



Planning & Building Department  
6280 W 800N  
McCordsville, IN 46055  
Phone: 317.335.3604  
Email: [building@mccordsville.org](mailto:building@mccordsville.org)

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### **PUBLIC HEARING INFORMATION**

Case #: BZA-22-015

Title: Request for a Development Standard Variance to allow solar panels to be visible from the street at 9701 N CR 700W

Meeting Date: this zoning petition is currently scheduled to be heard at the October 5th Board of Zoning Appeals meeting.

\*Meeting agenda and staff report will be available on the website by end of business day on the Friday preceding the applicable meeting. Go to [www.mcccordsville.org](http://www.mcccordsville.org) and click on "Agendas & Minutes".

## GENERAL NOTES

### CODE AND STANDARDS

1. ALL WORK SHALL COMPLY WITH 2009 INDIANA ELECTRIC CODE, 2012 INTERNATIONAL BUILDING CODE (IBC), 2018 INTERNATIONAL RESIDENTIAL CODE (IRC), 2006 INTERNATIONAL PLUMBING CODE (IPC), AND ALL STATE AND LOCAL BUILDING, ELECTRICAL, AND PLUMBING CODES.
2. DRAWINGS HAVE BEEN DETAILED ACCORDING TO UL LISTING REQUIREMENTS.

### SITE NOTES / OSHA REGULATION

1. A LADDER SHALL BE IN PLACE FOR INSPECTION IN COMPLIANCE WITH OSHA REGULATIONS.
2. THE PV MODULES ARE CONSIDERED NON-COMBUSTIBLE AND THIS SYSTEM IS A UTILITY INTERACTIVE SYSTEM.
3. THE SOLAR PV INSTALLATION SHALL NOT OBSTRUCT ANY PLUMBING, MECHANICAL, OR BUILDING ROOF VENTS.
4. ROOF COVERINGS SHALL BE DESIGNED, INSTALLED, AND MAINTAINED IN ACCORDANCE WITH THIS CODE AND THE APPROVED MANUFACTURER'S INSTRUCTIONS SUCH THAT THE ROOF COVERING SHALL SERVE TO PROTECT THE BUILDING OR STRUCTURE.
5. NO. OF SHINGLE LAYERS : 1

### SOLAR CONTRACTOR

1. MODULE CERTIFICATIONS WILL INCLUDE UL1703, IEC61646, IEC61730.
2. IF APPLICABLE, MODULE GROUNDING LUGS MUST BE INSTALLED AT THE MARKED GROUNDING LUG HOLES PER THE MANUFACTURER'S INSTALLATION REQUIREMENTS.
3. AS INDICATED BY DESIGN, OTHER NRTL LISTED MODULE GROUNDING DEVICES MAY BE USED IN PLACE OF STANDARD GROUNDING LUGS AS SHOWN IN MANUFACTURER DOCUMENTATION AND APPROVED BY THE AHJ.
4. CONDUIT AND WIRE SPECIFICATIONS ARE BASED ON MINIMUM CODE REQUIREMENTS AND ARE NOT MEANT TO LIMIT UP-SIZING AS REQUIRED BY FIELD CONDITIONS.
5. CONDUIT POINT OF PENETRATION FROM EXTERIOR TO INTERIOR TO BE INSTALLED AND SEALED WITH A SUITABLE SEALING COMPOUND.
6. DC WIRING LIMITED TO MODULE FOOTPRINT W/ ENPHASE AC SYSTEM.
7. ENPHASE WIRING SYSTEMS SHALL BE LOCATED AND SECURED UNDER THE ARRAY W/ SUITABLE WIRING CLIPS.
8. MAX DC VOLTAGE CALCULATED USING MANUFACTURER PROVIDED TEMP COEFFICIENT FOR VOC UNLESS NOT AVAILABLE.
9. ALL INVERTERS, MOTOR GENERATORS, PHOTOVOLTAIC MODULES, PHOTOVOLTAIC PANELS, AC PHOTOVOLTAIC MODULES, DC COMBINERS, DC-TO-DC CONVERTERS, SOURCE CIRCUIT COMBINERS, AND CHARGE CONTROLLERS INTENDED FOR USE IN A PHOTOVOLTAIC POWER SYSTEM WILL BE IDENTIFIED AND LISTED FOR THE APPLICATION PER NEC 690.4(B).
10. ALL SIGNAGE TO BE PLACED IN ACCORDANCE WITH LOCAL BUILDING CODE.
11. TERMINALS AND LUGS WILL BE TIGHTENED TO MANUFACTURER TORQUE SPECIFICATIONS (WHEN PROVIDED) IN ACCORDANCE WITH NEC CODE 110.14(D) ON ALL ELECTRICAL CONNECTIONS.

### EQUIPMENT LOCATIONS

1. PROPER ACCESS AND WORKING CLEARANCE AROUND EXISTING AND PROPOSED ELECTRICAL EQUIPMENT WILL BE PROVIDED AS PER SECTION NEC 110.26.
2. EQUIPMENT INSTALLED IN DIRECT SUNLIGHT MUST BE RATED FOR EXPECTED OPERATING TEMPERATURE AS SPECIFIED BY NEC 690.31(A) AND NEC TABLE 310.15(B).
3. ALL EQUIPMENT SHALL BE INSTALLED ACCESSIBLE TO QUALIFIED PERSONNEL ACCORDING TO NEC APPLICABLE CODES.
4. ALL COMPONENTS ARE LISTED FOR THEIR PURPOSE AND RATED FOR OUTDOOR USAGE WHEN APPROPRIATE.

## PROJECT INFORMATION:

**NUMBER OF STORIES:** 3+  
**CONDUIT RUN:** Exterior  
**ECOBEE QTY:** 0  
**LIGHT BULB QTY:** 0  
**PV METER:** Not Required

### ROOF TYPE (1) INFORMATION:

**ROOF TYPE:** Comp Shingle  
**FRAMING TYPE:** Rafter  
**SHEATHING TYPE:** OSB  
**ATTACHMENT:** SFM Infinity Switchblade Flashkit  
**RACKING:** Unirac SFM Infinity @ 48" OC Portrait / 64" OC Landscape  
**NUMBER OF ATTACHMENTS:** 123

### ROOF TYPE (2) INFORMATION (IF APPLICABLE):

\*SEE PV4.2

## SYSTEM TO BE INSTALLED INFORMATION:

**SYSTEM SIZE:** 24.4 kW DC  
**MODULE TYPE:** (61) Q.Peak Duo BLK ML-G10+ 400  
**INVERTER TYPE:** Enphase IQ8PLUS-72-2-US  
**MONITORING:** (N) 200A 20-40 Main Lug Load Center NEMA 3R

## AERIAL VIEW



### DESIGN CRITERIA

**WIND SPEED:** 115 MPH  
**GROUND SNOW LOAD:** 20 lb/ft<sup>2</sup>  
**WIND EXPOSURE FACTOR:** C  
**SEISMIC DESIGN CATEGORY:** B

### SITE SPECIFICATIONS

CONSTRUCTION - V-B  
 ZONING: RESIDENTIAL

### SCOPE OF WORK

INSTALLATION OF UTILITY INTERACTIVE PHOTOVOLTAIC SOLAR SYSTEM AND ANY NECESSARY ADDITIONAL WORK NEEDED FOR INSTALLATION.

### SHEET INDEX

**PV1** - COVER SHEET  
**PV2** - SITE PLAN  
**PV3** - ROOF PLAN  
**PV4** - STRUCTURAL  
**PV5** - ELECTRICAL 3-LINE DIAGRAM  
**PV6** - ELECTRICAL CALCULATIONS  
**PV7** - WARNING LABELS AND LOCATIONS  
(ALL OTHER SHEETS AS REQUIRED)  
**SS** - PRODUCT SPEC. SHEETS

Digitally signed  
by John A.

Calvert  
Date: 2022.07.22  
16:42:43 -06'00'

### UTILITY COMPANY:

Ninestar Connect

### PERMIT ISSUER:

Town of McCordsville



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PV INSTALLATION  
PROFESSIONAL

Scott Gurney  
#PV-011719-015866

CONTRACTOR:  
BRS FIELD OPS  
800-377-4480

**CUSTOMER INFORMATION:**

Jonathan Carter  
9701 N 700 W  
MCCORDSVILLE, Indiana 46055  
DC SYSTEM SIZE: 24.4 kW DC

DRAWING BY:

Enphase Energy

PLOT DATE:

July 21, 2022

PROJECT NUMBER:

511835

SHEET NAME:

COVER SHEET

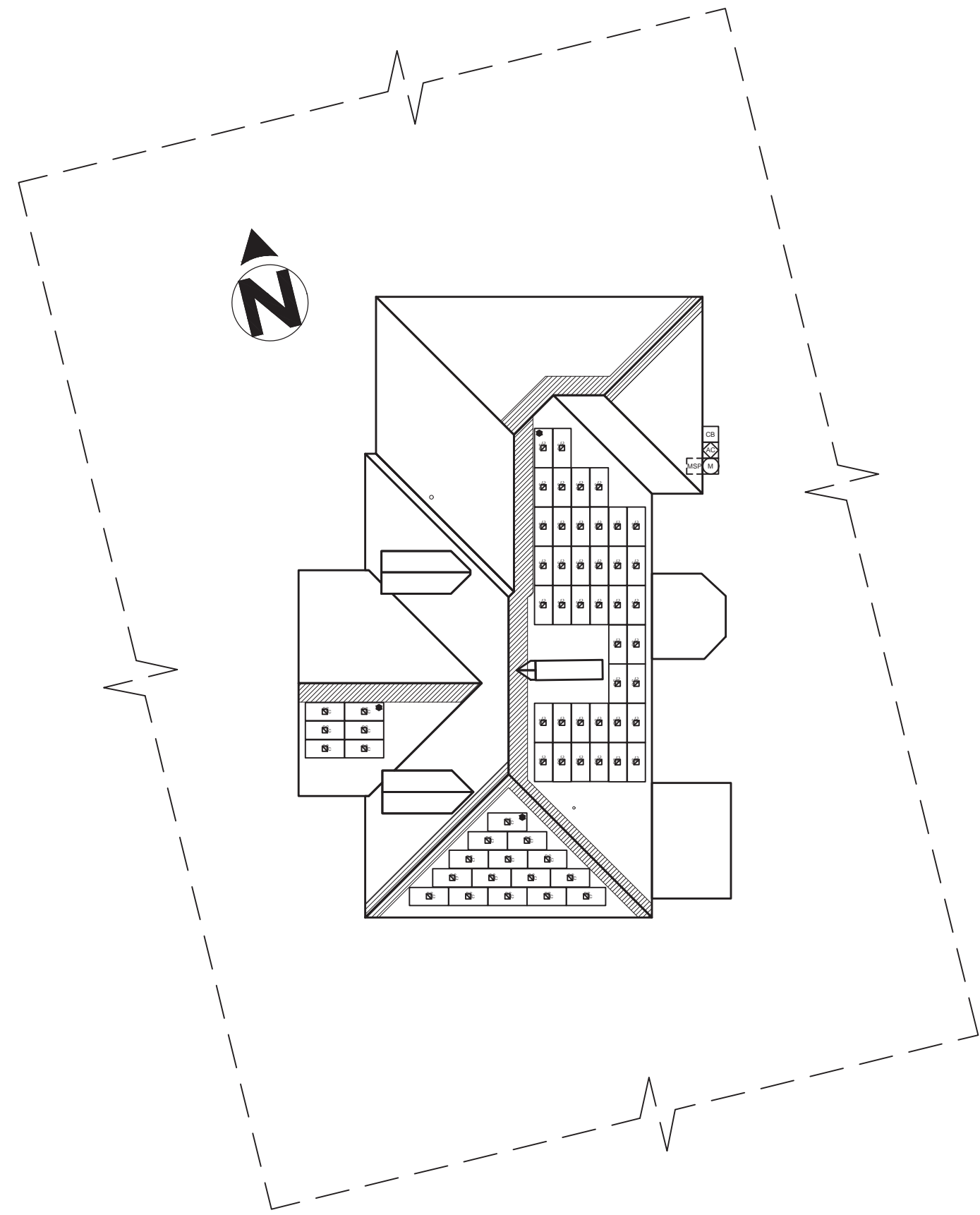
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






PAGE NUMBER:

PV1

FRONT OF HOME  
9701 N 700 W



### LEGEND

-  JUNCTION BOX
-  UTILITY METER
-  MAIN SERVICE PANEL
-  AC DISCONNECT
-  COMBINER BOX
-  LOAD CENTER
-  SUBPANEL
-  PV METER
-  TRANSFER SWITCH
-  SUNPOWER ESS
-  SUNPOWER HUB+
-  REMOTE POWER OFF
-  FIRE SETBACK
-  TRENCHING
-  PROPERTY LINE

SCALE: 3/64" = 1'-0"

Sealed For  
Existing Roof &  
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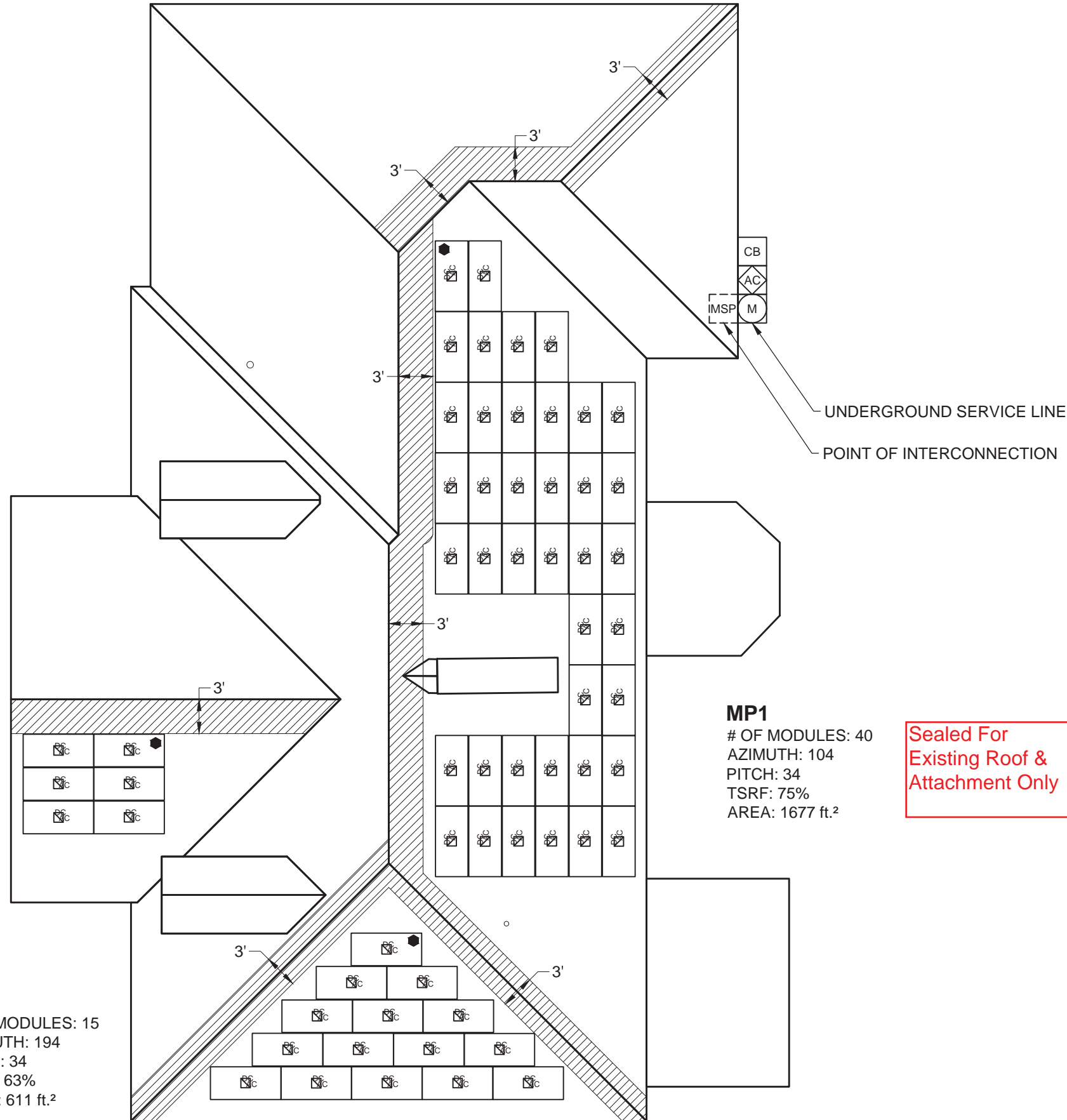
SHEET NAME:  
SITE PLAN

REVISION: 0	PAGE NUMBER: PV2
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FRONT OF HOME



**MP2**  
 # OF MODULES: 6  
 AZIMUTH: 194  
 PITCH: 34  
 TSRF: 81%  
 AREA: 424 ft.<sup>2</sup>

**MP3**  
 # OF MODULES: 15  
 AZIMUTH: 194  
 PITCH: 34  
 TSRF: 63%  
 AREA: 611 ft.<sup>2</sup>
















**MP1**  
 # OF MODULES: 40  
 AZIMUTH: 104  
 PITCH: 34  
 TSRF: 75%  
 AREA: 1677 ft.<sup>2</sup>

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### LEGEND

-  JUNCTION BOX
-  UTILITY METER
-  MAIN SERVICE PANEL
-  AC DISCONNECT
-  COMBINER BOX
-  LOAD CENTER
-  SUBPANEL
-  PV METER
-  TRANSFER SWITCH
-  SUNPOWER ESS
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-  REMOTE POWER OFF
-  FIRE SETBACK
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SCALE: 3/32" = 1'-0"



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

CONTRACTOR:  
 BRS FIELD OPS  
 800-377-4480

**CUSTOMER INFORMATION:**  
 Jonathan Carter  
 9701 N 700 W  
 MCCORDSVILLE, Indiana 46055  
**DC SYSTEM SIZE: 24.4 kW DC**

DRAWING BY:  
 Enphase Energy

PLOT DATE:  
 July 21, 2022

PROJECT NUMBER:  
 511835

SHEET NAME:  
 ROOF PLAN

REVISION: <b>0</b>	PAGE NUMBER: <b>PV3</b>
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**STRUCTURAL INFORMATION:**

**ROOF TYPE (1):**

ROOF TYPE: Comp Shingle  
 SHEATHING TYPE: OSB  
 FRAMING TYPE: Rafter  
 FRAMING SIZE: 2x8 @ 16" OC  
 CEILING JOIST SIZE: 2x8 @ 16" OC

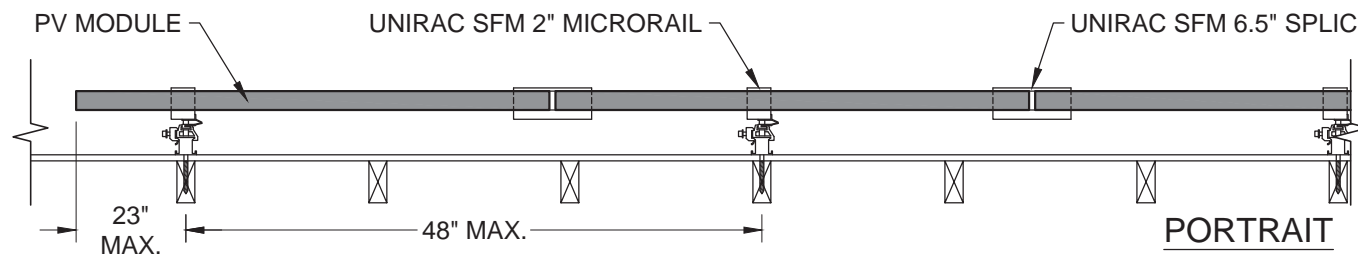
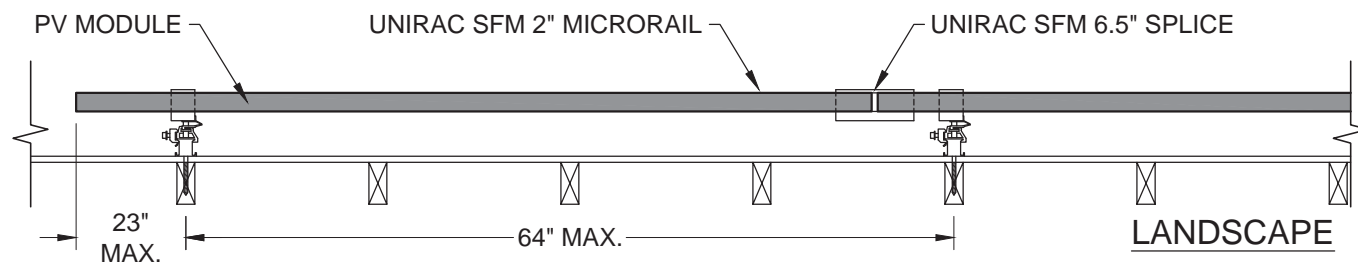
ATTACHMENT: SFM Infinity Switchblade Flashkit  
 RACKING: Unirac SFM Infinity  
 @ 48" OC Portrait / 64" OC Landscape  
 NUMBER OF ATTACHMENTS: 123

PV MODULE COUNT: 61 Modules  
 TOTAL ARRAY AREA: 1068.1 ft<sup>2</sup> (17.51ft<sup>2</sup>/panel)  
 TOTAL ROOF AREA: 6364 ft<sup>2</sup>  
 ARRAY/ROOF AREA: 16.8%  
 ARRAY WEIGHT: 3,050 lbs (50 lbs/panel)  
 DISTRIBUTED LOAD: 2.86 lbs/ft<sup>2</sup>  
 POINT LOAD: 24.8 lbs/attachment

**STRUCTURAL NOTES:**

----  
 Please use interior conduit on MP2

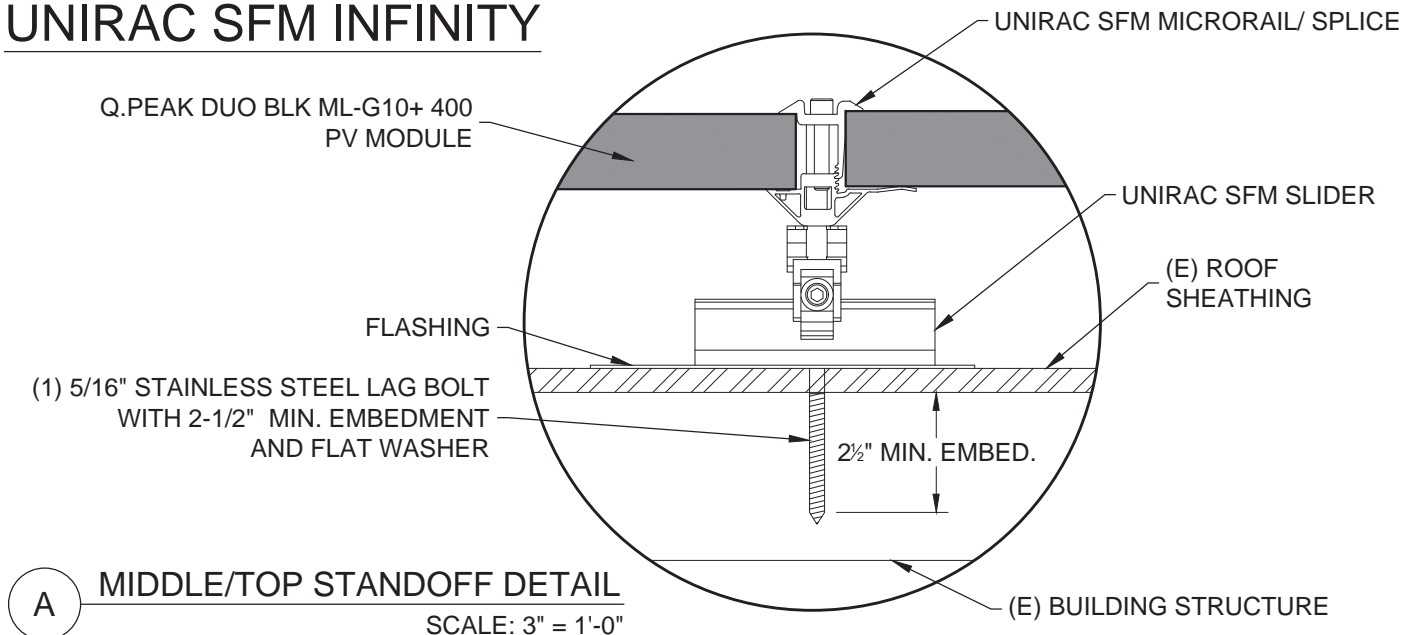
\*NOTE: LISTED NUMBER OF ATTACHMENT POINTS ARE AN ESTIMATE ONLY AND MAY VARY BASED ON FIELD CONDITIONS. MAXIMUM ATTACHMENT SPACING TO BE FOLLOWED PER ENGINEER OF RECORD SPECIFICATIONS.



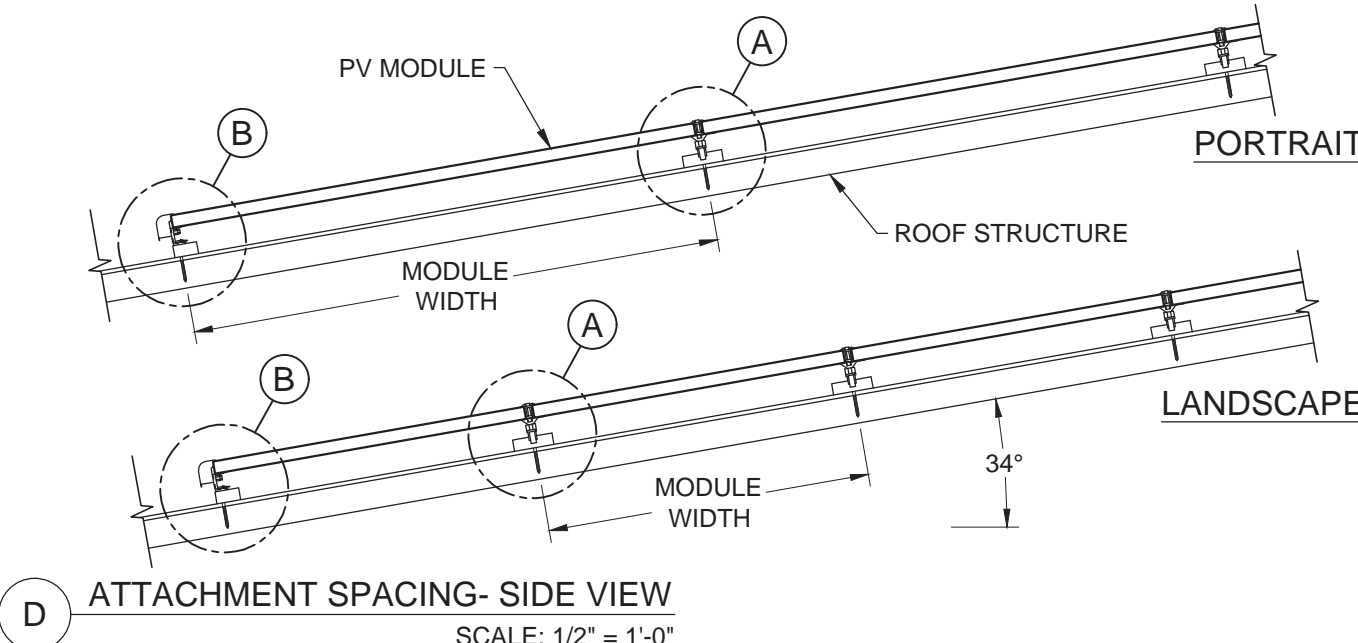
**C ATTACHMENT SPACING- FRONT VIEW**  
 SCALE: 3/4" = 1'-0"

-RACKING ATTACHMENTS TO BE STAGGERED BY SHIFTING EACH SUBSEQUENT ROW OF ATTACHMENTS OVER ONE RAFTER.

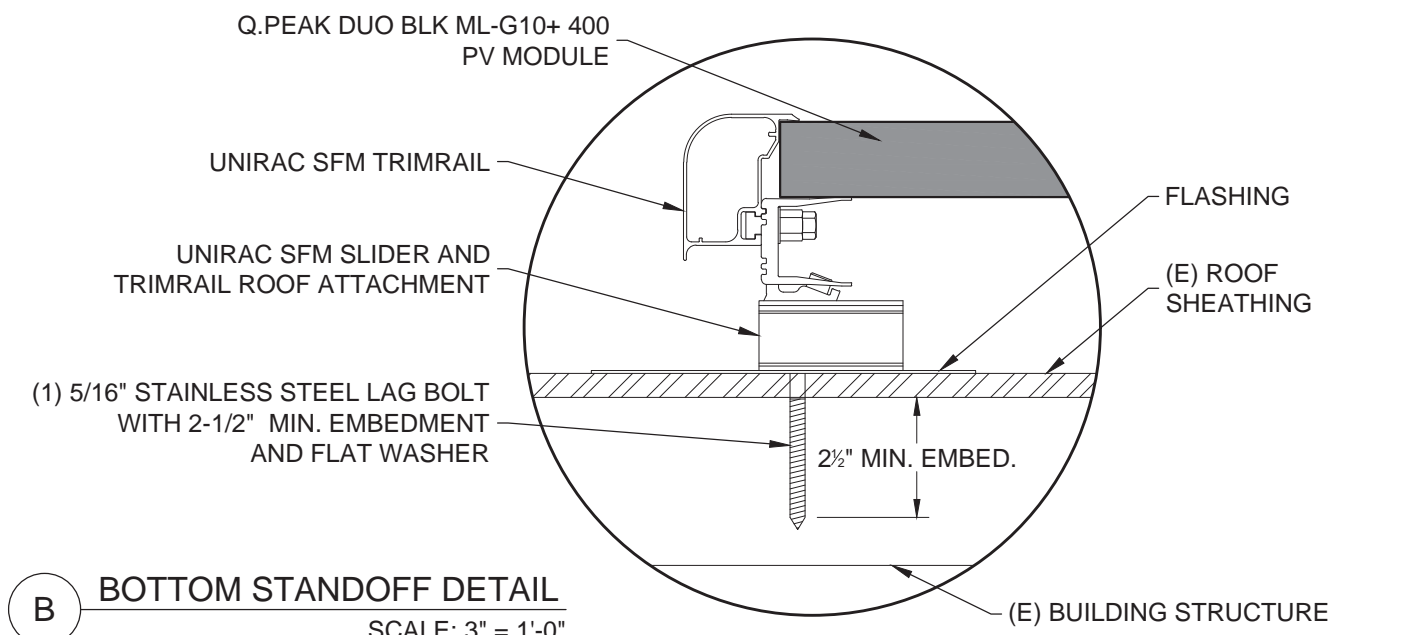
**UNIRAC SFM INFINITY**



**A MIDDLE/TOP STANDOFF DETAIL**  
 SCALE: 3" = 1'-0"



**D ATTACHMENT SPACING- SIDE VIEW**  
 SCALE: 1/2" = 1'-0"



**B BOTTOM STANDOFF DETAIL**  
 SCALE: 3" = 1'-0"

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DRAWING BY:  
 Enphase Energy

PLOT DATE:  
 July 21, 2022

PROJECT NUMBER:  
 511835

SHEET NAME:  
 STRUCTURAL

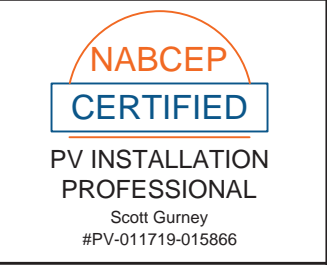
REVISION: 0 PAGE NUMBER: PV4

15	(1) 3 AWG THHN/THWN-2, CU., BLACK (L1)	75.0 A AC	3	(5) 6 AWG THHN/THWN-2, CU., BLACK (L1)	MAX 16.0 A AC	2	(1) 10 AWG THHN/THWN-2, CU., BLACK (L1)	MAX 16.0 A AC	1	(1) 12-2 TC-ER, THHN/THWN-2, CU.	MAX 16.0 A AC
	(1) 3 AWG THHN/THWN-2, CU., RED (L2)	240 V AC		(5) 6 AWG THHN/THWN-2, CU., RED (L2)	240 V AC		(1) 10 AWG THHN/THWN-2, CU., RED (L2)	240 V AC		(1) 6 AWG BARE, CU (EGC)	240 V AC
	(1) 3 AWG THHN/THWN-2, CU., WHITE (N)			(1) 10 AWG THHN/THWN-2, CU., GREEN (EGC)			(1) 10 AWG THHN/THWN-2, CU., GREEN (EGC)				
	(1) 8 AWG THHN/THWN-2, CU., GREEN (EGC)			OR 6 - 2 UF-8 W/G, THHN/THWN-2, SOLID CU.							
	(1) 1 INCH EMT	EXTERIOR		(1) 1 1/4 INCH EMT	EXTERIOR		(1) 3/4 INCH EMT	EXTERIOR		(1) 1 INCH EMT	EXTERIOR
16	(1) 3 AWG THHN/THWN-2, CU., BLACK (L1)	75.0 A AC									
	(1) 3 AWG THHN/THWN-2, CU., RED (L2)	240 V AC									
	(1) 3 AWG THHN/THWN-2, CU., WHITE (N)										
	(1) 1 INCH EMT	EXTERIOR									



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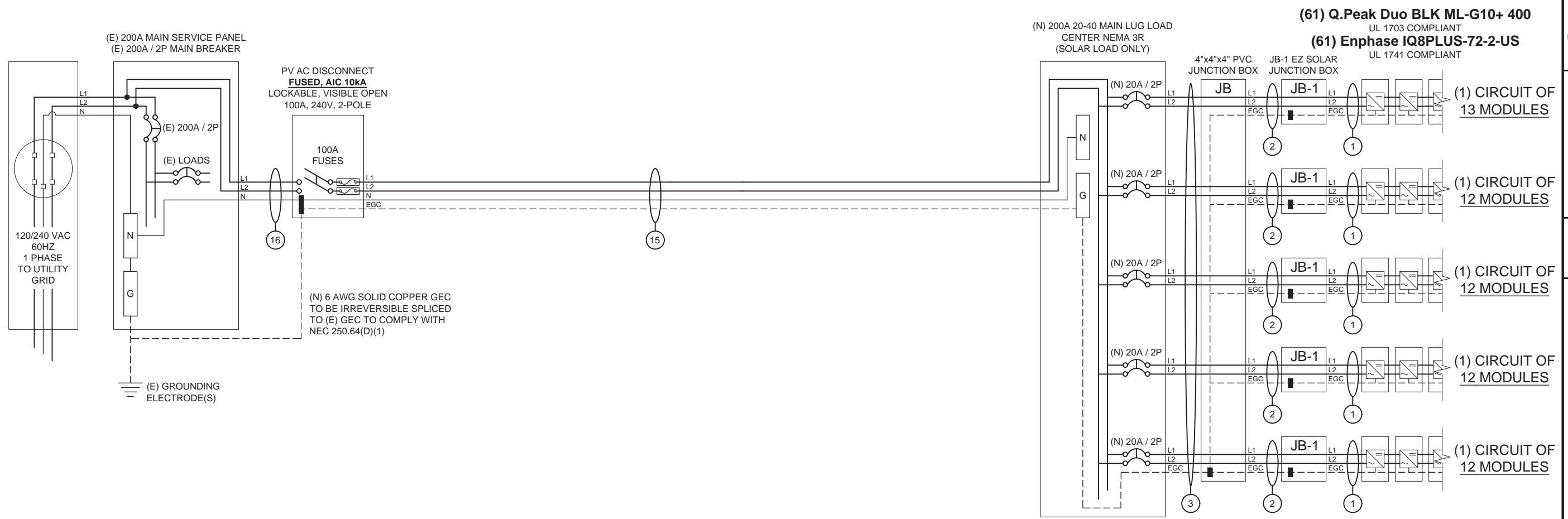
CONTRACTOR:  
BRS FIELD OPS  
800-377-4480

**CUSTOMER INFORMATION:**  
Jonathan Carter  
9701 N 700 W  
MCCORDSVILLE, Indiana 46055  
DC SYSTEM SIZE: 24.4 kW DC

**DESIGNER NOTES:**

SUPPLY-SIDE TAP IN MSP, INTERIOR POI. CAP ANY LOSE WIRE INSIDE OF MSP.

**ELECTRICAL NOTES:**



**INTERCONNECTION NOTES**

705.11 AN ELECTRIC POWER PRODUCTION SOURCE, WHERE CONNECTED TO THE SUPPLY SIDE OF THE SERVICE DISCONNECTING MEANS AS PERMITTED IN 230.82(6), SHALL COMPLY WITH 705.11 (A) THROUGH (E).



UTILITY COMPANY: Ninestar Connect      PERMIT ISSUER: Town of McCordsville

DRAWING BY: Enphase Energy	
PLOT DATE: July 21, 2022	
PROJECT NUMBER: 511835	
SHEET NAME: ELECTRICAL	
REVISION: 0	PAGE NUMBER: PV5



MODULE SPECIFICATIONS		Q.Peak Duo BLK ML-G10+ 400
RATED POWER (STC)		400 W
MODULE VOC		45.3 V DC
MODULE VMP		37.1 V DC
MODULE IMP		10.8 A DC
MODULE ISC		11.1 A DC
VOC CORRECTION		-0.27 %/°C
VMP CORRECTION		-0.34 %/°C
SERIES FUSE RATING		20 A DC
ADJ. MODULE VOC @ ASHRAE LOW TEMP		51.0 V DC
ADJ. MODULE VMP @ ASHRAE 2% AVG. HIGH TEMP		32.2 V DC

MICROINVERTER SPECIFICATIONS		Enphase IQ8+ Microinverters
POWER POINT TRACKING (MPPT) MIN/MAX		30 - 58 V DC
MAXIMUM INPUT VOLTAGE		60 V DC
MAXIMUM DC SHORT CIRCUIT CURRENT		15 A DC
MAXIMUM USABLE DC INPUT POWER		440 W
MAXIMUM OUTPUT CURRENT		1.23 A AC
AC OVERCURRENT PROTECTION		20 A
MAXIMUM OUTPUT POWER		290 W
CEC WEIGHTED EFFICIENCY		97 %

AC PHOTOVOLTAIC MODULE MARKING (NEC 690.52)	
NOMINAL OPERATING AC VOLTAGE	240 V AC
NOMINAL OPERATING AC FREQUENCY	47 - 68 HZ AC
MAXIMUM AC POWER	240 VA AC
MAXIMUM AC CURRENT	1.0 A AC
MAXIMUM OCPD RATING FOR AC MODULE	20 A AC

DESIGN LOCATION AND TEMPERATURES	
TEMPERATURE DATA SOURCE	ASHRAE 2% AVG. HIGH TEMP
STATE	Indiana
CITY	MCCORDSVILLE
WEATHER STATION	INDIANAPOLIS INTL AP
ASHRAE EXTREME LOW TEMP (°C)	-22
ASHRAE 2% AVG. HIGH TEMP (°C)	32

SYSTEM ELECTRICAL SPECIFICATIONS	CIR 1	CIR 2	CIR 3	CIR 4	CIR 5	CIR 6
NUMBER OF MODULES PER MPPT	13	12	12	12	12	
DC POWER RATING PER CIRCUIT (STC)	5200	4800	4800	4800	4800	
TOTAL MODULE NUMBER	61 MODULES					
STC RATING OF ARRAY	24400W DC					
AC CURRENT @ MAX POWER POINT (IMP)	16.0	14.8	14.8	14.8	14.8	
MAX. CURRENT (IMP X 1.25)	19.9875	18.45	18.45	18.45	18.45	
OCPD CURRENT RATING PER CIRCUIT	20	20	20	20	20	
MAX. COMB. ARRAY AC CURRENT (IMP)	75.0					
MAX. ARRAY AC POWER	17690W AC					

AC VOLTAGE RISE CALCULATIONS	DIST (FT)	COND.	∕RISE(V)	VEND(V)	%VRISE
VRISE SEC. 1 (MICRO TO JBOX)	43.2	12 Cu.	2.09	242.09	0.87%
VRISE SEC. 2 (JBOX TO COMBINER BOX)	105	10 Cu.	4.26	244.26	1.78%
VRISE SEC. 3 (COMBINER BOX TO POI)	10	3 Cu.	0.38	240.38	0.16%
TOTAL VRISE			6.74	246.74	

PHOTOVOLTAIC AC DISCONNECT OUTPUT LABEL (NEC 690.54)	
AC OUTPUT CURRENT	75.0 A AC
NOMINAL AC VOLTAGE	240 V AC

CONDUCTOR SIZE CALCULATIONS		
MICROINVERTER TO JUNCTION BOX (1)	MAX. SHORT CIRCUIT CURRENT (ISC) =	16.0 A AC
	MAX. CURRENT (ISC X1.25) =	20.0 A AC
	CONDUCTOR (TC-ER, COPPER (90°C)) =	12 AWG
	CONDUCTOR RATING =	30 A
	AMB. TEMP. AMP. CORRECTION =	0.96
	ADJUSTED AMP. =	28.8 > 20.0
JUNCTION BOX TO JUNCTION BOX (2)	MAX. SHORT CIRCUIT CURRENT (ISC) =	16.0 A AC
	MAX. CURRENT (ISC X1.25) =	20.0 A AC
	CONDUCTOR (THWN-2, COPPER (75°C TERM.)) =	10 AWG
	CONDUCTOR RATING =	35 A
	CONDUIT FILL DERATE =	1
	AMB. TEMP. AMP. CORRECTION =	0.76
	ADJUSTED AMP. =	26.6 > 20.0
JUNCTION BOX TO COMBINER BOX (3)	MAX. SHORT CIRCUIT CURRENT (ISC) =	16.0 A AC
	MAX. CURRENT (ISC X1.25) =	20.0 A AC
	CONDUCTOR (THWN-2, COPPER (75°C TERM.)) =	6 AWG
	CONDUCTOR RATING =	65 A
	CONDUIT FILL DERATE =	0.5
	AMB. TEMP. AMP. CORRECTION =	0.96
	ADJUSTED AMP. =	31.2 > 20.0
COMBINER BOX TO MAIN PV OCPD (15)	INVERTER RATED AMPS =	75.0 A AC
	MAX. CURRENT (RATED AMPS X1.25) =	93.79 A AC
	CONDUCTOR (THWN-2, COPPER (75°C TERM.)) =	3 AWG
	CONDUCTOR RATING =	100 A
	CONDUIT FILL DERATE =	1
	AMB. TEMP. AMP. CORRECTION =	0.96
	ADJUSTED AMP. =	96 > 93.8

### GROUNDING NOTES

1. A GROUNDING ELECTRODE SYSTEM IN ACCORDANCE WITH [NEC 690.47] AND [NEC 250.50-60] SHALL BE PROVIDED. PER [NEC 690.47], THE GROUNDING ELECTRODE SYSTEM OF AN EXISTING BUILDING MAY BE USED AND BE BONDED AT THE SERVICE ENTRANCE. IF EXISTING SYSTEM IS INACCESSIBLE, OR INADEQUATE, OR IS ONLY METALLIC WATER PIPING, A SUPPLEMENTAL GROUNDING ELECTRODE WILL BE USED AT THE INVERTER LOCATION CONSISTING OF A UL LISTED 8 FT GROUND ROD WITH ACORN CLAMP.
2. THE GROUNDING ELECTRODE CONDUCTOR SHALL BE PROTECTED FROM PHYSICAL DAMAGE BETWEEN THE GROUNDING ELECTRODE AND THE PANEL (OR INVERTER) IF SMALLER THAN #6 AWG COPPER WIRE PER [NEC 250.64(B)]. THE GROUNDING ELECTRODE CONDUCTOR WILL BE CONTINUOUS, EXCEPT FOR SPLICES OR JOINTS AT BUSBARS WITHIN LISTED EQUIPMENT PER [NEC 250.64(C)].
3. GROUNDING ELECTRODE CONDUCTORS SHALL BE NO LESS THAN 8 AWG AND NO GREATER THAN 6 AWG COPPER AND BONDED TO THE EXISTING GROUNDING ELECTRODE TO PROVIDE FOR A COMPLETE SYSTEM.
4. PV SYSTEM SHALL BE GROUNDED IN ACCORDANCE TO [NEC 250.21], [NEC TABLE 250.122], AND ALL METAL PARTS OR MODULE FRAMES ACCORDING TO [NEC 690.46].
5. MODULE SOURCE CIRCUITS SHALL BE GROUNDED IN ACCORDANCE TO [NEC 690.42].
6. THE GROUNDING CONNECTION TO A MODULE SHALL BE ARRANGED SUCH THAT THE REMOVAL OF A MODULE DOES NOT INTERRUPT A GROUNDED CONDUCTOR TO ANOTHER MODULE.
7. EACH MODULE WILL BE GROUNDED USING THE SUPPLIED CONNECTION POINTS IDENTIFIED IN THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.
8. ENCLOSURES SHALL BE PROPERLY PREPARED WITH REMOVAL OF PAINT/FINISH AS APPROPRIATE WHEN GROUNDING EQUIPMENT WITH TERMINATION GROUNDING LUGS.
9. GROUNDING SYSTEM COMPONENTS SHALL BE LISTED FOR THEIR PURPOSE, AND GROUNDING DEVICES EXPOSED TO THE ELEMENTS SHALL BE RATED FOR DIRECT BURIAL.
10. GROUNDING AND BONDING CONDUCTORS SHALL BE COPPER, SOLID OR STRANDED, AND BARE WHEN EXPOSED.
11. EQUIPMENT GROUNDING CONDUCTORS SHALL BE SIZED ACCORDING TO [NEC 690.45] AND BE A MINIMUM OF 10 AWG WHEN NOT EXPOSED TO DAMAGE (6 AWG SHALL BE USED WHEN EXPOSED TO DAMAGE).
12. GROUNDING AND BONDING CONDUCTORS, IF INSULATED, SHALL BE COLOR CODED GREEN (OR MARKED GREEN IF 4 AWG OR LARGER).
13. ALL CONDUIT BETWEEN THE UTILITY AC DISCONNECT AND THE POINT OF CONNECTION SHALL HAVE GROUNDED BUSHINGS AT BOTH ENDS.
14. SYSTEM GEC SIZED ACCORDING TO [NEC 690.47], [NEC TABLE 250.66], DC SYSTEM GEC SIZED ACCORDING TO [NEC 250.166], MINIMUM 8 AWG WHEN INSULATED, 6 AWG WHEN EXPOSED TO DAMAGE.
15. EXPOSED NON-CURRENT CARRYING METAL PARTS OF MODULE FRAMES, EQUIPMENTS, AND CONDUCTOR ENCLOSURES SHALL BE GROUNDED IN ACCORDANCE WITH [NEC 250.134] OR [NEC 250.136(A)] REGARDLESS OF VOLTAGE.

### WIRING & CONDUIT NOTES

1. ALL CONDUIT SIZES AND TYPES, SHALL BE LISTED FOR ITS PURPOSE AND APPROVED FOR THE SITE APPLICATIONS.
2. BOLTED CONNECTION REQUIRED IN DC DISCONNECTS ON THE WHITE GROUNDED CONDUCTOR (USE POLARIS BLOCK OR NEUTRAL BAR).
3. ANY CONNECTION ABOVE LIVE PARTS MUST BE WATERTIGHT. REDUCING WASHERS DISALLOWED ABOVE LIVE PARTS, MEYERS HUBS RECOMMENDED
4. UV RESISTANT CABLE TIES (NOT ZIP TIES) USED FOR PERMANENT WIRE MANAGEMENT OFF THE ROOF SURFACE IN ACCORDANCE WITH [NEC 110.2.110.3(A-B)].
5. SOLADECK JUNCTION BOXES MOUNTED FLUSH WITH ROOF SURFACE TO BE USED FOR WIRE MANAGEMENT AND AS FLASHED ROOF PENETRATIONS FOR INTERIOR CONDUIT RUNS.
6. ALL PV CABLES AND HOMERUN WIRES BE TYPE USE-2, AND SINGLE-CONDUCTOR CABLE LISTED AND IDENTIFIED AS PV WIRE, TYPE TC-ER, OR EQUIVALENT; ROUTED TO SOURCE CIRCUIT COMBINER BOXES AS REQUIRED.
7. ALL CONDUCTORS AND OCPD SIZES AND TYPES SPECIFIED ACCORDING TO [NEC 690.8] FOR MULTIPLE CONDUCTORS.
8. ALL PV DC CONDUCTORS IN CONDUIT EXPOSED TO SUNLIGHT SHALL BE INSTALLED AT LEAST 7/8" ABOVE THE ROOF SURFACE AND DERATED ACCORDING TO [NEC TABLE 310.15 (B)(2)(A)], [NEC TABLE 310.15(B)(3)(A)], & [NEC 310.15(B)(3)(C)].
9. EXPOSED ROOF PV DC CONDUCTORS SHALL BE USE-2, 90°C RATED, WET AND UV RESISTANT, AND UL LISTED RATED FOR 600V, UV RATED SPIRAL WRAP SHALL BE USED TO PROTECT WIRE FROM SHARP EDGES.
10. PHASE AND NEUTRAL CONDUCTORS SHALL BE DUAL RATED THHN/THWN-2 INSULATED, 90°C RATED, WET AND UV RESISTANT, RATED FOR 600V
11. 4-WIRE DELTA CONNECTED SYSTEMS HAVE THE PHASE WITH THE HIGHER VOLTAGE TO GROUND MARKED ORANGE OR IDENTIFIED BY OTHER EFFECTIVE MEANS.
12. ALL SOURCE CIRCUITS SHALL HAVE INDIVIDUAL SOURCE CIRCUIT PROTECTION
13. VOLTAGE DROP LIMITED TO 2% FOR DC CIRCUITS AND 3% FOR AC CIRCUITS
14. NEGATIVE GROUNDED SYSTEMS DC CONDUCTORS SHALL BE COLOR CODED AS FOLLOWS: DC POSITIVE- RED (OR MARKED RED), DC NEGATIVE- GREY (OR MARKED GREY)
15. POSITIVE GROUNDED SYSTEMS DC CONDUCTORS COLOR CODED: DC POSITIVE- GREY (OR MARKED GREY), DC NEGATIVE- BLACK (OR MARKED BLACK)
16. AC CONDUCTORS >4AWG COLOR CODED OR MARKED: PHASE A OR L1- BLACK, PHASE B OR L2- RED, PHASE C OR L3- BLUE, NEUTRAL- WHITE/GRAY
- \* USE-2 IS NOT INDOOR RATED BUT PV CABLE IS RATED THWN/THWN-2 AND MAY BE USED INSIDE
- \*\* USE-2 IS AVAILABLE AS UV WHITE
17. RIGID CONDUIT, IF INSTALLED, (AND/OR NIPPLES) MUST HAVE A PULL BUSHING TO PROTECT WIRES.
18. IF CONDUIT DETERMINED TO BE RAN THROUGH ATTIC IN FIELD THEN CONDUIT WILL BE EITHER EMT, FMC, OR MC CABLE IF DC CURRENT COMPLYING WITH [NEC 690.31], [NEC 250.118(10)]. DISCONNECTING MEANS SHALL COMPLY WITH [NEC 690.13] AND [NEC 690.15].
19. CONDUIT RAN THROUGH ATTIC WILL BE AT LEAST 18" BELOW ROOF SURFACE COMPLYING WITH [NEC 230.6(4)] AND SECURED NO GREATER THAN 6' APART PER [NEC 330.30(B)].



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PV INSTALLATION  
PROFESSIONAL

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#PV-011719-015866

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### CUSTOMER INFORMATION:

Jonathan Carter  
9701 N 700 W  
MCCORDSVILLE, Indiana 46055  
DC SYSTEM SIZE: 24.4 kW DC

DRAWING BY:

Enphase Energy

PLOT DATE:

July 21, 2022

PROJECT NUMBER:

511835

SHEET NAME:

ELEC CALCS

REVISION:

0

PAGE NUMBER:

PV6

# STANDARD LABELS

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

**LABEL 1**  
FOR PV SYSTEM DISCONNECTING MEANS WHERE THE LINE AND LOAD TERMINALS MAY BE ENERGIZED IN THE OPEN POSITION. [NEC 690.13(B)]

**⚠ PHOTOVOLTAIC SYSTEM AC DISCONNECT ⚠**  
RATED AC OUTPUT CURRENT 75.03 A  
NOMINAL OPERATING AC VOLTAGE 240 V

**LABEL 2**  
SHALL BE MARKED AT AN ACCESSIBLE LOCATION AT THE DISCONNECTING MEANS AS A POWER SOURCE AND WITH THE RATED AC OUTPUT CURRENT AND THE NOMINAL OPERATING AC VOLTAGE. [NEC 690.54]

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

**LABEL 3**  
IF INTERCONNECTING LOAD SIDE, INSTALL THIS LABEL ANYWHERE THAT IS POWERED BY BOTH THE UTILITY AND THE SOLAR PV SYSTEM, IE. MAIN SERVICE PANEL AND SUBPANELS. [NEC 705.12(B)(3)]

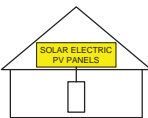
**⚠ WARNING**  
POWER SOURCE OUTPUT CONNECTION  
DO NOT RELOCATE THIS OVERCURRENT DEVICE

**LABEL 4**  
APPLY TO THE DISTRIBUTION EQUIPMENT ADJACENT TO THE BACK-FED BREAKER FROM THE POWER SOURCE. [NEC 705.12(B)(2)]

**⚠ WARNING**  
THIS EQUIPMENT FED BY MULTIPLE SOURCES. TOTAL RATING OF ALL OVERCURRENT DEVICES, EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE, SHALL NOT EXCEED AMPACITY OF BUSBAR.

**LABEL 5**  
APPLY TO THE PV COMBINER BOX [NEC 705.12 (3)(3)]

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



**LABEL 6**  
BUILDINGS WITH PV SYSTEMS SHALL HAVE A PERMANENT LABEL LOCATED AT EACH SERVICE EQUIPMENT LOCATION TO WHICH THE PV SYSTEMS ARE CONNECTED OR AT AN APPROVED READILY VISIBLE LOCATION AND SHALL INDICATE THE LOCATION OF RAPID SHUTDOWN INITIATION DEVICES. [NEC 690.56(C)]

**RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM**

**LABEL 7**  
SIGN LOCATED AT RAPID SHUT DOWN DISCONNECT SWITCH [NEC 690.56(C)(2)]

**⚠ WARNING**  
MAIN DISTRIBUTION UTILITY DISCONNECT(S)  
POWER TO THIS BUILDING IS ALSO SUPPLIED FROM A ROOF MOUNTED SOLAR ARRAY WITH A RAPID SHUTDOWN DISCONNECTING MEANS GROUPED AND LABELED WITHIN LINE OF SIGHT AND 10 FT OF THIS LOCATION

**LABEL 8**  
PERMANENT PLAQUE OR DIRECTORY DENOTING THE LOCATION OF ALL ELECTRIC POWER SOURCE DISCONNECTING MEANS ON OR IN THE PREMISES SHALL BE INSTALLED AT EACH SERVICE EQUIPMENT LOCATION AND AT THE LOCATION(S) OF THE SYSTEM DISCONNECT(S) FOR ALL ELECTRIC POWER PRODUCTION SOURCES CAPABLE OF BEING INTERCONNECTED. [2017 NEC 705.10]

**⚠ WARNING**  
POWER TO THIS BUILDING IS ALSO SUPPLIED FROM MAIN DISTRIBUTION UTILITY DISCONNECT LOCATED

**LABEL 9**  
PERMANENT PLAQUE OR DIRECTORY DENOTING THE LOCATION OF ALL ELECTRIC POWER SOURCE DISCONNECTING MEANS ON OR IN THE PREMISES SHALL BE INSTALLED AT EACH SERVICE EQUIPMENT LOCATION AND AT THE LOCATION(S) OF THE SYSTEM DISCONNECT(S) FOR ALL ELECTRIC POWER PRODUCTION SOURCES CAPABLE OF BEING INTERCONNECTED. [2017 NEC 705.10]

**⚠ WARNING**  
POWER TO THIS BUILDING IS ALSO SUPPLIED FROM A ROOF MOUNTED SOLAR ARRAY. SOLAR ARRAY RAPID SHUTDOWN DISCONNECT IS LOCATED OUTSIDE NEXT TO THE UTILITY METER.

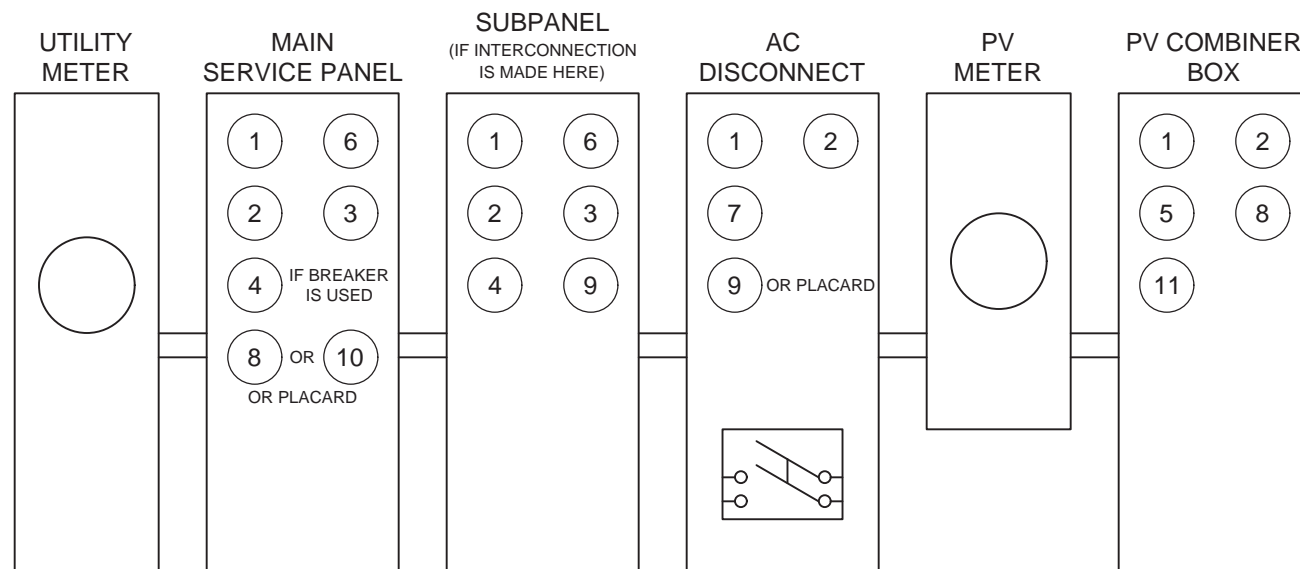
**LABEL 10**  
PERMANENT PLAQUE OR DIRECTORY TO BE LOCATED AT MAIN SERVICE EQUIPMENT DENOTING THE LOCATION OF THE RAPID SHUTDOWN SYSTEM DISCONNECTING MEANS IF SOLAR ARRAY RAPID SHUTDOWN DISCONNECTING SWITCH IS NOT GROUPED AND WITHIN LINE OF SITE OF MAIN SERVICE DISCONNECTING MEANS. [2017 NEC 705.10 AND 690.56(C)(1)]

**⚠ WARNING**  
PHOTOVOLTAIC SYSTEM COMBINER PANEL  
DO NOT ADD LOADS

**LABEL 11**  
PERMANENT PLAQUE OR DIRECTORY TO BE LOCATED AT AC COMBINER PANEL. [NEC 110.21(B)]

**WARNING: PHOTOVOLTAIC POWER SOURCE**

**LABEL 12**  
AT EXPOSED RACEWAYS, CABLE TRAYS, COVERS AND ENCLOSURES OF JUNCTION BOXES, AND OTHER WIRING METHODS. [NEC 690.31(G)(3&4)]



# ADDITIONAL LABELS



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LABELS

REVISION: 0 PAGE NUMBER: PV7

## LABELING NOTES

- 1) LABELS CALLED OUT ACCORDING TO ALL COMMON CONFIGURATIONS. ELECTRICIAN TO DETERMINE EXACT REQUIREMENTS IN THE FIELD PER CURRENT NEC AND LOCAL CODES AND MAKE APPROPRIATE ADJUSTMENTS.
- 2) LABELING REQUIREMENTS BASED ON THE 2017 & 2020 NEC CODE, OSHA STANDARD 19010.145, ANSIZ535.
- 3) MATERIAL BASED ON THE REQUIREMENTS OF THE AHJ.
- 4) LABELS TO BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED AND SHALL NOT BE HANDWRITTEN [NEC 110.21]

\*ELECTRICAL DIAGRAM SHOWN ABOVE IS FOR LABELING PURPOSES ONLY. NOT AN ACTUAL REPRESENTATION OF EQUIPMENT AND CONNECTIONS TO BE INSTALLED. LABEL LOCATIONS PRESENTED MAY VARY DEPENDING ON TYPE OF INTERCONNECTION METHOD AND LOCATION PRESENTED ON 3 LINE DIAGRAM. 3 LINE DIAGRAM ON PV5 TO REFLECT ACTUAL REPRESENTATION OF PROPOSED SCOPE OF WORK.





## IQ8 and IQ8+ Microinverters

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



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



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



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



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

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IQ8SP-DS-0002-01-EN-US-2022-03-17

### Easy to install

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

### High productivity and reliability

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

### Microgrid-forming

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

\* Only when installed with IQ System Controller 2, meets UL 1741.

\*\* IQ8 and IQ8Plus supports split phase, 240V installations only.

## IQ8 and IQ8+ Microinverters

INPUT DATA (DC)		IQ8-60-2-US	IQ8PLUS-72-2-US
Commonly used module pairings <sup>1</sup>	W	235 – 350	235 – 440
Module compatibility		60-cell/120 half-cell	60-cell/120 half-cell, 66-cell/132 half-cell and 72-cell/144 half-cell
MPPT voltage range	V	27 – 37	29 – 45
Operating range	V	25 – 48	25 – 58
Min/max start voltage	V	30 / 48	30 / 58
Max input DC voltage	V	50	60
Max DC current <sup>2</sup> [module Isc]	A		15
Overvoltage class DC port			II
DC port backfeed current	mA		0
PV array configuration		1x1 Ungrounded array; No additional DC side protection required; AC side protection requires max 20A per branch circuit	
OUTPUT DATA (AC)		IQ8-60-2-US	IQ8PLUS-72-2-US
Peak output power	VA	245	300
Max continuous output power	VA	240	290
Nominal (L-L) voltage/range <sup>3</sup>	V	240 / 211 – 264	
Max continuous output current	A	1.0	1.21
Nominal frequency	Hz	60	
Extended frequency range	Hz	50 – 68	
AC short circuit fault current over 3 cycles	Arms	2	
Max units per 20 A (L-L) branch circuit <sup>4</sup>		16	13
Total harmonic distortion		<5%	
Overvoltage class AC port		III	
AC port backfeed current	mA	30	
Power factor setting		1.0	
Grid-tied power factor (adjustable)		0.85 leading – 0.85 lagging	
Peak efficiency	%	97.5	97.6
CEC weighted efficiency	%	97	97
Night-time power consumption	mW	60	
MECHANICAL DATA			
Ambient temperature range		-40°C to +60°C (-40°F to +140°F)	
Relative humidity range		4% to 100% (condensing)	
DC Connector type		MC4	
Dimensions (HxWxD)		212 mm (8.3") x 175 mm (6.9") x 30.2 mm (1.2")	
Weight		1.08 kg (2.38 lbs)	
Cooling		Natural convection – no fans	
Approved for wet locations		Yes	
Pollution degree		PD3	
Enclosure		Class II double-insulated, corrosion resistant polymeric enclosure	
Environ. category / UV exposure rating		NEMA Type 6 / outdoor	
COMPLIANCE			
Certifications		CA Rule 21 (UL 1741-SA), UL 62109-1, UL1741/IEEE1547, FCC Part 15 Class B, ICES-0003 Class B, CAN/CSA-C22.2 NO. 107.1-01	
		This product is UL Listed as PV Rapid Shut Down Equipment and conforms with NEC 2014, NEC 2017, and NEC 2020 section 690.12 and C22.1-2018 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according to manufacturer's instructions.	

(1) No enforced DC/AC ratio. See the compatibility calculator at <https://link.enphase.com/module-compatibility>

(2) Maximum continuous input DC current is 10.6A (3) Nominal voltage range can be extended beyond nominal if required by the utility. (4) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.

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SHEET NAME:

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REVISION:

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# Enphase IQ Combiner 4/4C

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



X-IQ-AM1-240-4C

X-IQ-AM1-240-4



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

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

### Smart

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

### Simple

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

### Reliable

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



## Enphase IQ Combiner 4/4C

### MODEL NUMBER

IQ Combiner 4 (X-IQ-AM1-240-4)	IQ Combiner 4 with Enphase IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and consumption monitoring (+/- 2.5%). Includes a silver solar shield to match the IQ Battery system and IQ System Controller 2 and to deflect heat.
IQ Combiner 4C (X-IQ-AM1-240-4C)	IQ Combiner 4C with Enphase IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and consumption monitoring (+/- 2.5%). Includes Enphase Mobile Connect cellular modem (CELLMODEM-M1-06-SP-05), a plug-and-play industrial-grade cell modem for systems up to 60 microinverters. (Available in the US, Canada, Mexico, Puerto Rico, and the US Virgin Islands, where there is adequate cellular service in the installation area.) Includes a silver solar shield to match the IQ Battery and IQ System Controller and to deflect heat.

### ACCESSORIES AND REPLACEMENT PARTS (not included, order separately)

Ensemble Communications Kit COMMS-CELLMODEM-M1-06 CELLMODEM-M1-06-SP-05 CELLMODEM-M1-06-AT-05	- Includes COMMS-KIT-01 and CELLMODEM-M1-06-SP-05 with 5-year Sprint data plan for Ensemble sites - 4G based LTE-M1 cellular modem with 5-year Sprint data plan - 4G based LTE-M1 cellular modem with 5-year AT&T data plan
Circuit Breakers BRK-10A-2-240V BRK-15A-2-240V BRK-20A-2P-240V BRK-15A-2P-240V-B BRK-20A-2P-240V-B	Supports Eaton BR210, BR215, BR220, BR230, BR240, BR250, and BR260 circuit breakers. Circuit breaker, 2 pole, 10A, Eaton BR210 Circuit breaker, 2 pole, 15A, Eaton BR215 Circuit breaker, 2 pole, 20A, Eaton BR220 Circuit breaker, 2 pole, 15A, Eaton BR215B with hold down kit support Circuit breaker, 2 pole, 20A, Eaton BR220B with hold down kit support
EPLC-01	Power line carrier (communication bridge pair), quantity - one pair
XA-SOLARSHIELD-ES	Replacement solar shield for IQ Combiner 4/4C
XA-PLUG-120-3	Accessory receptacle for Power Line Carrier in IQ Combiner 4/4C (required for EPLC-01)
XA-ENV-PCBA-3	Replacement IQ Gateway printed circuit board (PCB) for Combiner 4/4C
X-IQ-NA-HD-125A	Hold down kit for Eaton circuit breaker with screws.

### ELECTRICAL SPECIFICATIONS

Rating	Continuous duty
System voltage	120/240 VAC, 60 Hz
Eaton BR series busbar rating	125 A
Max. continuous current rating	65 A
Max. continuous current rating (input from PV/storage)	64 A
Max. fuse/circuit rating (output)	90 A
Branch circuits (solar and/or storage)	Up to four 2-pole Eaton BR series Distributed Generation (DG) breakers only (not included)
Max. total branch circuit breaker rating (input)	80A of distributed generation / 95A with IQ Gateway breaker included
Production metering CT	200 A solid core pre-installed and wired to IQ Gateway
Consumption monitoring CT (CT-200-SPLIT)	A pair of 200 A split core current transformers

### MECHANICAL DATA

Dimensions (WxHxD)	37.5 x 49.5 x 16.8 cm (14.75" x 19.5" x 6.63"), Height is 21.06" (53.5 cm) with mounting brackets.
Weight	7.5 kg (16.5 lbs)
Ambient temperature range	-40° C to +46° C (-40° to 115° F)
Cooling	Natural convection, plus heat shield
Enclosure environmental rating	Outdoor, NRTL-certified, NEMA type 3R, polycarbonate construction
Wire sizes	• 20 A to 50 A breaker inputs: 14 to 4 AWG copper conductors • 60 A breaker branch input: 4 to 1/0 AWG copper conductors • Main lug combined output: 10 to 2/0 AWG copper conductors • Neutral and ground: 14 to 1/0 copper conductors Always follow local code requirements for conductor sizing.
Altitude	To 2000 meters (6,560 feet)

### INTERNET CONNECTION OPTIONS

Integrated Wi-Fi	802.11b/g/n
Cellular	CELLMODEM-M1-06-SP-05, CELLMODEM-M1-06-AT-05 (4G based LTE-M1 cellular modem). Note that an Enphase Mobile Connect cellular modem is required for all Ensemble installations.
Ethernet	Optional, 802.3, Cat5E (or Cat 6) UTP Ethernet cable (not included)

### COMPLIANCE

Compliance, IQ Combiner	UL 1741, CAN/CSA C22.2 No. 107.1, 47 CFR, Part 15, Class B, ICES 003 Production metering: ANSI C12.20 accuracy class 0.5 (PV production) Consumption metering: accuracy class 2.5
Compliance, IQ Gateway	UL 60601-1/CANCSA 22.2 No. 61010-1

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

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PV INSTALLATION  
PROFESSIONAL  
Scott Gurney  
#PV-011719-015866

CONTRACTOR:  
BRS FIELD OPS  
385-498-6700

SHEET NAME:

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powered by  
**Q.ANTUM DUO Z**



# Q.PEAK DUO BLK ML-G10+

## 385-405

ENDURING HIGH PERFORMANCE



### BREAKING THE 20% EFFICIENCY BARRIER

Q.ANTUM DUO Z Technology with zero gap cell layout boosts module efficiency up to 20.9%.



### THE MOST THOROUGH TESTING PROGRAMME IN THE INDUSTRY

Q CELLS is the first solar module manufacturer to pass the most comprehensive quality programme in the industry: The new "Quality Controlled PV" of the independent certification institute TÜV Rheinland.



### INNOVATIVE ALL-WEATHER TECHNOLOGY

Optimal yields, whatever the weather with excellent low-light and temperature behavior.



### ENDURING HIGH PERFORMANCE

Long-term yield security with Anti LID Technology, Anti PID Technology<sup>1</sup>, Hot-Spot Protect and Traceable Quality Tra.Q™.



### EXTREME WEATHER RATING

High-tech aluminum alloy frame, certified for high snow (5400Pa) and wind loads (4000Pa).



### A RELIABLE INVESTMENT

Inclusive 25-year product warranty and 25-year linear performance warranty<sup>2</sup>.

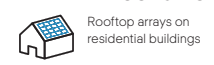
<sup>1</sup> APT test conditions according to IEC / TS 62804-1:2015, method A (-1500V, 96h)  
<sup>2</sup> See data sheet on rear for further information.



6 BUSBAR CELL TECHNOLOGY

12 BUSBAR CELL TECHNOLOGY

### THE IDEAL SOLUTION FOR:

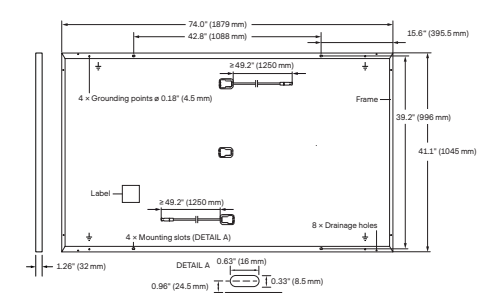


Engineered in Germany



### MECHANICAL SPECIFICATION

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

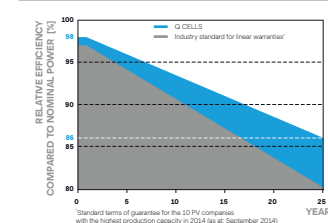


### ELECTRICAL CHARACTERISTICS

POWER CLASS	385	390	395	400	405	
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC <sup>1</sup> (POWER TOLERANCE +5 W / -0 W)						
Power at MPP <sup>1</sup>	P <sub>MPP</sub> [W]	385	390	395	400	405
Short Circuit Current <sup>1</sup>	I <sub>SC</sub> [A]	11.04	11.07	11.10	11.14	11.17
Open Circuit Voltage <sup>1</sup>	V <sub>OC</sub> [V]	45.19	45.23	45.27	45.30	45.34
Current at MPP	I <sub>MPP</sub> [A]	10.59	10.65	10.71	10.77	10.83
Voltage at MPP	V <sub>MPP</sub> [V]	36.36	36.62	36.88	37.13	37.39
Efficiency <sup>1</sup>	η [%]	≥ 19.6	≥ 19.9	≥ 20.1	≥ 20.4	≥ 20.6
MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT <sup>2</sup>						
Power at MPP	P <sub>MPP</sub> [W]	288.8	292.6	296.3	300.1	303.8
Short Circuit Current	I <sub>SC</sub> [A]	8.90	8.92	8.95	8.97	9.00
Open Circuit Voltage	V <sub>OC</sub> [V]	42.62	42.65	42.69	42.72	42.76
Current at MPP	I <sub>MPP</sub> [A]	8.35	8.41	8.46	8.51	8.57
Voltage at MPP	V <sub>MPP</sub> [V]	34.59	34.81	35.03	35.25	35.46

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

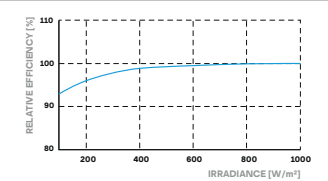
### Q CELLS PERFORMANCE WARRANTY



At least 98% of nominal power during first year. Thereafter max. 0.5% degradation per year. At least 93.5% of nominal power up to 10 years. At least 86% of nominal power up to 25 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Q CELLS sales organisation of your respective country.

### PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m<sup>2</sup>)

### TEMPERATURE COEFFICIENTS

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

### PROPERTIES FOR SYSTEM DESIGN

Maximum System Voltage V <sub>sys</sub>	[V]	1000 (IEC) / 1000 (UL)	PV module classification	Class II
Maximum Series Fuse Rating	[A DC]	20	Fire Rating based on ANSI / UL 61730	TYPE 2
Max. Design Load, Push / Pull <sup>3</sup>	[lbs/ft <sup>2</sup> ] / [kg/m <sup>2</sup> ]	75 (3600 Pa) / 55 (2660 Pa)	Permitted Module Temperature on Continuous Duty	-40 °F up to +185 °F (-40 °C up to +85 °C)
Max. Test Load, Push / Pull <sup>3</sup>	[lbs/ft <sup>2</sup> ] / [kg/m <sup>2</sup> ]	113 (5400 Pa) / 84 (4000 Pa)		

<sup>3</sup> See Installation Manual

### QUALIFICATIONS AND CERTIFICATES

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



### PACKAGING INFORMATION

Horizontal packaging	76.4 in / 1940 mm	43.3 in / 1100 mm	48.0 in / 1220 mm	1656 lbs / 751 kg	24 pallets	24 pallets	32 modules
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**Note:** Installation instructions must be followed. See the installation and operating manual or contact our technical service department for further information on approved installation and use of this product.

Hanwha Q CELLS America Inc.  
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Specifications subject to technical changes © Q CELLS Q.PEAK DUO BLK ML-G10+ 385-405\_DA\_2022-02\_Rev.01\_NA

Product data sheet  
Characteristics

**D223NRB**  
Safety switch, general duty, fusible, 100A, 2 poles, 30 hp, 120 VAC, NEMA 3R, bolt-on provision, neutral factory installed

Product availability : Stock - Normally stocked in distribution facility



Price\* : 480.00 USD



Main

Product	Single Throw Safety Switch
Current Rating	100 A
Certifications	UL listed file E2875
Enclosure Rating	NEMA 3R
Disconnect Type	Fusible disconnect switch
Factory Installed Neutral	Neutral (factory installed)
Short Circuit Current Rating	100 kA maximum depending on fuse H, K or R
Mounting Type	Surface
Number of Poles	2
Electrical Connection	Lugs
Duty Rating	General duty
Voltage Rating	240 V AC
Wire Size	AWG 14...AWG 1 copper AWG 12...AWG 1 aluminium

Complementary

Maximum Horse Power Rating	7,5 hp 240 V AC 60 Hz 1 phase NEC 240.6 15 hp 240 V AC 60 Hz 3 phase NEC 240.6 15 hp 240 V AC 60 Hz 1 phase NEC 430.52 30 hp 240 V AC 60 Hz 3 phase NEC 430.52
Tightening torque	35 lbf.in (3.95 N.m) 0.00...0.01 in <sup>2</sup> (2.08...5.26 mm <sup>2</sup> ) AWG 14...AWG 10) 40 lbf.in (4.52 N.m) 0.01 in <sup>2</sup> (8.37 mm <sup>2</sup> ) AWG 8) 35 lbf.in (3.95 N.m) AWG 14...AWG 10) 45 lbf.in (5.08 N.m) 0.02...0.03 in <sup>2</sup> (12.3...21.12 mm <sup>2</sup> ) AWG 6...AWG 4) 50 lbf.in (5.65 N.m) AWG 3...AWG 1)
Height	17.5 in (444.50 mm)

\* Price is "List Price" and may be subject to a trade discount - check with your local distributor or retailer for actual price.

Width	10.56 in (268.22 mm)
Depth	6.5 in (165.10 mm)

Ordering and shipping details

Category	00106 - D & DU SW,NEMA3R, 30-200A
Discount Schedule	DE1A
GTIN	00785901460701
Nbr. of units in pkg.	1
Package weight(Lbs)	15.46 lb(US) (7.01 kg)
Returnability	Yes
Country of origin	US

Packing Units

Unit Type of Package 1	PCE
Package 1 Height	7.30 in (18.542 cm)
Package 1 width	10.80 in (27.432 cm)
Package 1 Length	20.00 in (50.8 cm)
Unit Type of Package 2	PAL
Number of Units in Package 2	40
Package 2 Weight	650.00 lb(US) (294.835 kg)
Package 2 Height	41.00 in (104.14 cm)
Package 2 width	41.00 in (104.14 cm)
Package 2 Length	48.00 in (121.92 cm)

Offer Sustainability

Sustainable offer status	Green Premium product
California proposition 65	WARNING: This product can expose you to chemicals including: Lead and lead compounds, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov
REACH Regulation	REACH Declaration
REACH free of SVHC	Yes
EU RoHS Directive	Compliant EU RoHS Declaration
Mercury free	Yes
RoHS exemption information	Yes
China RoHS Regulation	China RoHS declaration Product out of China RoHS scope. Substance declaration for your information.
Environmental Disclosure	Product Environmental Profile
PVC free	Yes

Contractual warranty

Warranty	18 months
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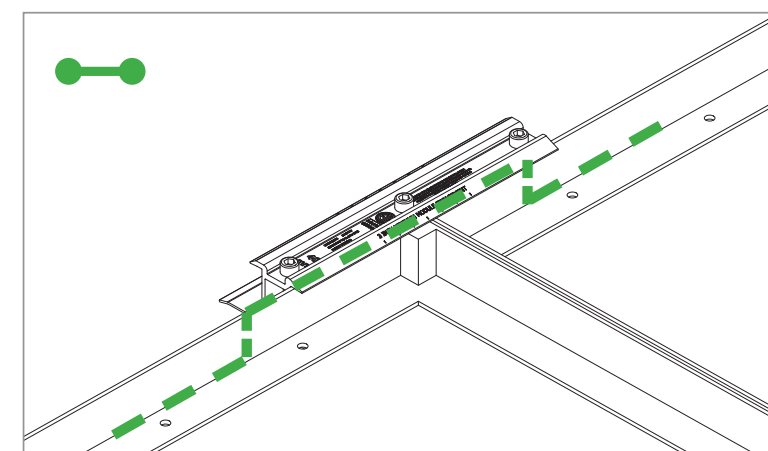
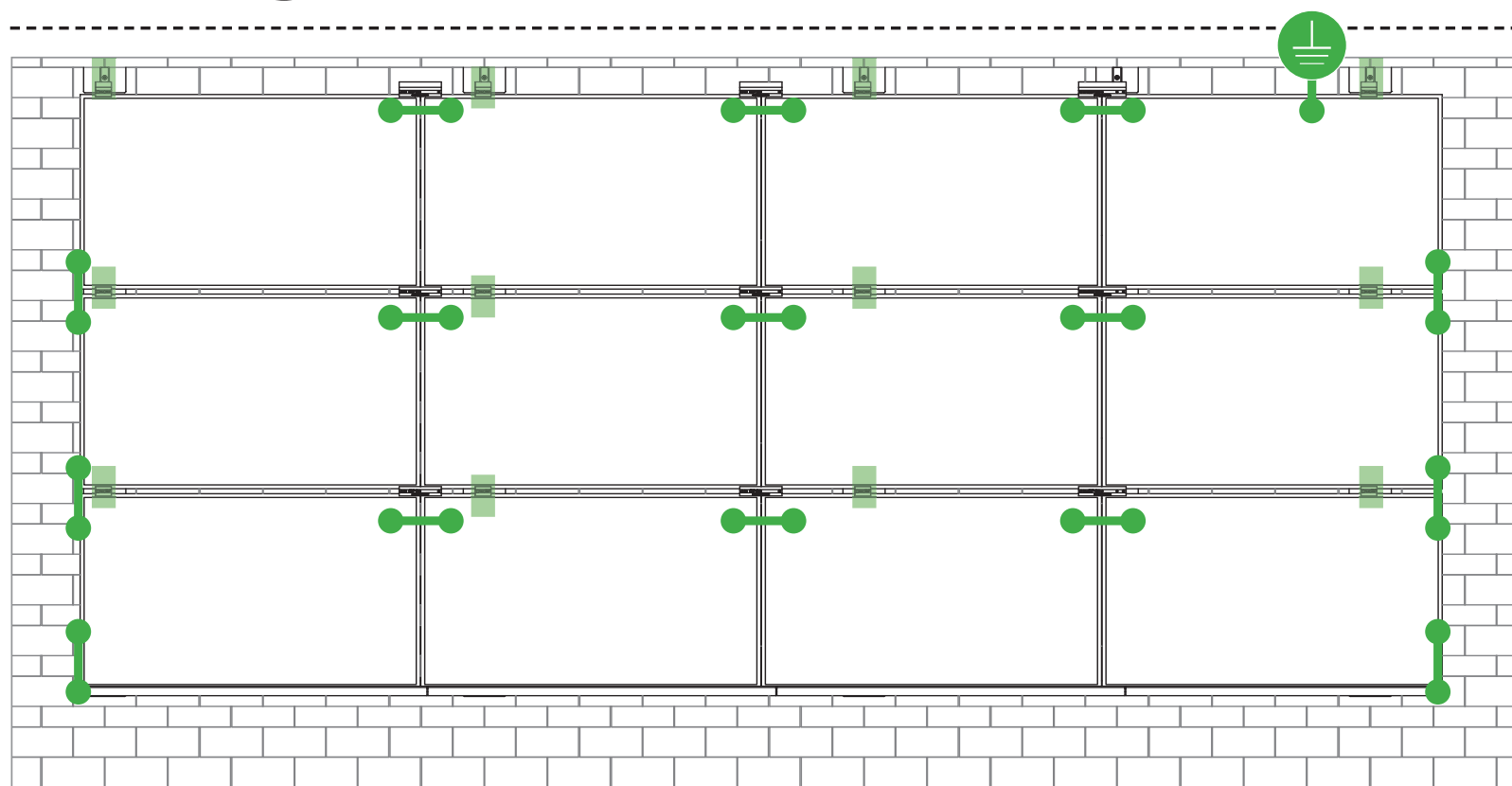
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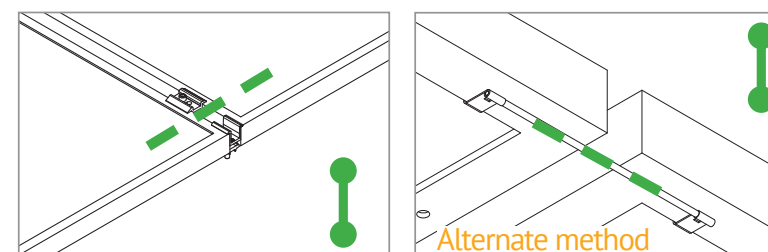
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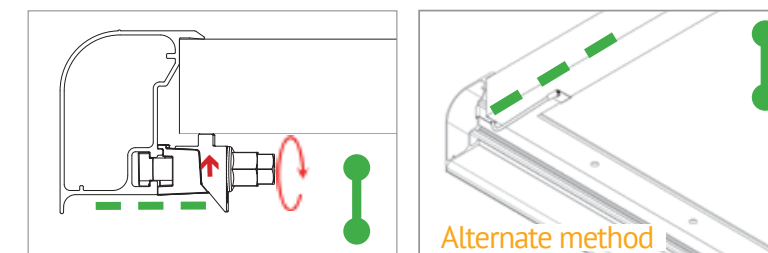
### E-W BONDING PATH:

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)

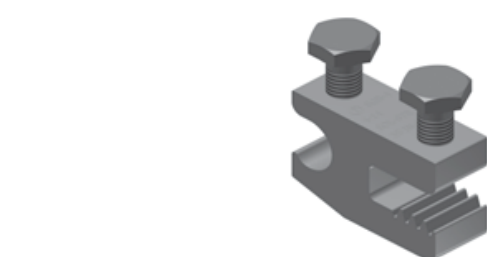
Star Washer is Single Use Only



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 Ilco Lay-In Lug (GBL-4DBT)

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

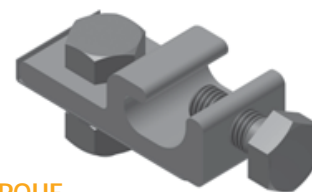


TERMINAL TORQUE, Install Conductor and torque to the following:  
4-14 AWG: 35in-lbs

#### LUG DETAIL & TORQUE INFO Ilco 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.

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# UL CODE COMPLIANCE NOTES

## INSTALLATION GUIDE

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### 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 V and W 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



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Manufacture	Module Model / Series
Aleo	P-Series
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).
Aptos	DNA-120-(BF/MF)26 DNA-144-(BF/MF)26
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
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
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, JAP72SY-xxx/ZZ, JAP6(k)-60-xxx/4BB, JAP60SY-xxx/ZZ, JAM6(k)-72-xxx/ZZ, JAM72SY-xxx/ZZ, JAM6(k)-60-xxx/ZZ, JAM60SY-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 UL2703Construction 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 L for further information

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Manufacture	Module Model / Series
Panasonic	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)
REC	Alpha (72) (Black) (Pure) N-Peak (Black) N-Peak 2 (Black) PEAK Energy Series PEAK Energy BLK2 Series PEAK Energy 72 Series

Manufacture	Module Model / Series
REC (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
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)
Solaria	PowerXT-xxxR-(AC/PD/BD) PowerXT-xxxC-PD PowerXT-xxxR-PM (AC)
SolarWorld	Sunmodule Protect, Sunmodule Plus
Sonali	SS 230 - 265
Suntech	STP
Suniva	MV Series & Optimus Series
Sun Edison/Flextronics	F-Series, R-Series & FLEX FXS Series
SunPower	X-Series, E-Series & P-Series
Talesun	TP572, TP596, TP654, TP660, TP672, Hipor M, Smart

Manufacture	Module Model / Series
Tesla	SC, SC B, SC B1, SC B2 TxxxS
Trina	PA05, PD05, DD05, DE06, DD06, PE06, PD14, PE14, DD14, DE09.05, DE14, DE15, PE15H
Upsolar	UP-MxxxP(-B), UP-MxxxM(-B)
URE	D7MxxxH7A, D7(M/K)xxxH8A FAKxxx(C8G/E8G), FAMxxxE7G-BB FAMxxxE8G(-BB)
Vikram	Eldora, Solivo, Somera
Waaree	AC & Adiya Series
Winaico	WST & WSP Series
Yingli	YGE & YLM Series
ZN Shine	ZXM6-72

- 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 UL2703Construction 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 L for further information

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<b>Product:</b>	Photovoltaic Mounting System, Sun Frame Microrail Installation Guide, PUB2021NOV29
<b>Brand Name:</b>	Unirac
<b>Models:</b>	Unirac SFM

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<b>Product:</b>	Photovoltaic Mounting System, Sun Frame Microrail Installation Guide, PUB2021NOV29
<b>Brand Name:</b>	Unirac
<b>Models:</b>	Unirac SFM

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**Country:** USA **Country:**

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<b>Product:</b>	Photovoltaic Mounting System, Sun Frame Microrail Installation Guide, PUB2021NOV29
<b>Brand Name:</b>	Unirac
<b>Models:</b>	Unirac SFM

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<b>Product:</b>	Photovoltaic Mounting System, Sun Frame Microrail Installation Guide, PUB2021NOV29
<b>Brand Name:</b>	Unirac
<b>Models:</b>	Unirac SFM

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1.0 Reference and Address		
Report Number	102393982LAX-002	Original 11-Apr-2016 Revised: 2-Jan-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:29May2019] 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		
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2.0 Product Description	
Product	Photovoltaic Mounting System, Sun Frame Microrail Installation Guide, PUB2021NOV29
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, 1b, and 1c for a complete list of PV modules evaluated with these racking systems</p>
	Other Ratings



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**7.0 Illustrations**

**Illustration 1 - Approved PV Modules**

Manufacture	Module Model / Series	Manufacture	Module Model / Series
Aleo	P-Series	Eco Solargy	Orion 1000 & Apollo 1000
Astronergy	CH5M6612P, CH5M6612P/HV, CH5M6612M, CH5M6612M/HV, CH5M6610M (BL)(BF)/(HF), CH5M72M-HC	ET Solar	ET-M672BHxxxTW
Auxin	AXN6M610T, AXN6P610T, AXN6M612T & AXN6P612T	FreeVolt	Mono PERC
Axitec	AXIblackpremium 60 (35mm), AXIpower 60 (35mm), AXIpower 72 (40mm), AXIpremium 60 (35mm), AXIpremium 72 (40mm).	GCL	GCL-P6 & GCL-M6 Series
Aptos	DNA-120-(BF/MF)26 DNA-144-(BF/MF)26	Hansol	TD-AN3, TD-AN4, UB-AN1, UD-AN1
Boviet	BVM6610, BVM6612	Heliene	36M, 60M, 60P, 72M & 72P Series
BYD	P6K & MHK-36 Series	HT Solar	HT60-156(M) (NDV) (-F), HT 72-156(M/P)
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	Hyundai	KG, MG, TG, RI, RG, TI, MI, HI & KI Series HiA-SxxxHG
Centrosolar America	C-Series & E-Series	ITEK	IT, IT-HE & IT-SE Series
CertainTeed	CT2xxxMxx-01, CT2xxxPxx-01, CTxxxMxx-02, CTxxxM-03, CTxxxMxx-04, CTxxxHC11-04	Japan Solar	JPS-60 & JPS-72 Series
Dehui	DH-60M	JA Solar	JAP6 60-xxx, JAM6-60-xxx/5I, JAM6(K)-60/xxx, JAP6(k)-72-xxx/4BB, JAP725YY-xxx/ZZ, JAP6(k)-60-xxx/4BB, JAP605YY-xxx/ZZ, JAM6(k)-72-xxx/ZZ, JAM725YY-xxx/ZZ, JAM6(k)-60-xxx/ZZ, JAM605YY-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

**7.0 Illustrations**

**Illustration 1a - Approved PV Modules Continue**

Manufacture	Module Model / 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	Panasonic	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
LONGi	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)(HPH)-xxxM (35mm) LR6-72(BK)(HV)(PE)(PB)(PH)-xxxM (40mm)	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)
Mission Solar Energy	MSE Series	REC	Alpha (72) (Black) (Pure) N-Peak (Black) N-Peak 2 (Black) PEAK Energy Series PEAK Energy BLK2 Series PEAK Energy 72 Series
Mitsubishi	MJE & MLE Series		
Neo Solar Power Co.	D6M & D6P Series		



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**7.0 Illustrations**

**Illustration 1b - Approved PV Modules Continue**

Manufacture	Module Model / Series	Manufacture	Module Model / Series
REC (cont.)	TwinPeak Series TwinPeak 2 Series TwinPeak 2 BLK2 Series TwinPeak 2S(M)72(XV) TwinPeak 3 Series (38mm) TP4 (Black)	Tesla	SC, SC B, SC B1, SC B2 TxxxS
Renesola	Vitrus2 Series & 156 Series	Trina	PA05, PD05, DD05, DE06, DD06, PE06, PD14, PE14, DD14, DE09.05, DE14, DE15, PE15H
Risen	RSM72-6 (MDG) (M), RSM60-6	Upsolar	UP-MxxxP(-B), UP-MxxxM(-B)
S-Energy	SN72 & SN60 Series (40mm)	URE	D7MxxxH7A, D7(M/K)xxxH8A FAKxxx(C8G/E8G), FAMxxxE7G-BB FAMxxxE8G(-BB)
Seraphim	SEG-6 & SRP-6 Series	Vikram	Eldora, Solivo, Somera
Sharp	NU-SA & NU-SC Series	Waaree	AC & Adiya Series
Silfab	SLA, SLG, BC Series & SILxxx(BL/NL/NT/HL/ ML/BK/NX/NU/HC)	Winaico	WST & WSP Series
Solaria	PowerXT-xxxR-(AC/PD/BD) PowerXT-xxxC-PD PowerXT-xxxR-PM (AC)	Yingli	YGE & YLM Series
SolarWorld	Sunmodule Protect, Sunmodule Plus	ZN Shine	ZXM6-72
Sonali	SS 230 - 265		
Suntech	STP		
Suniva	MV Series & Optimus Series		
Sun Edison/Flextronics	F-Series, R-Series & FLEX FXS Series		
SunPower	X-Series, E-Series & P-Series		
Talesun	TP572, TP596, TP654, TP660, TP672, Hipor M, Smart		



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IN CONNECTION WITH THE SALE AND  
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OF BLUE RAVEN SOLAR LLC.



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

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

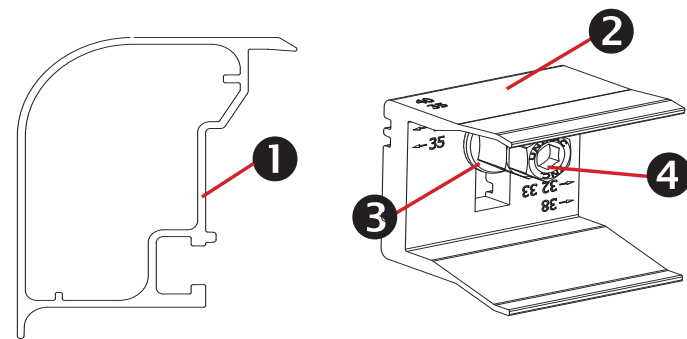
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SHEET NAME:  
**SPEC SHEET**

REVISION: ----	PAGE NUMBER: <b>SS</b>
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### Trimrail™ and Module Clips

#### Sub-Components:

1. Trim Rail
2. Module Clip
3. T-Bolt
4. Tri-Drive Nut

#### Trimrail™

##### Functions:

- Required front row structural support (with module clips)
- Module mounting
- Installation aid
- Aesthetic trim

##### Features:

- Mounts directly to L-feet
- Aligns and captures module leading edge
  - Supports discrete module thicknesses from 32, 33, 35, 38, and 40mm

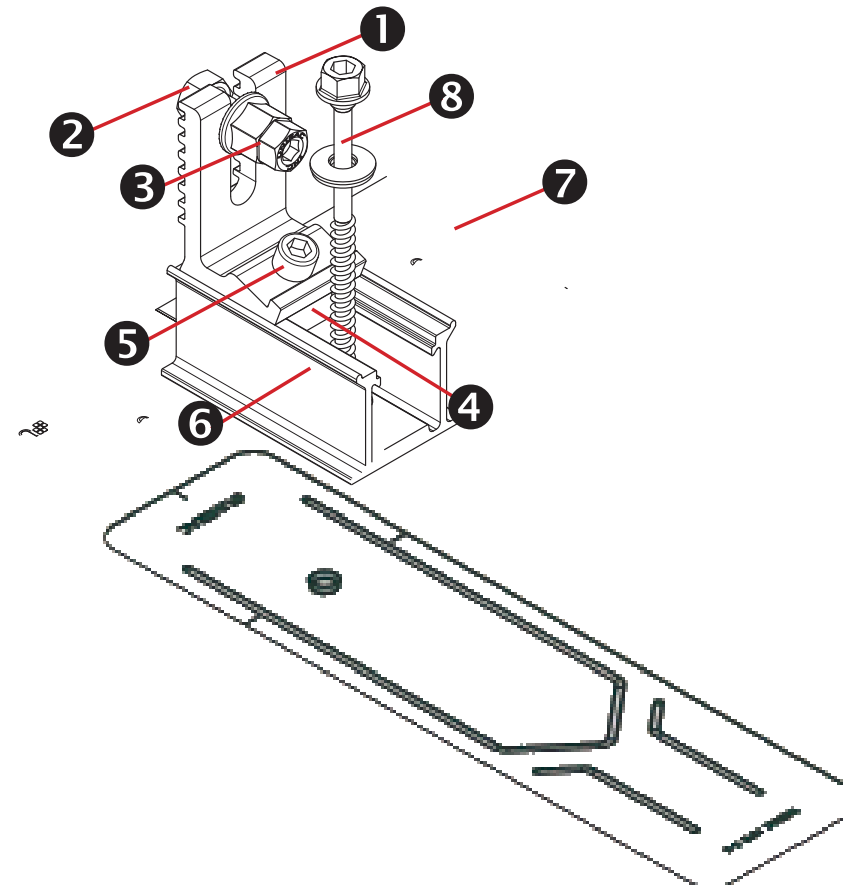
#### Module Clips

##### Functions:

- Required front row structural support (with trimrail)
- Module mounting

##### Features:

- Mounts to Trimrail™ with T-bolt and tri-drive nut
- Manually adjustable to fit module thicknesses 32, 33, 35, 38, and 40mm.



### Trimrail™ Flashkit

#### Sub-Components:

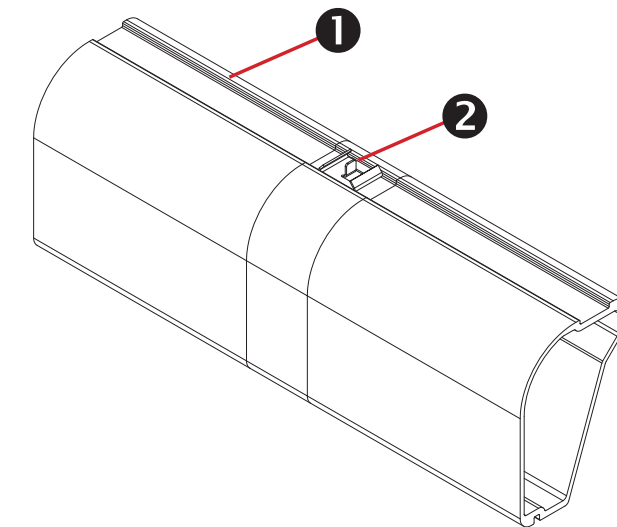
- L-Foot
- Hex bolt
- Tri-drive nut
- Channel Nut
- Socket Head Cap Screw
- 3\" Channel/Slider w/grommet
- 3\" Wide Flashing
- Structural Screw & SS EPDM Washer

##### Functions:

- Attach Trimrail™ to roof attachment / flashing
- Patented roof sealing technology at roof attachment point

##### Features:

- Slot provides vertical adjustments to level array
- Slider provides north/south adjustment along the slope of the roof
- Shed and Seal Technology



### Trimrail™ Splice

#### Sub-Components:

1. Structural Splice Extrusion
2. Bonding Clip

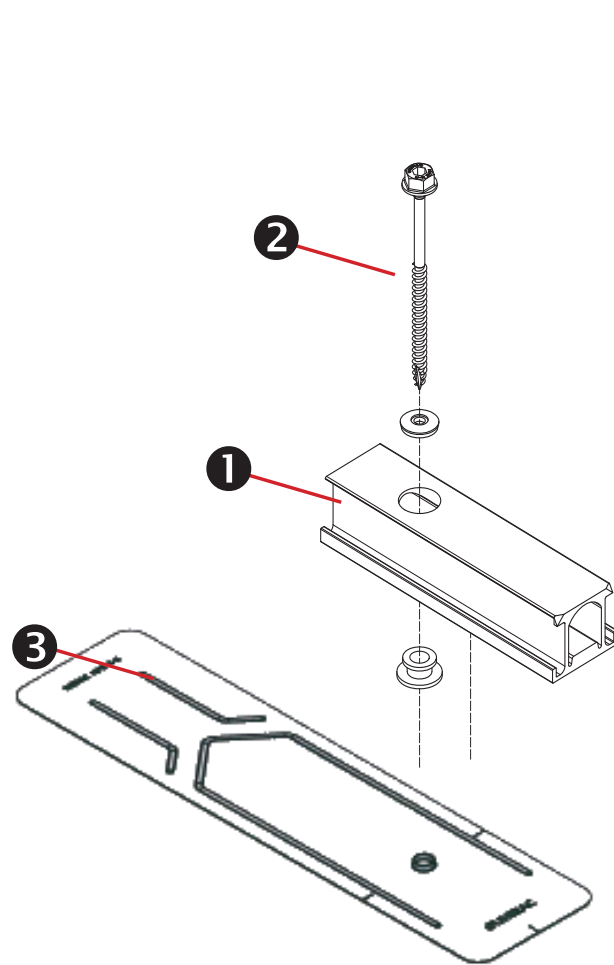
##### Functions:

- Front row structural support
- Installation aid
- Structurally connects 2 pieces of Trimrail™
- Electrically bonds 2 pieces of Trimrail™

##### Features:

- Aligns and connects Trimrail™ pieces
- Tool-less installation





### SFM Slider Flashkit

#### Sub-Components:

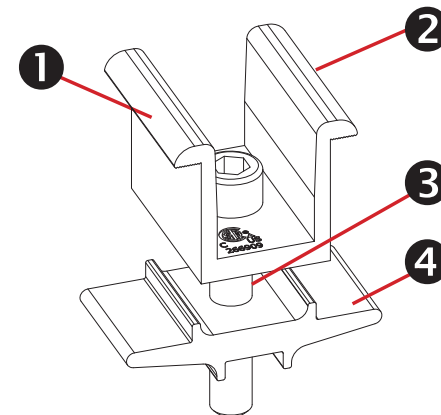
1. Slider w/grommet
2. Structural Screw & SS EPDM washer
3. 3" Wide Flashing

#### Functions:

- Patented Shed & Seal roof sealing technology at roof attachment point
- For use with compatible 2" Microrail or 8" Attached Splices

#### Features:

- Slider provides north/south adjustment along the slope of the roof
- Shed and Seal Technology



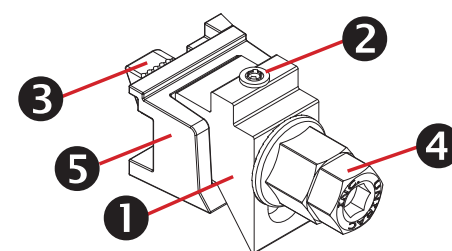
### Module-to-Module N-S Bonding

#### Sub-Components:

1. Clamp
2. Bonding Pins (2)
3. 5/16" Socket Head Cap Screw
4. Clamp Base

#### Functions/ Features:

- Row to row bonding
- Single Use Only
- Fits module sizes 32-40mm



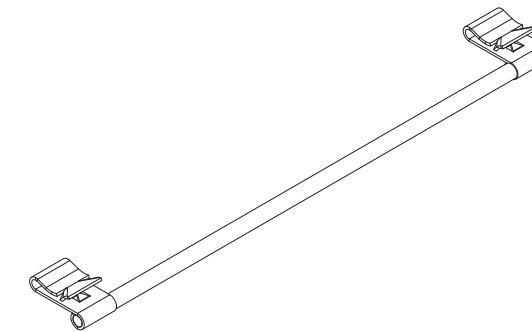
### Trim -to- Module Bonding Clamp and Floating Trim Clamp

#### Sub-Components:

1. Wedge
2. Bonding Pin
3. T-Bolt
4. Nut
5. Cast Base

#### Functions/ Features:

- Module to Trimrail™ bonding - single use only
- Attaches Trimrail™ to module when fewer than 2 rafter attachment points are available
- Fits module sizes 32-40mm
- Fits module sizes 32-40mm



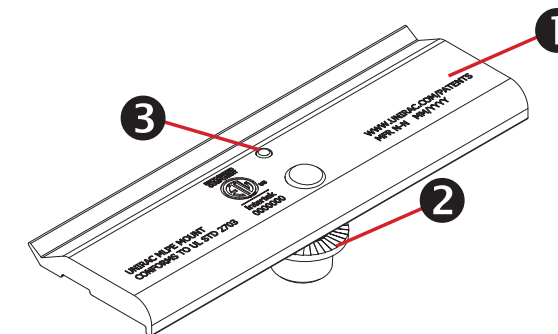
### Wire Bonding Clip w/ 8AWG

#### Functions:

- Row to row bonding
- Module to Trimrail™ bonding
- Single Use Only

#### Features:

Tool-less installation



### MLPE Mounting Assembly

#### Sub-Components:

1. MLPE Mount Base
2. 5/16 Socket Head Cap Screw
3. Bonding Pin

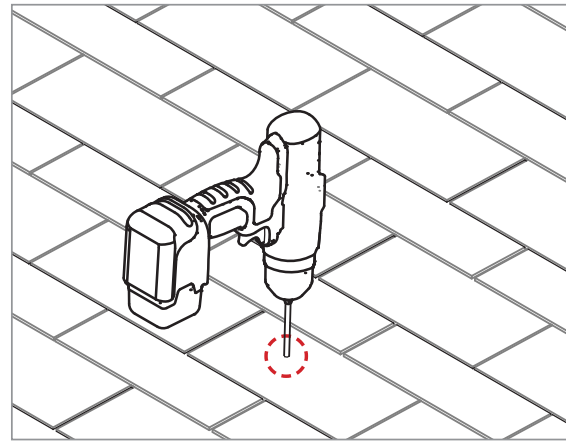
#### Functions:

- Securely mounts MLPE to module frames
- MLPE to module bonding

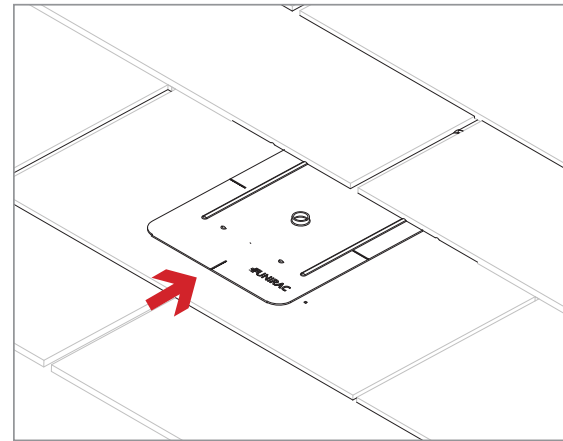
#### Features:

- Mounts easily to typical module flange
- UL2703 Recognized

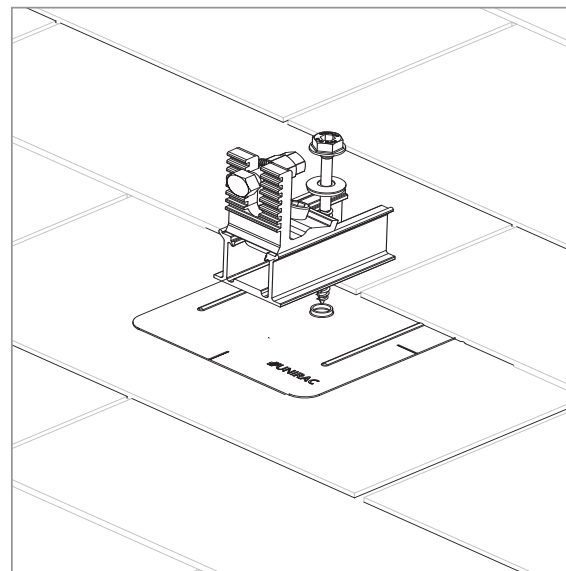
MLPE = Module Level Power Electronics,  
e.g. microinverter or power optimizer



**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.

