

# RESIDENTIAL ROOFTOP SOLAR PERMIT PACKAGE



**Antonio Johnny**  
 67 James Allen Ln  
 Dunn, North Carolina 28334  
 415-941-9964



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

**SCOPE OF WORK**  
 INSTALLATION OF ROOFTOP MOUNTED  
 PHOTVOLTAIC 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



**TYPICAL STRUCTURAL INFORMATION**

ROOF MATERIAL: Comp Shingle  
 SHEATHING TYPE: OSB  
 FRAMING TYPE: Manufactured Truss  
 RACKING TYPE: UNIRAC SFM INFINITY  
 ATTACHMENT TYPE: UNIRAC SFM INFINITY FLASHKIT  
 TOTAL ATTACHMENTS: 21

**NEW PV SYSTEM INFORMATION**

AC SYSTEM SIZE: 3.78 kW AC  
 DC SYSTEM SIZE: 5.04 kW DC  
 MODULE TYPE: (12) REC Solar REC420AA Pure-R  
 INVERTER TYPE: Enphase IQ7X-96-2-US

**TOTAL DC SYSTEM SIZE**  
 5.04 kW DC

**TOTAL AC SYSTEM SIZE**  
 3.78 kW AC

**DESIGN CRITERIA**

WIND SPEED: 119  
 WIND EXPOSURE FACTOR: C  
 RISK CATEGORY: II  
 GROUND SNOW LOAD: 10  
 ROOF SNOW LOAD: 7  
 SEISMIC DESIGN CATEGORY: B

**WEATHER STATION DATA**

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

**INFORMATION FOR INSTALLER**

ECOBEE QTY: 0  
 LED LIGHTBULB QTY: 0

**GENERAL NOTES**

Sealed For  
 Existing Roof &  
 Attachment Only



12/11/23  
 Firm No. : D-0449

AHJ Harnett County	Digitally signed by John A. Calvert
UTILITY COMPANY Duke Energy NC	Date: 2023.12.11 12:28:18 -07'00'

**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

CUSTOMER NAME: **Antonio Johnny**  
 67 James Allen Ln  
 Dunn, North Carolina 28334

AHJ: Harnett County  
 UTILITY COMPANY: Duke Energy NC

PROJECT ID: **898102**

DC SYSTEM SIZE: 5.04 kW DC  
 AC SYSTEM SIZE: 3.78 kW AC

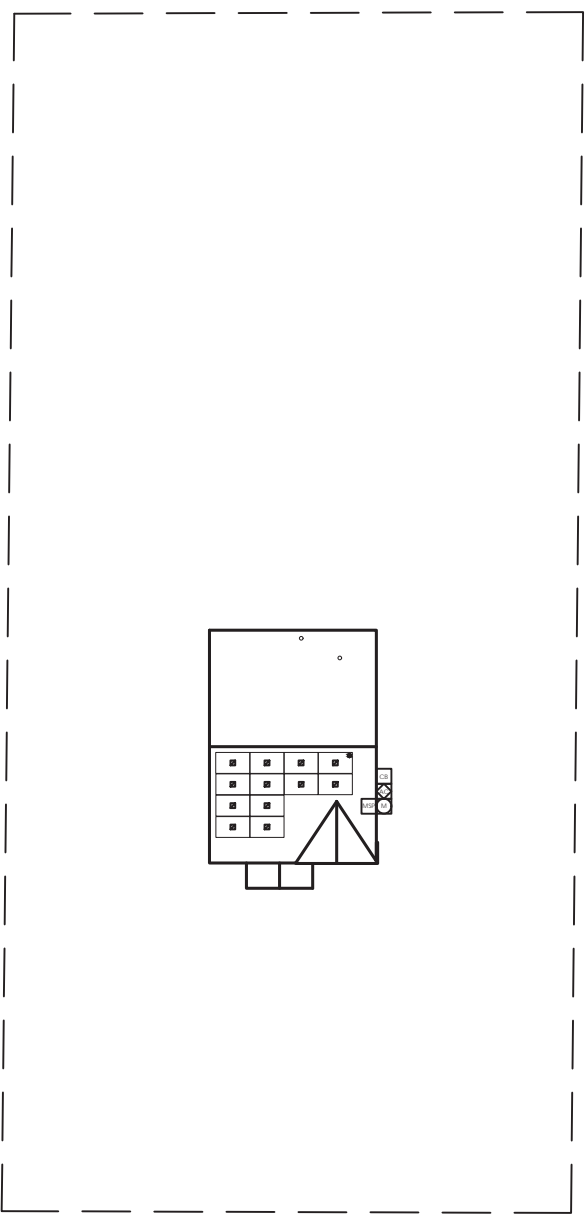
REVISIONS:  
 A) ---  
 B) ---  
 C) ---  
 D) ---

DRAWN BY: Brendan Fillmore  
 PLOT DATE: December 9, 2023  
 DRAWING TITLE: Cover Sheet  
 DRAWING NUMBER: **PV1**

**CUSTOMER NAME:** Antonio Johnny  
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**AHJ:** Harnett County

**UTILITY COMPANY:** Duke Energy NC



**FRONT OF HOME**  
67 James Allen Ln

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Existing Roof &  
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12/11/23  
Firm No. : D-0449

**PROJECT ID:**  
**898102**

**DC SYSTEM SIZE:**  
5.04 kW DC

**AC SYSTEM SIZE:**  
3.78 kW AC

**REVISIONS:**

A	----
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















**DRAWN BY:**  
Brendan Fillmore

**PLOT DATE:**  
December 9, 2023

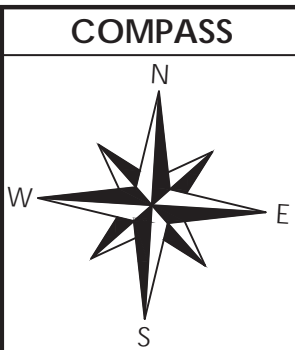
**DRAWING TITLE:**  
Site Plan

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

**SITE PLAN**  
SCALE: 1/32" = 1'-0"

LEGEND					
	ROOF TOP JUNCTION BOX		BREAKER ENCLOSURE		GENERATOR ATS PANEL
	UTILITY METER		AC DISCONNECT		UTILITY METER CT CABINET
	MAIN SERVICE PANEL		PV PRODUCTION METER		SUNPOWER HUB+
	SUBPANEL		COMBINER BOX		SUNVAULT ESS
			REMOTE POWER OFF SWITCH		NEW PV SYSTEM
			FIRE SETBACK HATCH		TRENCH OR OVERHEAD
			PROPERTY LINE		

PV SYSTEM SPECIFICATIONS
<i>NEW PV SYSTEM INFORMATION</i>
<b>PV MODULE:</b> (12) REC Solar REC420AA Pure-R, <b>POWER RATING:</b> 420 W <b>MICROINVERTER:</b> Enphase IQ7X-96-2-US, <b>POWER RATING:</b> 315 W



DC SYSTEM SIZE: 5.04 KW DC MODULE: REC 420 INVERTER(S): Enphase IQ7X Microinverters

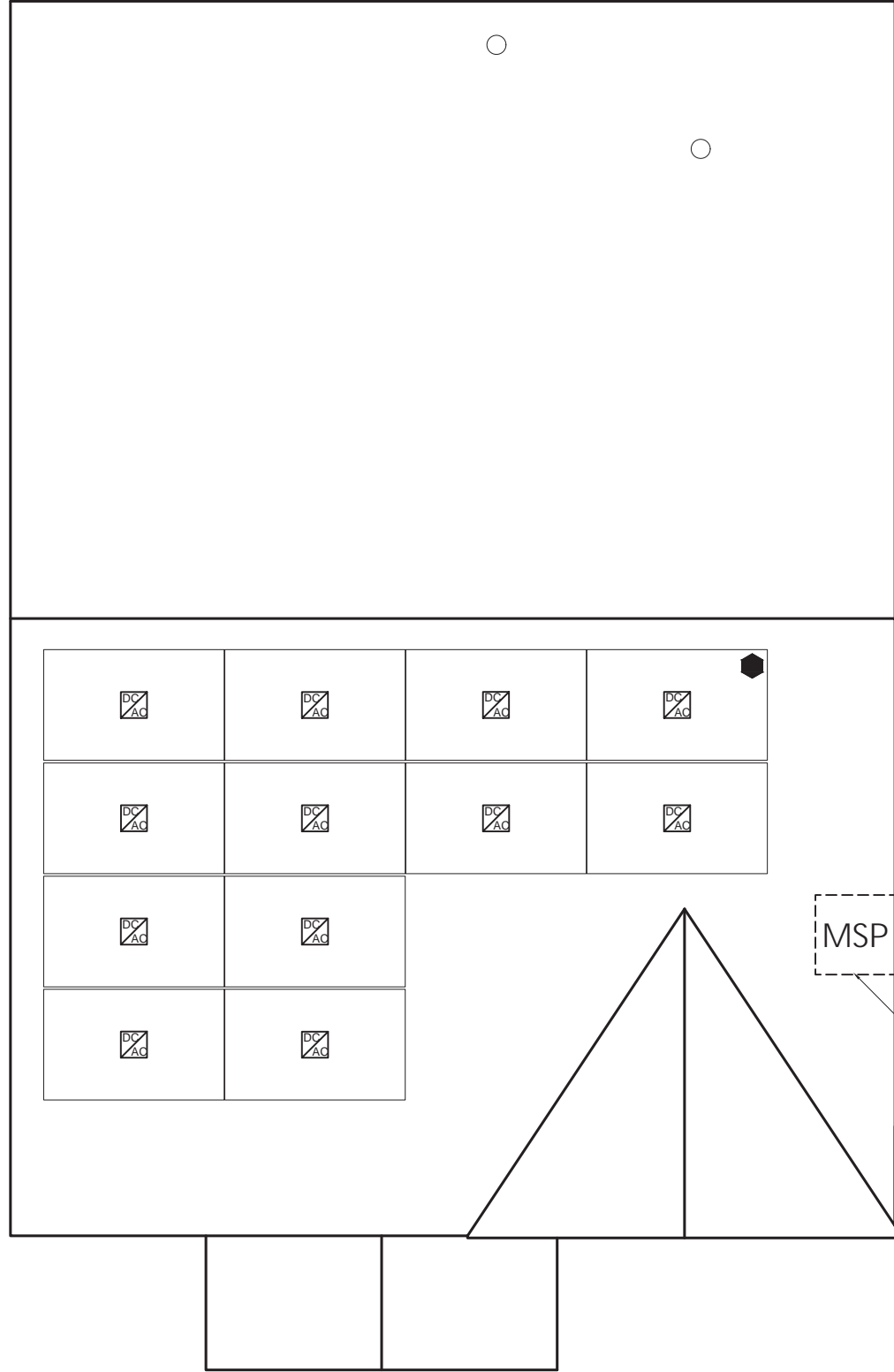


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**MP1**  
MODULE QTY: 12  
AZIMUTH: 176  
PITCH: 18  
TSRF: 98  
AREA: 495 ft<sup>2</sup>



12/11/23  
Firm No. : D-0449

**ROOF PLAN**  
SCALE: 3/16" = 1'-0"

CUSTOMER NAME:

PROJECT ID:

**898102**

DC SYSTEM SIZE:

5.04 kW DC

AC SYSTEM SIZE:

3.78 kW AC

REVISIONS:

A	----
B	----
C	----
D	----

DRAWN BY:

Brendan Fillmore

PLOT DATE:

December 9, 2023

DRAWING TITLE:

Roof Plan

DRAWING NUMBER:

**PV3**

**LEGEND**

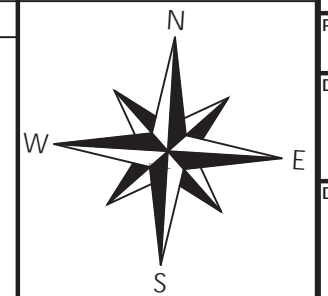
ROOF TOP JUNCTION BOX	BREAKER ENCLOSURE	GENERATOR ATS PANEL	REMOTE POWER OFF SWITCH	NEW PV SYSTEM
UTILITY METER	AC DISCONNECT	UTILITY METER CT CABINET	FIRE SETBACK HATCH	
MAIN SERVICE PANEL	PV PRODUCTION METER	SUNPOWER HUB+	TRENCH OR OVERHEAD	
SUBPANEL	COMBINER BOX	SUNVAULT ESS	PROPERTY LINE	

**PV SYSTEM SPECIFICATIONS**

NEW PV SYSTEM INFORMATION

**PV MODULE:** (12) REC Solar REC420AA Pure-R, **POWER RATING:** 420 W  
**MICROINVERTER:** Enphase IQ7X-96-2-US, **POWER RATING:** 315 W

**COMPASS**

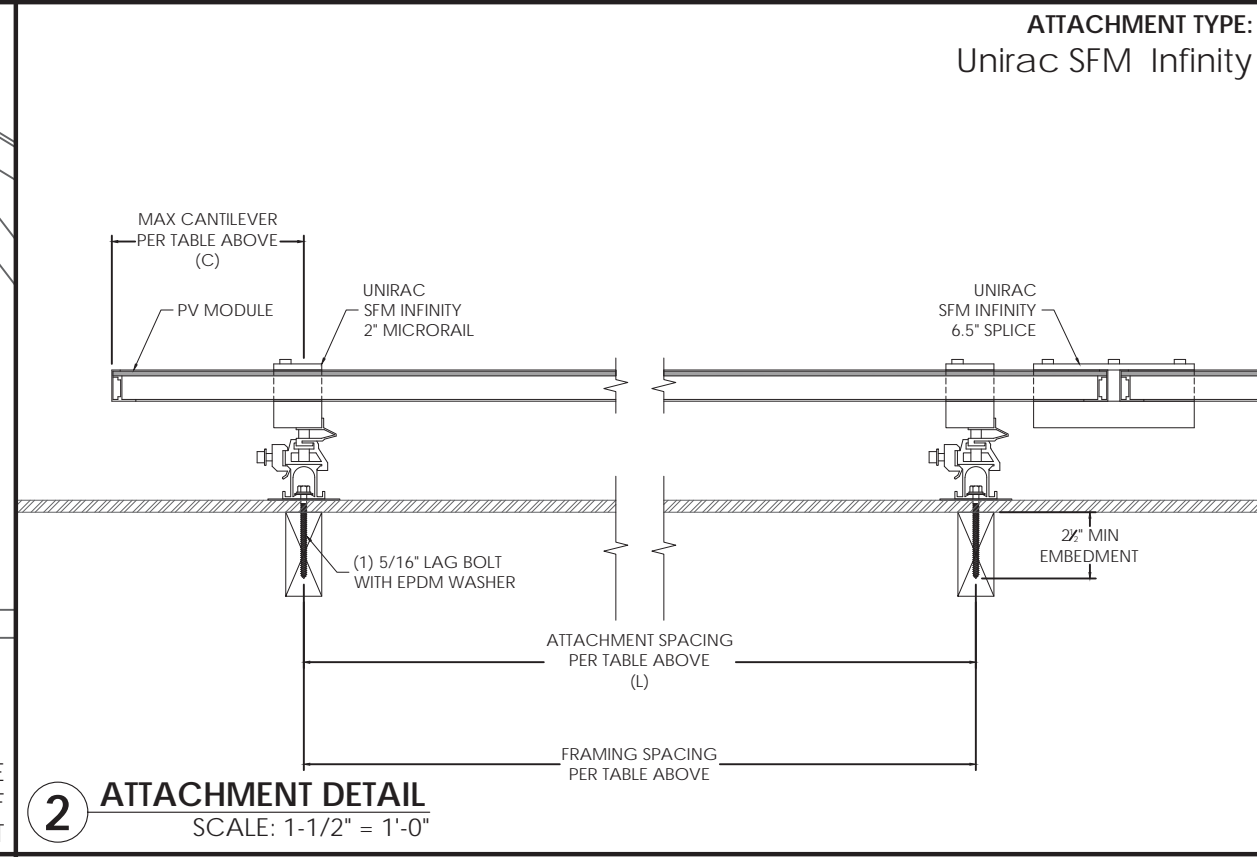
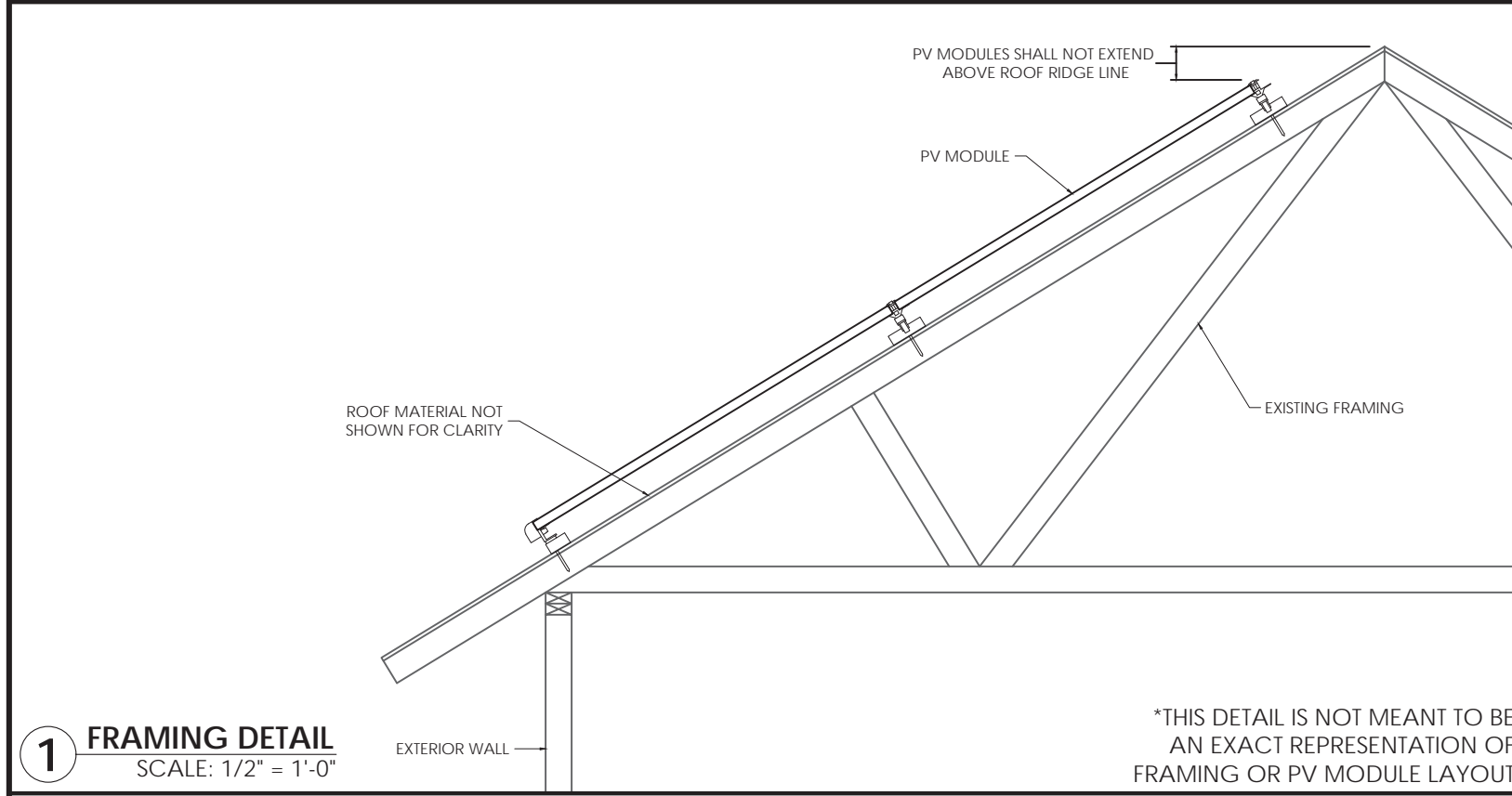


	PANEL COUNT	AZIMUTH (DEG)	PITCH (DEG)	TSRF (%)	AREA (ft <sup>2</sup> )	ROOF MATERIAL	SHEATHING TYPE	FRAMING TYPE	FRAMING SIZE AND SPACING	CEILING JOIST/PURLINS SIZE AND SPACING	RACKING TYPE	ATTACHMENT TYPE	MAXIMUM ATTACHMENT SPACING (S)	MAXIMUM CANTILEVER (C)
MP1	12	176	18	98	495	Comp Shingle	OSB	Manufactured Truss	2x6 @ 24 in OC	2x6 @ 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 (ft <sup>2</sup> )	249.7
TOTAL ROOF AREA (ft <sup>2</sup> )	1195
DISTRIBUTED LOAD (psf)	0.21
ROOF COVERAGE (%)	20.9
TOTAL PV ARRAY WEIGHT (lbs)	249.24
TOTAL PV ATTACHMENTS	21
POINT LOAD (lbs/att.)	11.9

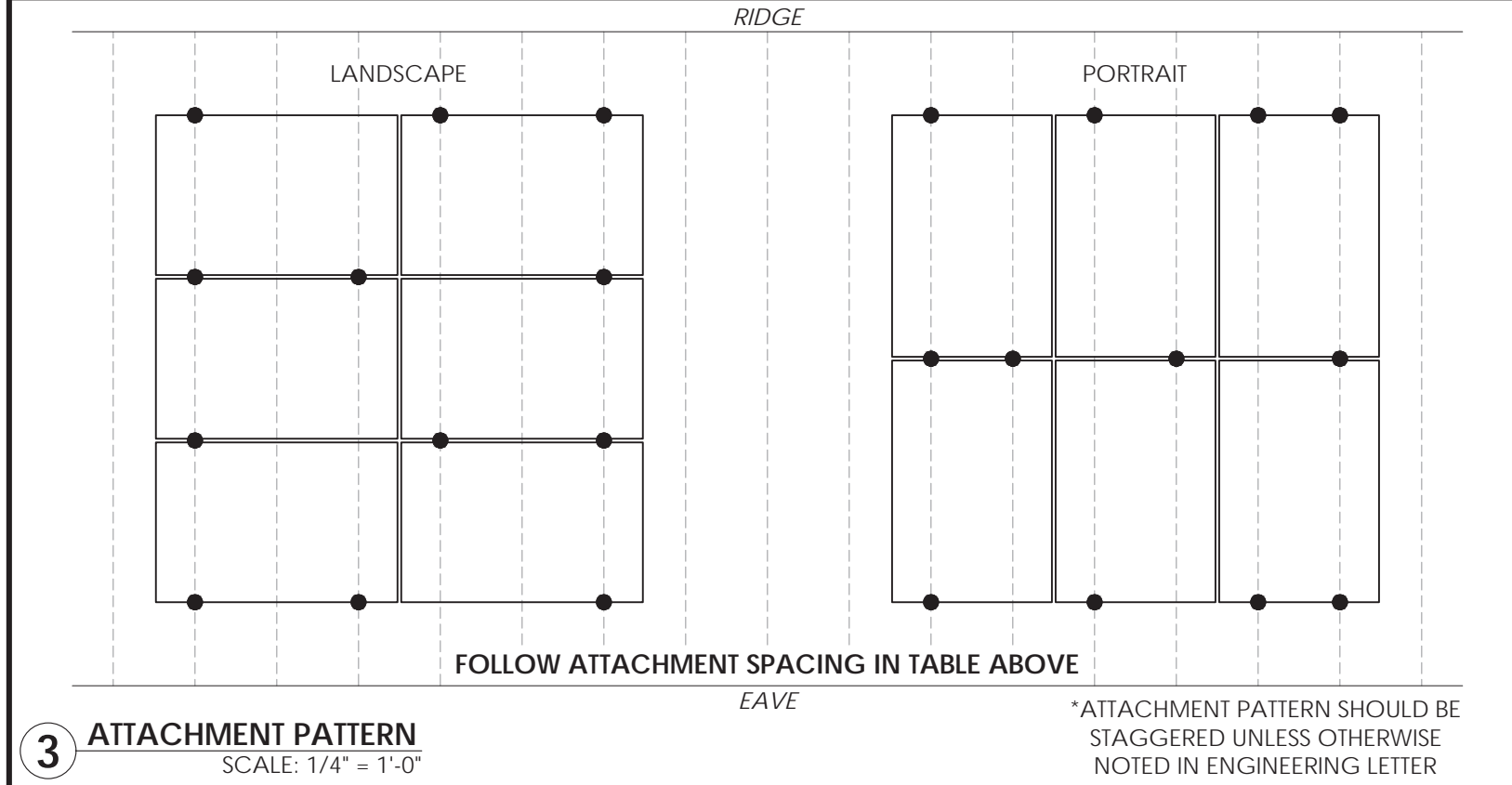


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NOTES

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AC SYSTEM SIZE: 3.78 kW AC

REVISIONS:

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C	----
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DRAWN BY: Brendan Fillmore

PLOT DATE: December 9, 2023

DRAWING TITLE: Structural

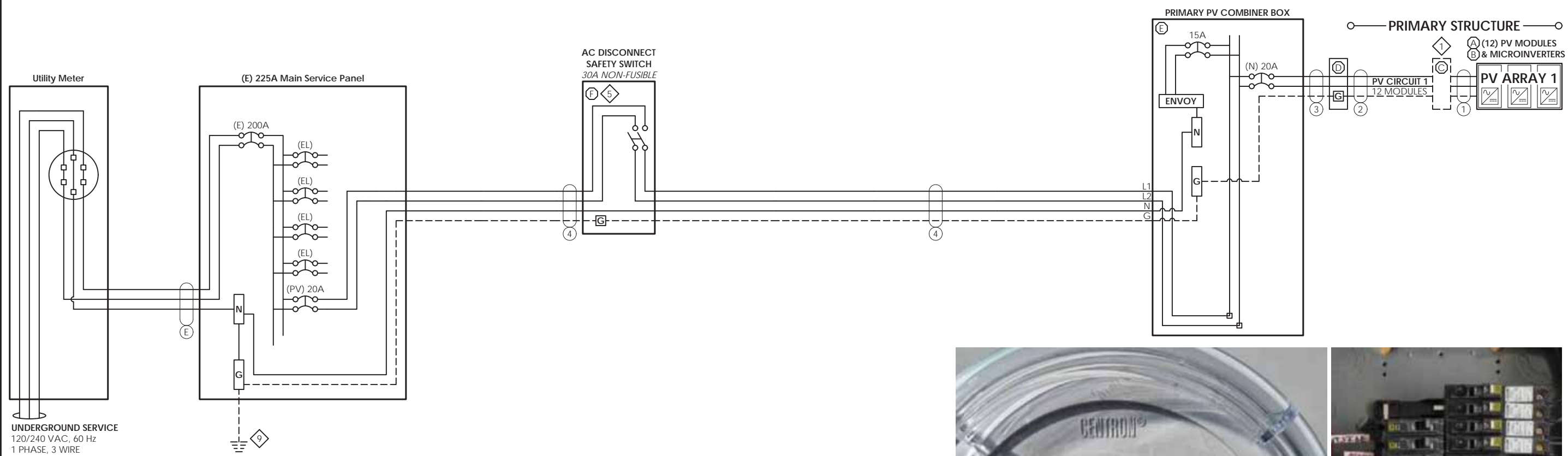
DRAWING NUMBER: PV4

4	L1 (1) 10 AWG THHN/THWN-2 CU BLACK	3/4 INCH EMT	Exterior
	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		

3	L1 (1) 10 AWG THHN/THWN-2 CU BLACK	3/4 INCH EMT	Exterior
	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		

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

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



UTILITY METER  
120/240 VAC, 60 Hz  
1 PHASE, 3 WIRE

**GENERAL NOTES**

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.

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12

EQUIPMENT DESCRIPTIONS	
(A) PV MODULE: REC Solar REC420AA Pure-R, 420 W DC, UL 1703 / UL 61730 COMPLIANT	
(B) MICROINVERTER: ENPHASE IQ7X-96-2-US, 315 W AC (0.315 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 IQ COMBINER 4 (X-IO-AM1-240-4)	
(F) SQUARE-D SAFETY SWITCH 30A, 2P, 240VAC, NON-FUSIBLE (DU221RB)	



**OTHER NOTES**

12 MICROINVERTERS X 315 W AC = 3.78 KW AC; PANEL WATTAGE = 420 W DC



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**DC SYSTEM SIZE:** 5.04 kW DC

**AC SYSTEM SIZE:** 3.78 kW AC

REVISIONS:	
(A)	----
(B)	----
(C)	----
(D)	----

**DRAWN BY:** Brendan Fillmore

**PLOT DATE:** December 9, 2023

**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	3.78kW AC
DC SYSTEM SIZE	5.04kW DC
PV MODULES	
QUANTITY	12
TYPE	REC Solar REC420AA Pure-R
WATTAGE	420W DC
MICROINVERTERS	
TYPE	Enphase IQ7X-96-2-US
OUTPUT CURRENT	1.31A AC
NOMINAL VOLTAGE	240V AC
OUTPUT POWER	315W AC

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

PV BREAKER BACKFEED CALCULATIONS			
NEC 705.12(B)(3)(2)			
(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
<i>*THESE CALCULATIONS ARE ONLY APPLICABLE IF PV INTERCONNECTION IS A LOAD SIDE BREAKER*</i>			
<i>*PV BREAKER MUST BE RATED LESS THAN OR EQUAL TO AVAILABLE BACKFEED FOR CODE COMPLIANCE*</i>			

WIRE SIZE SPECIFICATIONS										
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
MINIMUM CONDUCTOR AMPACITY	19.65A AC	19.65A AC	19.65A AC	19.69A 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)	79	30	20	5	---	---	---	---	---	---
CALCULATED VOLTAGE DROP	2.08%	0.5%	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	12	0	0	0	0	0	0	0	0	0	0	0	0
RATED AC OUTPUT CURRENT (I <sub>out</sub> )	15.7A	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%)	19.7A	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> )	15.7A								0.0A				
MINIMUM AMPACITY (C <sub>out</sub> x 125%)	19.7A								0.0A				
COMBINED PV BREAKER RATING	20AA								0AA				

TOTAL VOLTAGE DROP	
WIRE TAG #	VOLTAGE DROP
WIRE TAG #1	2.08%
WIRE TAG #2	0.5%
WIRE TAG #3	0.33%
WIRE TAG #4	0.08%
WIRE TAG #5	0%
WIRE TAG #6	0%
<b>TOTAL</b>	<b>2.990000%</b>



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DC SYSTEM SIZE:  
5.04 kW DC

AC SYSTEM SIZE:  
3.78 kW AC

REVISIONS:	
△ A	----
△ B	----
△ C	----
△ D	----

DRAWN BY:  
Brendan Fillmore

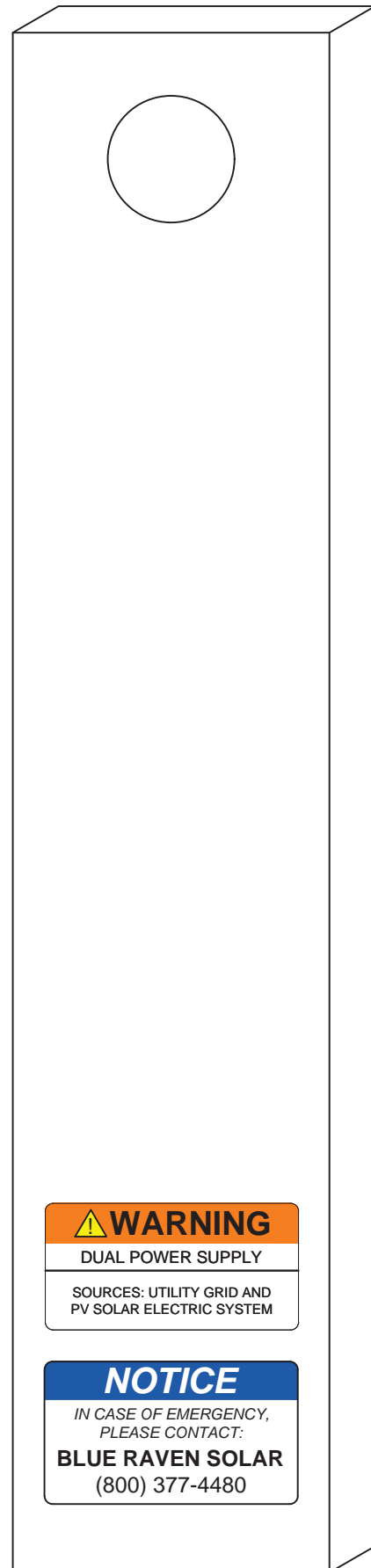
PLOT DATE:  
December 9, 2023

DRAWING TITLE:  
Electrical Calculations

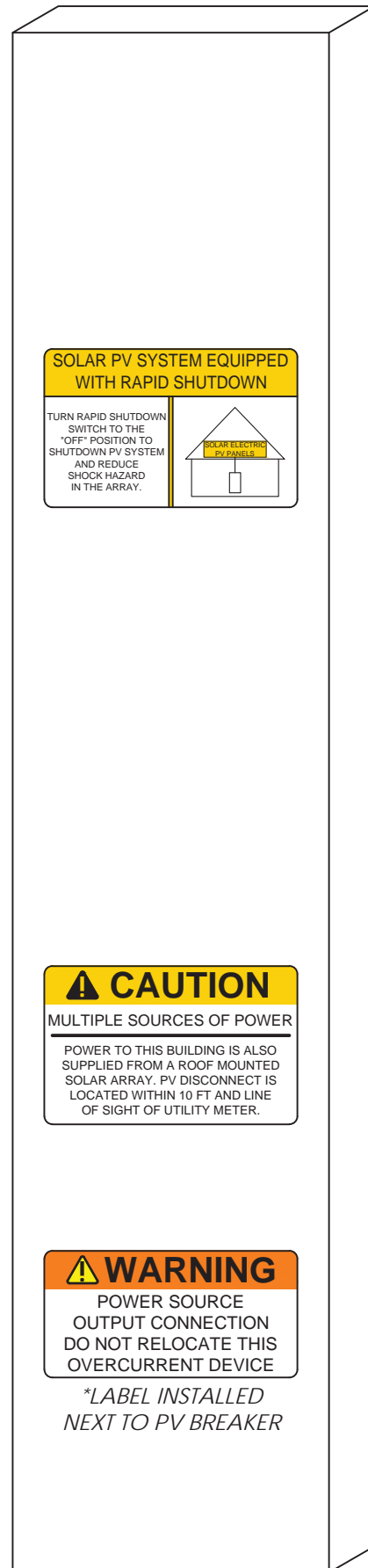
DRAWING NUMBER:  
**PV6**

# WARNING LABELS FOR PHOTOVOLTAIC SYSTEM

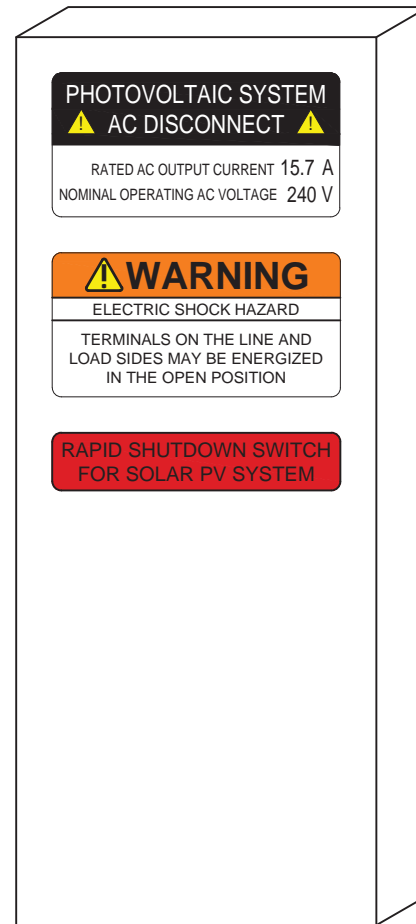
UTILITY METER



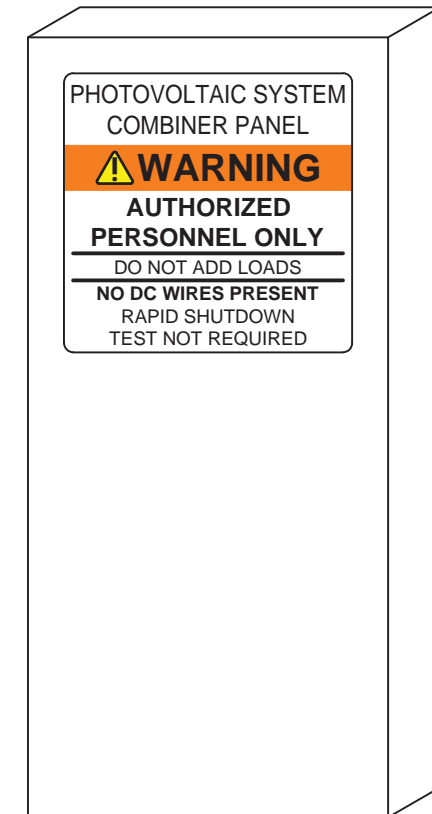
MAIN SERVICE PANEL



AC DISCONNECT



PV COMBINER BOX



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**DC SYSTEM SIZE:** 5.04 kW DC

**AC SYSTEM SIZE:** 3.78 kW AC

**REVISIONS:**

A	----
B	----
C	----
D	----

**DRAWN BY:** Brendan Fillmore

**PLOT DATE:** December 9, 2023

**DRAWING TITLE:** Warning Labels

**DRAWING NUMBER:** PV7

LABELS WITH ROUND CORNERS ARE ADHESIVE STICKERS  
LABELS WITH SQUARE CORNERS ARE PLASTIC ENGRAVED PLACARDS

SOLAR'S MOST TRUSTED



# REC ALPHA PURE-R SERIES

## PRODUCT SPECIFICATIONS

COMPACT PANEL SIZE

9 A MODULE CURRENT COMPATIBLE WITH MLPE

430 WP  
20.7 W/FT<sup>2</sup>  
22.3% EFFICIENCY



LEAD-FREE  
ROHS COMPLIANT

EXPERIENCE  
**α**  
PERFORMANCE

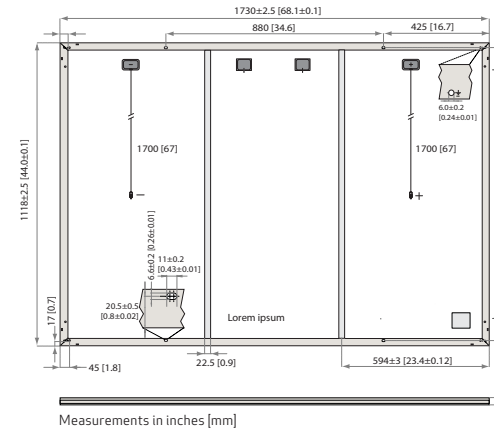
## REC ALPHA PURE-R SERIES

### PRODUCT SPECIFICATIONS



#### GENERAL DATA

Cell type:	80 half-cut REC bifacial, heterojunction cells with lead-free, gapless technology
Glass:	0.13in(3.2mm) solar glass with anti-reflective surface treatment in accordance with EN 12150
Backsheet:	Highly resistant polymer (black)
Frame:	Anodized aluminum (black)
Junction box:	4-part, 4 bypass diodes, lead-free IP68 rated, in accordance with IEC 62790
Connectors:	Stäubli MC4 PV-KBT4/KST4 (12 AWG) in accordance with IEC 62852, IP68 only when connected
Cable:	12 AWG (4 mm <sup>2</sup> ) PV wire, 67 + 67 in (1.7 + 1.7 m) in accordance with EN 50618
Dimensions:	68.1 x 44.0 x 1.2 in (20.77 ft <sup>2</sup> ) / 1730 x 1118 x 30 mm (1.93 m <sup>2</sup> )
Weight:	47.4 lbs (21.5 kg)
Origin:	Made in Singapore



#### ELECTRICAL DATA

	Product Code*: RECxxxAA PURE-R			
Power Output - P <sub>MAX</sub> (Wp)	400	410	420	430
Watt Class Sorting - (W)	0/+10	0/+10	0/+10	0/+10
Nominal Power Voltage - V <sub>MPP</sub> (V)	48.8	49.4	50.0	50.5
Nominal Power Current - I <sub>MPP</sub> (A)	8.20	8.30	8.40	8.52
Open Circuit Voltage - V <sub>OC</sub> (V)	58.9	59.2	59.4	59.7
Short Circuit Current - I <sub>SC</sub> (A)	8.80	8.84	8.88	8.91
Power Density (W/ft <sup>2</sup> )	19.26	19.74	20.22	20.70
Panel Efficiency (%)	20.7	21.2	21.8	22.3
Power Output - P <sub>MAX</sub> (Wp)	305	312	320	327
Nominal Power Voltage - V <sub>MPP</sub> (V)	46.0	46.6	47.1	47.6
Nominal Power Current - I <sub>MPP</sub> (A)	6.64	6.70	6.80	6.88
Open Circuit Voltage - V <sub>OC</sub> (V)	55.5	55.8	56.0	56.3
Short Circuit Current - I <sub>SC</sub> (A)	7.11	7.16	7.20	7.24

Values at standard test conditions (STC: air mass AM 1.5, irradiance 1075 W/sq ft (1000 W/m<sup>2</sup>), temperature 77°F (25°C), based on a production spread with a tolerance of P<sub>MAX</sub>, V<sub>OC</sub> & I<sub>SC</sub> ±3% with one watt class. Nominal module operating temperature (NMOT): air mass AM 1.5, irradiance 800 W/m<sup>2</sup>, temperature 68°F (20°C), windspeed 3.3 ft/s (1 m/s). \* Where xxx indicates the nominal power class (P<sub>MAX</sub>) at STC above.

#### MAXIMUM RATINGS

Operational temperature:	-40 ... +85°C
System voltage:	1000 V
Test load (front):	+7000 Pa (146 lbs/ft <sup>2</sup> )
Test load (rear):	-4000 Pa (83.5 lbs/ft <sup>2</sup> )
Series fuse rating:	25 A
Reverse current:	25 A

\* See installation manual for mounting instructions. Design load = Test load / 1.5 (safety factor)

#### WARRANTY

	Standard	REC ProTrust
Installed by an REC Certified Solar 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%

See warranty documents for details. Conditions apply

Available from:

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.

#### CERTIFICATIONS

IEC 61215:2016, IEC 61730:2016, UL 61730
IEC 62804 PID
IEC 61701 Salt Mist
IEC 62716 Ammonia Resistance
UL 61730 Fire Type 2
IEC 62782 Dynamic Mechanical Load
IEC 61215-2:2016 Hailstone (35mm)
IEC 62321 Lead-free acc. to RoHS EU 863/2015
ISO 14001, ISO 9001, IEC 45001, IEC 62941



#### TEMPERATURE RATINGS\*

Nominal Module Operating Temperature:	44°C (±2°C)
Temperature coefficient of P <sub>MAX</sub> :	-0.24 %/°C
Temperature coefficient of V <sub>OC</sub> :	-0.24 %/°C
Temperature coefficient of I <sub>SC</sub> :	0.04 %/°C

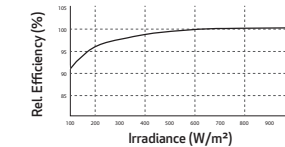
\*The temperature coefficients stated are linear values

#### DELIVERY INFORMATION

Panels per pallet:	33
Panels per 40 ft GP/high cube container:	858 (26 pallets)
Panels per 53 ft truck:	858 (26 pallets)

#### LOW LIGHT BEHAVIOUR

Typical low irradiance performance of module at STC:



REC Solar PTE. LTD.  
20 Tuas South Ave. 14  
Singapore 637312  
post@recgroup.com  
www.recgroup.com



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#PV-011719-015866

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385-498-6700

Specifications subject to change without notice.

Ref: PD-05-AAPR Rev 3.1 03.23

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## IQ7X Microinverter

The high-powered, smart grid-ready **IQ7X Microinverter** dramatically simplifies the installation process while achieving the highest system efficiency for systems with 96-cell modules.

Part of the Enphase Energy System, the IQ7X Microinverter integrates with the IQ Gateway, IQ Battery, and the Enphase Installer App monitoring and analysis software.

The IQ Series Microinverters extend the reliability standards set forth by previous generations and undergo over a million hours of power-on testing, enabling Enphase to provide an industry-leading warranty of up to 25-years.

### Easy to Install

- Lightweight and simple
- Faster installation with improved, lighter two-wire cabling
- Built-in rapid shutdown compliant (NEC 2014, 2017 & 2020)

### Efficient and Reliable

- Optimized for high powered 96-cell\* modules
- Highest CEC efficiency of 97.5%
- More than a million hours of testing
- Class II double-insulated enclosure
- UL listed

### Smart Grid-Ready

- Complies with advanced grid support, voltage and frequency ride-through requirements
- Remotely updates to respond to changing grid requirements
- Configurable for varying grid profiles
- Meets CA Rule 21 (UL 1741-SA) and IEEE 1547:2018 (UL 1741-SB, 3<sup>rd</sup> Ed.)

\* The IQ7X is required to support 96-cell modules.

## IQ7X Microinverter

INPUT DATA (DC)	IQ7X-96-2-US	
Commonly used module pairings <sup>1</sup>	320W - 460W	
Module compatibility	96-cell PV modules	
Maximum input DC voltage	79.5V	
Peak power tracking voltage	53V - 64V	
Operating range	25V - 79.5V	
Min/Max start voltage	33V/79.5V	
Max DC short circuit current (module I <sub>sc</sub> )	10A	
Overvoltage class DC port	II	
DC port backfeed current	0A	
PV array configuration	1 x 1 ungrounded array; No additional DC side protection required; AC side protection requires max 20A per branch circuit	
OUTPUT DATA (AC)	@ 240VAC	@ 208VAC
Peak output power	320VA	
Maximum continuous output power	315VA	
Nominal (L-L) voltage/range <sup>2</sup>	240V/211-264V	208V/183-229V
Maximum continuous output current	1.31A (240VAC)	1.51A (208VAC)
Nominal frequency	60 Hz	
Extended frequency range	49 - 68 Hz	
AC short circuit fault current over 3 cycles	5.8 Arms	
Maximum units per 20A (L-L) branch circuit <sup>3</sup>	12 (240VAC)	10 (208VAC)
Overvoltage class AC port	III	
AC port backfeed current	18 mA	
Power factor setting	1.0	
Power factor (adjustable)	0.85 leading ... 0.85 lagging	
EFFICIENCY	@240VAC	@208VAC
CEC weighted efficiency	97.5 %	97.0 %
MECHANICAL DATA		
Ambient temperature range	-40°C to +60°C	
Relative humidity range	4% to 100% (condensing)	
Connector type (IQ7X-96-2-US)	MC4 (or Amphenol H4 UTX with optional Q-DCC-5 adapter)	
Dimensions (WxHxD)	212 mm x 175 mm x 30.2 mm (without bracket)	
Weight	1.08 kg (2.38 lbs)	
Cooling	Natural convection - No fans	
Approved for wet locations	Yes	
Pollution degree	PD3	
Enclosure	Class II double-insulated, corrosion resistant polymeric enclosure	
Environmental category/UV exposure rating	NEMA Type 6/outdoor	
FEATURES		
Communication	Power Line Communication (PLC)	
Monitoring	Enphase Installer App and monitoring options Compatible with IQ Gateway	
Disconnecting means	The AC and DC connectors have been evaluated and approved by UL for use as the load-break disconnect required by NEC 690.	
Compliance	CA Rule 21 (UL 1741-SA), IEEE 1547:2018 (UL 1741-SB, 3 <sup>rd</sup> Ed.) HEI Rule 14H SRD 2.0 UL 62109-1, 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 C22.1-2015 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according manufacturer's instructions.	

1. Pairing PV modules with wattage above the limit may result in additional clipping losses. See the compatibility calculator at <https://link.enphase.com/module-compatibility>.
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.

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

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IQ7X-DS-0099-EN-US-12-27-2022



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# 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](http://enphase.com)

## IQ Combiner 4/4C



The **IQ Combiner 4/4C** with IQ Gateway and integrated LTE-M1 cell modem (included only with IQ Combiner 4C) consolidates interconnection equipment into a single enclosure. It 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 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
- Supports Wi-Fi, Ethernet, or cellular connectivity
- Optional AC receptacle available for PLC bridge
- Provides production metering and consumption monitoring

### Simple

- Mounts on single stud with centered brackets
- Supports bottom, back and side conduit entry
- Allows up to four 2-pole branch circuits for 240VAC 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
- X2-IQ-AM1-240-4 and X2-IQ-AM1-240-4C comply with IEEE 1547:2018 (UL 1741-SB, 3<sup>rd</sup> Ed.)

## IQ Combiner 4/4C

### MODEL NUMBER

IQ Combiner 4 X-IQ-AM1-240-4 X2-IQ-AM1-240-4 (IEEE 1547:2018)	IQ Combiner 4 with 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 and IQ System Controller 2 and to deflect heat.
IQ Combiner 4C X-IQ-AM1-240-4C X2-IQ-AM1-240-4C (IEEE 1547:2018)	IQ Combiner 4C with IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 ± 0.5%) and consumption monitoring (± 2.5%). Includes 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)

Supported microinverters	IQ6, IQ7, and IQ8. (Do not mix IQ6/7 Microinverters with IQ8)
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 - 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
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)
X-IQ-NA-HD-125A	Hold-down kit for Eaton circuit breaker with screws
Consumption monitoring CT (CT-200-SPLIT/CT-200-CLAMP)	A pair of 200A split core current transformers

### ELECTRICAL SPECIFICATIONS

Rating	Continuous duty
System voltage	120/240VAC, 60 Hz
Eaton BR series busbar rating	125A
Max. continuous current rating	65A
Max. continuous current rating (input from PV/storage)	64A
Max. fuse/circuit rating (output)	90A
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
IQ Gateway breaker	10A or 15A rating GE/Siemens/Eaton included
Production metering CT	200A solid core pre-installed and wired to IQ Gateway

### MECHANICAL DATA

Dimensions (WxHxD)	37.5 cm x 49.5 cm x 16.8 cm (14.75 in x 19.5 in x 6.63 in). Height is 53.5 cm (21.06 in) 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	• 20A to 50A breaker inputs: 14 to 4 AWG copper conductors • 60A 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	Up to 3,000 meters (9,842 feet)

### INTERNET CONNECTION OPTIONS

Integrated Wi-Fi	IEEE 802.11b/g/n
Cellular	CELLMODEM-M1-06-SP-05, CELLMODEM-M1-06-AT-05 (4G based LTE-M1 cellular modem). Note that an Mobile Connect cellular modem is required for all Enphase Energy System installations.
Ethernet	Optional, IEEE 802.3, Cat5E (or Cat6) UTP Ethernet cable (not included)

### COMPLIANCE

Compliance, IQ Combiner	CA Rule 21 (UL 1741-SA) IEEE 1547:2018 - UL 1741-SB, 3 <sup>rd</sup> Ed. (X2-IQ-AM1-240-4 and X2-IQ-AM1-240-4C) CAN/CSA C22.2 No. 107.1, Title 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

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IQ-C-4-4C-DS-0103-EN-US-12-29-2022



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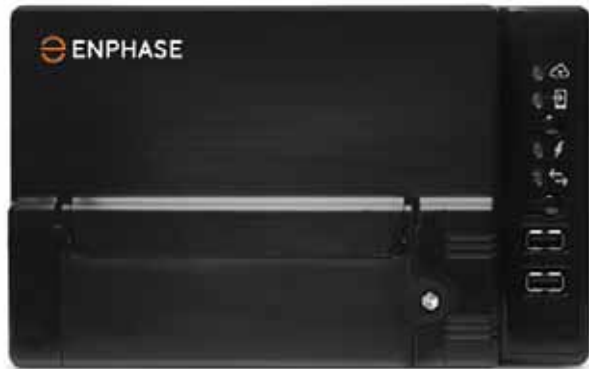
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# Enphase IQ Envoy

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).
-------------------------------------	---

### 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
---------------------------------	-----------

### 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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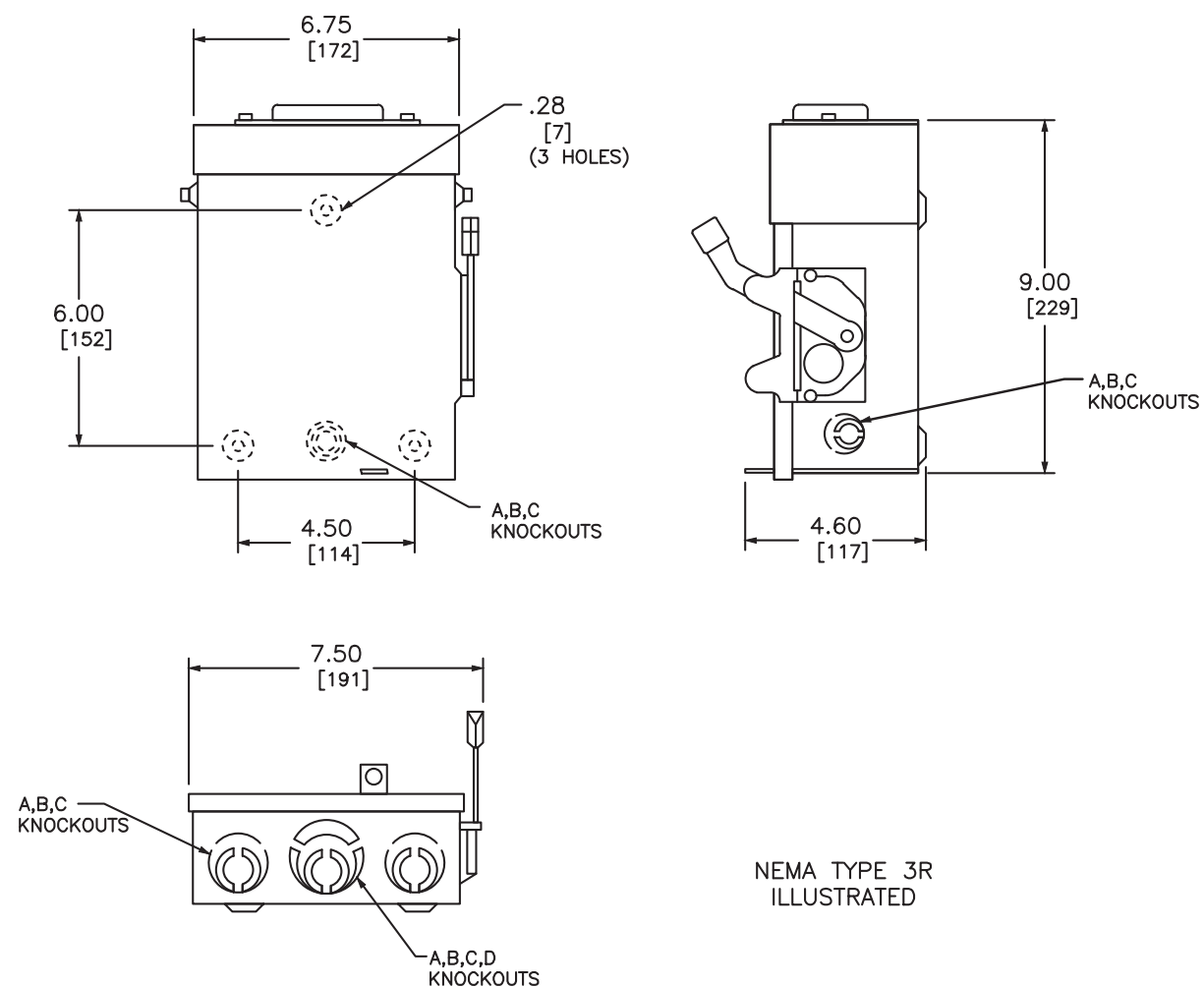
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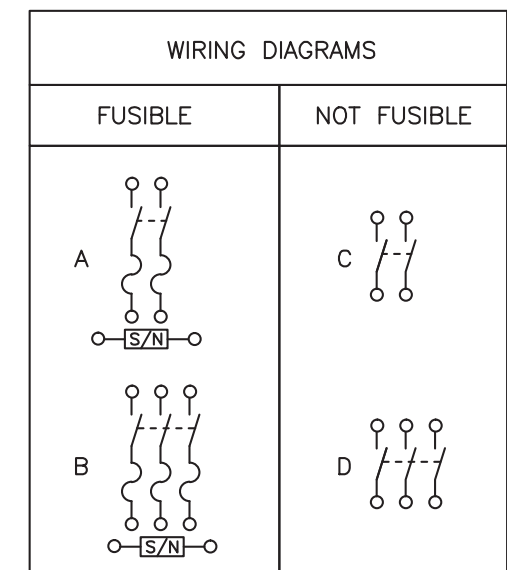
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NEMA TYPE 3R ILLUSTRATED



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



by Schneider Electric

DWG# 1852  
NO.

DRAWING BY:

PLOT DATE:

PROJECT NUMBER:

SHEET NAME:  
**SPEC SHEET**

REVISION: **----** PAGE NUMBER: **SS**

### A. System Specifications and Ratings

- Maximum Voltage: 1,000 Volts
- Maximum Current: 80 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
  - Approved wire connectors: must conform to UL1741
- 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.

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:	<b>15-20 LBS</b>
CERTIFICATION:	<b>UL STANDARD 1741, NEMA 3R</b>
WEIGHT:	<b>1.45 LBS</b>



PV INSTALLATION PROFESSIONAL  
Scott Gurney  
#PV-011719-015866

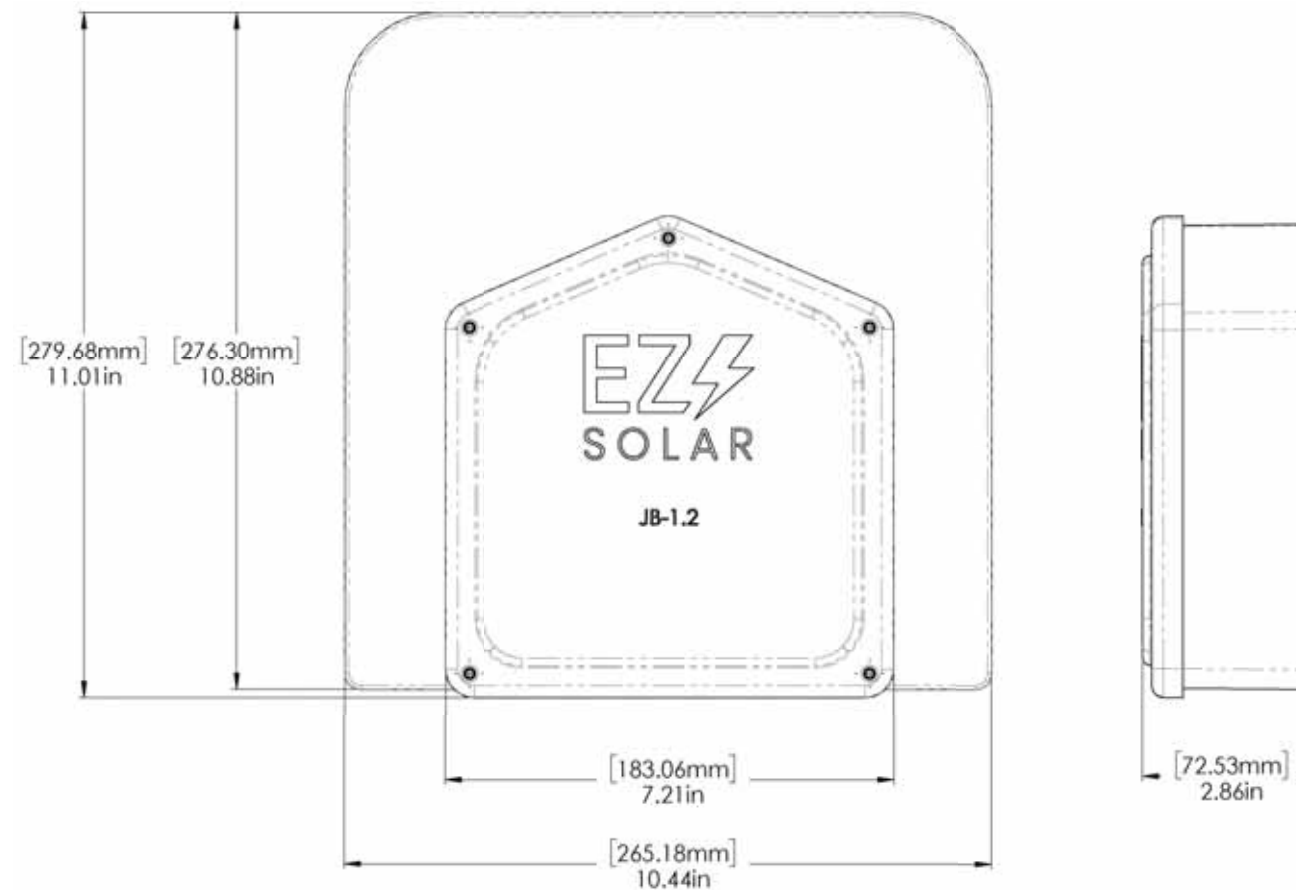
CONTRACTOR:  
BRS FIELD OPS  
385-498-6700

Table 1: Typical Wire Size, Torque Loads and Ratings

	1 Conductor	2 Conductor	Torque				
			Type	NM	Inch Lbs	Voltage	Current
ABB Z56 terminal block	10-24 awg	15-24 awg	Sol/Str	0.5-0.7	6.2-8.85	600V	30 amp
ABB Z510 terminal block	6-24 awg	17-20 awg	Sol/Str	1.0-1.6	8.85-14.16	600V	40 amp
ABB Z516 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 WING-NUT Wire Connector	8-18 awg		Sol/Str	Self Torque	Self Torque	600V	
Ideal 451 Yellow WING-NUT Wire Connector	10-18 awg		Sol/Str	Self Torque	Self Torque	600V	
Ideal, In-Sure Push-In Connector Part #39	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	14-24 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	2	3	4 or More
	mm (inch)	mm (inch)	mm (inch)	mm (inch)
14-10 (2.1-5.3)	Not specified	-	-	-
8 (8.4)	38.1 (1-1/2)	-	-	-
6 (13.3)	50.8 (2)	-	-	-

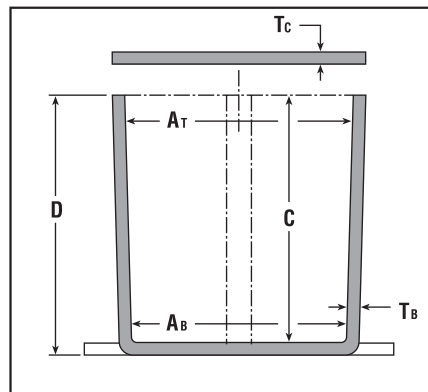
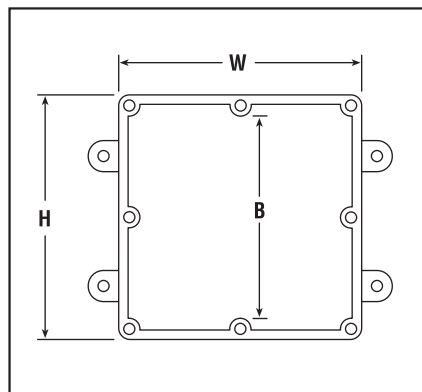


# Rigid Nonmetallic Conduit – Junction Boxes

## Molded Nonmetallic Junction Boxes 6P Rated

It's another first from Carlon® - the first nonmetallic junction boxes UL Listed with a NEMA 6P rating per Section 314.29, Exception of the National Electrical Code. Manufactured from PVC or PPO thermoplastic molding compound and featuring foam-in-place gasketed lids attached with stainless steel screws, these rugged enclosures offer all the corrosion resistance and physical properties you need for direct burial applications.

Type 6P enclosures are intended for indoor or outdoor use, primarily to provide a degree of protection against contact with enclosed equipment, falling dirt, hose-directed water, entry of water during prolonged submersion at a limited depth, and external ice formation.



- All Carlon Junction Boxes are UL Listed and maintain a minimum of a NEMA Type 4/4x Rating.
- Parts numbers with an asterisk (\*) are UL Listed and maintain a NEMA Type 6P Rating and Type 4/4X Rating.

Part No.	Size in Inches H x W x D	Std. Ctn. Qty.	Min. A <sub>T</sub>	Min. A <sub>B</sub>	Min. B	Min. C	T <sub>a</sub>	T <sub>c</sub> Typical	Material		Std. Ctn. Wt. (Lbs.)
									PVC	Thermo-plastic	
E989NNJ-CAR*	4 x 4 x 2	5	3 11/16	3 5/8	N/A	2	.160	.155	X		3
E987N-CAR*	4 x 4 x 4	5	3 11/16	3 1/2	N/A	4	.160	.155	X		4
†E989NNR-CAR*	4 x 4 x 6	4	3 11/16	3 3/8	N/A	6	.160	.200	X		5
E989PPJ-CAR*	5 x 5 x 2	4	4 11/16	4 1/2	N/A	2	.110	.150		X	3
E987R-CAR*	6 x 6 x 4	2	6	5 5/8	N/A	4	.190	.190		X	3
E989RRR-UPC*	6 x 6 x 6	8	5 5/8	5 3/8	N/A	6	.160	.150		X	14
E989N-CAR	8 x 8 x 4	1	8	8	N/A	4	.185	.190		X	2
E989SSX-UPC	8 x 8 x 7	2	7 21/32	7 5/16	N/A	7	.160	.150		X	6
E989UUN	12 x 12 x 4	3	11 5/8	11 1/2	11 1/8	4	.160	.150		X	12
E989R-UPC	12 x 12 x 6	2	11 5/16	11 7/8	11 7/16	6	.265	.185		X	10

VIEW SHOWN LESS COVER FOR CLARITY

SIZE	A	B	C
E989NNJ E989NNJB E989NNJ-CAR E989NNJCL E989NNJL (4X4X2)	2.00 (50,8)	4.63 (117,6)	5.13 (130,2)
E989NNR E989NNR-CAR (4X4X6)	6.00 (152,4)	5.00 (127,0)	5.50 (139,7)

NOTES:  
1. MATERIAL: PVC  
2. NEMA TYPES: 4/4X, 6P

**GENERAL NOTES**

- ALL DIMENSIONS ARE FOR REFERENCE ONLY.
- DIMENSIONS IN BRACKETS [ ] ARE IN METRIC UNITS.

**REVISIONS**

F	SEE ERN 2016195 FOR APPROVAL SIGNATURES & RELEASE DATE. PROJECT NO: 5AM000006
---	---

**Thomas & Betts**  
www.tnb.com

DESCRIPTION: **MOLDED NON-METALLIC ENCLOSURE**

ORIGINAL PROJECT NO / ( ERN NO )	SHEET NO:	REV. NO:	DRAWING NO:
/ ( )	2 OF 2	F	WSD-AC01977

SECTION A-A  
SCALE 0.500

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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**

REVISION:

PAGE NUMBER:

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**SS**

“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

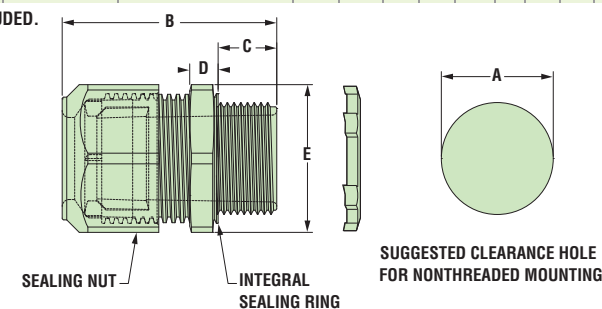
The Ultimate in Liquid Tight Strain Relief Protection

ALL NEW  
PRODUCT!



GLAND CONFIGURATION Conductors	PART NO.	DESCRIPTION	UL/CSA or SA	PART DIMENSIONS											
				A Clearance Hole Dia.	B Max. O.A. Length	C Thread Length	D Wrenching Nut Thickness	E Flat Size							
Type * Size mm.	No. Black			in.   mm.	in.   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

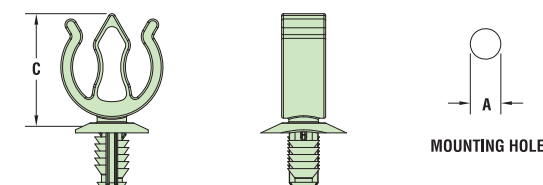
- Two new cordgrips now accommodate the Enphase Q Cable – M3231GCZ (1/2" NPT) and M3234GDA-SM (3/4" NPT).
- The 1/2" version provides liquid tight entry for one Enphase Q Cable – .24 x .38" (6,1 x 9,7 mm).
- The 3/4" version provides liquid tight entry for up to two Enphase Q Cables – .24 x .38" (6,1 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 1-2 Wires		PART NO.	DESCRIPTION	MOUNTING HOLE DIA. A		OVERALL HEIGHT C		
Minimum in.   mm.	Maximum in.   mm.	Minimum in.   mm.	Maximum in.   mm.			in.   mm.	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

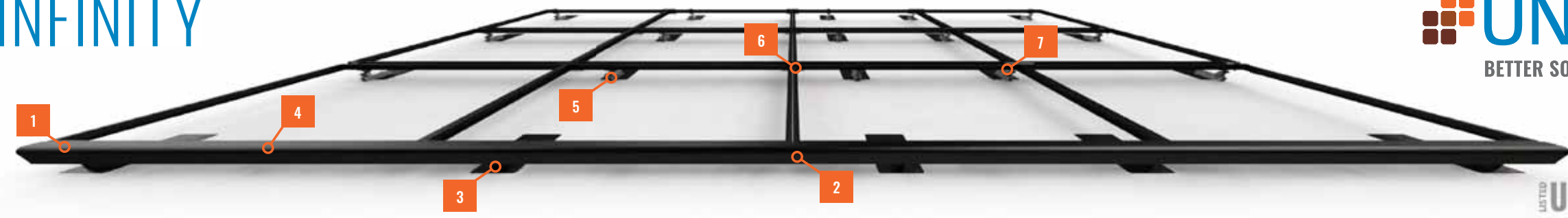


Material	Nylon 6/6 with extended UV Capabilities
Flammability Rating	94V-2
Temperature Range	Dynamic -4°F (-20°C) to 185°F (85°C)

- 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



UL2703



## 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.

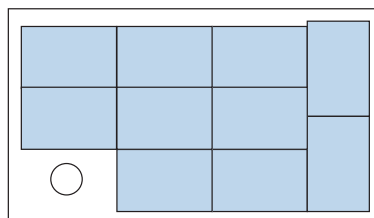
**87%** OF HOMEOWNERS  
**PREFER**

## 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

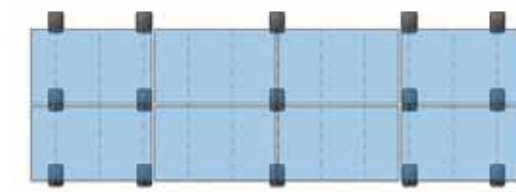
	PART NAME	DESCRIPTION
1	TRIMRAIL	Structural front trim provides aesthetic and aligns modules.
2	TRIMRAIL SPLICE	Connects and electrically bonds sections of TRIMRAIL.
3	TRIMRAIL FLASHKIT	Attaches TRIMRAIL to roof. Available for comp shingle or tile.
4	MODULE CLIPS	Secure modules to TRIMRAIL.
5	MICRORAIL	Connects modules to SLIDERS. Provides post-install array leveling.
6	SPLICE	Connects and supports modules. Provides east-west bonding. ATTACHED SPLICE 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 TRIMRAIL for refined aesthetic.
	TRIMRAIL BONDING CLAMP	Electrically bonds TRIMRAIL 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



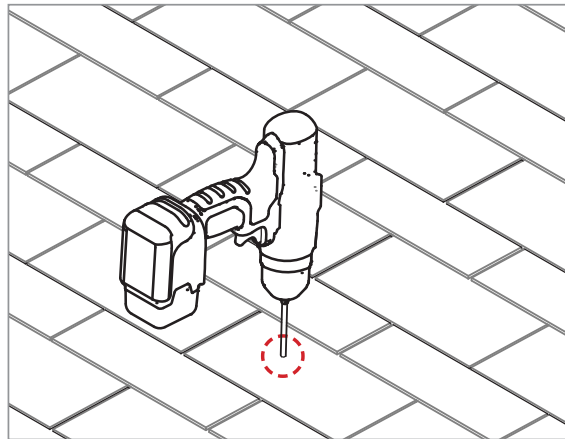
RAIL 20 Attachments

## 30% LOGISTICS SAVINGS

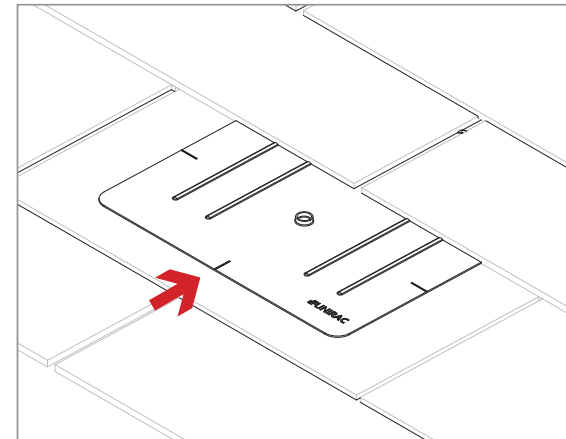
With fewer SKUs and compact components, **SFM INFINITY** is easier to stock, easier to transport, and easier to lift to the roof. Plus, make more efficient use of your vehicle fleet.



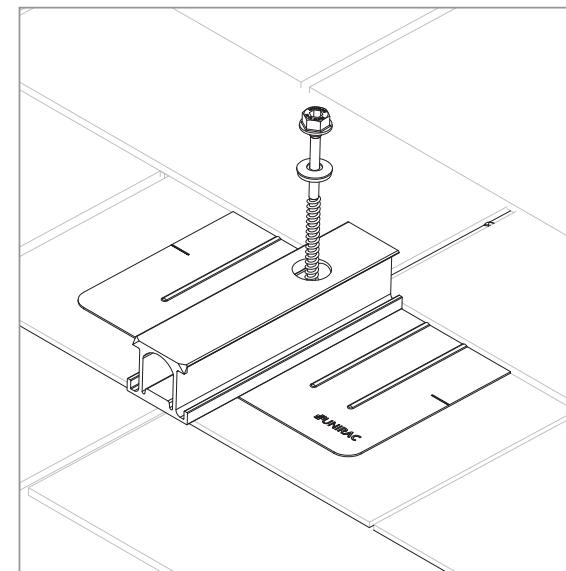
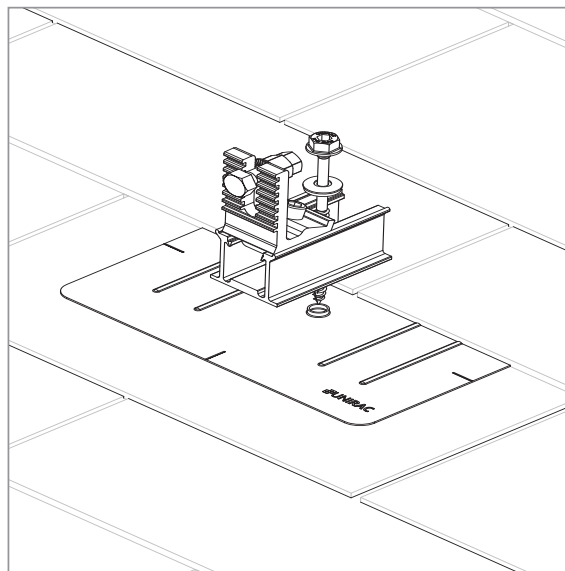
**SFM INFINITY REVOLUTIONIZES ROOFTOP SOLAR WITH BENEFITS ACROSS YOUR BUSINESS, FROM DESIGN AND LOGISTICS, THROUGH ARRAY INSTALLATION AND SERVICE.**



**PILOT HOLES:**  
Drill pilot holes for lag screws or structural screws (as necessary) at marked attachment points

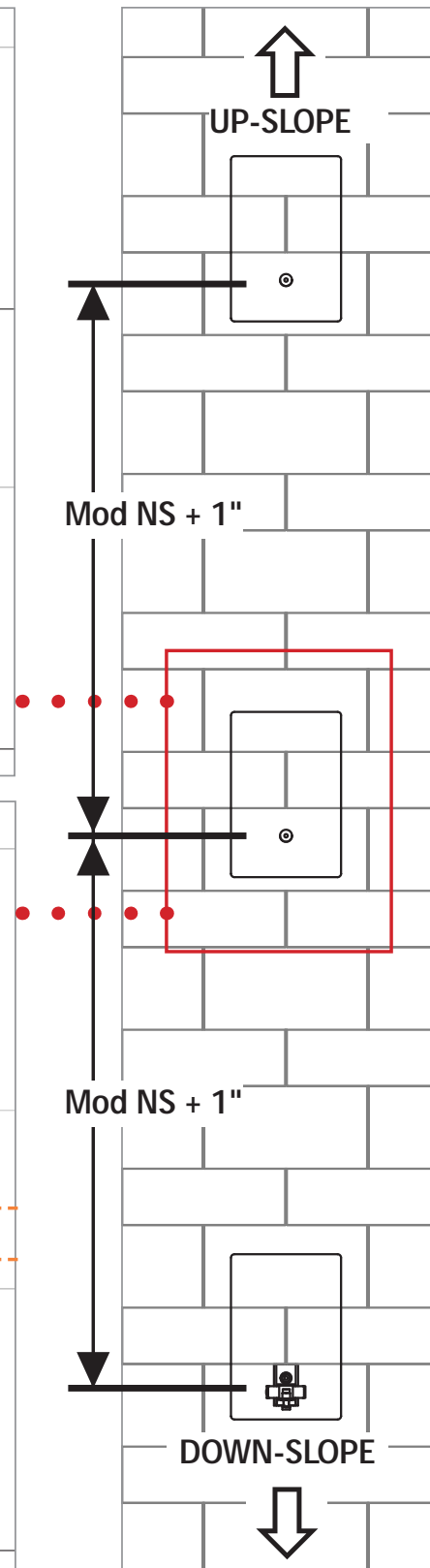
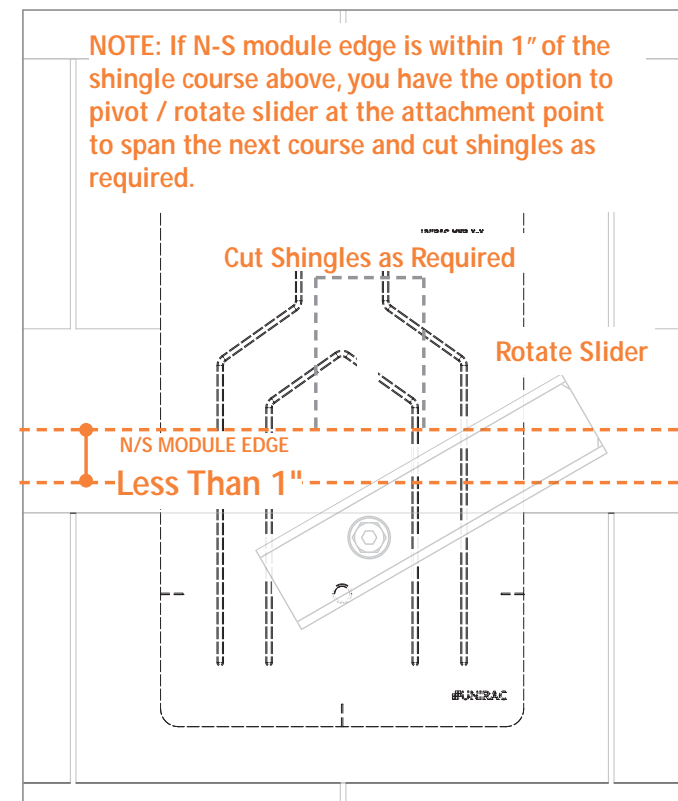
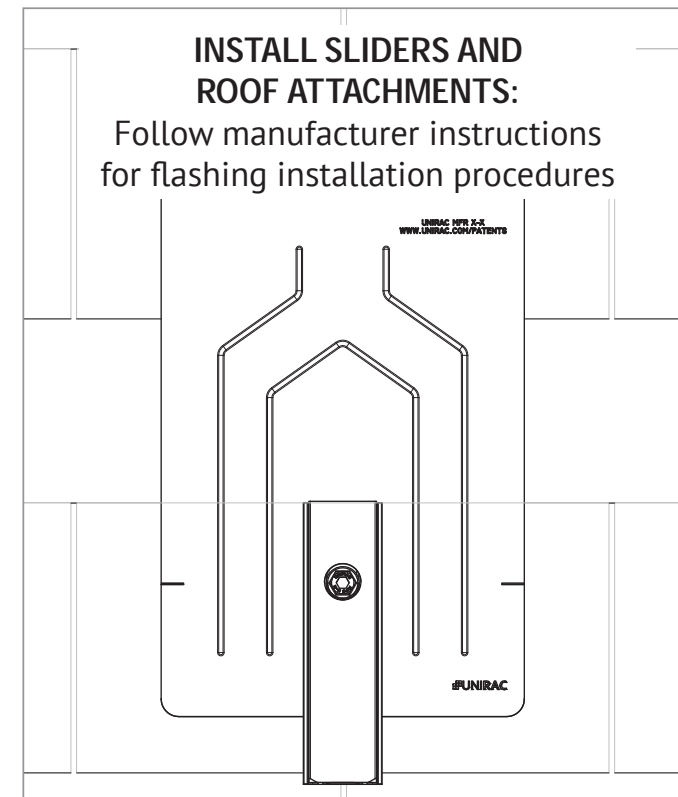


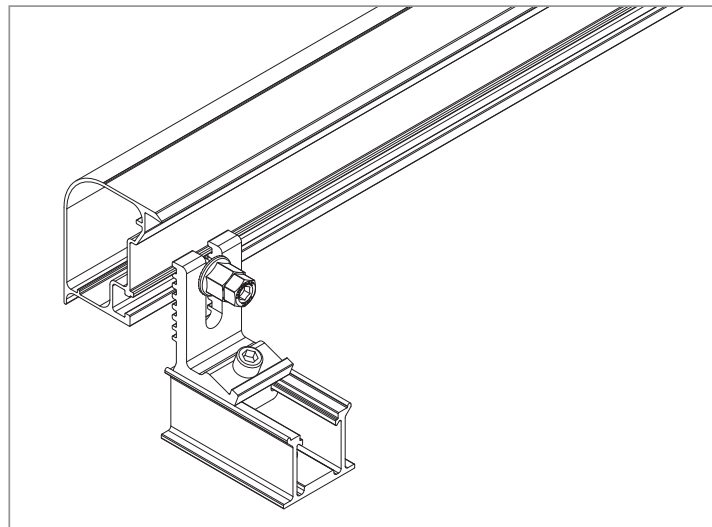
**FLASHINGS:**  
Place flashings



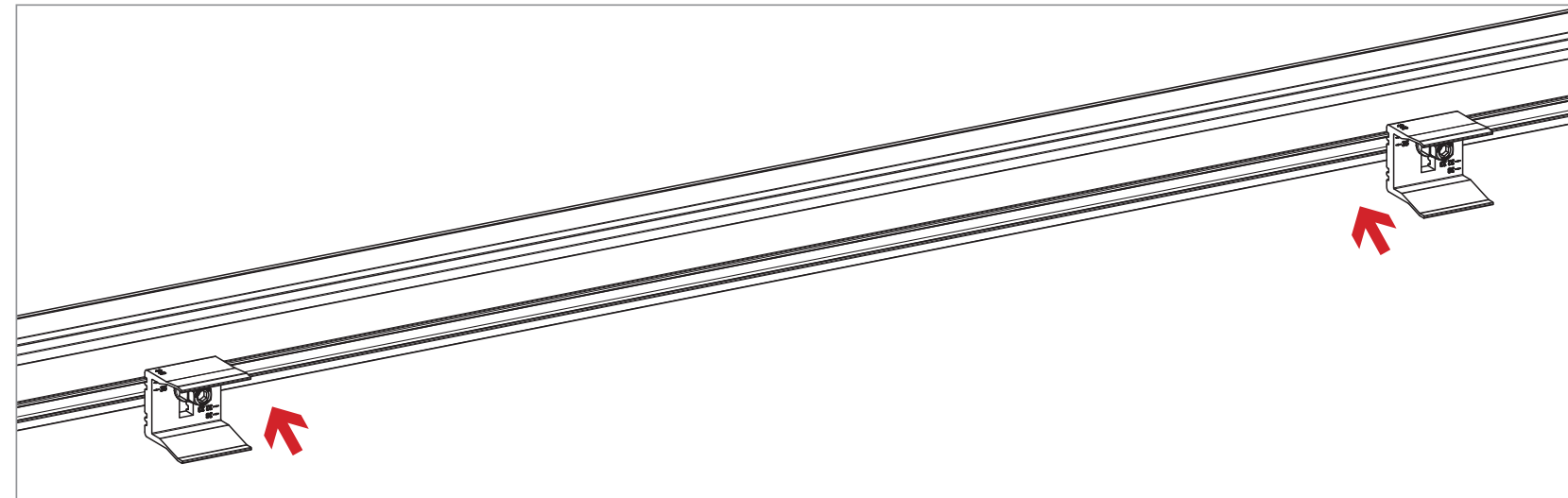
**INSTALL SLIDERS AND TRIMRAIL ROOF ATTACHMENTS:**

- Insert flashings per manufacturer instructions
- NOTE: Use Lag screw or structural fastener with a maximum diameter of 5/16"**
- Attach sliders to rafters
- Verify proper row to row spacing for module size (Mod NS + 1")
- Ensure that Trimrail™ roof attachments in each row have sufficient engagement with slider dovetails for proper attachment.



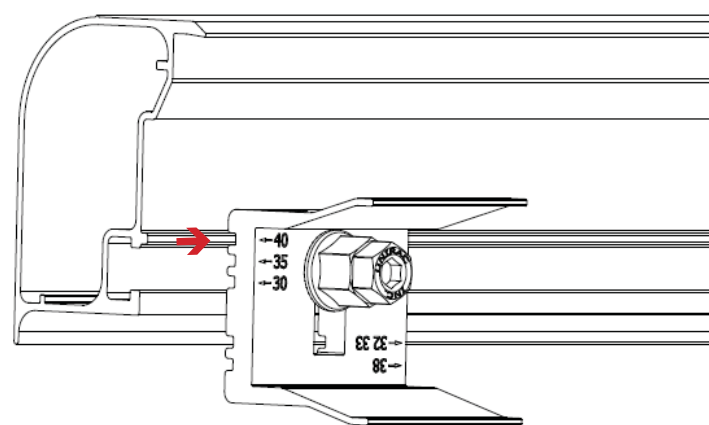


**ATTACH TRIMRAIL TO ROOF ATTACHMENT:**  
Attach rail using 3/8" hex bolt & Tri-drive or serrated flange nuts. Make sure Trimrail™ is level across all Trimrail™ roof attachments. After rail is level, tighten channel clamp bolts to secure Trimrail™ roof attachments to channels.

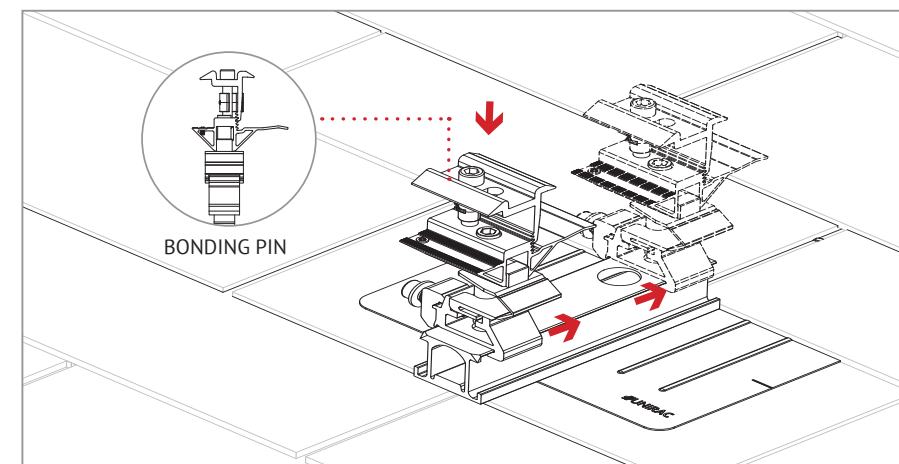
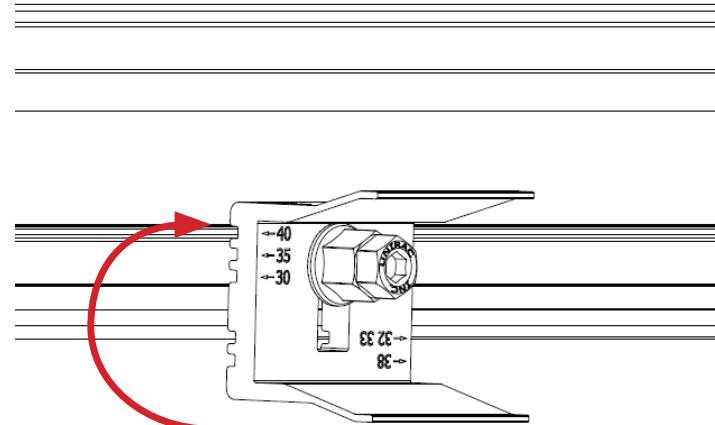


**INSTALL MODULE CLIPS ON TRIMRAIL:**  
Attach module clips to Trimrail using 3/8" T-bolts and Tri-drive or serrated flange nuts. A minimum of two clips are required per module. Refer to SFM D&E guide and U-builder for required position and quantity of module clips.

**NOTE:** module clips may be pre-installed on trimrail prior to attaching trimrail to roof attachments

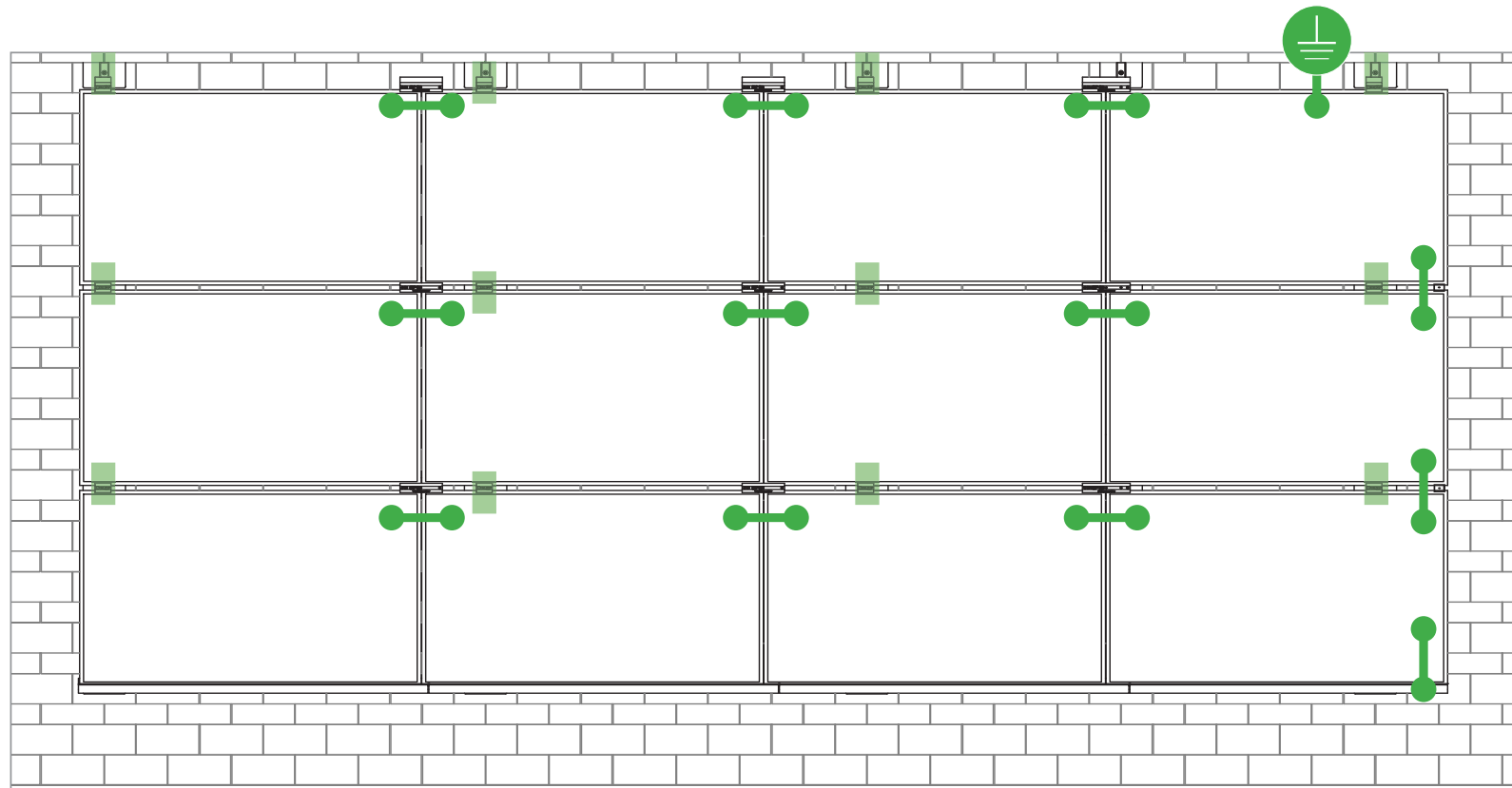


**POSITION MODULE CLIPS ACCORDING TO MODULE THICKNESS:**  
Align notch in module clip with trimrail rib according to module thickness (identified in mm on faces of module clips). Rotate clip to position at required location.



**NOTE:** Bonding pin on Microrails should be positioned downslope.

**INSTALL MICRORAILS:**  
Install Microrail™ at marked attachment points. Click Microrail™ into sliders and push Microrail™ to top of slider. Ensure that cap remains in upper most (40mm) position.



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

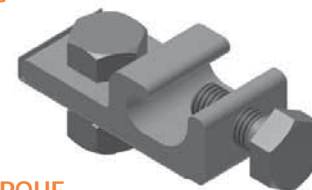
**TERMINAL TORQUE,**  
Install Conductor and torque to the following:  
4-14 AWG: 35in-lbs



**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



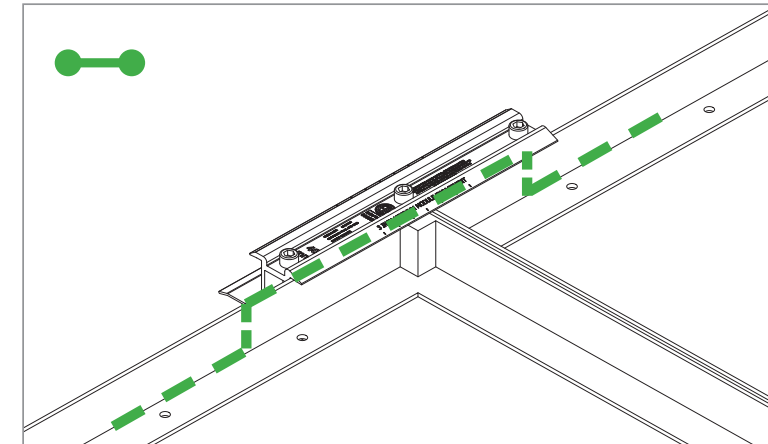
**TERMINAL TORQUE,**  
Install Conductor and torque to the following:  
6-14 AWG: 7ft-lbs

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

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

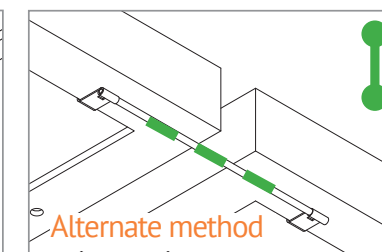
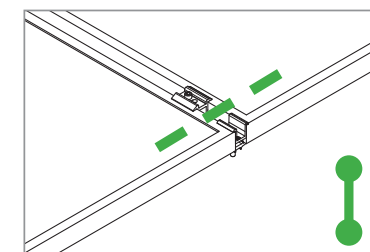
**NOTE: ISOLATE COPPER FROM ALUMINUM CONTACT TO PREVENT CORROSION**

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.



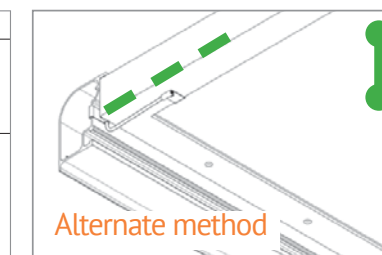
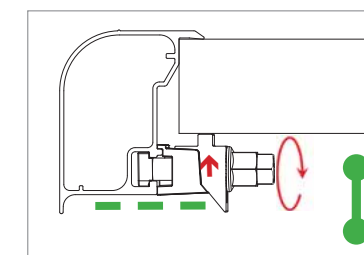
**E-W BONDING PATH:**

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

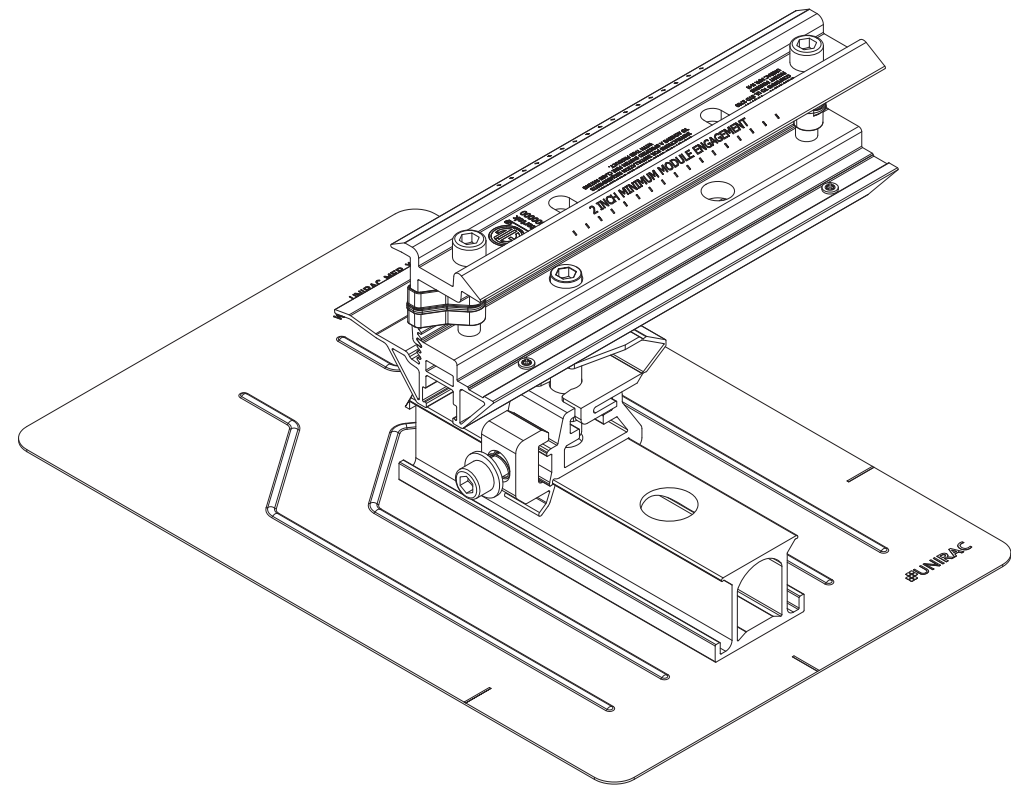
### UL2703 TEST MODULES

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

**LABEL MARKINGS**

- System fire class rating: See installation instructions for installation requirements to achieve a specified system fire class rating with Unirac.
- Unirac SUNFRAME MICRORAIL™ is listed to UL 2703.
- All splices within a system are shipped with marking indicating date and location of manufacture.



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







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
FAX	NA	FAX
Email	klaus.nicolaedis@unirac.com toddg@unirac.com	Email
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

