-2-57, IEC 60335-2-58, IEC 60335-2-59, IEC 60335-2-60, IEC 60335-2-61, IEC 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# Enphase IQ Envoy

The **Enphase IQ Envoy™** communications gateway delivers solar production and energy consumption data to Enphase Enlighten™ monitoring and analysis software for comprehensive, remote maintenance and management of the Enphase IQ System.

With integrated revenue grade production metering and optional consumption monitoring, Envoy IQ is the platform for total energy management and integrates with the Enphase Ensemble™ and the Enphase IQ Battery™.



### Smart

- Enables web-based monitoring and control
- Bidirectional communications for remote upgrades
- Supports power export limiting and zeroexport applications

### Simple

- Easy system configuration using Enphase Installer Toolkit™ mobile app
- Flexible networking with Wi-Fi, Ethernet, or cellular

### Reliable

- Designed for installation indoors or outdoors
- Five-year warranty

## Enphase IQ Envoy

### MODEL NUMBERS

Enphase IQ Envoy™ ENV-IQ-AM1-240	Enphase IQ Envoy communications gateway with integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and optional consumption monitoring (+/- 2.5%). Includes one 200A continuous rated production CT (current transformer).
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### ACCESORIES (Order Separately)

Enphase Mobile Connect™ CELLMODEM-M1 (4G based LTE-M/5-year data plan) CELLMODEM-M1-B (4G-based LTE-M1/5-year data plan)	Plug and play industrial grade cellular modem with data plan 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.)
Consumption Monitoring CT CT-200-SPLIT	Split-core consumption CTs enable whole home metering.
Ensemble Communications Kit COMMS-KIT-01	Installed at the IQ Envoy. For communications with Enphase Encharge™ storage and Enphase Enpower™ smart switch. Includes USB cable for connection to IQ Envoy or Enphase IQ Combiner™ and allows wireless communication with Encharge and Enpower.

### POWER REQUIREMENTS

Power requirements	120/240 VAC split-phase. Max 20 A overcurrent protection required.
Typical Power Consumption	5W

### CAPACITY

Number of microinverters polled	Up to 600
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### MECHANICAL DATA

Dimensions (WxHxD)	21.3 x 12.6 x 4.5 cm (8.4" x 5" x 1.8")
Weight	17.6 oz (498 g)
Ambient temperature range	-40° to 65° C (-40° to 149° F) -40° to 46° C (-40° to 115° F) if installed in an enclosure
Environmental rating	IP30. For installation indoors or in an NRTL-certified, NEMA type 3R enclosure.
Altitude	To 2000 meters (6,560 feet)
Production CT	- Limited to 200A of continuous current / 250A OCPD – 72kW AC - Internal aperture measures 19.36mm to support 250MCM THWN conductors (max) - UL2808 certified for revenue grade metering
Consumption CT	- For electrical services to 250A with parallel runs up to 500A - Internal aperture measures 0.84" x 0.96" (21.33mm x 24.38mm) to support 3/0 THWN conductor - UL2808 certified, for use at service entrance for services up to 250Vac

### INTERNET CONNECTION OPTIONS

Integrated Wi-Fi	802.11b/g/n
Ethernet	802.3, Cat5E (or Cat 6) UTP Ethernet cable (not included)
Mobile	CELLMODEM-M1 (4G) or CELLMODEM-M1-B (4G). Not included. Note that an Enphase Mobile Connect cellular modem is required for all Ensemble installations.

### COMPLIANCE

Compliance	UL 61010-1 CAN/CSA C22.2 No. 61010-1 47 CFR, Part 15, Class B, ICES 003 IEC/EN 61010-1:2010, EN50065-1, EN61000-4-5, EN61000-6-1, EN61000-6-2 Metering: ANSI C12.20 accuracy class 0.5 (PV production only)
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Orem, UT 84097

800.377.4480  
WWW.BLUERAVENSOLAR.COM

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**PV INSTALLATION PROFESSIONAL**  
Scott Gurney  
#PV-011719-015866

**CONTRACTOR:**  
BRS FIELD OPS  
385-498-6700

DRAWING BY:

PLOT DATE:

PROJECT NUMBER:

SHEET NAME:

**SPEC SHEET**

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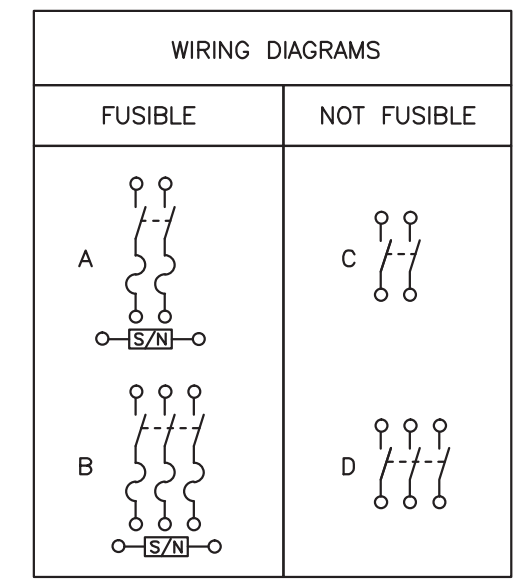
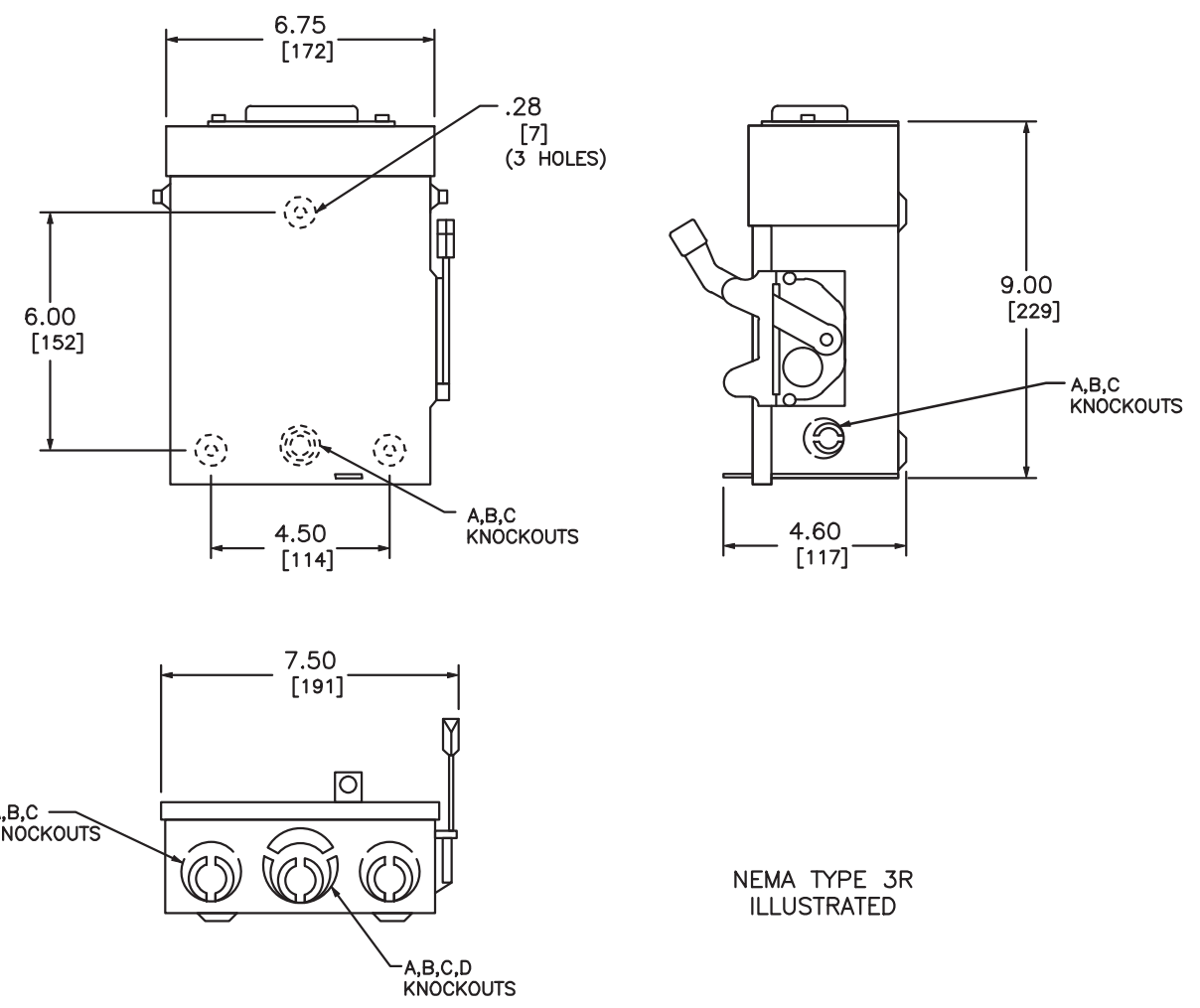
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**TERMINAL LUGS ‡**

AMPERES	MAX. WIRE	MIN. WIRE	TYPE
30	# 6 AWG	# 12 AWG	AL
	# 6 AWG	# 14 AWG	CU

**KNOCKOUTS**

SYMBOL	A	B	C	D
CONDUIT SIZE	.50	.75	1	1.25

DUAL DIMENSIONS: INCHES  
MILLIMETERS

CATALOG NUMBER	VOTAGE RATINGS	WIRING DIAG.	HORSEPOWER RATINGS					
			120VAC		240VAC			
			STD.	MAX.	STD.		MAX.	
			1 Ø	1 Ø	1 Ø	3 Ø	1 Ø	3 Ø
D211NRB●■	240VAC	A	1/2	2	1 1/2	-	3	-
D221NRB	240VAC	A	-	-	1 1/2	3*	3	7 1/2*
D321NRB	240VAC	B	-	-	1 1/2	3	3	7 1/2
DU221RB	240VAC	C	-	-	-	-	3	-
DU321RB	240VAC	D	-	-	-	-	3	7 1/2

**NOTES:**  
 FINISH - GRAY BAKED ENAMEL ELECTRODEPOSITED OVER CLEANED PHOSPHATIZED STEEL.  
 UL LISTED - FILE E-2875  
 ALL NEUTRALS - INSULATED GROUNDABLE  
 SUITABLE FOR USE AS SERVICE EQUIPMENT  
 TOP OF NEMA TYPE 3R SWITCHES HAVE PROVISIONS FOR MAXIMUM 2 1/2" BOLT-ON HUB.  
 SHORT CIRCUIT CURRENT RATINGS:  
 ● 10,000 AMPERES.  
 ■ 10,000 AMPERES WHEN USED WITH OR PROTECTED BY CLASS H OR K FUSES.  
 ■ 100,000 AMPERES WITH CLASS R FUSES.  
 \* FOR CORNER GROUNDING DELTA SYSTEMS.  
 ■ PLUG FUSES  
 ‡ LUGS SUITABLE FOR 60°C OR 75° CONDUCTORS.

GENERAL DUTY SAFETY SWITCHES  
 VISIBLE BLADE TYPE  
 30 AMPERE  
 ENCLOSURE - NEMA TYPE 3R RAINPROOF

**SQUARE D**  
 by Schneider Electric

DWG# 1852  
 No.

### A. System Specifications and Ratings

- Maximum Voltage: 1,000 Volts
- Maximum Current: **JB-1.2:** 80 Amps; **JB-1.XL:** 120 Amps
- Allowable Wire: 14 AWG – 6 AWG
- Spacing: Please maintain a spacing of at least ½” between uninsulated live parts and fittings for conduit, armored cable, and uninsulated live parts of opposite polarity.
- Enclosure Rating: Type 3R
- Roof Slope Range: 2.5 – 12:12
- Max Side Wall Fitting Size: 1”
- Max Floor Pass-Through Fitting Size: 1”
- Ambient Operating Conditions: (-35°C) - (+75°C)
- Compliance:
  - **JB-1.2:** UL1741, CSA C22.2 No. 290; **JB-1.XL:** UL1741, CSA C22.2 No. 290
  - Approved wire connectors: must conform to UL1741, CSA C22.2 No. 290
- System Marking: **Interek Symbol and File #5019942**
- Periodic Re-inspections: If re-inspections yield loose components, loose fasteners, or any corrosion between components, components that are found to be affected are to be replaced immediately.



**Table 1: Typical Wire Size, Torque Loads and Ratings**

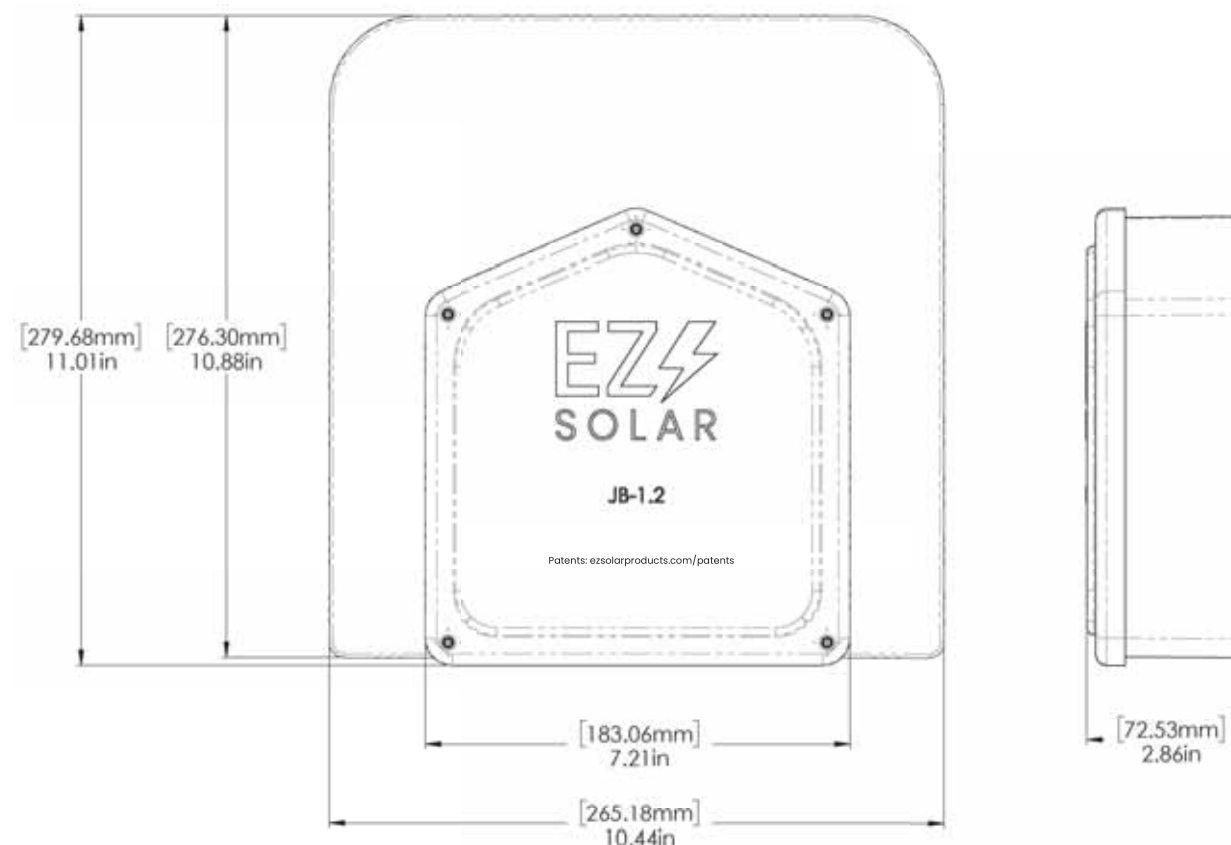
	1 Conductor	2 Conductor	Torque				
			Type	NM	Inch Lbs	Voltage	Current
ABB ZS6 terminal block	10-24 awg	16-24 awg	Sol/Str	0.5-0.7	6.2-8.85	600V	30 amp
ABB ZS10 terminal block	6-24 awg	12-20 awg	Sol/Str	1.0-1.6	8.85-14.16	600V	40 amp
ABB ZS16 terminal block	4-24 awg	10-20 awg	Sol/Str	1.6-2.4	14.6-21.24	600V	60 amp
ABB M6/8 terminal block	8-22 awg		Sol/Str	.08-1	8.85	600V	50 amp
Ideal 452 Red <small>WING-NUT Wire Connector</small>	8-18 awg		Sol/Str	Self-Torque	Self-Torque	600V	
Ideal 451 Yellow <small>WING-NUT Wire Connector</small>	10-18 awg		Sol/Str	Self-Torque	Self-Torque	600V	
Ideal, In-Sure <small>Push-In Connector Part #39</small>	10-14 awg		Sol/Str	Self-Torque	Self-Torque	600V	
WAGO, 2204-1201	10-20 awg	16-24 awg	Sol/Str	Self-Torque	Self-Torque	600V	30 amp
WAGO, 221-612	10-20 awg	10-24 awg	Sol/Str	Self-Torque	Self-Torque	600V	30 amp
Dottie DRC75	6-12 awg		Sol/Str	Snap-In	Snap-In		
ESP NG-53	4-6 awg		Sol/Str		45	2000V	
	10-14 awg		Sol/Str		35		
ESP NG-717	4-6 awg		Sol/Str		45	2000V	
	10-14 awg		Sol/Str		35		
Brumall 4-5,3	4-6 awg		Sol/Str		45	2000V	
	10-14 awg		Sol/Str		35		

**Table 2: Minimum wire-bending space for conductors through a wall opposite terminals in mm (inches)**

Wire size, AWG or kcmil (mm2)	Wires per terminal (pole)			
	1 mm (inch)	2 mm (inch)	3 mm (inch)	4 or More mm (inch)
14-10 (2.1-5.3)	Not Specified	-	-	-
8 (8.4)	38.1 (1-1/2)	-	-	-
6 (13.3)	50.8 (2)	-	-	-

ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	JB-1.2 BODY	POLYCARBONATE WITH UV INHIBITORS	1
2	JB-1.2 LID	POLYCARBONATE WITH UV INHIBITORS	1
3	#10 X 1-1/4" PHILLIPS PAN HEAD SCREW		6
4	#8 X 3/4" PHILLIPS PAN HEAD SCREW		6

SIZE	DWG. NO.	REV
<b>B</b>	<b>JB-1.2</b>	
SCALE: 1:2	WEIGHT: 1.45 LBS	SHEET 1 OF 3
TORQUE SPECIFICATION:	15-20 LBS	
CERTIFICATION:	UL 1741, NEMA 3R CSA C22.2 NO. 290	
WEIGHT:	1.45 LBS	



PROPRIETARY AND CONFIDENTIAL: THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF EZ SOLAR. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF EZ SOLAR IS PROHIBITED.



DRAWING NUMBER:

**SS**

RIGID PVC CONDUIT FITTINGS

JB444 JUNCTION BOXES

ISSUE DATE:  
DATE D'EMISSION: 2009 04 30

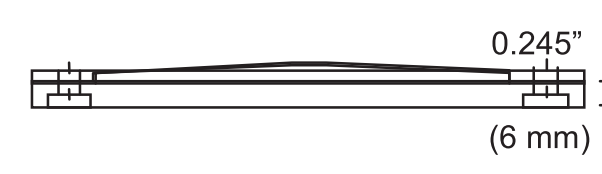
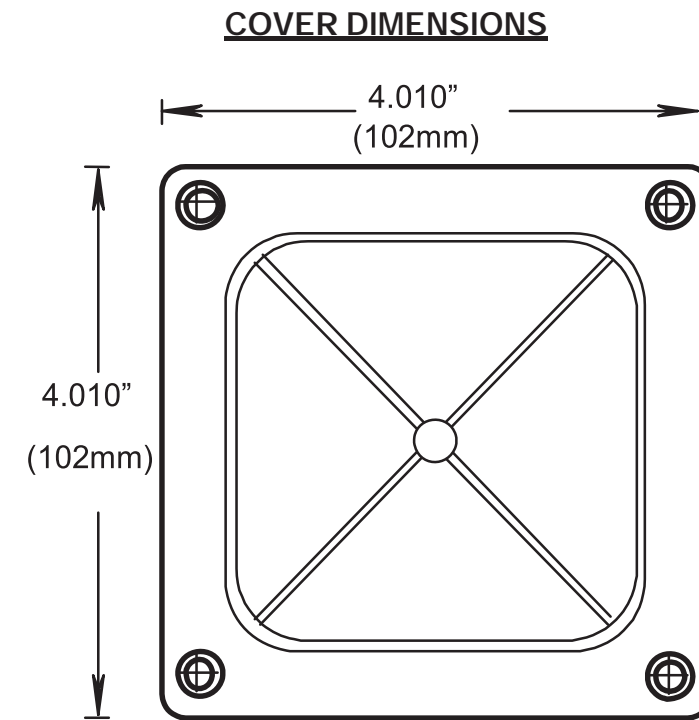
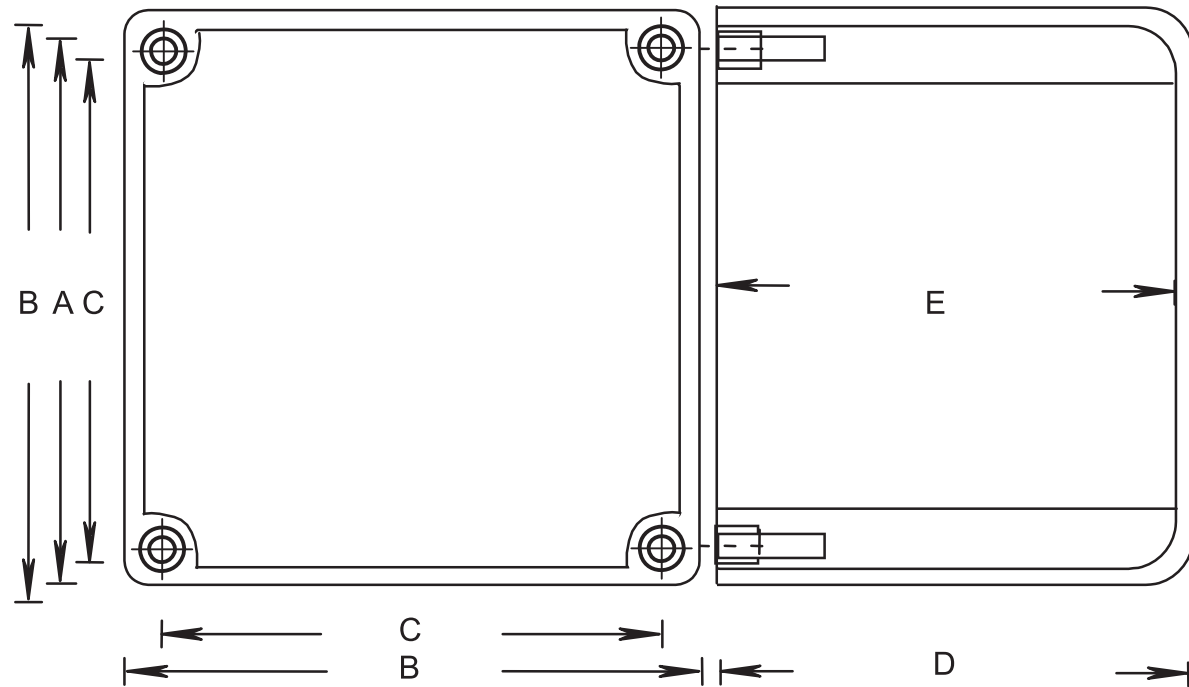
SUPERCEDES:  
REPLACE: 2004 07 15

RIGID PVC CONDUIT FITTINGS

JB444 JUNCTION BOXES

ISSUE DATE:  
DATE D'EMISSION: 2009 04 30

SUPERCEDES:  
REPLACE: 2004 07 15

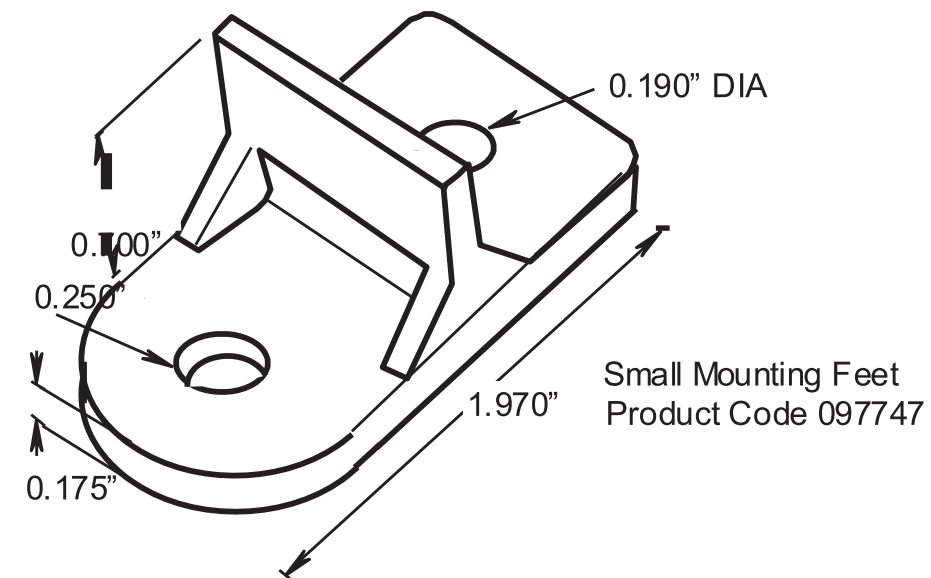


PRODUCT CODE	PART NUMBER	NOMINAL SIZE		A		B		C	
		(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)
076668	J444 STAHLIN	4	103	3.675	93	4.000	102	3.450	88
076259	AMJB444 ALLIED	4	103	3.675	93	4.000	102	3.450	88
077643*	2037-424T CANLET	4	103	3.675	93	4.000	102	3.450	88
077696	JB 444	4	103	4.000	101	4.395	112	3.950	101

PRODUCT CODE	PART NUMBER	NOMINAL SIZE		D		E		VOLUME	
		(in)	(mm)	(in)	(mm)	(in)	(mm)	(cu. In)	(cu. Cm)
076668	J444 STAHLIN	4	103	4.180	106.	3.850	98	51.5	844.6
076259	AMJB444 ALLIED	4	103	4.180	106	3.850	98	51.5	844.6
077643*	2037-424T CANLET	4	103	4.180	106	3.850	98	51.5	844.6
077696	JB 444	4	103	4.170	106	3.930	100	51.5	844.6

PRODUCT CODE	PART NUMBER	NOMINAL SIZE		GASKET CODE	INSERT CODE	SCREW CODE	M.FEET CODE
		(in)	(mm)				
076668	J444 STAHLIN	4	103		072538 (4)		
076259	AMJB444 ALLIED	4	103		072538 (4)		
077643*	2037-424T CANLET	4	103		072538 (4)		
077696	JB 444	4	103	097731	072538 (4) 072539 (2)	072522 (4) 072513 (2)	097747

\* BOX WITH MOLDED MOUNTING FEET, INSERT ONLY; NO COVER, OR GASKET, UL LISTED 576J





*"Stay Connected" with* **HEYCO** Solar Power Components  
*a PennEngineering® Company*

### Heyco®-Tite Liquid Tight Cordgrips for Enphase Q Cables

Straight-Thru, NPT Hubs with Integral Sealing Ring

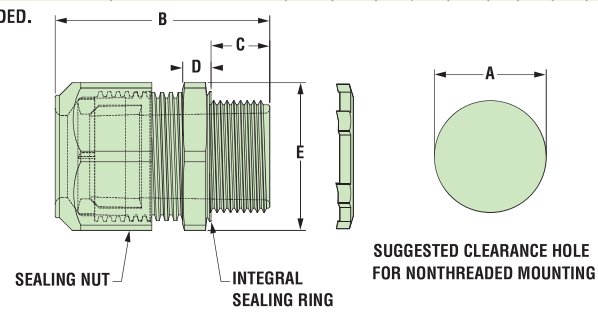
*The Ultimate in Liquid Tight Strain Relief Protection*

**ALL NEW PRODUCT!**



GLAND CONFIGURATION	PART NO.	DESCRIPTION	UL/CSA or SR	PART DIMENSIONS											
				A	B	C	D	E							
Type	Size	No.	Black	Clearance Hole Dia.	Max. O.A. Length	Thread Length	Wrenching Nut Thickness	Flat Size							
*	mm.			in.	mm.	in.	mm.	in.	mm.						
<b>Oval Gland</b>															
Q Cable	6.1 x 9.7	1	M3231GCZ	LTCG 1/2 6.1x9.7MM	UL/CSA	.875	22.2	1.70	43.2	.61	15.5	.21	5.3	.98	24.9
<b>Break-Thru Skinned Over Gland</b>															
Q Cables plus Ground	6.1 x 9.7 3.3	2 1	M3234GDA-SM	SMCG 3/4 2-6.1x9.7MM 1-3.3MM	UL/CSA	1.040	26.4	2.00	50.8	.62	15.7	.25	6.4	1.30	33.0

Metal Locknuts INCLUDED.



Material	Nylon 6/6 with TPE Sealing Gland
Certifications	UL Listed under Underwriters' Laboratories File E504900 CSA Certified by the Canadian Standards Association File 93876
Flammability Rating	94V-2
Temperature Range	Static -40°F (-40°C) to 239°F (115°C) Dynamic -4°F (-20°C) to 212°F (100°C)
IP Rating	IP 68

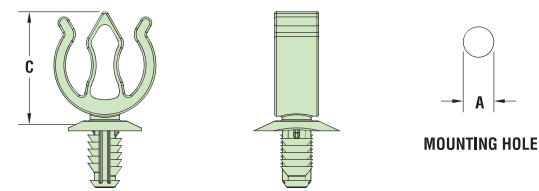
- Two new cordgrips now accommodate the Enphase Q Cable – M3231GCZ (1/2" NPT) and M3234GDA-SM (3/4" NPT).
- The 1/2" version provides liquid tight entry for one Enphase Q Cable – .24 x .38" (6,1 x 9,7 mm).
- The 3/4" version provides liquid tight entry for up to two Enphase Q Cables – .24 x .38" (6,1 x 9,7 mm) and an additional .130" (3,3 mm) dia. hole for a #8 solid grounding cable.
- The 3/4" version utilizes our skinned-over technology so any unused holes will retain a liquid tight seal.
- Rated for use with DG Cable.

### Heyco® Helios® UVX Clip – Blind Mount

**ALL NEW PRODUCT!**



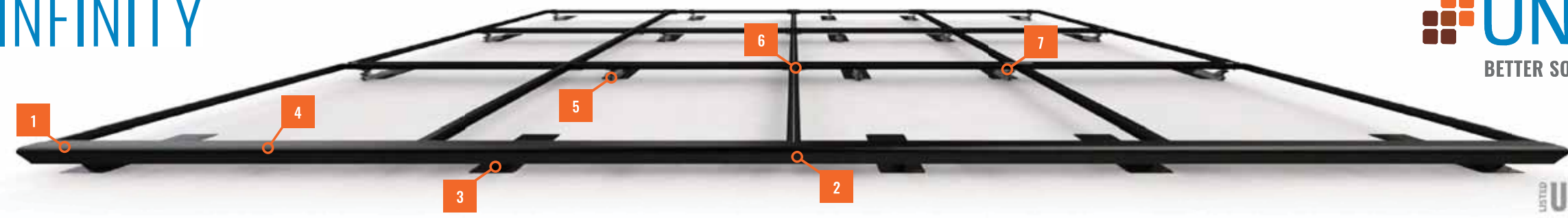
PANEL THICKNESS RANGE		WIRE DIAMETER RANGE		PART NO.	DESCRIPTION	MOUNTING HOLE DIA. A	OVERALL HEIGHT C
Minimum	Maximum	1-2 Wires					
in.	mm.	in.	mm.			in.	mm.
<b>1-2 Wires</b>							
.028	0,7	.250	6,4	.23 (5,8 mm) - .32 (8,0 mm) each cable	S6520 S6560	Helios UVX Clip 100 Pack Helios UVX Clip Bulk	.260 6,6 .96 24,4



Material	Nylon 6/6 with extended UV Capabilities
Flammability Rating	94V-2
Temperature Range	Dynamic -4°F (-20°C) to 185°F (85°C)

- The jersey pine tree mounting style installs easily with superior holding power.
- UVX nylon protects from corrosion due to outdoor exposure.
- Installs into .260" (6,6 mm) mounting hole.
- Holds up to 2 cables between .230 - .315" (5,8 - 8,0 mm) each.
- Cables install with fingertip pressure.
- Molded from our robust UVX nylon 6/6 with extended UV capabilities for our Solar 20 Year Warranty.

# SFM INFINITY



LISTED **UL2703** WITH A DESIGN APPROVAL, LISTED SYSTEM CLASSIFICATION



## 2 INSTALLS PER DAY

Make two installs per day your new standard. **SFM INFINITY** has fewer roof attachments, one tool installation, and pre-assembled components to get you off the roof 40% faster.

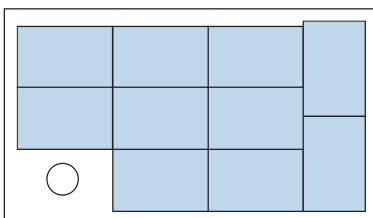
**87%** OF HOMEOWNERS PREFER

## BETTER AESTHETICS








Install the system with the aesthetics preferred by homeowners, with integrated front trim, trim end caps, dark components, and recessed hardware.

## MAXIMUM POWER DENSITY




Easily mix module orientations to achieve optimal power density without incurring the increased bill of materials, labor, and attachments required by rail.



## SYSTEM OVERVIEW

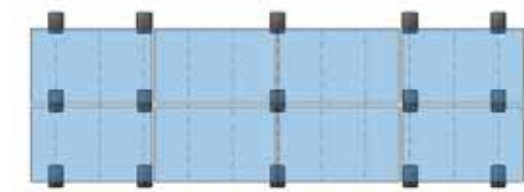
	PART NAME	DESCRIPTION
1	 TRIMRAIL	Structural front trim provides aesthetic and aligns modules.
2	 TRIMRAIL SPLICE	Connects and electrically bonds sections of <b>TRIMRAIL</b> .
3	 TRIMRAIL FLASHKIT	Attaches <b>TRIMRAIL</b> to roof. Available for comp shingle or tile.
4	 MODULE CLIPS	Secure modules to <b>TRIMRAIL</b> .
5	 MICRORAIL	Connects modules to SLIDERS. Provides post-install array leveling.
6	 SPLICE	Connects and supports modules. Provides east-west bonding. <b>ATTACHED SPLICE</b> also available.
7	 SLIDER FLASHKIT	Roof attachment and flashing. Available for comp shingle and tile.

## BONDING AND ACCESSORIES

	PART NAME	DESCRIPTION
	 TRIMRAIL ENDCAPS	Covers ends of <b>TRIMRAIL</b> for refined aesthetic.
	 TRIMRAIL BONDING CLAMP	Electrically bonds <b>TRIMRAIL</b> and modules
	 N/S BONDING CLAMP	Electrically bonds rows of modules

## 20% FEWER ATTACHMENTS

Save time and money on every project: **SFM INFINITY** requires fewer attachments than rail systems.



**SFM INFINITY** 15 Attachments



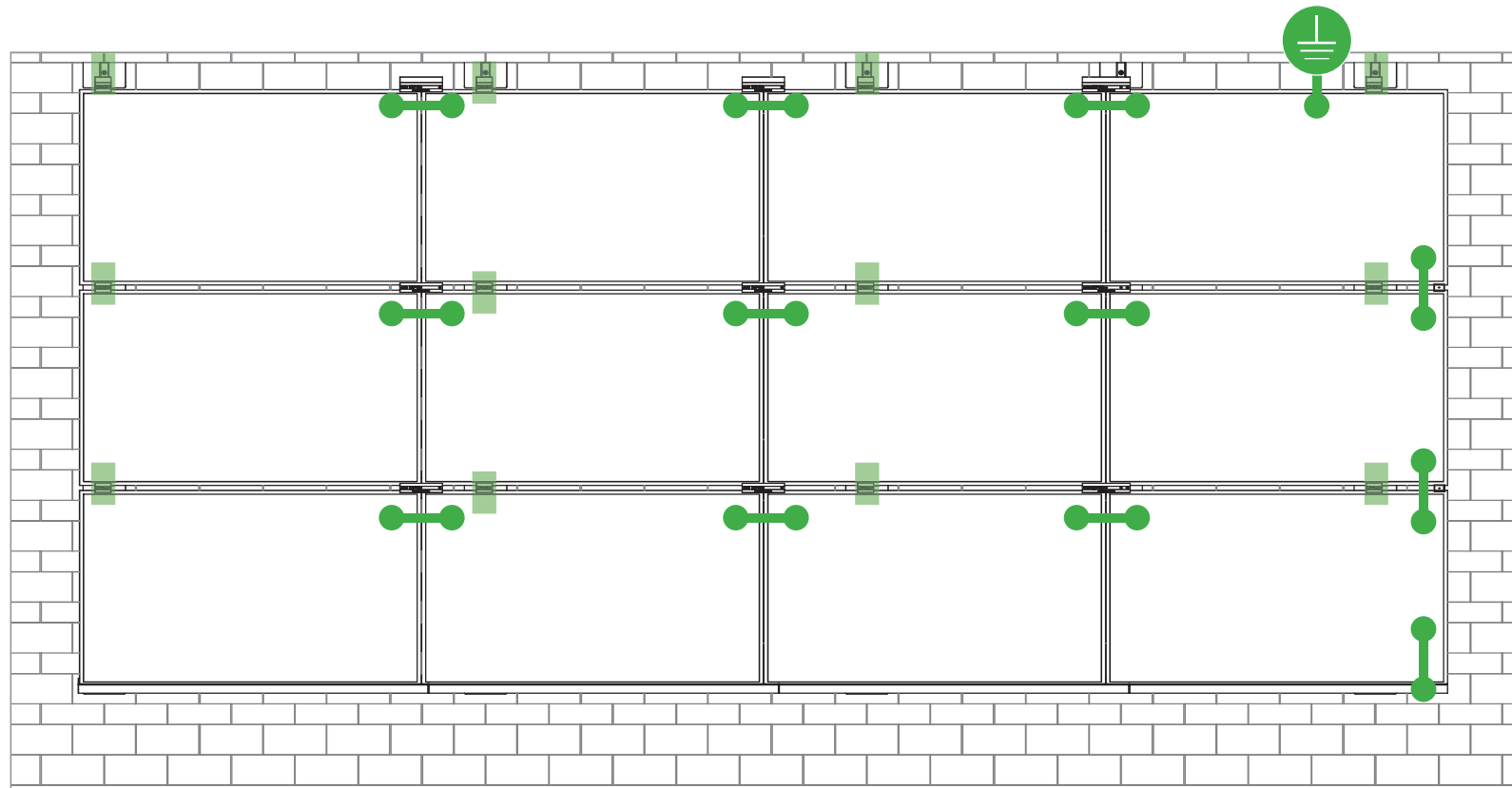
**RAIL** 20 Attachments

## 30% LOGISTICS SAVINGS

With fewer SKUs and compact components, **SFM INFINITY** is easier to stock, easier to transport, and easier to lift to the roof. Plus, make more efficient use of your vehicle fleet.



**SFM INFINITY REVOLUTIONIZES ROOFTOP SOLAR WITH BENEFITS ACROSS YOUR BUSINESS, FROM DESIGN AND LOGISTICS, THROUGH ARRAY INSTALLATION AND SERVICE.**



Star Washer is Single Use Only



**TERMINAL TORQUE,**  
Install Conductor and torque to the following:  
4-6 AWG: 35in-lbs  
8 AWG: 25 in-lbs  
10-14 AWG: 20 in-lbs

**LUG DETAIL & TORQUE INFO**  
**IlSCO Lay-In Lug (GBL-4DBT)**

- 10-32 mounting hardware
- Torque = 5 ft-lb
- AWG 4-14 - Solid or Stranded

**TERMINAL TORQUE,**  
Install Conductor and torque to the following:  
4-14 AWG: 35in-lbs



**LUG DETAIL & TORQUE INFO**  
**IlSCO Flange Lug (SGB-4)**

- 1/4" mounting hardware
- Torque = 75 in-lb
- AWG 4-14 - Solid or Stranded

WEEBLUG Single Use Only



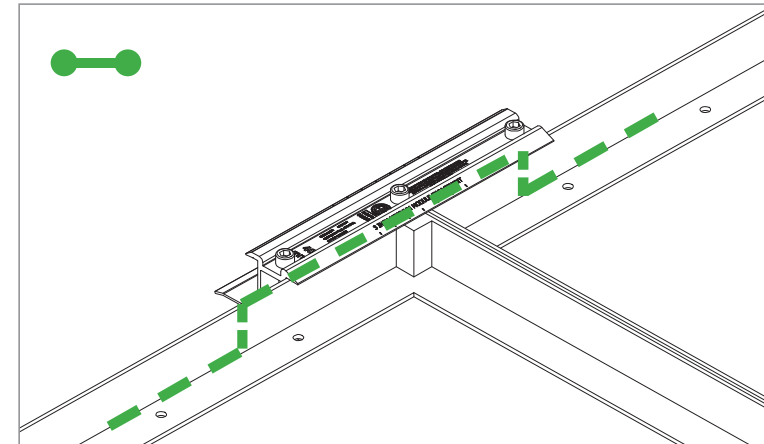
**TERMINAL TORQUE,**  
Install Conductor and torque to the following:  
6-14 AWG: 7ft-lbs

**LUG DETAIL & TORQUE INFO**  
**Wiley WEEBLug (6.7)**

- 1/4" mounting hardware
- Torque = 10 ft-lb
- AWG 6-14 - Solid or Stranded

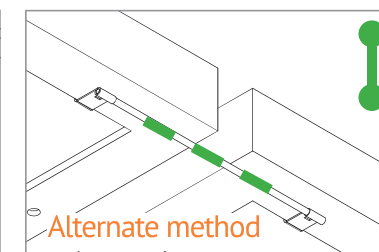
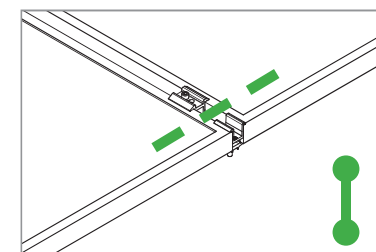
**NOTE: ISOLATE COPPER FROM ALUMINUM CONTACT TO PREVENT CORROSION**

**System bonding is accomplished through modules. System grounding accomplished by attaching a ground lug to any module at a location on the module specified by the module manufacturer.**



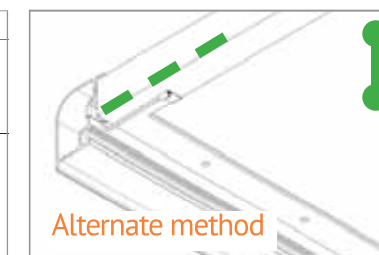
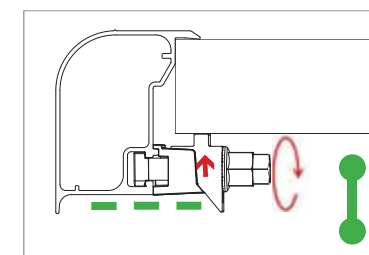
**E-W BONDING PATH:**

E-W module to module bonding is accomplished with 2 pre-installed bonding pins which engage on the secure side of the Microrail™ and splice.



**N-S BONDING PATH:**

N-S module to module bonding is accomplished with bonding clamp with 2 integral bonding pins. (refer also to alternate method)



**TRIMRAIL BONDING PATH:**

Trimrail to module bonding is accomplished with bonding clamp with integral bonding pin and bonding T-bolt. (refer also to alternate method)

### SYSTEM LEVEL FIRE CLASSIFICATION

The system fire class rating requires installation in the manner specified in the SUNFRAME MICRORAIL (SFM) Installation Guide. SFM has been classified to the system level fire portion of UL 1703. This UL 1703 classification has been incorporated into the UL 2703 product certification. SFM has achieved Class A, B & C system level performance for low slope & steep sloped roofs when used in conjunction with type 1 and type 2 modules. Class A, B & C system level fire

performance is inherent in the SFM design, and no additional mitigation measures are required. The fire classification rating is valid for any roof pitch. There is no required minimum or maximum height limitation above the roof deck to maintain the Class A, B & C fire rating for SFM. SUNFRAME MICRORAIL™ components shall be mounted over a fire resistant roof covering rated for the application.

Module Type	Roof Slope	System Level Fire Rating	Microrail Direction	Module Orientation	Mitigation Required
Type 1 and Type 2	Steep Slope & Low Slope	Class A, B & C	East-West	Landscape OR Portrait	None Required

### UL2703 TEST MODULES

See pages 22 and 23 for a list of modules that were electrically and mechanically tested or qualified with the SUNFRAME MICRORAIL (SFM) components outlined within this Installation Guide.

- Maximum Area of Module = 27.76 sqft
- UL2703 Design Load Ratings:
  - a) Downward Pressure – 113 PSF / 5400 Pa
  - b) Upward Pressure – 50 PSF / 2400 Pa
  - c) Down-Slope Load – 21.6 PSF / 1034 Pa
- Tested Loads:
  - a) Downward Pressure – 170 PSF / 8000 Pa
  - b) Upward Pressure – 75 PSF / 3500 Pa
  - c) Down-Slope Load – 32.4 PSF / 1550 Pa
- Maximum Span = 6ft
- Use with a maximum over current protection device OCPD of 30A
- System conforms to UL Std 2703, certified to LTR AE-001-2012
- Rated for a design load of 2400 Pa / 5400 Pa with 24 inch span
- PV modules may have a reduced load rating, independent of the SFM load rating. Please consult the PV module manufacturer's installation guide for more information
- Down-Slope design load rating of 30 PSF/ 1400 Pa for module areas of 22.3 sq ft or less

Manufacture	Module Model / Series
Aleo	P-Series
Aptos	DNA-120-(BF/MF)26 DNA-144-(BF/MF)26
Astronergy	CHSM6612P, CHSM6612P/HV, CHSM6612M, CHSM6612M/HV, CHSM6610M (BL)(BF)/(HF), CHSM72M-HC
Auxin	AXN6M610T, AXN6P610T, AXN6M612T & AXN6P612T
Axitec	AXIblackpremium 60 (35mm), AXIpower 60 (35mm), AXIpower 72 (40mm), AXIpremium 60 (35mm), AXIpremium 72 (40mm).
Boviet	BVM6610, BVM6612
BYD	P6K & MHK-36 Series
Canadian Solar	CS1(H/K/U/Y)-MS CS3(K/L/U), CS3K-MB-AG, CS3K-(MS/P) CS3N-MS, CS3U-MB-AG, CS3U-(MS/P), CS3W CS5A-M, CS6(K/U), CS6K-(M/P), CS6K-MS CS6P-(M/P), CS6U-(M/P), CS6V-M, CS6X-P
Centrosolar America	C-Series & E-Series
CertainTeed	CT2xxMxx-01, CT2xxPxx-01, CTxxxMxx-02, CTxxxM-03, CTxxxMxx-04, CTxxxHC11-04
Dehui	DH-60M

Manufacture	Module Model / Series
Eco Solargy	Orion 1000 & Apollo 1000
ET Solar	ET-M672BHxxxTW
Freedom Forever	FF-MP-BBB-370
FreeVolt	Mono PERC
GCL	GCL-P6 & GCL-M6 Series
Hansol	TD-AN3, TD-AN4, UB-AN1, UD-AN1
Heliene	36M, 60M, 60P, 72M & 72P Series, 144HC M6 Monofacial/ Bifacial Series, 144HC M10 SL Bifacial
HT Solar	HT60-156(M) (NDV) (-F), HT 72-156(M/P)
Hyundai	KG, MG, TG, RI, RG, TI, MI, HI & KI Series HiA-SxxxHG
ITEK	iT, iT-HE & iT-SE Series
Japan Solar	JPS-60 & JPS-72 Series
JA Solar	JAP6 60-xxx, JAM6-60-xxx/SI, JAM6(K)-60/ xxx, JAP6(k)-72-xxx/4BB, JAP72SYY-xxx/ZZ, JAP6(k)-60-xxx/4BB, JAP60SYY-xxx/ZZ, JAM6(k)-72-xxx/ZZ, JAM72SYY-xxx/ZZ, JAM6(k)-60-xxx/ZZ, JAM60SYY-xxx/ZZ. i. YY: 01, 02, 03, 09, 10 ii. ZZ: SC, PR, BP, HiT, IB, MW, MR
Jinko	JKM & JKMS Series Eagle JKMxxxM JKMxxxM-72HL-V
Kyocera	KU Series

Manufacture	Module Model / Series	
LG Electronics	LGxxxN2T-A4 LGxxx(A1C/E1C/E1K/N1C/N1K/N2T/N2W/ Q1C/Q1K/S1C/S2W)-A5 LGxxxN2T-B5 LGxxxN1K-B6 LGxxx(A1C/M1C/M1K/N1C/N1K/Q1C/Q1K/ QAC/QAK)-A6 LGxxx(N1C/N1K/N2T/N2W)-E6 LGxxx(N1C/N1K/N2W/S1C/S2W)-G4 LGxxxN2T-J5 LGxxx(N1K/N1W/N2T/N2W)-L5 LGxxx(N1C/Q1C/Q1K)-N5 LGxxx (N1C/N1K/N2W/Q1C/Q1K)-V5	
	LR4-60(HIB/HiH/HPB/HPH)-xxxM LR4-72(HiH/HPH)-xxxM LR6-60(BP/HBD/HIBD)-xxxM (30mm) LR6-60(BK)(PE)(HPB)(HPH)-xxxM (35mm) LR6-60(BK)(PE)(PB)(PH)-xxxM (40mm) LR6-72(BP)(HBD)(HIBD)-xxxM (30mm) LR6-72(HV)(BK)(PE)(PH)(PB)(HPH)-xxxM (35mm) LR6-72(BK)(HV)(PE)(PB)(PH)-xxxM (40mm)	
	Mission Solar Energy	MSE Series
	Mitsubishi	MJE & MLE Series
	Neo Solar Power Co.	D6M & D6P Series

- Unless otherwise noted, all modules listed above include all wattages and specific models within that series. Variable wattages are represented as "xxx"
- Items in parenthesis are those that may or may not be present in a compatible module's model ID
- Slashes "/" between one or more items indicates that either of those items may be the one that is present in a module's model ID
- Please see the SFM UL2703 Construction Data Report at Unirac.com to ensure the exact solar module selected is approved for use with SFM
- SFM Infinity is not compatible with module frame height of less than 30mm and more than 40mm. See Module Mounting section, page 12 for further information

Manufacture	Module Model / Series
Panasonic	EVPVxxx (H/K/PK), VBHNxxxSA15 & SA16, VBHNxxxSA17 & SA18, VBHNxxxSA17(E/G) & SA18E, VBHNxxxKA01 & KA03 & KA04, VBHNxxxZA01, VBHNxxxZA02, VBHNxxxZA03, VBHNxxxZA04
Peimar	SGxxxM (FB/BF)
Phono Solar	PS-60, PS-72
Prism Solar	P72 Series
Q.Cells	Plus, Pro, Peak, G3, G4, G5, G6(+), G7, G8(+) Pro, Peak L-G2, L-G4, L-G5, L-G6, L-G7 Q.PEAK DUO BLK-G6+ Q.PEAK DUO BLK-G6+/TS Q.PEAK DUO (BLK)-G8(+) Q.PEAK DUO L-G8.3/BFF Q.PEAK DUO (BLK) ML-G9(+) Q.PEAK DUO XL-G9/G9.2/G9.3 Q.PEAK DUO (BLK) ML-G10(+) Q.PEAK DUO XL-G(10/10.2/10.3/10.c/10.d) Q.PEAK DUO BLK ML-G10+ / t
REC Solar	Alpha (72) (Black) (Pure) RECxxxAA PURE-R RECxxxNP3 Black N-Peak (Black) N-Peak 2 (Black) PEAK Energy Series PEAK Energy BLK2 Series PEAK Energy 72 Series

Manufacture	Module Model / Series
REC Solar (cont.)	TwinPeak Series TwinPeak 2 Series TwinPeak 2 BLK2 Series TwinPeak 2S(M)72(XV) TwinPeak 3 Series (38mm) TP4 (Black)
Renesola	Vitrus2 Series & 156 Series
Risen	RSM72-6 (MDG) (M), RSM60-6
SEG Solar	SEG-xxx-BMD-HV SEG-xxx-BMD-TB
S-Energy	SN72 & SN60 Series (40mm)
Seraphim	SEG-6 & SRP-6 Series
Sharp	NU-SA & NU-SC Series
Silfab	SLA, SLG, BC Series & SILxxx(BL/NL/NT/HL/ML/BK/NX/NU/HC)
Solarever USA	SE-166*83-xxxM-120N
Solaria	PowerXT-xxxR-(AC/PD/BD) PowerXT-xxxC-PD PowerXT-xxxR-PM (AC)
SolarWorld	Sunmodule Protect, Sunmodule Plus
Sonali	SS-M-360 to 390 Series, SS-M-390 to 400 Series, SS-M-440 to 460 Series, SS-M-430 to 460 BiFacial Series, SS 230 - 265
SunEdison	F-Series, R-Series & FLEX FXS Series

Manufacture	Module Model / Series
Suniva	MV Series & Optimus Series
SunPower	A-Series A400-BLK , SPR-MAX3-XXX-R, X-Series, E-Series & P-Series
Suntech	STP, STPXXXS - B60/Wnhb
Talesun	TP572, TP596, TP654, TP660, TP672, Hipor M, Smart
Tesla	SC, SC B, SC B1, SC B2 TxxxH, TxxxS
Trina	PA05, PD05, DD05, DE06, DD06, PE06, PD14, PE14, DD14, DE09.05, DE14, DE15, PE15H
Upsolar	UP-MxxxP(-B), UP-MxxxM(-B)
United Renewable Energy (URE)	D7MxxxH7A, D7(M/K)xxxH8A FAKxxx(C8G/E8G), FAMxxxE7G-BB FAMxxxE8G(-BB) FBMxxxMFG-BB
Vikram	Eldora, Solivo, Somera
Waaree	AC & Adiya Series
Winaico	WST & WSP Series
Yingli	YGE & YLM Series
ZN Shine	ZXM6-72, ZXM6-NH144-166_2094

- Unless otherwise noted, all modules listed above include all wattages and specific models within that series. Variable wattages are represented as "xxx"
- Items in parenthesis are those that may or may not be present in a compatible module's model ID
- Slashes "/" between one or more items indicates that either of those items may be the one that is present in a module's model ID
- Please see the SFM UL2703 Construction Data Report at Unirac.com to ensure the exact solar module selected is approved for use with SFM
- SFM Infinity is not compatible with module frame height of less than 30mm and more than 40mm. See Module Mounting section, page 12 for further information

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**Applicant:** Unirac, Inc  
**Address:** 1411 Broadway Blvd NE  
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**Country:** USA  
**Party Authorized To Apply Mark:** Same as Manufacturer  
**Report Issuing Office:** Intertek Testing Services NA, Inc., Lake Forest, CA  
**Control Number:** 5003705 **Authorized by:** Kenneth Leary  
for L. Matthew Snyder, Certification Manager



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Intertek Testing Services NA Inc.  
545 East Algonquin Road, Arlington Heights, IL 60005  
Telephone 800-345-3851 or 847-439-5667 Fax 312-283-1672

<b>Standard(s):</b>	Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels [UL 2703:2015 Ed.1+R:24Mar2021] PV Module and Panel Racking Mounting System and Accessories [CSA TIL No. A-40:2020]
<b>Product:</b>	Photovoltaic Mounting System, Sun Frame Microrail Installation Guide, PUB2023MAY10
<b>Brand Name:</b>	Unirac
<b>Models:</b>	Unirac SFM

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**Applicant:** Unirac, Inc  
**Address:** 1411 Broadway Blvd NE  
Albuquerque, NM 87102  
**Country:** USA  
**Party Authorized To Apply Mark:** Same as Manufacturer  
**Report Issuing Office:** Intertek Testing Services NA, Inc., Lake Forest, CA  
**Control Number:** 5014989 **Authorized by:** Kenneth Leary  
for L. Matthew Snyder, Certification Manager



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545 East Algonquin Road, Arlington Heights, IL 60005  
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<b>Standard(s):</b>	Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels [UL 2703:2015 Ed.1+R:24Mar2021] PV Module and Panel Racking Mounting System and Accessories [CSA TIL No. A-40:2020]
<b>Product:</b>	Photovoltaic Mounting System, Sun Frame Microrail Installation Guide, PUB2023MAY10
<b>Brand Name:</b>	Unirac
<b>Models:</b>	Unirac SFM





1.0 Reference and Address		
Report Number	102393982LAX-002	Original 11-Apr-2016 Revised: 5-Oct-2022
Standard(s)	Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels [UL 2703:2015 Ed.1+R:24Mar2021] PV Module and Panel Racking Mounting System and Accessories [CSA TIL No. A-40:2020]	
Applicant	Unirac, Inc	Manufacturer 2
Address	1411 Broadway Blvd NE Albuquerque, NM 87102	Address
Country	USA	Country
Contact	Klaus Nicolaedis Todd Ganshaw	Contact
Phone	505-462-2190 505-843-1418	Phone
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Manufacturer 3		Manufacturer 4
Address		Address
Country		Country
Contact		Contact
Phone		Phone
FAX		FAX
Email		Email
Manufacturer 5		
Address		
Country		
Contact		
Phone		
FAX		

1.0 Reference and Address		
Report Number	102393982LAX-002	Original 11-Apr-2016 Revised: 5-Oct-2022
Email		

2.0 Product Description	
Product	Photovoltaic Mounting System, Sun Frame Microrail Installation Guide, PUB2022SEP28
Brand name	Unirac
Description	<p>The product covered by this report is the Sun Frame Micro Rail roof mounted Photovoltaic Rack Mounting System. This system is designed to provide bonding and grounding to photovoltaic modules. The mounting system employs anodized or mill finish aluminum brackets that are roof mounted using the slider, outlined in section 4 of this report. There are no rails within this product, whereas the 3" Micro Rail, Floating Splice, and 9" Attached Splice electrically bond the modules together forming the path to ground.</p> <p>The Micro Rails are installed onto the module frame by using a stainless steel bolt anodized with black oxide with a stainless type 300 bonding pin, torqued to 20 ft-lbs, retaining the modules to the bracket. The bonding pin of the Micro Rail when bolted and torqued, penetrate the anodized coating of the photovoltaic module frame (at bottom flange) to contact the metal, creating a bonded connection from module to module.</p> <p>The grounding of the entire system is intended to be in accordance with the latest edition of the National Electrical Code, including NEC 250: Grounding and Bonding, and NEC 690: Solar Photovoltaic Systems or the Canadian Electrical Code, CSA C22.1 Part 1 in accordance to the revision in effect in the jurisdiction in which the project resides. Any local electrical codes must be adhered in addition to the national electrical codes. The Grounding Lug is secured to the photovoltaic module, torqued in accordance with the installation manual provided in this document.</p> <p>Other optional grounding includes the use of the Enphase UL2703 certified grounding system, which requires a minimum of 2 micro-inverters mounted to the same rail, and using the same engage cable.</p>

2.0 Product Description	
Models	Unirac SFM
Model Similarity	NA
Ratings	<p>Fuse Rating: 30A</p> <p>Module Orientation: Portrait or Landscape Maximum Module Size: 17.98 ft<sup>2</sup> UL2703 Design Load Rating: 33 PSF Downward, 33 PSF Upward, 10 PSF Down-Slope Tested Loads - 50 psf/2400Pa Downward, 50psf/2400Pa Uplift, 15psf/720Pa Down Slope Trina TSM-255PD05.08 and Sunpower SPR-E20-327 used for Mechanical Loading</p> <p>Increased size ML test: Maximum Module Size: 22.3 ft<sup>2</sup> UL2703 Design Load Rating: 113 PSF Downward, 50 PSF Upward, 30 PSF Down-Slope LG355S2W-A5 used for Mechanical Loading test. Mounting configuration: Four mountings on each long side of panel with the longest span of 24" UL2703 Design Load Rating: 46.9 PSF Downward, 40 PSF Upward, 10 PSF Down-Slope LG395N2W-A5, LG360S2W-A5 and LG355S2W-A5 used for used for Mechanical Loading test. Mounting configuration: Six mountings for two modules used with the maximum span of 74.5" IEC 61646 Test Loads - 112.78 psf/5400Pa Downward, 50psf/2400Pa Uplift</p> <p>Mechanical Load test to add FlashLoc Slider and Trim Assemblies to UL2703 and IEC 61646 Certifications, &amp; Increase SFM System UL2703 Module Size: Maximum Module Size: 27.76 ft<sup>2</sup> UL2703 Design Load Rating: 113 PSF Downward, 50 PSF Upward, 21.6 PSF Down-Slope Jinko Eagle 72HM G5 used for Mechanical Loading test. Mounting configuration: Four mountings on each long side of panel with the longest span of 24" Maximum module size: 21.86 ft<sup>2</sup> IEC 61646 Test Loads - 112.78 psf/5400Pa Downward, 75psf/3600Pa Uplift SunPower model SPR-A430-COM-MLSD used for Mechanical Loading</p> <p>Fire Class Resistance Rating: - Class A for Steep Slope Applications when using Type 1 Modules. Can be installed at any interstitial gap. Installations must include Trim Rail. - Class A for Steep Slope Applications when using Type 2 Modules. Can be installed at any interstitial gap. Installations must include Trim Rail. - Class A Fire Rated for Low Slope applications with Type 1 or 2 listed photovoltaic modules. This system was evaluated with a 5" gap between the bottom of the module and the roof's surface</p> <p>See section 7.0 illustrations # 1, 1a and 1b for a complete list of PV modules evaluated with these racking systems</p>
Other Ratings	NA