

June 24, 2022

Lumio Solar  
12600 Challenger Parkway, Suite 200  
Orlando, FL 32826

Scott  
Wyssling,  
PE

Digitally signed by Scott Wyssling, PE  
DN: C=US, S=Utah, L=Alpine,  
O=Wyssling Consulting, OU=Engineering,  
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Reason: I am the author of this document  
Location: your signing location here  
Date: 2022.06.24 16:41:33-06'00'  
Foxit PDF Editor Version: 11.2.2

Re: Engineering Services  
Ratzlaff Residence  
563 Southwest Heathridge Drive, Lake City FL  
12.000 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:** Prefabricated wood trusses at 24" on center. All truss members are constructed of 2 x 4 dimensional lumber.  
**Roof Material:** Composite Asphalt Shingles  
**Roof Slopes:** 27 +/- degrees  
**Attic Access:** Accessible  
**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
- **Ground Snow Load** = 0 psf
- **Wind Load** based on ASCE 7-16
  - Ultimate Wind Speed = 120 mph (based on Risk Category II)
  - Exposure Category B

*Analysis performed of the existing roof structure utilizing the above loading criteria is in accordance with the FBC 2020 7<sup>th</sup> 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 framing will support the additional panel loading without damage, if installed correctly.*

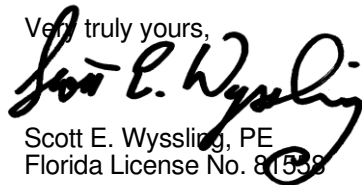
**D. Solar Panel Anchorage**

1. The solar panels shall be mounted in accordance with the most recent Unirac installation manual. 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. The maximum allowable withdrawal force for a  $\frac{5}{16}$ " lag screw is 235 lbs per inch of penetration as identified in the National Design Standards (NDS) of timber construction specifications. Based on a minimum penetration depth of  $2\frac{1}{2}$ ", the allowable capacity per connection is greater than the design withdrawal force (demand). Considering the variable factors for the existing roof framing and installation tolerances, the connection using one  $\frac{5}{16}$ " diameter lag screw with a minimum of  $2\frac{1}{2}$ " embedment will be adequate and will include a sufficient factor of safety.
3. Considering the wind speed, roof slopes, size and spacing of framing members, and condition of the roof, the panel supports shall be placed no greater than 48" on center.
4. Panel supports connections shall be staggered to distribute load to adjacent framing members.

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 7<sup>th</sup> Edition*, current industry standards and practice, 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,

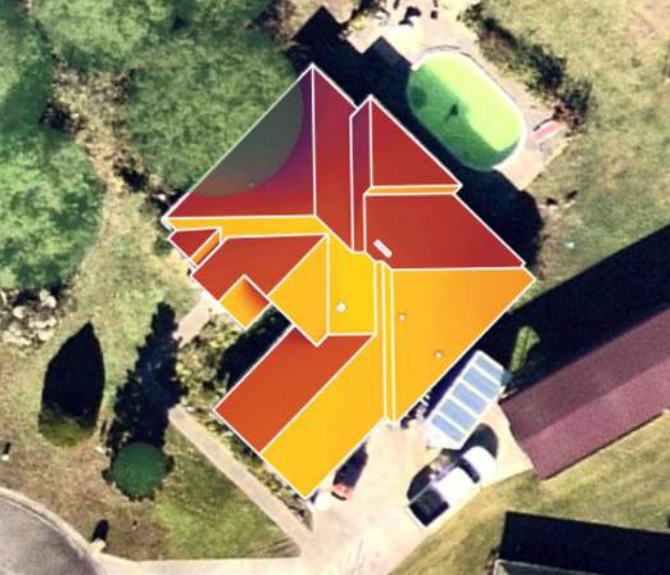
  
Scott E. Wyssling, PE  
Florida License No. 81558

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

Date Signed 6/24/2022



**SCOPE OF WORK:**  
TO INSTALL A ROOF MOUNTED SOLAR PHOTOVOLTAIC SYSTEM AT THE OWNER RESIDENCE LOCATED AT 563 SW HEATHRIDGE DR, LAKE CITY, FL 32024.

SYSTEM DC RATING: 12.00 KWDC  
SYSTEM AC RATING: 8.71 KWAC

- GENERAL NOTES:**
- THESE CONSTRUCTION DOCUMENTS HAVE BEEN BASED ON FIELD INSPECTIONS AND OTHER INFORMATION AVAILABLE AT THE TIME. ACTUAL FIELD CONDITIONS MAY REQUIRE MODIFICATIONS IN CONSTRUCTION DETAILS.
  - ARCHITECT HAS NOT BEEN RETAINED TO SUPERVISE ANY CONSTRUCTION OR INSTALLATION OF ANY EQUIPMENT AT SITE.
  - CONTRACTOR HAS THE FULL RESPONSIBILITY TO CHECK AND VERIFY ALL DIMENSIONS AND EXISTING CONDITIONS. ANY DISCREPANCIES SHALL BE REPORTED TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK. ANY WORK STARTED BEFORE CONSULTATION AND ACCEPTANCE BY THE ENGINEER SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR AND SHALL BE SUBJECT TO CORRECTION BY THEM WITHOUT ADDITIONAL COMPENSATION.
  - THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR THE PROPER INSTALLATION AND COMPLETION OF THE WORK WITH APPROVED MATERIALS.
  - THE CONTRACTOR SHALL PERFORM THE WORK IN STRICT CONFORMANCE WITH THE LOCAL LAWS, REGULATIONS AND THE NATIONAL ELECTRIC CODE.

- ELECTRICAL NOTES:**
- THE EQUIPMENT AND ALL ASSOCIATED WIRING AND INTERCONNECTION SHALL BE INSTALLED ONLY BY QUALIFIED PEOPLE. A QUALIFIED PERSON IS ONE WHO HAS SKILLS AND KNOWLEDGE RELATED TO THE CONSTRUCTION AND OPERATION OF THE ELECTRICAL EQUIPMENT AND INSTALLATIONS AND HAS RECEIVED SAFETY TRAINING TO RECOGNIZE AND AVOID THE HAZARDS INVOLVED. (NEC 690.4(C), NEC 2017).
  - NEW CONDUIT ROUTING SHOWN IS ESSENTIALLY SCHEMATIC. SUBCONTRACTOR SHALL LAY OUT RUNS TO SUIT FIELD CONDITIONS AND THE COORDINATION REQUIREMENTS OF OTHER TRADES.
  - ARRAY WIRING SHOULD NOT BE READILY ACCESSIBLE EXCEPT TO QUALIFIED PERSONNEL.
  - ALL CONDUCTORS AND WIRE TIES EXPOSED TO SUNLIGHT ARE LISTED AS UV RESISTANT.
  - ALL CONDUIT SIZES AND TYPES, SHALL BE LISTED FOR ITS PURPOSE AND APPROVED FOR THE SITE APPLICATIONS.



| SHEET INDEX |                             |
|-------------|-----------------------------|
| CS-0        | COVER SHEET & BOM           |
| E-1         | STRING LAYOUT & SIGNAGE     |
| E-2         | ELECTRICAL DIAGRAM & CALCS. |
| E-3+        | EQUIPMENT SPECIFICATIONS    |

| GOVERNING CODES                                                                                      |  |
|------------------------------------------------------------------------------------------------------|--|
| 2018 NFPA 1 (FIRE CODE)<br>2017 NATIONAL ELECTRICAL CODE<br>2020 FLORIDA BUILDING CODE (7TH EDITION) |  |
| AUTHORITY HAVING JURISDICTION (AHJ): COLUMBIA COUNTY                                                 |  |

| BILL OF MATERIALS |     |                                                       |
|-------------------|-----|-------------------------------------------------------|
| EQUIPMENT         | QTY | DESCRIPTION                                           |
| SOLAR PV MODULE   | 30  | Q.PEAK DUO BLK ML-G10+ 400W                           |
| MICROINVERTER     | 30  | ENPHASE IQ8PLUS-72-2-US                               |
| JUNCTION BOX      | 1   | JUNCTION BOX, NEMA 3R, UL LISTED                      |
| COMBINER BOX      | 1   | ENPHASE IQ COMBINER 4/4C W/ IQ ENVOY (X-IQ-AM1-240-4) |
| AC DISCONNECT     | 1   | FUSED AC DISCONNECT, 240V, NEMA 3R, UL LISTED         |
| POWER PERFECT BOX | 1   | (ES1PN), 120V/240V, NEMA 3X                           |

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PROJECT NAME & ADDRESS

ROBERT RATZLAFF  
RESIDENCE  
563 SW HEATHRIDGE DR  
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ENGINEER CONTACT INFORMATION

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REVISIONS

| DESCRIPTION | DATE | REV |
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Date: 6/23/22

SHEET NAME

COVER SHEET & BOM

SHEET NUMBER

CS-0



| LEGEND |                          |
|--------|--------------------------|
| X      | - MODULE STRING ID       |
| (E)    | - EXISTING               |
| (N)    | - NEW                    |
| (M)    | - UTILITY METER          |
| MSP    | - MAIN SERVICE PANEL     |
| ACD    | - AC DISCONNECT          |
| CB     | - COMBINER BOX           |
| LC     | - LOAD CENTER            |
| SP     | - SUBPANEL               |
| JB     | - JUNCTION BOX           |
| SCT    | - STRING CENTER TAP      |
| ---    | - CONDUIT                |
| BAT    | - ENERGY STORAGE         |
| ICD    | - INTERCONNECTION DEVICE |
| BUL    | - BACK UP LOADS PANEL    |

- ADHESIVE FASTENED SIGNS:**
- ANSI Z535.4-2011 PRODUCT SAFETY SIGNS AND LABELS, PROVIDES GUIDELINES FOR SUITABLE FONT SIZES, WORDS, COLORS, SYMBOLS, AND LOCATION REQUIREMENTS FOR LABELS. NEC 110.21(B)(1).
  - THE LABEL SHALL BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED. NEC 110.21(B)(3).
  - ADHESIVE FASTENED SIGNS MAY BE ACCEPTABLE IF PROPERLY ADHERED. VINYL SIGNS SHALL BE WEATHER RESISTANT.

⚠

WARNING

⚠

ELECTRIC SHOCK HAZARD

DO NOT TOUCH TERMINALS  
TERMINALS ON BOTH THE LINE AND  
LOAD SIDES MAY BE ENERGIZED  
IN THE OPEN POSITION

LABEL LOCATION:  
COMBINER BOX/ EMT  
ENCLOSURES/ AC DISCONNECT/  
MAIN SERVICE PANEL  
PER CODE: NEC 2017, 690.13(B)

EMERGENCY RESPONDER

SOLAR PV SYSTEM EQUIPPED  
WITH RAPID SHUTDOWN

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

LABEL LOCATION:  
RAPID SHUTDOWN  
(AC DISCONNECT)  
PER CODE: NEC 690.56 (C)(1) &  
NFPA11.12.2.1.1.1, 11.12.2.1.4

WARNING: PHOTOVOLTAIC  
POWER SOURCE

LABEL LOCATION:  
CONDUIT/ RACEWAY/ ENCLOSURES/  
COMBINER BOX/ AC DISCONNECT  
PER CODE: NEC2017, 690.31(G)(3)(4)

PHOTOVOLTAIC  
AC DISCONNECT

LABEL LOCATION:  
AC DISCONNECT/ BREAKER/  
POINTS OF CONNECTION  
PER CODE: NEC2017, 690.13(B)

PHOTOVOLTAIC AC DISCONNECT

RATED AC OUTPUT CURRENT 36.3 A

NOMINAL OPERATING AC VOLTAGE 240 V

LABEL LOCATION:  
AC DISCONNECT  
PER CODE: NEC2017, 690.53

RAPID SHUTDOWN  
SWITCH FOR  
SOLAR PV SYSTEM

LABEL LOCATION:  
RAPID SHUTDOWN  
(AC DISCONNECT)  
PER CODE: NEC 690.58 (C)(3)

⚠

WARNING

⚠

DUAL POWER SOURCE

SOURCES: UTILITY GRID AND  
PV SOLAR ELECTRIC SYSTEM

LABEL LOCATION:  
POINT OF INTERCONNECTION  
PER CODE: NEC 2017, 705.12(B)

! WARNING !

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

LABEL LOCATION:  
ANY ELECTRICAL PANEL THAT IS FED BY  
BOTH THE UTILITY AND THE PHOTOVOLTAIC  
SYSTEM (AC DISCONNECT, MSP)  
PER CODE: NEC 705.12(B)(2)(3)(C)

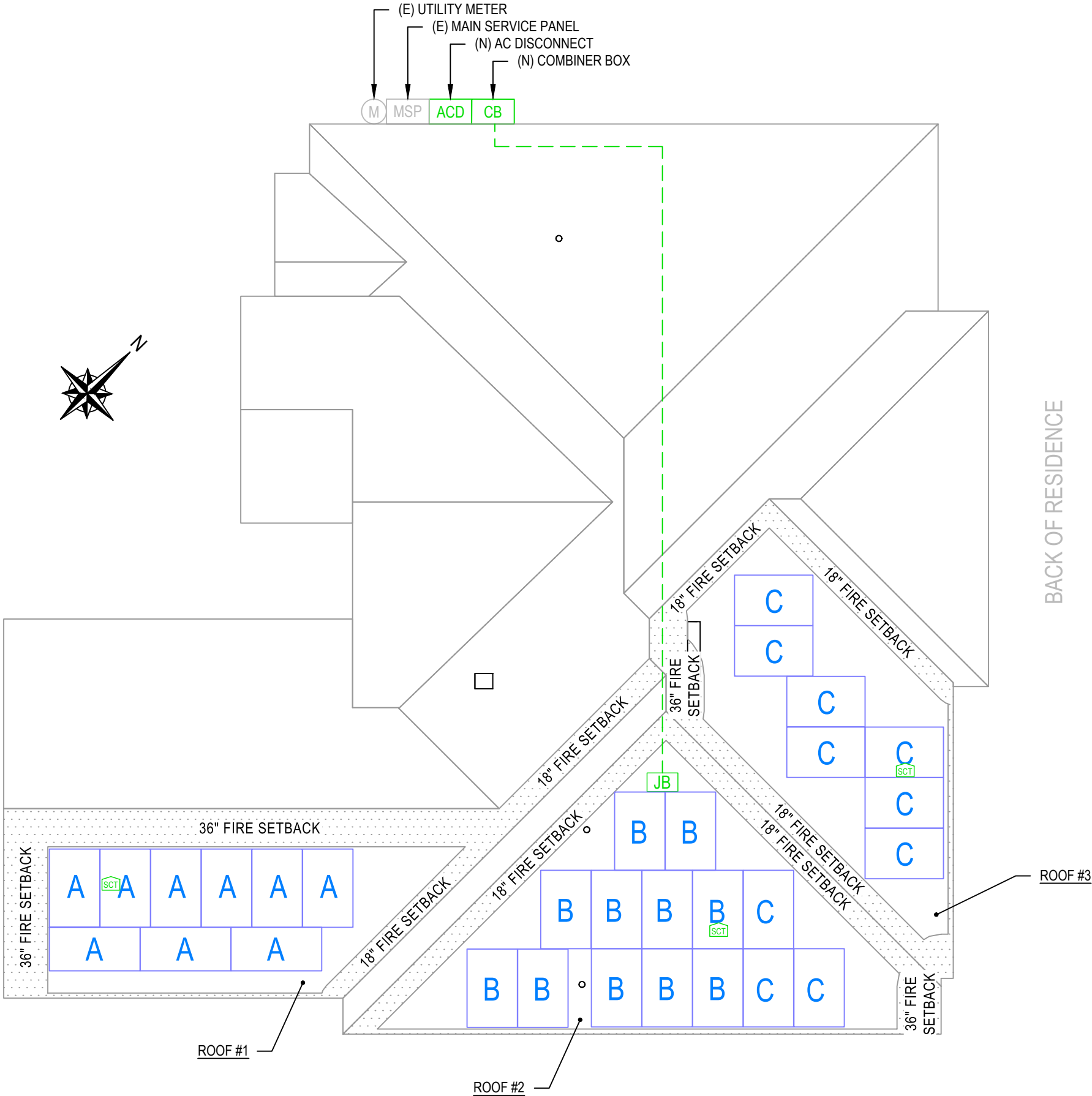
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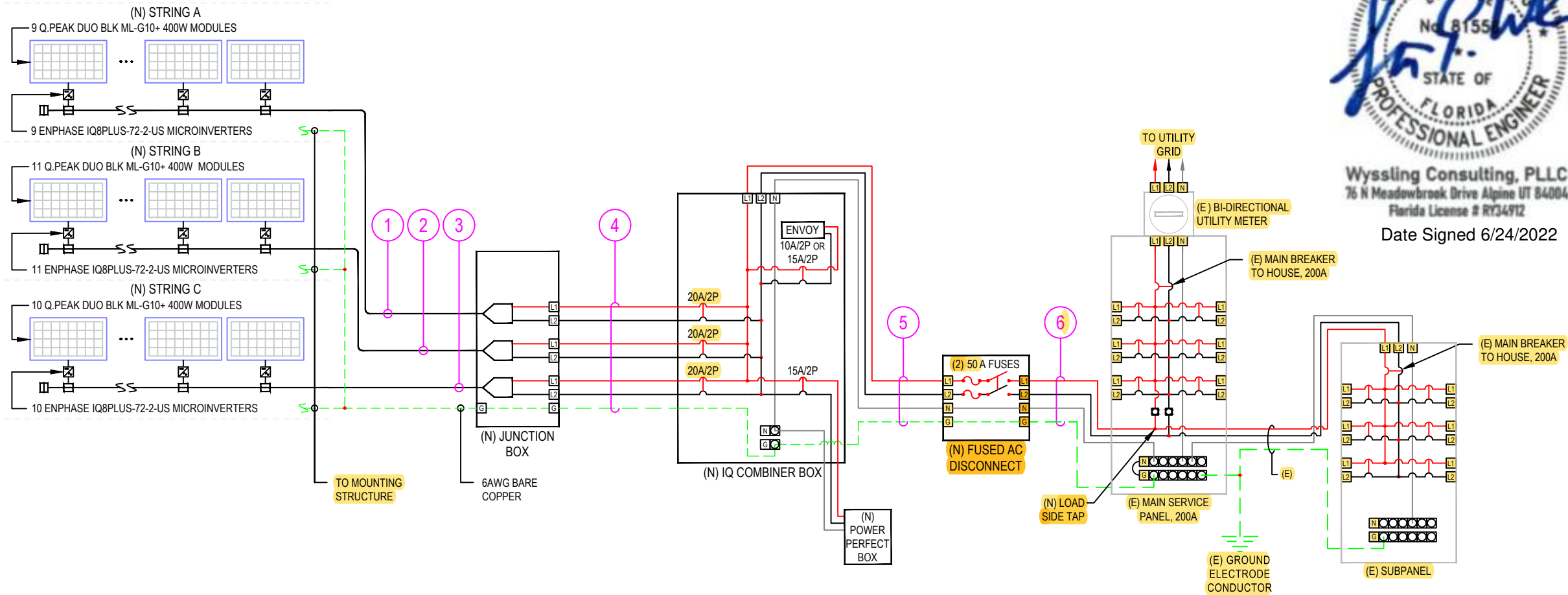
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| ID | INITIAL CONDUCTOR LOCATION | FINAL CONDUCTOR LOCATION | MIN. CONDUCTOR SIZE (AWG) |               | MIN. DIA CONDUIT SIZE (IN.) | # OF PARALLEL CIRCUITS | CURRENT-CARRYING CONDUCTORS IN CONDUIT | OCPD (A) | MIN. EGC SIZE (AWG) |               | TEMP. CORR. FACTOR |      | CONDUIT FILL FACTOR | CONT. CURRENT (A) | MAX. CURRENT (A) | BASE AMP. (A) | DERATED AMP. (A) | TERM. AMP. RATING (A) | LENGTH (FT) | VOLTAGE DROP (%) |
|----|----------------------------|--------------------------|---------------------------|---------------|-----------------------------|------------------------|----------------------------------------|----------|---------------------|---------------|--------------------|------|---------------------|-------------------|------------------|---------------|------------------|-----------------------|-------------|------------------|
| 1  | STRING A                   | JUNCTION BOX             | 12                        | Q CABLE       | N/A                         | 1                      | 2                                      | N/A      | 6                   | BARE COPPER   | 0.76               | 55°C | N/A                 | 10.89             | 13.61            | 30            | N/A              | N/A                   | 60.00       | 0.44             |
| 2  | STRING B                   | JUNCTION BOX             | 12                        | Q CABLE       | N/A                         | 1                      | 2                                      | N/A      | 6                   | BARE COPPER   | 0.76               | 55°C | N/A                 | 13.31             | 16.64            | 30            | N/A              | N/A                   | 50.00       | 0.45             |
| 3  | STRING C                   | JUNCTION BOX             | 12                        | Q CABLE       | N/A                         | 1                      | 2                                      | N/A      | 6                   | BARE COPPER   | 0.76               | 55°C | N/A                 | 12.1              | 15.13            | 30            | N/A              | N/A                   | 55.00       | 0.45             |
| 4  | JUNCTION BOX               | IQ COMBINER              | 10                        | THWN-2 COPPER | 0.75 LTNM                   | 3                      | 6                                      | 20       | 10                  | THWN-2 COPPER | 0.76               | 55°C | 0.8                 | 13.31             | 16.64            | 40            | 24.3             | 35                    | 65.00       | 0.90             |
| 5  | IQ COMBINER                | AC DISCONNECT            | 8                         | THWN-2 COPPER | 0.75 LTNM                   | 1                      | 3                                      | 50       | 10                  | THWN-2 COPPER | 0.96               | 34°C | 1                   | 36.3              | 45.38            | 55            | 52.8             | 50                    | 5.00        | 0.12             |
| 6  | AC DISCONNECT              | MSP                      | 6                         | THWN-2 COPPER | 0.75 LTNM                   | 1                      | 3                                      | N/A      | 8                   | THWN-2 COPPER | 0.96               | 34°C | 1                   | 36.3              | 45.38            | 75            | 72.0             | 65                    | 5.00        | 0.07             |

NOTE: LTNM OR EQUIVALENT TYPE CONDUIT



LEGEND

(E) - EXISTING  
(N) - NEW

DESIGN TEMPERATURE SPECIFICATIONS

|                                   |      |
|-----------------------------------|------|
| RECORD LOW TEMP                   | 1°C  |
| AMBIENT TEMP (HIGH TEMP 2%)       | 34°C |
| CONDUIT HEIGHT                    | 1.0" |
| CONDUCTOR TEMPERATURE RATE (ROOF) | 55°C |

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1 ELECTRICAL LINE DIAGRAM

E-2 SCALE: NTS



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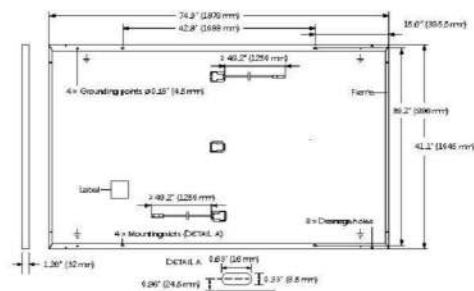
**ELECTRICAL LINE  
DIAGRAM & CALCS.**

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**E-2**



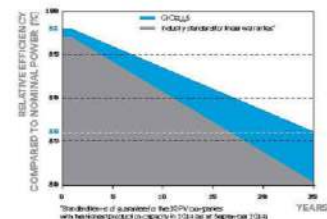
|              |                                                                                                           |
|--------------|-----------------------------------------------------------------------------------------------------------|
| Format       | 74.0 in x 41.1 in x 1.26 in (including frame)<br>(1879 mm x 1045 mm x 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 x 22 monocrystalline Q-ANTUM solar half cells                                                           |
| Junction Box | 2.09-3.98 in x 1.26-2.36 in x 0.50-0.71 in<br>(53-101 mm x 32-60 mm x 15-18 mm), IP67, with bypass diodes |
| Cable        | 4 mm <sup>2</sup> Solar cable; (+) $\pm 49.2$ in (1250 mm), (-) $\pm 49.2$ in (1250 mm)                   |
| Connector    | Stäubli MC4; IP68                                                                                         |



| POWER CLASS                                                                                   |                                    | 385                  | 390   | 395   | 400   | 405   |       |
|-----------------------------------------------------------------------------------------------|------------------------------------|----------------------|-------|-------|-------|-------|-------|
| MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC <sup>1</sup> (POWER TOLERANCE +5W / -0W) |                                    |                      |       |       |       |       |       |
| Minimum                                                                                       | Power at MPP <sup>2</sup>          | P <sub>MPP</sub> [W] | 385   | 390   | 395   | 400   | 405   |
|                                                                                               | Short Circuit Current <sup>3</sup> | I <sub>SC</sub> [A]  | 11.04 | 11.07 | 11.10 | 11.14 | 11.17 |
|                                                                                               | Open Circuit Voltage <sup>4</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>5</sup>            | η [%]                | ≥19.6 | ≥19.9 | ≥20.1 | ≥20.4 | ≥20.6 |
| MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT <sup>1</sup>                         |                                    |                      |       |       |       |       |       |
| Minimum                                                                                       | 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 | 35.47 |

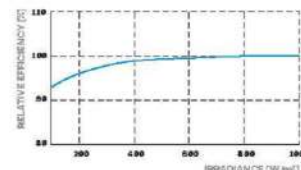
<sup>4</sup>Measurement tolerances  $P_{app} \pm 3\%$ ;  $I_{SC}$ ,  $V_{OC} \pm 5\%$  at STC:  $1000 \text{ W/m}^2$ ,  $25 \pm 2^\circ\text{C}$ , AM 1.5 according to IEC 60904-3. <sup>5</sup> $800 \text{ W/m}^2$ , NMOT, spectrum AM 1.5.

### PERFORMANCE AT LOW IRRADIANCE



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.



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 $I_{SC}$  | $\alpha$ | [%/K] | +0.04 | Temperature Coefficient of $V_{OC}$  | $\beta$ | [%/K] | -0.27             |
| Temperature Coefficient of $P_{MPP}$ | $\gamma$ | [%/K] | -0.34 | Nominal Module Operating Temperature | NMOT    | [°F]  | 109±5.4 (43±3 °C) |

|                                            |                        |                            |                                                    |                                           |
|--------------------------------------------|------------------------|----------------------------|----------------------------------------------------|-------------------------------------------|
| Maximum System Voltage $V_{sys}$           | [V]                    | 1000 (EC)/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> ] | 75 (3600 Pa)/55 (2660 Pa)  | Permitted Module Temperature<br>on Continuous Duty | -40°F up to +185°F<br>(-40°C up to +85°C) |
| Max. Test Load, Push / Pull <sup>3</sup>   | [lbs/ft <sup>2</sup> ] | 113 (5400 Pa)/84 (4000 Pa) |                                                    |                                           |

<sup>2</sup> See Installation Manual

### PACKAGING INFORMATION

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



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

Specifications subject to technical changes © **CELLS Q.PEAK** DUO BLK ML-G10 a+ 385-405\_2021-05\_Ren01\_NA

| INPUT DATA (DC)                                      |    | I08-60-2-US                                                                                                                                                                                                                                                                                                                                                                                            | I08PLUS-72-2-US                                 |
|------------------------------------------------------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| Commonly used module pairings <sup>1</sup>           | W  | 235 – 350                                                                                                                                                                                                                                                                                                                                                                                              | 235 – 440                                       |
| Module compatibility                                 |    | 60-cell/120 half-cell                                                                                                                                                                                                                                                                                                                                                                                  | 60-cell/120 half-cell and 72-cell/144 half-cell |
| MPPT voltage range                                   | V  | 27 – 37                                                                                                                                                                                                                                                                                                                                                                                                | 29 – 45                                         |
| Operating range                                      | V  | 25 – 48                                                                                                                                                                                                                                                                                                                                                                                                | 25 – 58                                         |
| Min/max start voltage                                | V  | 30 / 48                                                                                                                                                                                                                                                                                                                                                                                                | 30 / 58                                         |
| Max input DC voltage                                 | V  | 50                                                                                                                                                                                                                                                                                                                                                                                                     | 60                                              |
| Max DC current <sup>2</sup> [module Isc]             | A  | 15                                                                                                                                                                                                                                                                                                                                                                                                     |                                                 |
| Overvoltage class DC port                            |    | II                                                                                                                                                                                                                                                                                                                                                                                                     |                                                 |
| DC port backfeed current                             | mA | 0                                                                                                                                                                                                                                                                                                                                                                                                      |                                                 |
| PV array configuration                               |    | 1x1 Ungrounded array; No additional DC side protection required; AC side protection requires max 20A per branch circuit                                                                                                                                                                                                                                                                                |                                                 |
| OUTPUT DATA (AC)                                     |    | I08-60-2-US                                                                                                                                                                                                                                                                                                                                                                                            | I08PLUS-72-2-US                                 |
| Peak output power                                    | VA | 245                                                                                                                                                                                                                                                                                                                                                                                                    | 300                                             |
| Max continuous output power                          | VA | 240                                                                                                                                                                                                                                                                                                                                                                                                    | 290                                             |
| Nominal (L-L) voltage/range <sup>3</sup>             | V  | 240 / 211 – 264                                                                                                                                                                                                                                                                                                                                                                                        |                                                 |
| Max continuous output current                        | A  | 1.0                                                                                                                                                                                                                                                                                                                                                                                                    | 1.21                                            |
| Nominal frequency                                    | Hz | 60                                                                                                                                                                                                                                                                                                                                                                                                     |                                                 |
| Extended frequency range                             | Hz | 50 – 68                                                                                                                                                                                                                                                                                                                                                                                                |                                                 |
| Max units per 20 A (L-L) branch circuit <sup>4</sup> |    | 16                                                                                                                                                                                                                                                                                                                                                                                                     | 13                                              |
| Total harmonic distortion                            |    | <5%                                                                                                                                                                                                                                                                                                                                                                                                    |                                                 |
| Overvoltage class AC port                            |    | III                                                                                                                                                                                                                                                                                                                                                                                                    |                                                 |
| AC port backfeed current                             | mA | 30                                                                                                                                                                                                                                                                                                                                                                                                     |                                                 |
| Power factor setting                                 |    | 1.0                                                                                                                                                                                                                                                                                                                                                                                                    |                                                 |
| Grid-tied power factor (adjustable)                  |    | 0.85 leading – 0.85 lagging                                                                                                                                                                                                                                                                                                                                                                            |                                                 |
| Peak efficiency                                      | %  | 97.5                                                                                                                                                                                                                                                                                                                                                                                                   | 97.6                                            |
| CEC weighted efficiency                              | %  | 97                                                                                                                                                                                                                                                                                                                                                                                                     | 97                                              |
| Night-time power consumption                         | mW | 60                                                                                                                                                                                                                                                                                                                                                                                                     |                                                 |
| MECHANICAL DATA                                      |    |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                 |
| Ambient temperature range                            |    | -40°C to +60°C (-40°F to +140°F)                                                                                                                                                                                                                                                                                                                                                                       |                                                 |
| Relative humidity range                              |    | 4% to 100% (condensing)                                                                                                                                                                                                                                                                                                                                                                                |                                                 |
| DC Connector type                                    |    | MC4                                                                                                                                                                                                                                                                                                                                                                                                    |                                                 |
| Dimensions (HxWxD)                                   |    | 212 mm (8.3") x 175 mm (6.9") x 30.2 mm (1.2")                                                                                                                                                                                                                                                                                                                                                         |                                                 |
| Weight                                               |    | 1.08 kg (2.38 lbs)                                                                                                                                                                                                                                                                                                                                                                                     |                                                 |
| Cooling                                              |    | Natural convection – no fans                                                                                                                                                                                                                                                                                                                                                                           |                                                 |
| Approved for wet locations                           |    | Yes                                                                                                                                                                                                                                                                                                                                                                                                    |                                                 |
| Acoustic noise at 1 m                                |    | <60 dBA                                                                                                                                                                                                                                                                                                                                                                                                |                                                 |
| Pollution degree                                     |    | PD3                                                                                                                                                                                                                                                                                                                                                                                                    |                                                 |
| Enclosure                                            |    | Class II double-insulated, corrosion resistant polymeric enclosure                                                                                                                                                                                                                                                                                                                                     |                                                 |
| Environ. category / UV exposure rating               |    | NEMA Type 6 / outdoor                                                                                                                                                                                                                                                                                                                                                                                  |                                                 |
| COMPLIANCE                                           |    |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                 |
| Certifications                                       |    | CA Rule 21 (UL 1741-SA), UL 62109-1, UL1741/IEEE1547, FCC Part 15 Class B, ICES-0003 Class B, CAN/CSA-C22.2 NO. 1071-01<br><br>This product is UL Listed as PV Rapid Shut Down Equipment and conforms with NEC 2014, NEC 2017, and NEC 2020 section 690.12 and C22.1-2018 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according to manufacturer's instructions. |                                                 |

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

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



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## REVISIONS

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Drawn by: N.R.

Checked by: S.W.

Date: 6/23/20

## SHEET NAME

## EQUIPMENT SPECIFICATIONS

## SHEET NUMBER

E-3

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<br>COMMS-CELLMODEM-M1-06<br>CELLMODEM-M1-06-SP-05<br>CELLMODEM-M1-06-AT-05            | - Includes COMMS-KIT-01 and CELLMODEM-M1-06-SP-05 with 5-year Sprint data plan for Ensemble sites<br>- 4G based LTE-M1 cellular modem with 5-year Sprint data plan<br>- 4G based LTE-M1 cellular modem with 5-year AT&T data plan                                                                                                                                                                                                                                                                                                                                                              |
| Circuit Breakers<br>BRK-10A-2-240V<br>BRK-15A-2-240V<br>BRK-20A-2P-240V<br>BRK-15A-2P-240V-B<br>BRK-20A-2P-240V-B | Supports Eaton BR210, BR215, BR220, BR230, BR240, BR250, and BR260 circuit breakers.<br>Circuit breaker, 2 pole, 10A, Eaton BR210<br>Circuit breaker, 2 pole, 15A, Eaton BR215<br>Circuit breaker, 2 pole, 20A, Eaton BR220<br>Circuit breaker, 2 pole, 15A, Eaton BR215B with hold down kit support<br>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<br>• 60 A breaker branch input: 4 to 1/0 AWG copper conductors<br>• Main lug combined output: 10 to 2/0 AWG copper conductors<br>• Neutral and ground: 14 to 1/0 copper conductors<br>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<br>Production metering: ANSI C12.20 accuracy class 0.5 (PV production)<br>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](https://enphase.com)

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Checked by: S.W.  
Date: 6/23/22

SHEET NAME

EQUIPMENT SPECIFICATIONS

SHEET NUMBER

E-4