WYSSLING CONSULTING
COMMUNITY ENGINEERING WITH SMALL BUSINESS VALUE

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June 16, 2022

Vale Sollar
8726 Lovett Avenue
Orlando, FL 32832

Scott E Wyssling, PE

Digitally signed by Scott E Wyssling, PE
DN: C=US, S=Utah, L=Alpine, O=Wyssling Consulting, CN="Scott E Wyssling, PE", E=swyssling@wysslingconsulting.com
Reason: I am the author of this document
Location: your signing location here
Date: 2022.06.16 17:39:00-06'00'
Foxit PDF Editor Version: 11.1.0

Re: Engineering Services
Farman Residence
1290 SW Castle Heights Terrace, Lake City FL
11.470 kW System

To Whom It May Concern:

We have received information regarding solar panel installation on the roof of the above referenced structure. Our evaluation of the structure is to verify the existing capacity of the roof system and its ability to support the additional loads imposed by the proposed solar system.

A. Site Assessment Information

1. Site visit documentation identifying attic information including size and spacing of framing for the existing roof structure.
2. Design drawings of the proposed system including a site plan, roof plan and connection details for the solar panels. This information will be utilized for approval and construction of the proposed system.

B. Description of Structure:

Roof Framing: *Assumed* Prefabricated wood trusses at 24" on center. All truss members are constructed of 2x4 dimensional lumber with interior walls providing additional support.
Roof Material: Metal roofing
Roof Slope: 7 degrees
Attic Access: Inaccessible
Foundation: Permanent

C. Loading Criteria Used

- **Dead Load**
  - Existing Roofing and framing = 7 psf
  - New Solar Panels and Racking = 3 psf
  - TOTAL = 10 PSF
- **Live Load** = 20 psf (reducible) – 0 psf at locations of solar panels
- **Wind Load** based on ASCE 7-16
  - Ultimate Wind Speed = 145 mph (based on Risk Category II)
  - Exposure Category C

Analysis performed of the existing roof structure utilizing the above loading criteria is in accordance with the FBC 2020, 7th Edition, including provisions allowing existing structures to not require strengthening if the new loads do not exceed existing design loads by 105% for gravity elements and 110% for seismic elements. This analysis indicates that the existing rafters will support the additional panel loading without damage, if installed correctly.

Solar Panel Anchorage

1. The solar panels shall be mounted in accordance with the most recent "*S-5 Installation Manual*", which can be found on the S-5 website (*http://s-5.com/*). If during solar panel installation, the roof framing members appear unstable or deflect non-uniformly, our office should be notified before proceeding with the installation.
2. System will be attached to the metal roofing material utilizing the patented S-5 connection. Installation of the connections shall be in accordance with the manufacturer's recommendations.
3. Considering the roof slopes, the size, spacing, condition of roof, the panel supports shall be placed no greater than 48" o/c.

Based on the above evaluation, this office certifies that with the racking and mounting specified, the existing roof system will adequately support the additional loading imposed by the solar system. This evaluation is in conformance with the FBC 2020, 7th Edition, current industry standards, and is based on information supplied to us at the time of this report.

Should you have any questions regarding the above or if you require further information do not hesitate to contact me.

Very truly yours,

Scott E. Wyssling, PE
Florida License No. 81558

SCOTT E WYSSLING
LICENSE
No. 81558
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

Wyssling Consulting, PLLC
76 N Meadowbrook Drive
Alpine UT 84004 COA # RY34912

AERIAL VIEW:

STREET VIEW:

GENERAL NOTES

1. INSTALLATION OF SOLAR PHOTOVOLTAIC SYSTEM SHALL BE IN ACCORDANCE WITH NEC ARTICLE 690, AND ALL OTHER APPLICABLE NEC CODES WHERE NOTED OR EXISTING
2. PROPER ACCESS AND WORKING CLEARANCE AROUND EXISTING AND PROPOSED ELECTRICAL EQUIPMENT WILL COMPLY WITH NEC ARTICLE 110
3. ALL WIRES, INCLUDING THE GROUNDING ELECTRODE CONDUCTOR SHALL BE PROTECTED FROM PHYSICAL DAMAGE IN ACCORDANCE WITH NEC ARTICLE 250
4. THE PV MODULES ARE CONSIDERED NON-COMBUSTIBLE; THIS SYSTEM IS UTILITY INTERACTIVE PER UL 1741 AND DOES NOT INCLUDE STORAGE BATTERIES OR OTHER ALTERNATIVE STORAGE SOURCES
5. ALL DC WIRES SHALL BE SIZED ACCORDING TO [NEC 690.8]
6. DC CONDUCTORS SHALL BE WITHIN PROTECTED RACEWAYS IN ACCORDANCE WITH [NEC 690.31]
7. ALL SIGNAGE TO BE PLACED IN ACCORDANCE WITH LOCAL JURISDICTIONAL BUILDING CODE

PHOTOVOLTAIC (PV) SYSTEM SPECIFICATIONS

EQUIPMENT:
AC System Size: 8.99 kW AC
DC SYSTEM SIZE: 11.47 kW DC
(31) Aptos DNA-120-MF26-370W PV Modules
(31) Enphase IQ7PLUS-72-2-US Inverter(s)
RACKING: S-5! - S-5-U Clamp

APPLICABLE GOVERNING CODES

2017 NEC
2020 FBC 7TH EDITION, BUILDING
2020 FBC 7TH EDITION, RESIDENTIAL
2020 FBC 7TH EDITION, EXISTING BUILDING
2020 FFPC

SITE SPECIFICATIONS

OCCUPANCY: R-3
ZONING: RESIDENTIAL

SCOTT E. WYSSLING LICENSE No. 81551 STATE OF FLORIDA PROFESSIONAL ENGINEER

Wyssling Consulting, PLLC
76 N Meadowbrook Drive Alpine UT 84004
Florida License # RY34912

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CONTRACTOR INFORMATION:
VALE SOLLAR
7939 CORKFIELD AVE
ORLANDO FL 32832
License #EC13011054

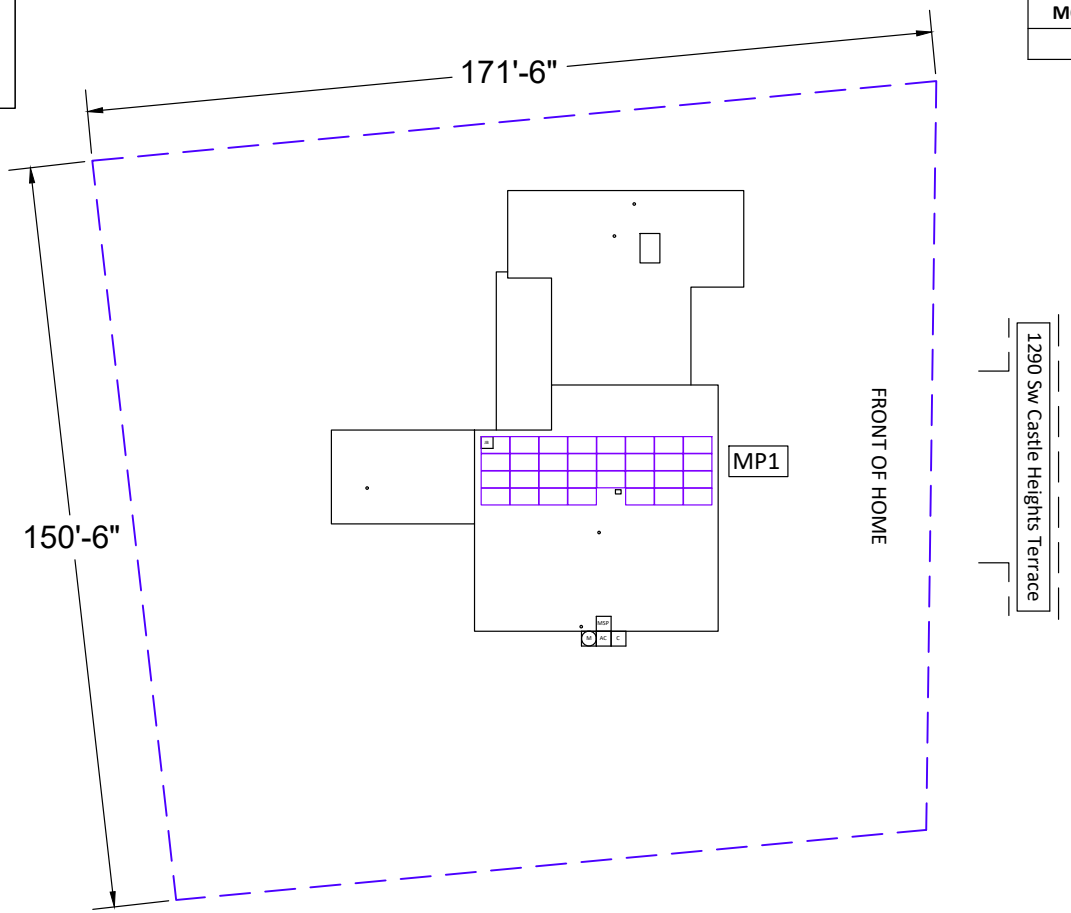
SITE INFORMATION

Lou Farman
1290 Sw Castle Heights Terrace
Lake City, FL 32025
AC System Size: 8.99 kW AC
DC System Size: 11.47 kW DC
Lat, 30.1723648999999
Long, -82.638933
(31) Aptos DNA-120-MF26-370W PV Modules
(31) Enphase IQ7PLUS-72-2-US Inverter(s)

Florida Power & Light

SHEET INDEX:

DRAWN BY: SoloCAD
DATE: June 15, 2022
COVER PAGE - PV01



ARRAY DETAILS:		
MOUNTING PLANE:	**AZIMUTH:**	**TILT:**
MP1	187°	7°

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EQUIPMENT LEGEND:

M UTILITY METER	AC VISIBLE, LOCKABLE, LABELED AC DISCONNECT	INV INVERTER	SUB SUB PANEL	SD SERVICE DISCONNECT	PV MODULES	FIRE ACCESS PATHWAY (3' TYP)			
MSP MAIN SERVICE PANEL	PV METER SOCKET (FOR UTILITY PV METER)	C COMBINER BOX	LC LOAD CENTER	BATT BATTERY(IES)	JB JUNCTION BOX	PROPERTY LINE			

VISIBLE, LOCKABLE, LABELED AC DISCONNECT LOCATED WITHIN 10' OF UTILITY METER

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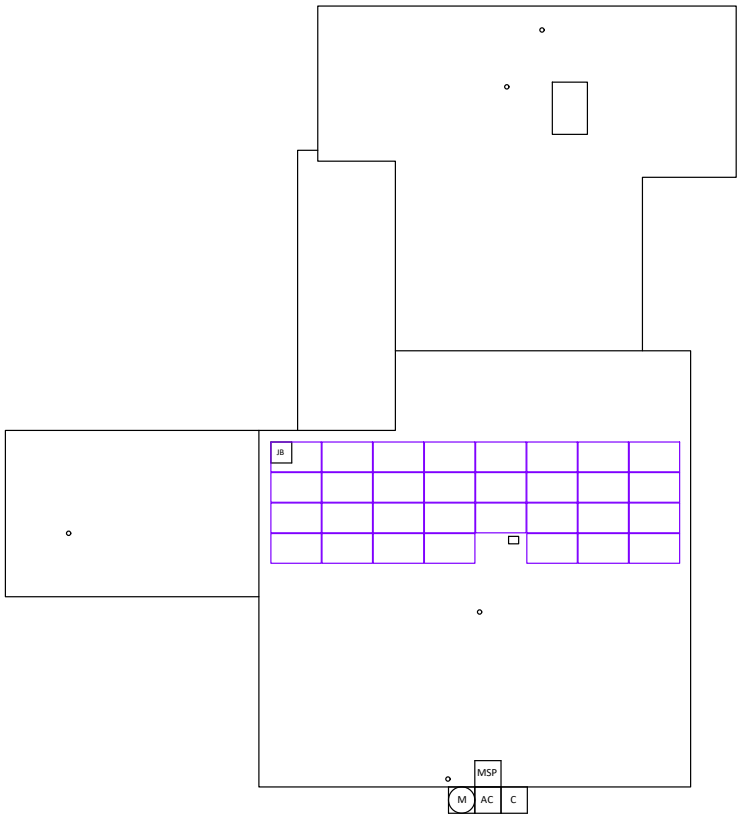
DATE: June 15, 2022
SITE PLAN - PV02



EQUIPMENT INFORMATION:		ROOF INFO:		PHOTOVOLTAIC ARRAY STRUCTURAL CRITERIA:	
RAIL MANUFACTURER:	Unirac	ROOF TYPE:	Standing Seam Metal	PV MODULE COUNT:	31
RAIL PART NUMBER:	SM	ROOF FRAMING:	Manufactured Truss	ARRAY AREA:	MODULE COUNT * 19.64 ft² = 608.84
ATTACHMENTS	S-5! - S-5-U Clamp	RAFTER/TOP CHORD SIZE:	2x4	ROOF AREA:	4684 ft²
ATTACHMENT QTY:	103	RAFTER/TOP CHORD SPACING:	24"	PERCENT OF ROOF COVERED:	13%
SPLICE QTY:	22	ATTACHMENT SPACING:	48''	ARRAY WEIGHT:	MODULE COUNT * 45 lbs = 1395 lbs
MIDCLAMP QTY:	52			POINT LOAD:	ARRAY LBS/ATTACHMENTS = 13.54
ENDCLAMP QTY:	20			DISTRIBUTED LOAD: (lbs/ft²)	(ARRAY) WEIGHT/AREA = 2.29 lbs/ft²

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Florid[illegible]

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DATE:
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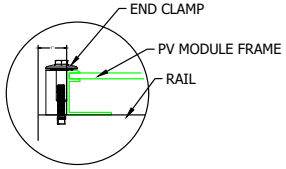
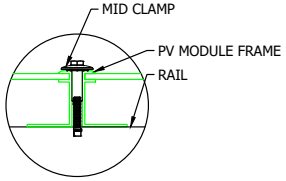
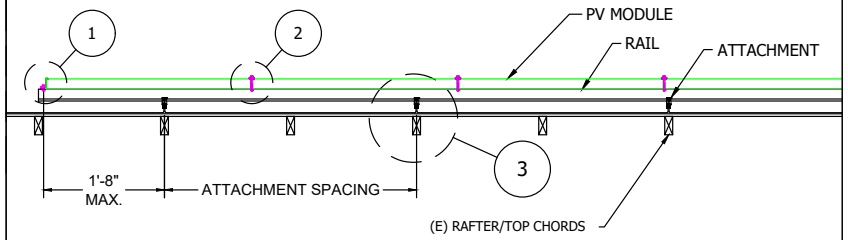
ROOF ATTACHMENTS - PV03



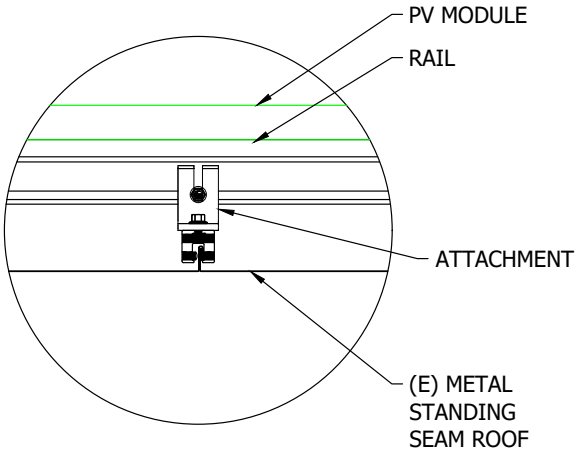
1 END CLAMP DETAILS



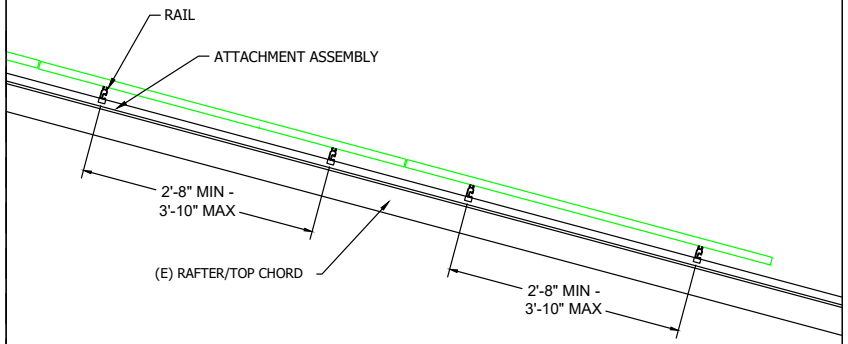
2 MID CLAMP DETAILS



FRONT VIEW



3 DETAIL, MOUNTING AND FLASHING



SIDE VIEW

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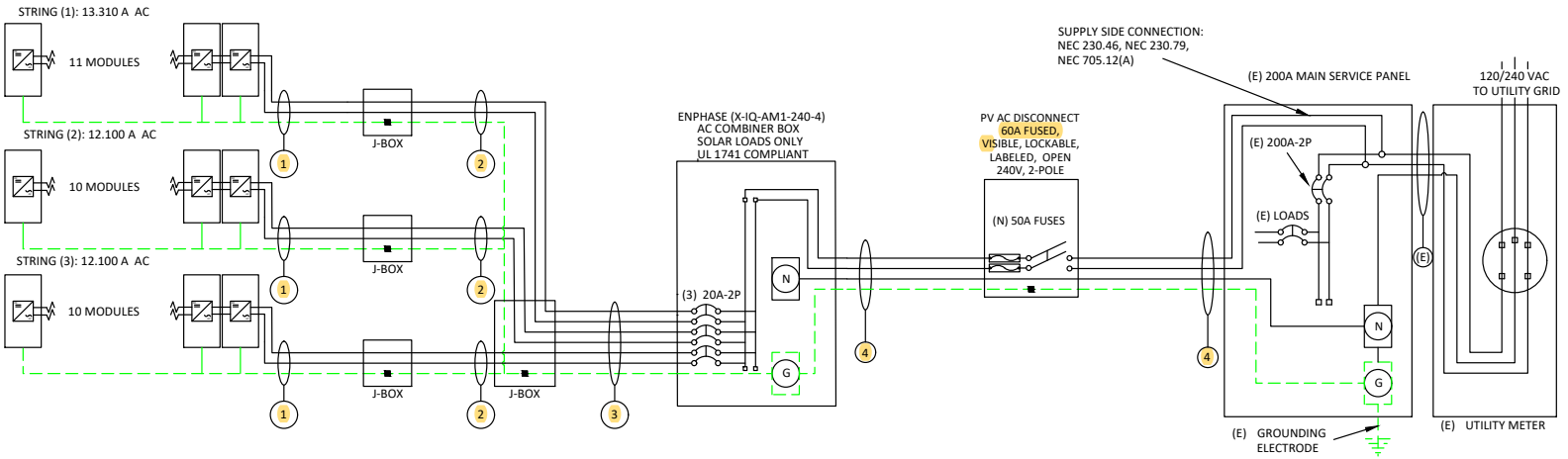
DRAWN BY: SoloCAD
DATE: June 15, 2022
MOUNTING DETAIL - PV04

Aptos DNA-120-MF26-370W Specs	
POWER MAX (PMAX):	370W
OPEN CIRCUIT VOLTAGE (VOC):	40.8V
MAX POWER-POINT CURRENT (IMP):	10.87A
MAX POWER-POINT VOLTAGE (VMP):	34.06V
SHORT CIRCUIT CURRENT (ISC):	11.51A
SERIES FUSE RATING:	20 A

Enphase IQ7PLUS-72-2-US Specs	
MAX INPUT VOLTAGE:	60 V
MAX DC SHORT CIRCUIT CURRENT:	15 A
MAXIMUM OUTPUT POWER:	290 W
MAXIMUM OUTPUT CURRENT:	1.21 A
NOM. OUTPUT VOLTAGE:	240 V
MAX UNITS PER 20A CIRCUIT:	13
1-Phase, 60 HZ, UL 1741 Listed	

Equipment Schedule			
TYPE:	QTY:	DESCRIPTION:	RATING:
MODULES:	(31)	Aptos DNA-120-MF26-370W	370 W
INVERTERS:	(31)	Enphase IQ7PLUS-72-2-US	290 W
AC DISCONNECTS:	(1)	PV AC Disconnect, 240V, 2-Pole	60 A

Conduit & Conductor Schedule				
TAG	QTY	WIRE GAUGE	DESCRIPTION	CONDUIT SIZE
1	(2)	12-2	TC-ER, THWN-2, COPPER (L1, L2)	N/A - FREE AIR
	(1)	6 AWG	THWN-2 COPPER - (GROUND)	
2	(2)	10 AWG	THHN/THWN-2, COPPER - (L1, L2)	3/4" EMT
	(1)	10 AWG	THWN-2 COPPER - (GROUND)	
3	(6)	10 AWG	THHN/THWN-2, COPPER - (L1, L2)	3/4" EMT
	(1)	10 AWG	THWN-2 COPPER - (GROUND)	
4	(3)	6 AWG	THWN-2 COPPER - (L1, L2, NEUTRAL)	3/4" EMT
	(1)	8 AWG	THWN-2 COPPER - (GROUND)	



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VISIBLE, LOCKABLE,
LABELED AC DISCONNECT
LOCATED WITHIN 10'
OF UTILITY METER

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DRAWN BY: SoloCAD

DATE:
June 15, 2022

LINE DIAGRAM - PV05

STRING CALCULATIONS			
Enphase IQ7PLUS-72-2-US	STRING #1	STRING #2	STRING #3
MAX AC CURRENT:	13.31A	12.10A	12.10A
MICRO INVERTERS IN SERIES	11	10	10
NOMINAL STRING VOLTAGE:	240V	240V	240V
MAX AC OUTPUT POWER	3190W	2900W	2900W
ARRAY DC POWER:	11470W		
TOTAL MAX AC CURRENT:	37.51A		

NUMBER OF CURRENT CARRYING CONDUCTORS	PERCENT OF VALUES
4-6	.80
7-9	.70
10-20	.50

SYSTEM OCPD CALCULATIONS	
INVERTER MODEL(S):	Enphase IQ7PLUS-72-2-US
# OF INVERTERS:	31
MAX OUTPUT CURRENT:	1.21A
(# OF INVERTERS) X (MAX OUTPUT CURRENT) X 125% <= OCPD RATING	
(31 X 1.21A X 1.25) = 46.8875A <= 50A, OK	

BUSBAR CALCULATIONS - 120% RULE	
MAIN BUSBAR RATING:	200A
MAIN DISCONNECT RATING:	200A
PV OCPD RATING:	50A
(MAIN BUS RATING X 120%) - MAIN DISCONNECT RATING >= OCPD RATING	
(200A X 1.2) - 200A = 40A, >= 50A, OK	

Conduit & Conductor Schedule

TAG	QTY	WIRE GAUGE	DESCRIPTION	CONDUIT SIZE	CONDUCTOR RATING	CONDUCTOR TEMP. RATE	AMBIENT TEMP	TEMP. DERATE	# OF CONDUCTORS DERATE	CONDUCTOR RATING W/DERATES	CONDUIT FILL
1	(2)	12-2	TC-ER, THWN-2, COPPER (L1, L2)	N/A - FREE AIR	30A	90°C	34°C	0.96	N/A - FREE AIR	28.8A	N/A - FREE AIR
	(1)	6 AWG	THWN-2 COPPER - (GROUND)								
2	(2)	10 AWG	THHN/THWN-2, COPPER - (L1, L2)	3/4" EMT	40A	90°C	34°C	0.96	1	38.4A	11.9%
	(1)	10 AWG	THWN-2 COPPER - (GROUND)								
3	(6)	10 AWG	THHN/THWN-2, COPPER - (L1, L2)	3/4" EMT	40A	90°C	34°C	0.96	0.8	30.72A	27.8%
	(1)	10 AWG	THWN-2 COPPER - (GROUND)								
4	(3)	6 AWG	THWN-2 COPPER - (L1, L2, NEUTRAL)	3/4" EMT	65A	75°C	34°C	0.94	1	61.1A	35.5%
	(1)	8 AWG	THWN-2 COPPER - (GROUND)								

GROUNDING & GENERAL NOTES:

1. PV INVERTER IS UNGROUNDED, TRANSFORMER-LESS TYPE.
2. DC GEC AND AC EGC TO BE SPLICED TO EXISTING ELECTRODE
3. ANY EXISTING WIRING INVOLVED WITH PV SYSTEM CONNECTION THAT IS FOUND TO BE INADEQUATE PER CODE SHALL BE CORRECTED PRIOR TO FINAL INSPECTION.
4. JUNCTION BOX QUANTITIES, AND PLACEMENT SUBJECT TO CHANGE IN THE FIELD - JUNCTION BOXES DEPICTED ON ELECTRICAL DIAGRAM REPRESENT WIRE TYPE TRANSITIONS.
5. AC DISCONNECT NOTED IN EQUIPMENT SCHEDULE OPTIONAL IF OTHER AC DISCONNECTING MEANS IS LOCATED WITHIN 10' OF SERVICE DISCONNECT.

INTERCONNECTION NOTES

1. GROUND FAULT PROTECTION IN ACCORDANCE WITH [NEC 215.9] & [NEC 230.95]
2. SUPPLY SIDE INTERCONNECTION ACCORDING TO [NEC705.12(A)] WITH SERVICE ENTRANCE CONDUCTORS IN ACCORDANCE WITH [NEC 240.21(B)]

DISCONNECT NOTES

1. DISCONNECTING SWITCHES SHALL BE WIRED SUCH THAT WHEN THE SWITCH IS OPENED THE CONDUCTORS REMAINING LIVE ARE CONNECTED TO THE TERMINALS MARKED "LINE SIDE" (TYPICALLY THE UPPER TERMINALS)
2. AC DISCONNECT MUST BE ACCESSIBLE TO QUALIFIED UTILITY PERSONNEL, BE LOCKABLE, AND BE A VISIBLE-BREAK SWITCH.
3. FUSED AC DISCONNECT TO BE USED.

CONTRACTOR INFORMATION:
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DRAWN BY: SoloCAD
DATE:
June 15, 2022

ELECTRICAL CALCS - PV06

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

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

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

LABEL 2
PLACED ADJACENT TO THE BACK-FED BREAKER FROM THE INVERTER IF TIE IN CONSISTS OF LOAD SIDE CONNECTION TO BUSBAR.
[NEC 705.12(B)(2)(3)(b)]

WARNING
INVERTER OUTPUT CONNECTION
DO NOT RELOCATE THIS OVERCURRENT DEVICE

LABEL 3
PLACED ADJACENT TO THE BACK-FED BREAKER FROM THE INVERTER IF TIE IN CONSISTS OF LOAD SIDE CONNECTION TO BUSBAR.
[NEC 705.12(B)(2)(3)(c)]

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

LABEL 4
EQUIPMENT CONTAINING OVERCURRENT DEVICES IN CIRCUITS SUPPLYING POWER TO A BUSBAR OR CONDUCTOR SUPPLIED FROM MULTIPLE SOURCES SHALL BE MARKED TO INDICATE THE PRESENCE OF ALL SOURCES
[NEC 705.12(B)(3)]

PHOTOVOLTAIC AC DISCONNECT
RATED AC OUTPUT CURRENT: 38
NOMINAL OPERATING AC VOLTAGE: 240

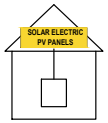
LABEL 5
AT POINT OF INTERCONNECTION, MARKED AT AC DISCONNECTING MEANS.
[NEC 690.54, NEC 690.13 (B)]

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 NATIONAL ELECTRIC CODE, OSHA STANDARD 19010.145, ANSI Z535.
3. MATERIAL BASED ON THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION.
4. LABELS TO BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED [NEC 110.21(B)(3)]
5. LABELS TO BE A MINIMUM LETTER HEIGHT OF 3/8", WHITE ON RED BACKGROUND; REFLECTIVE, AND PERMANENTLY AFFIXED [IFC 605.11.1.1]

WARNING: PHOTOVOLTAIC POWER SOURCE

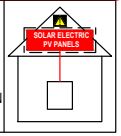
LABEL 6
AT DIRECT-CURRENT EXPOSED RACEWAYS, CABLE TRAYS, COVERS AND ENCLOSURES OF JUNCTION BOXES, AND OTHER WIRING METHODS; SPACED AT MAXIMUM 10FT SECTION OR WHERE SEPARATED BY ENCLOSURES, WALLS, PARTITIONS, CEILINGS, OR FLOORS.
[NEC 690.31(G)(3&4)]

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



LABEL 7
FOR PV SYSTEMS THAT SHUT DOWN THE ARRAY AND CONDUCTORS LEAVING THE ARRAY:
SIGN TO BE LOCATED ON OR NO MORE THAN 3 FT AWAY FROM SERVICE DISCONNECTING MEANS TO WHICH THE PV SYSTEMS ARE CONNECTED AND SHALL INDICATE THE LOCATION OF ALL IDENTIFIED RAPID SHUTDOWN SWITCHES IF NOT AT THE SAME LOCATION.
[NEC 690.56(C)(1)(A)]

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN
TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN CONDUCTORS OUTSIDE THE ARRAY. CONDUCTORS WITHIN THE ARRAY REMAIN ENERGIZED IN SUNLIGHT

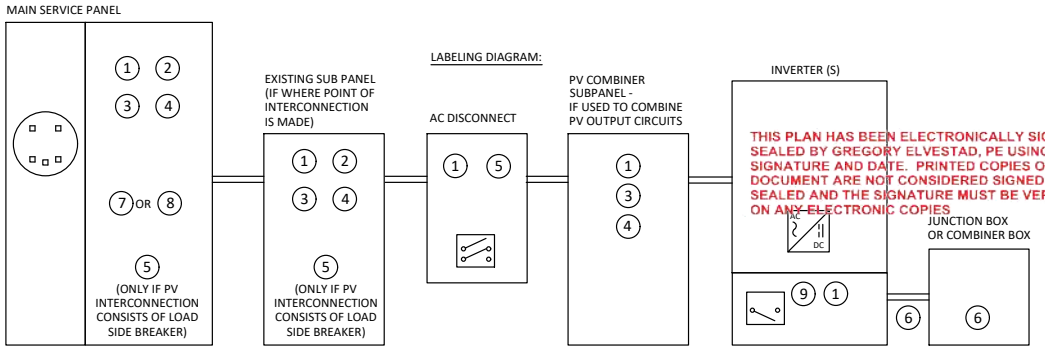


LABEL 8
FOR PV SYSTEMS THAT ONLY SHUT DOWN CONDUCTORS LEAVING THE ARRAY:
SIGN TO BE LOCATED ON OR NO MORE THAN 3 FT AWAY FROM SERVICE DISCONNECTING MEANS TO WHICH THE PV SYSTEMS ARE CONNECTED AND SHALL INDICATE THE LOCATION OF ALL IDENTIFIED RAPID SHUTDOWN SWITCHES IF NOT AT THE SAME LOCATION.
[NEC 690.56(C)(1)(b)]

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

LABEL 9
SIGN LOCATED AT RAPID SHUT DOWN DISCONNECT SWITCH [NEC 690.56(C)(3)].

LABELING DIAGRAM:



*ELECTRICAL DIAGRAM SHOWN ABOVE IS FOR LABELING PURPOSES ONLY. NOT AN ACTUAL REPRESENATION OF EQUIPMENT AND CONNECTIONS TO BE INSTALLED. LABEL LOCATIONS PRESENTED MAY VERY DEPENDING ON TYPE OF INTERCONNECTION METHOD AND LOCATION PRESENTED ON THE ELECTRICAL DIAGRAM PAGE.

CONTRACTOR INFORMATION:
VALE SOLLAR
7939 CORKFIELD AVE
ORLANDO FL 32832
License #EC13011054

SITE INFORMATION
Lou Farman
1290 Sw Castle Heights Terrace
Lake City, FL 32025
AC System Size: 8.99 kW AC
DC System Size: 11.47 kW DC
Lat, 30.1723648999999
Long, -82.638933
(31) Aptos DNA-120-MF26-370W PV Modules
(31) Enphase IQ7PLUS-72-2-US Inverter(s)

Florida [illegible]

THIS PLAN HAS BEEN ELECTRONICALLY SIGNED AND SEALED BY GREGORY ELVESTAD, PE USING A DIGITAL SIGNATURE AND DATE. PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES

SCOTT E WYSSLING
License
No. 81554
STATE OF FLORIDA
PROFESSIONAL ENGINEER

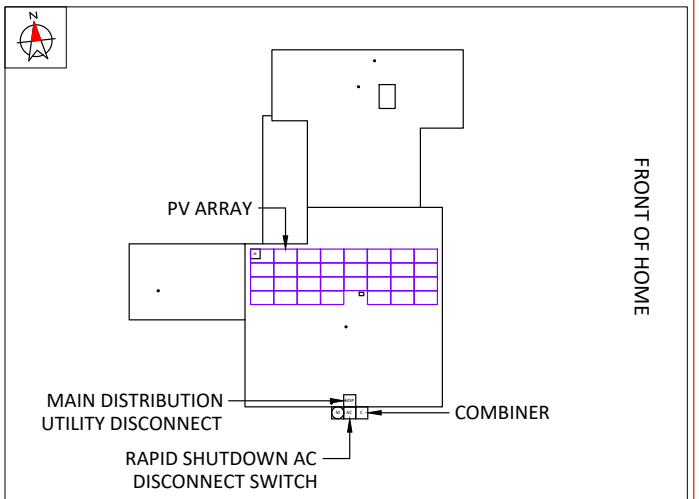
Wyssling Consulting, PLLC
76 N Meadowbrook Drive Alpine UT 84004
Florida License # RY34912

DRAWN BY: SoloCAD
DATE:
June 15, 2022

LABELS - PV07

CAUTION

POWER TO THIS BUILDING IS ALSO SUPPLIED FROM ROOF MOUNTED SOLAR ARRAYS WITH SAFETY DISCONNECTS AS SHOWN:



1290 Sw Castle Heights Terrace, Lake City FL 32025

DIRECTORY

PERMANENT PLAQUE OR DIRECTORY PROVIDING THE LOCATION OF THE SERVICE DISCONNECTING MEANS AND THE PHOTOVOLTAIC SYSTEM.

(ALL PLAQUES AND SIGNAGE WILL BE INSTALLED AS OUTLINED WITHIN: NEC 690.56(B)&(C), [NEC 705.10])

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ORLANDO FL 32832
License #EC13011054

SITE INFORMATION

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Lake City, FL 32025

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76 N Meadowbrook Drive Alpine UT 84004
Florida License # RY34912

DRAWN BY: SoloCAD

DATE:
June 15, 2022

PLACARD - PV08

SITE PHOTOS:

CONTRACTOR INFORMATION:
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7939 CORKFIELD AVE
ORLANDO FL 32832
License #EC13011054

SITE INFORMATION

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DRAWN BY: SoloCAD

DATE:
June 15, 2022

SITE PHOTOS - PV09

DNA 120

Residential I Commercial

, n 2 -
36V 3W0 3WW

6 m Split Cell Series impressively combines advanced solar technologies to maximize performance. Our patented 6 m l6 m n operate at high-efficencies in extreme temperatures. Contact our sales team today to learn more about our line of high-efficienty solar panels.

6 m
performance & module efficiency

Advanced split cell technology with 9 ultra-thin busbars allows for less resistance and more photon

Ideal solution for applications affected by shading

All-black design for pristine aesthetics
No excessive silver bussing or ribbons

Robust product design is resilient in extreme weather. Up to 5400 Pa snow load and 210 mph wind speeds

intertek CE

3V	3 p2. -	N2M M T

aptos solar technology

3a7V. @. v iS- yVV
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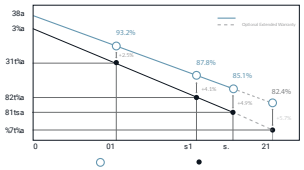
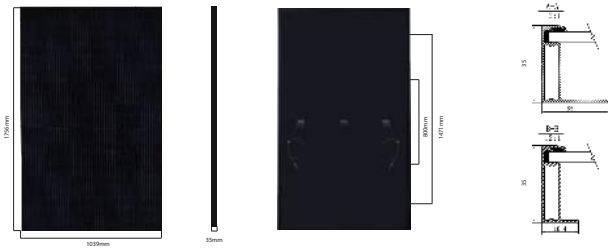


DNA 120



Electrical Specifiactions

	, I BlayVIX Ay W3W	, I BlayVIX Ay W3W0	, I BlayVIX Ay W36V
STCrated Output P I n	360W	365W	370W
Module Efficiency	19.73%	20.01%	20.29%
Open Circuit Voltage V_{oc} (V)	40.6	40.7	40.8
Short Circiut Current I_{sc} Imn	11.24	11.36	11.51
Rated Voltage V (V)	33.8	33.96	34.06
Rated Voltage I Imn	10.66	10.75	10.87

Standard Test Conditions for front-face of panel: 1000 W/m², 25°C, measurement uncertainty ±3%

Temperature Coefficients

Temperature Coefficients P	-0.36%
Temperature Coefficients I	+0.05%/°C
Temperature Coefficients V_{oc}	-0.29%/°C
Normal Operating Cell Temperature (NOCT)	44°C

Test Operating Conditions

Maximum Series Fuse	20A
Maximum System Voltage	1,500 VDC (UL&IEC)
Maximum Load Capacity (Per UL 1703)	5400 PA Snow Load / 210mph Wind Rating
Fire Performance Class	Class C/Type 1

Packaging Configuration

	30
Number of Pallets per 40ft. Container	26
Pallet Dimensions	1740 X 1140 X 1165
Pallet Weight (kg)	640
Container Weight (kg)	16640

Mechanical Properties

Cell Type	Monocrystalline
	3.2mm, anti-reflection coating, high transmission, low iron, tempered glass
Frame	Anodized Aluminum Alloy
Junction Box	IP68
Dimensions	1756 X 1039 X 35mm
Output Cable	4mm2 (EU)12AWG,39.37in.(1200mm)
Weight	45.19lbs.(20.5kg)
Cable Length	1200mm
Encapsulant	POE

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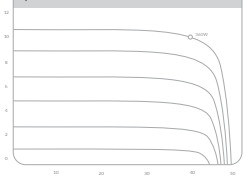


Certifications

intertek CE

UL61730-1, UL61730-2

h

aptos

Data Sheet
Enphase Microinverters
Region: AMERICAS

Enphase IQ 7 and IQ 7+ Microinverters

The high-powered smart grid-ready **Enphase IQ 7 Micro™** and **Enphase IQ 7+ Micro™** dramatically simplify the installation process while achieving the highest system efficiency.

Part of the Enphase IQ System, the IQ 7 and IQ 7+ Microinverters integrate with the Enphase IQ Envoy™, Enphase IQ Battery™, and the Enphase Enlighten™ monitoring and analysis software.

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)

Productive and Reliable

- Optimized for high powered 60-cell/120 half-cell and 72-cell/144 half-cell* modules
- 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)

* The IQ 7+ Micro is required to support 72-cell/144 half-cell modules.

To learn more about Enphase offerings, visit **enphase.com**

Enphase IQ 7 and IQ 7+ Microinverters

INPUT DATA (DC)	IQ7-60-2-US		IQ7PLUS-72-2-US	
Commonly used module pairings[1]	235 W - 350 W +		235 W - 440 W +	
Module compatibility	60-cell/120 half-cell PV modules only		60-cell/120 half-cell and 72-cell/144 half-cell PV modules	
Maximum input DC voltage	48 V		60 V	
Peak power tracking voltage	27 V - 37 V		27 V - 45 V	
Operating range	16 V - 48 V		16 V - 60 V	
Min/Max start voltage	22 V / 48 V		22 V / 60 V	
Max DC short circuit current (module Isc)	15 A		15 A	
Overvoltage class DC port	II		II	
DC port backfeed current	0 A		0 A	
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)	**IQ 7 Microinverter**		**IQ 7+ Microinverter**	
Peak output power	250 VA		295 VA	
Maximum continuous output power	240 VA		290 VA	
Nominal (L-L) voltage/range[2]	240 V / 211-264 V	208 V / 183-229 V	240 V / 211-264 V	208 V / 183-229 V
Maximum continuous output current	1.0 A (240 V)	1.15 A (208 V)	1.21 A (240 V)	1.39 A (208 V)
Nominal frequency	60 Hz		60 Hz	
Extended frequency range	47 - 68 Hz		47 - 68 Hz	
AC short circuit fault current over 3 cycles	5.8 Arms		5.8 Arms	
Maximum units per 20 A (L-L) branch circuit[3]	16 (240 VAC)	13 (208 VAC)	13 (240 VAC)	11 (208 VAC)
Overvoltage class AC port	III		III	
AC port backfeed current	18 mA		18 mA	
Power factor setting	1.0		1.0	
Power factor (adjustable)	0.85 leading ... 0.85 lagging		0.85 leading ... 0.85 lagging	
EFFICIENCY	**@240 V**	**@208 V**	**@240 V**	**@208 V**
Peak efficiency	97.6 %	97.6 %	97.5 %	97.3 %
CEC weighted efficiency	97.0 %	97.0 %	97.0 %	97.0 %
MECHANICAL DATA				
Ambient temperature range	-40°C to +65°C			
Relative humidity range	4% to 100% (condensing)			
Connector type	MC4 (or Amphenol H4 UTX with additional Q-DCC-5 adapter)			
Dimensions (HxWxD)	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	Enlighten Manager and MyEnlighten monitoring options. Both options require installation of an Enphase IQ Envoy.			
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) 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 C22.1-2015 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according manufacturer's instructions.			

1. No enforced DC/AC ratio. See the compatibility calculator at https://enphase.com/en-us/support/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**

Data Sheet
Enphase Networking

Enphase IQ Combiner 4/4C

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

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

LISTED

To learn more about Enphase offerings, visit **enphase.com**

ENPHASE

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
Envoy breaker	10A or 15A rating GE/Siemens/Eaton 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**

ENPHASE

SOLARMOUNT

UNIRAC

SOLARMOUNT defined the standard in solar racking. Features are designed to get installers off the roof faster. Our grounding & bonding process eliminates copper wire and grounding straps to reduce costs. Systems can be configured with standard or light rail to meet your design requirements at the lowest cost possible. The superior aesthetics package provides a streamlined clean edge for enhanced curb appeal, with no special brackets required for installation.

Now Featuring:

THE NEW FACE OF SOLAR RACKING

Superior Aesthetics Package

LOSE ALL OF THE COPPER & LUGS

System grounding through Enphase microinverters and trunk cables

SMALL IS THE NEXT NEW BIG THING

Light Rail is Fully Compatible with all SM Components

ENHANCED DESIGN & LAYOUT TOOLS

Featuring Google Map Capabilities within U-Builder

FAST INSTALLATION. SUPERIOR AESTHETICS

OPTIMIZED COMPONENTS • VERSATILITY • DESIGN TOOLS • QUALITY PROVIDER

SOLARMOUNT

UNIRAC

OPTIMIZED COMPONENTS

INTEGRATED BONDING & PRE-ASSEMBLED PARTS

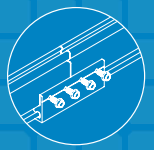
Components are pre-assembled and optimized to reduce installation steps and save labor time. Our new grounding & bonding process eliminates copper wire and grounding straps or bonding jumpers to reduce costs. Utilize the microinverter mount with a wire management clip for an easier installation.

INTEGRATED BONDING MIDCLAMP

VERSATILITY

ONE PRODUCT - MANY APPLICATIONS

Quickly set modules flush to the roof or at a desired tilt angle. Change module orientation to portrait or landscape while securing a large variety of framed modules on flat, low slope or steep pitched roofs. Available in mill, clear and dark anodized finishes to outperform your projects financial and aesthetic aspirations.



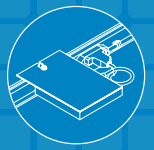
INTEGRATED BONDING SPLICE BAR

AUTOMATED DESIGN TOOL

DESIGN PLATFORM AT YOUR SERVICE

Creating a bill of materials is just a few clicks away with U-Builder, a powerful online tool that streamlines the process of designing a code compliant solar mounting system. Save time by creating a user profile, and recall preferences and projects automatically when you log in. You will enjoy the ability to share projects with customers: there's no need to print results and send to a distributor, just click and share.

INTEGRATED BONDING L-FOOT w/ T-BOLT



INTEGRATED BONDING MICROINVERTER MOUNT w/ WIRE MANAGEMENT

LISTED **UL2703** BONDING & GROUNDING MECHANICAL LOADING SYSTEMFIRE CLASSIFICATION

UNIRAC CUSTOMER SERVICE MEANS THE HIGHEST LEVEL OF PRODUCT SUPPORT

UNMATCHED EXPERIENCE | CERTIFIED QUALITY | ENGINEERING EXCELLENCE | BANKABLE WARRANTY | DESIGN TOOLS | PERMIT DOCUMENTATION

TECHNICAL SUPPORT

Unirac's technical support team is dedicated to answering questions & addressing issues in real time. An online library of documents including engineering reports, stamped letters and technical data sheets greatly simplifies your permitting and project planning process.

CERTIFIED QUALITY PROVIDER

Unirac is the only PV mounting vendor with ISO certifications for 9001:2015, 14001:2015 and OHSAS 18001:2007, which means we deliver the highest standards for fit, form, and function. These certifications demonstrate our excellence and commitment to first class business practices.

BANKABLE WARRANTY

Don't leave your project to chance. Unirac has the financial strength to back our products and reduce your risk. Have peace of mind knowing you are receiving products of exceptional quality. SOLARMOUNT is covered by a twenty five (25) year limited product warranty and a five (5) year limited finish warranty.

PROTECT YOUR REPUTATION WITH QUALITY RACKING SOLUTIONS BACKED BY ENGINEERING EXCELLENCE AND A SUPERIOR SUPPLY CHAIN

S-5!®

The Right Way!

S-5-U Clamp

The S-5-U clamp is by far our most popular and most versatile clamp. It fits about 85% of the standing seam profiles manufactured in North America—including most structural and architectural profiles. It can be used on vertically oriented seams and, by rotating the clamp 90 degrees, it can also be used on most horizontal 2" seam profiles.

Its simple design, generous dimensioning, and multiple hole orientations are what make the S-5-U clamp so versatile for use with the S-5!® snow retention products, such as ColorGard®, as well as with other heavy-duty applications.

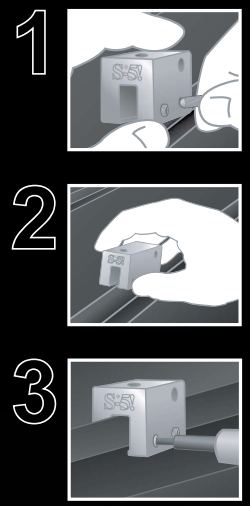
Installation is as simple as setting the specially patented round-point setscrews into the clamp, placing the clamp on the seam, and tightening them to the specified tension. Then, affix ancillary items using the bolt provided with the product. Go to www.S-5.com/tools for information and tools available for properly attaching and tensioning S-5! clamps.

S-5-U Mini Clamp

The S-5-U Mini is a bit shorter than the S-5-U and has one setscrew rather than two. The mini is the choice for attaching all kinds of rooftop accessories: signs, walkways, satellite dishes, antennas, rooftop lighting, lightning protection systems, solar arrays, exhaust stack bracing, conduit, condensate lines, mechanical equipment—just about anything!*

*S-5! mini clamps are not compatible with, and should not be used with S-5! SnoRail™/SnoFence™ or ColorGard® snow retention systems.

The right way to attach almost anything to metal roofs!



S-5-U and S-5-U Mini

The S-5-U clamp is our most popular and versatile clamp, fitting about 85% of the standing seam profiles in North America.

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S-5!®

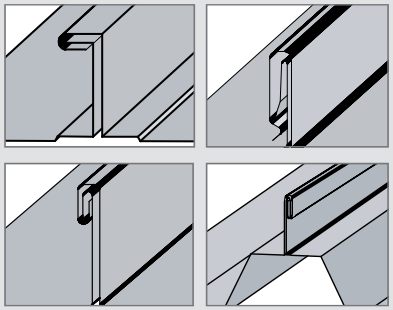
The Right Way!

The strength of the S-5-U clamp is in its simple design. The patented setscrews will slightly dimple the metal seam material but not pierce it—leaving the roof manufacturer's warranty intact.

The **S-5-U and S-5-U Mini clamps** are each furnished with the hardware shown to the right. Each box also includes a bit tip for tightening setscrews using an electric screw gun. A structural aluminum attachment clamp, the S-5-U is compatible with most common metal roofing materials excluding copper. All included hardware is stainless steel. Please visit **www.S-5.com** for more information including CAD details, metallurgical compatibilities and specifications.

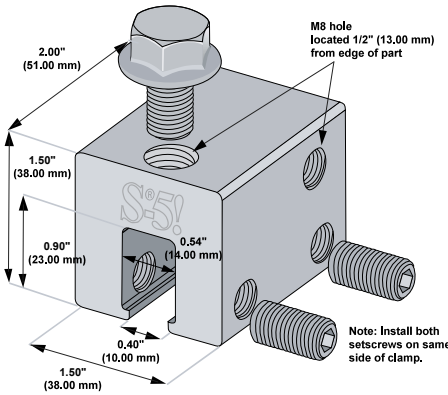
The S-5-U clamp has been tested for load-to-failure results on most major brands and profiles of standing seam roofing. The independent lab test data found at www.S-5.com can be used for load-critical designs and applications. S-5!® holding strength is unmatched in the industry.

Example Profiles

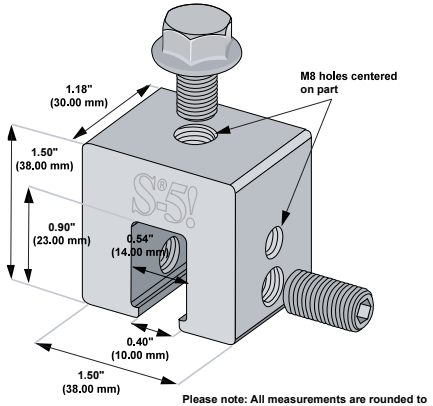


For horizontal seams under 0.65", do not use this clamp. Visit www.S-5.com for more detailed information and proper clamp usage.

S-5-U Clamp



S-5-U Mini Clamp



Please note: All measurements are rounded to the second decimal place.

S-5!® Warning! Please use this product responsibly!

Products are protected by multiple U.S. and foreign patents. Visit the website at www.S-5.com for complete information on patents and trademarks. For maximum holding strength, setscrews should be tensioned and re-tensioned as the seam material compresses. Clamp setscrew tension should be verified using a calibrated torque wrench between 160 and 180 inch pounds when used on 22ga steel, and between 130 and 150 inch pounds for all other metals and thinner gauges of steel. Consult the S-5! website at www.S-5.com for published data regarding holding strength.

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