

## SCOPE OF WORK

TO INSTALL (2) SOLAR PHOTOVOLTAIC (PV) SYSTEMS AT THE KNAUP RESIDENCE, LOCATED AT 1815 N TEJON STREET, COLORADO SPRINGS, COLORADO. THE POWER GENERATED BY THE PV SYSTEM WILL BE INTERCONNECTED WITH THE UTILITY GRID THROUGH THE EXISTING ELECTRICAL SERVICE EQUIPMENT. THE PV SYSTEM DOES NOT INCLUDE STORAGE BATTERIES.

## SYSTEM RATING (HOUSE)

4.840 kW DC STC  
4.224 kW AC

## EQUIPMENT SUMMARY (HOUSE)

(11) SUNPOWER SPR-M440-H-AC PV MODULES  
(11) ENPHASE IQ7HS-66-M-US [240V] PV INVERTERS  
(97) (9 X 10.75') LINEAR FEET SUNPOWER CLASSIC INVISIMOUNT

## NEW SYSTEM RATING (GARAGE)

3.520 kW DC STC  
3.072 kW AC

## EXISTING SYSTEM RATING (GARAGE)

3.280 kW DC STC  
2.792 kW AC

## NEW EQUIPMENT SUMMARY (GARAGE)

(8) SUNPOWER SPR-M440-H-AC PV MODULES  
(8) ENPHASE IQ7HS-66-M-US [240V] PV INVERTERS  
(86) (8 X 10.75') LINEAR FEET SUNPOWER CLASSIC INVISIMOUNT

## EXISTING EQUIPMENT SUMMARY (GARAGE)

(08) SUNPOWER SPR-A410-G-AC PV MODULES  
(08) ENPHASE IQ7AS [240V] PV INVERTERS  
(76) (7 X 10.75') LINEAR FEET SUNPOWER INVISIMOUNT

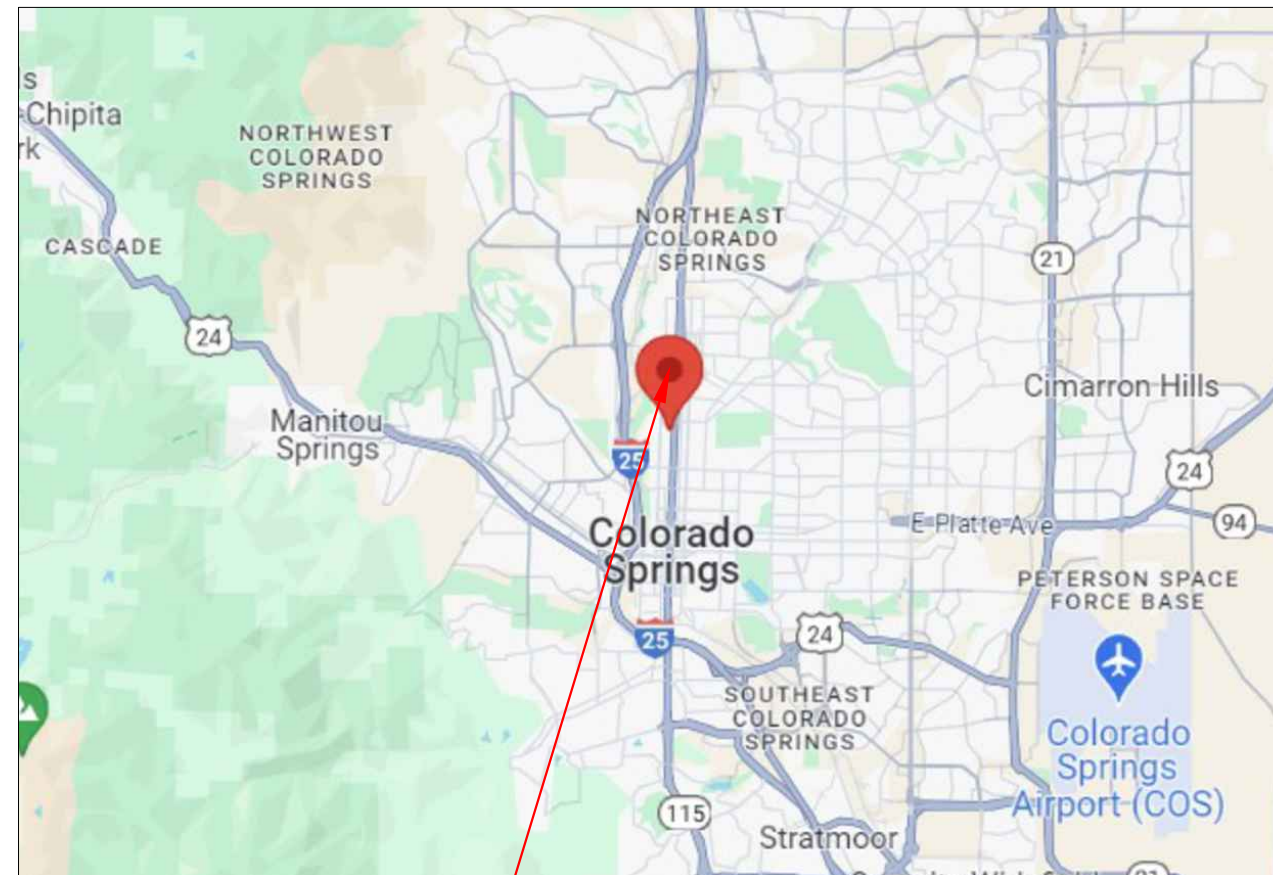
**PHASE 2 GARAGE ADDITION OF (08) MODULES TO AN EXISTING SYSTEM**

## SHEET INDEX

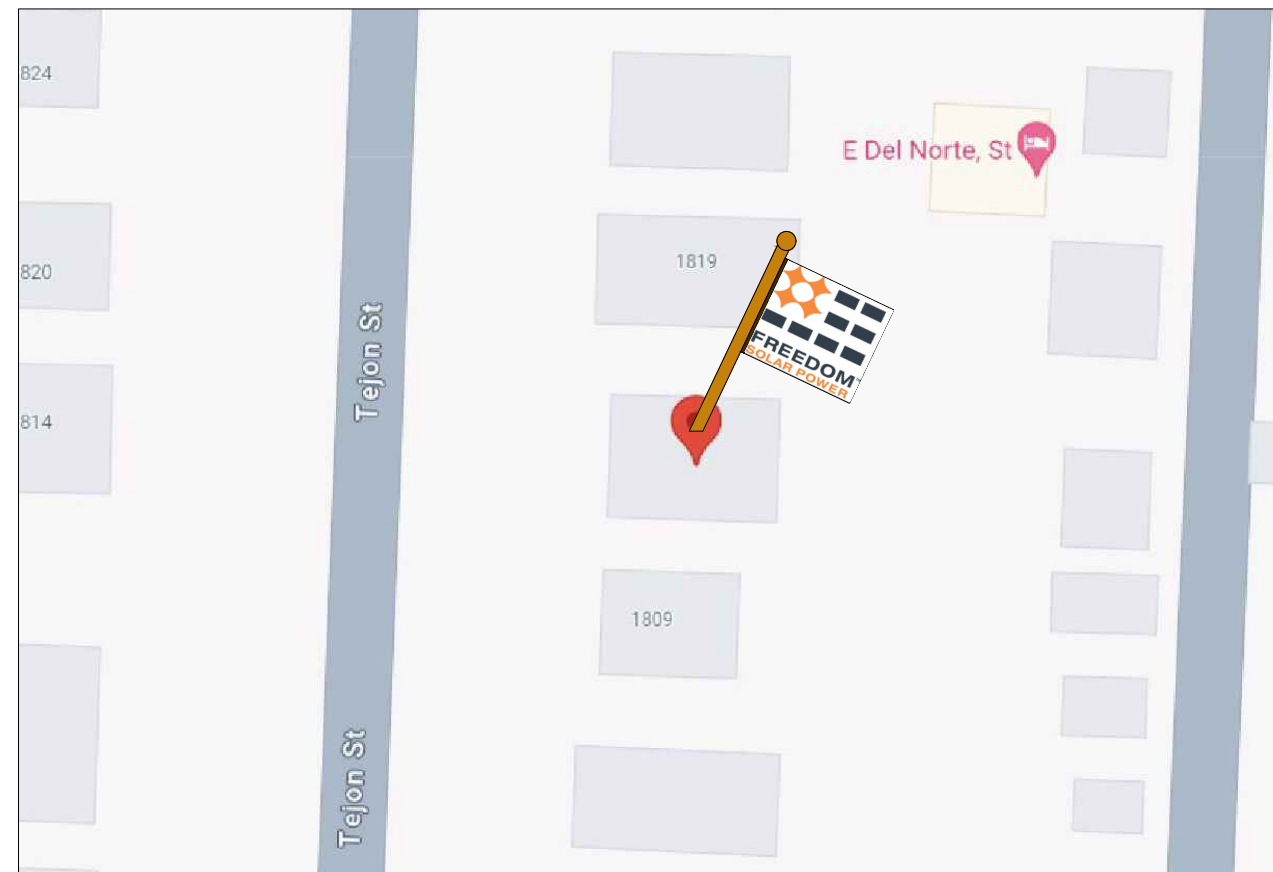
PV-0 COVER  
PV-1 SITE MAP AND PV LAYOUT (HOUSE)  
PV1A RACKING PLAN (HOUSE)  
PV-2 STRING MAP AND MONITORING LAYOUT (HOUSE)  
PV-3 ELECTRICAL DIAGRAM(HOUSE)  
PV-4 EQ WALL & MOUNTING DETAIL (HOUSE)  
PV-5 SYSTEM LABELING DETAIL (HOUSE)  
PV-6 SITE DIRECTORY PLACARD (HOUSE)  
PV-7 SAFETY PLAN (HOUSE)  
  
PV-8 SITE MAP AND PV LAYOUT (GARAGE)  
PV8A RACKING PLAN (GARAGE)  
PV-9 STRING MAP AND MONITORING LAYOUT (GARAGE)  
PV-10 ELECTRICAL DIAGRAM(GARAGE)  
PV-11 EQ WALL & MOUNTING DETAIL (GARAGE)  
PV-12 SYSTEM LABELING DETAIL (GARAGE)  
PV-13 SITE DIRECTORY PLACARD (GARAGE)  
PV-14 SAFETY PLAN (GARAGE)

## GOVERNING CODES

2020 NATIONAL ELECTRICAL CODE  
2023 PIKES PEAK REGIONAL BUILDING CODE (PPRBC)  
2021 INTERNATIONAL RESIDENTIAL CODE  
2021 INTERNATIONAL FIRE CODE  
UNDERWRITERS LABORATORIES (UL) STANDARDS  
OSHA 29 CFR 1910.269



PROJECT LOCATION



VICINITY MAP

CONTRACTOR



**FREEDOM™  
SOLAR POWER**

FREEDOM SOLAR LLC  
4801 FREIDRICH LN, STE 100  
AUSTIN, TX 78744  
512-759-8313  
TECL # 28621

### REVISIONS

DESCRIPTION	DATE	REV
DESIGN PACKET	01/25/2024	

PE STAMP

PROJECT NAME

MICHAEL G KNAUP  
1815 N TEJON STREET  
COLORADO SPRINGS,  
COLORADO, 80907  
(719) 323-3447

SHEET NAME

COVER

SHEET SIZE

ANSI B  
11" x 17"

SHEET NUMBER

PV-0

LEAD ID: 113645

**CONSTRUCTION SUMMARY**

- (11) (SUNPOWER SPR-M440-H-AC) SOLAR MODULES, 4.840 KW DC STC  
MODULE DIMENSIONS = 40.6" X 73.7" X 1.57"
- (11) ENPHASE IQ7HS-66-M-US [240V] PV INVERTERS  
COMBINED INVERTER OUTPUT = 4.224 KW AC.
- (97) (9 X 10.75') LINEAR FEET SUNPOWER CLASSIC INVISIMOUNT
- (36) RT-MINI ROOF ATTACHMENTS
- (01) SUNPOWER MONITORING

**SITE DETAILS**

ROOF TYPE: ASPHALT SHINGLE  
ARRAY #1 - TILT = 36°, AZIMUTH = 183°

**DESIGN CRITERIA:**

SITE ELEVATION = 6,098 FT  
130 MPH VULT, EXPOSURE C,  
SNOW LOAD = 30 PSF ROOF LOAD, 43 PSF GROUND LOAD

ARRAY AREA:  
(40.6"/12) X (73.7"/12) X 11 = 228.6 SQUARE FT

ROOF AREA = 1956.6 SQFT  
ARRAY AREA = 228.6 SQFT  
AREA COVERED BY ARRAY = 11.7%

**FALL PROTECTION REQUIRED**

**CONSTRUCTION NOTES**

- 1.) ALL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.
- 2.) ALL OUTDOOR EQUIPMENT SHALL BE RAINLIGHT WITH MINIMUM NEMA 3R RATING.
- 3.) ALL LOCATIONS ARE APPROXIMATE AND REQUIRE FIELD VERIFICATION.



CONTRACTOR



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SOLAR POWER

FREEDOM SOLAR LLC  
4801 FREDRICH LN, STE 100  
AUSTIN, TX 78744  
512-759-8313  
TECL # 28621

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PE STAMP

PROJECT NAME

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COLORADO SPRINGS,  
COLORADO, 80907  
(719) 323-3447

SHEET NAME

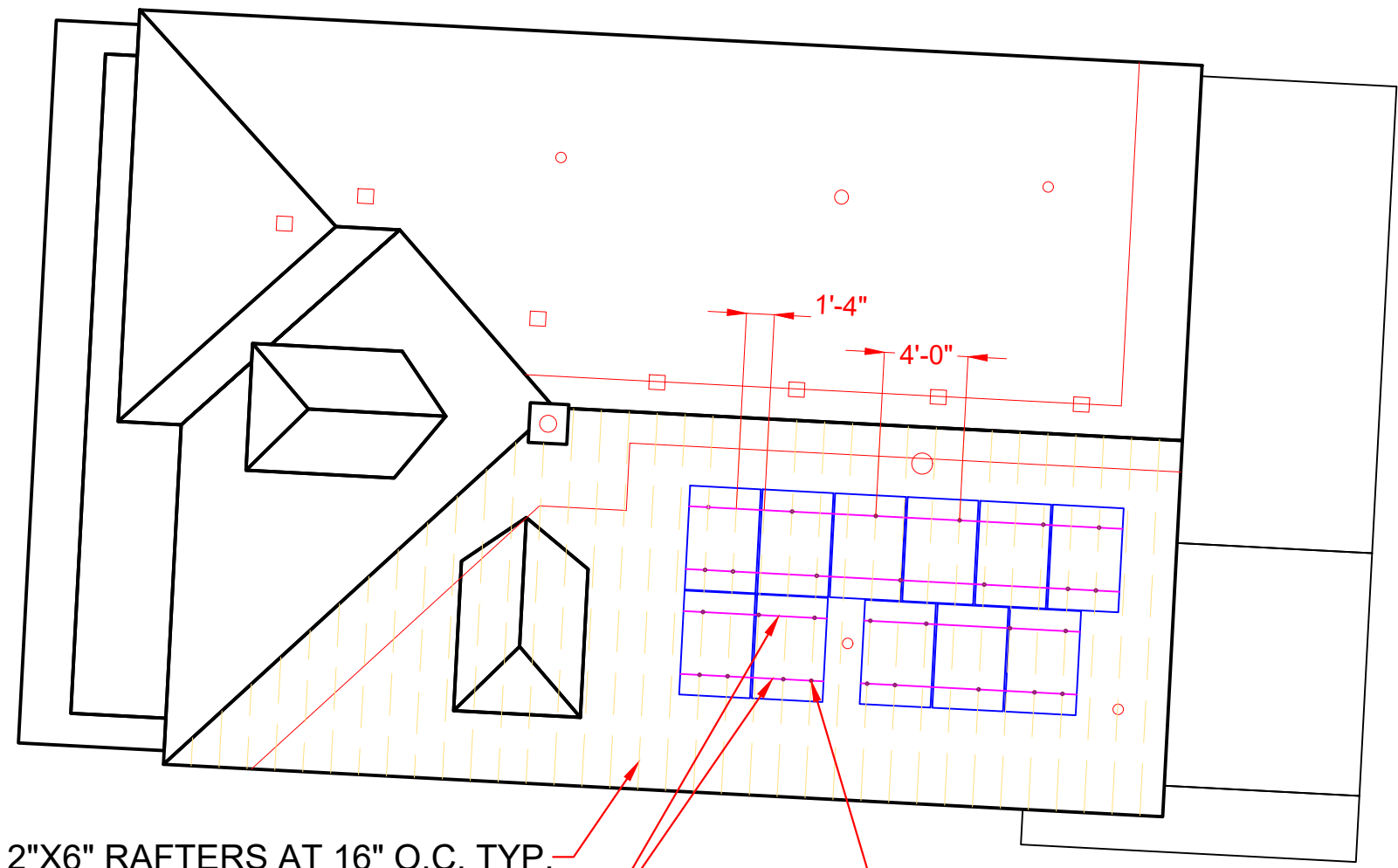
SITE MAP &  
PV LAYOUT  
**HOUSE**

SHEET SIZE

ANSI B  
11" x 17"

SHEET NUMBER

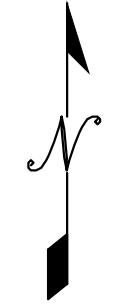
**PV-1**



2"X6" RAFTERS AT 16" O.C. TYP.

(2) RAILS PER ROW OF  
MODULES EVENLY SPACED

5-M5 X 60MM SCREWS INTO  
DECKING PER ATTACHMENT  
MAXIMUM ATTACHMENT SPAN IS  
16" O.C & 48" O.C. STAGGERED ALONG RAILS  
(MAX OFFSET SPAN IS 36" FROM  
OPPOSITE RAIL ATTACHMENT)



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COLORADO SPRINGS,  
COLORADO, 80907  
(719) 323-3447

SHEET NAME

RACKING PLAN  
**HOUSE**

SHEET SIZE

ANSI B  
11" x 17"

SHEET NUMBER

**PV-1A**

CONSTRUCTION NOTES

- 1.) ALL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.
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- 3.) ALL LOCATIONS ARE APPROXIMATE AND REQUIRE FIELD VERIFICATION.

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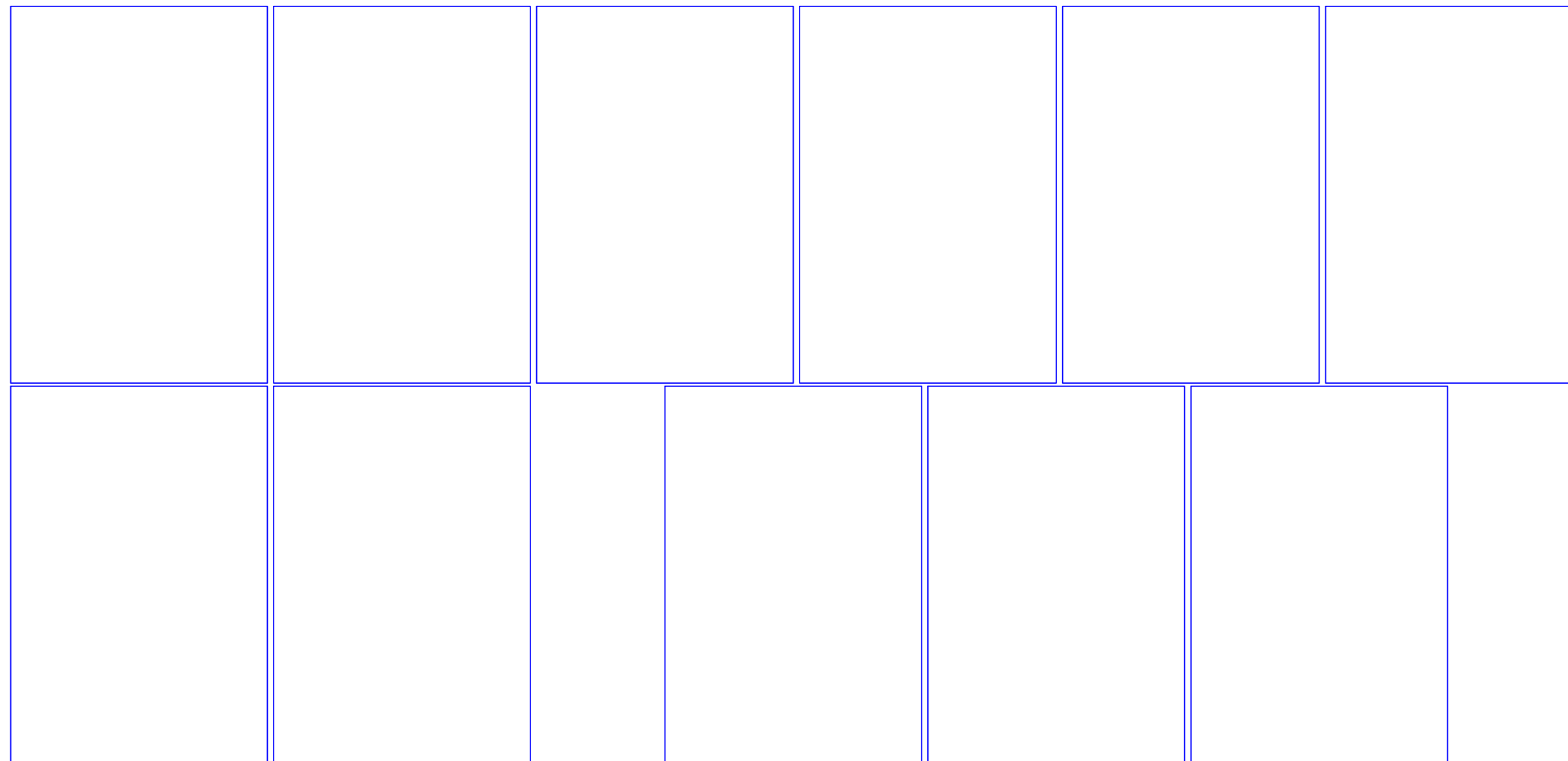
STRING MAP &  
MONITORING  
LAYOUT  
**HOUSE**

SHEET SIZE

ANSI B  
11" x 17"

SHEET NUMBER

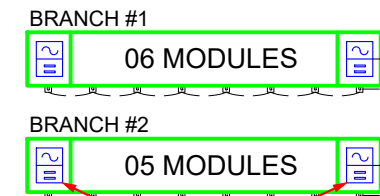
PV-2



SUNPOWER SUPERVISOR S/N \_\_\_\_\_

**SOLAR ARRAY - 4.840kW DC STC, 4.224 kW AC  
(11) (SUNPOWER SPR-M440-H-AC) MODULES**

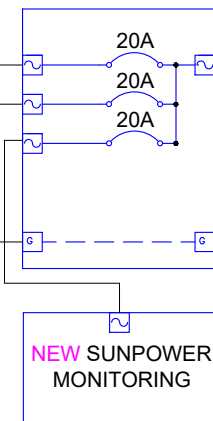
ROOFTOP JUNCTION BOX:  
TRANSITION FROM DG CABLE  
TO AWG #10 THWN-2  
NEMA 3R, UL LISTED



(11) (ENPHASE IQ7HS-66-M-US [240V])  
INVERTERS 240VAC, 1.60A MAX  
CEC WEIGHTED EFFICIENCY 97.0%  
NEMA 4R, UL LISTED, INTERNAL GFDI

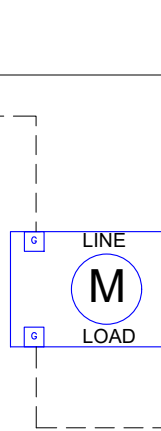
(4) AWG #10 CU THWN-2  
(1) AWG #8 CU THWN-2 GND  
IN 3/4" CONDUIT

**NEW SOLAR LOAD CENTER**  
240 VAC, 125A  
NEMA 3R, UL LISTED  
(3) 2P-20A BREAKERS

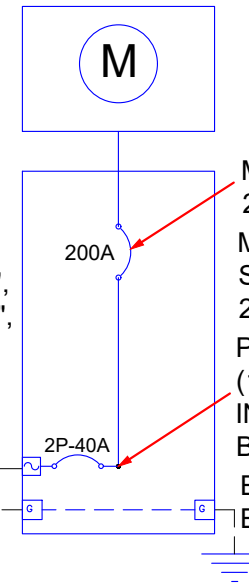


**(N) PV AC DISCONNECT**  
240VAC, 60A  
NON-FUSIBLE,  
NEMA 3R, UL LISTED  
VISIBLE, LOCKABLE, LABELED

(3) AWG #6 CU THWN-2  
(1) AWG #8 CU THWN-2 GND  
IN 1" CONDUIT



PV METER RINGLESS  
240VAC, 200A LEVER  
BYPASS, LENGTH: 14-1/2",  
WIDTH: 11", DEPTH: 4-1/8",  
MINIMUM #6 WIRE  
NEMA 3R, UL LISTED  
**MILBANK U4801-XL-5T9**



COLORADO SPRINGS UTILITIES  
REVENUE METER  
#434067  
1-PHASE, 240V

MAIN SERVICE DISCONNECT  
240V, 200A  
MAIN DISTRIBUTION PANEL  
SQD, 1P3W  
240V, 225A BUS  
POINT OF INTERCONNECTION  
(1) 2P-40A CIRCUIT BREAKER  
INSTALLED AT OPPOSITE END OF  
BUS FROM MAIN DISCONNECT  
EXISTING GROUNDING  
ELECTRODE SYSTEM

**ELECTRICAL NOTES**

- ALL EQUIPMENT TO BE LISTED BY UL OR OTHER NRTL, AND LABELED FOR ITS APPLICATION.
- ALL CONDUCTORS SHALL BE COPPER. ALUMINUM CONDUCTORS MAY BE USED IF CORRECTLY UPSIZED FOR AMPACITY RATING PER NEC 310.12 OR 310.16. ALL CONDUCTORS SHALL BE RATED FOR 600V AND 90°C WET ENVIRONMENT UNLESS OTHERWISE NOTED.
- WORKING CLEARANCES AROUND ALL NEW AND EXISTING ELECTRICAL EQUIPMENT SHALL COMPLY WITH NEC 110.26.
- DRAWINGS INDICATE THE GENERAL ARRANGEMENT OF SYSTEMS. CONTRACTOR SHALL FURNISH ALL NECESSARY OUTLETS, SUPPORTS, FITTINGS AND ACCESSORIES TO FULFILL APPLICABLE CODES AND STANDARDS.
- WHERE SIZES OF JUNCTION BOXES, RACEWAYS, AND CONDUITS ARE NOT SPECIFIED, THE CONTRACTOR SHALL SIZE THEM ACCORDINGLY. SPECIFIED CONDUIT AND WIRE SIZES ARE MINIMUM REQUIREMENTS AND LARGER SIZES SHALL BE PERMITTED.
- ALL WIRE TERMINATIONS SHALL BE APPROPRIATELY LABELED AND READILY VISIBLE.
- MAXIMUM MOUNTING HEIGHT FROM GRADE TO CENTER OF METER SOCKET SHALL BE 72" FOR RESIDENTIAL SINGLE PHASE METER SOCKETS 0-320 AMPS. MINIMUM MOUNTING HEIGHT IS 30" FROM FOR AUSTIN ENERGY, AND 48" FOR ALL OTHER JURISDICTIONS
- MINIMUM HORIZONTAL CLEARANCE FROM GAS REGULATOR TO ANY ELECTRICAL ENCLOSURE IS 36", EXCEPT AUSTIN ENERGY WHICH REQUIRES 48" CLEARANCE FROM GAS TO METER SOCKET
- PV DISCONNECT SHALL BE VISIBLE, LOCKABLE AND LABELED AND THE DOOR CANNOT BE OPENED WHEN HANDLE IS IN ON POSITION
- BY DEFAULT THE MONITORING DEVICE IS SHOWN CONNECTED TO A 20-AMP BREAKER IN THE SOLAR LOAD CENTER. ALTERNATIVELY, THE MONITORING DEVICE MAY BE CONNECTED TO A 20-AMP BREAKER AT THE MAIN DISTRIBUTION PANEL.
- ALL EQUIPMENT TERMINATIONS SHALL BE RATED FOR 75 DEGREES OR GREATER
- ALL CT WIRES SHALL BE CONSIDERED CLASS 1 PER NEC ARTICLE 725, AND BE MARKED AS RATED FOR 600V. PER 725.48(A) CLASS 1 CIRCUITS SHALL BE PERMITTED TO OCCUPY THE SAME RACEWAY AS OTHER CIRCUITS PROVIDED ALL CONDUCTORS ARE INSULATED FOR THE MAXIMUM VOLTAGE OF ANY CONDUCTOR IN THE RACEWAY.
- AWG #10 COPPER CONDUCTORS ARE SPECIFIED AS THE DEFAULT WIRE REQUIRED FROM THE PV ARRAY TO THE SOLAR LOAD CENTER, HOWEVER, AWG #12 COPPER CONDUCTORS MAY BE UTILIZED IF BOTH OF THE FOLLOWING CONDITIONS ARE MET: THE LENGTH OF THE CONDUCTOR IS LESS THAN 75 FT AND THERE ARE LESS THAN 8 CURRENT-CARRYING CONDUCTORS WITHIN THE RACEWAY.

**MOUNT CSU METER  
SOCKET CENTER 60"-72" FROM GRADE**

CALCULATIONS FOR CURRENT CARRYING CONDUCTORS	CALCULATIONS FOR OVERCURRENT DEVICES
<p>INVERTER OUTPUT WIRE AMPACITY CALCULATION [NEC 690.8(A)(1)(e)]: 1.60A PER INVERTER (ENPHASE IQ7HS-66-M-US [240V]) MAXIMUM INVERTER BRANCH CURRENT = (10)(1.60A) = 16.0A CONTINUOUS USE: #10 WIRE 75°C DERATED AMPACITY = (0.80)(35.0A) = 28.0A <b>28.0A &gt; 16.0A</b></p> <p>CONDITIONS OF USE: #10 WIRE 90°C DERATED AMPACITY = (0.91)(0.80)(40.0A) = 29.1A <b>29.1A &gt; 16.0A</b></p> <p>SOLAR LOAD CENTER OUTPUT WIRE AMPACITY CALCULATION [NEC 690.8(A)(1)(e)]: 1.60A PER INVERTER (ENPHASE IQ7HS-66-M-US [240V]) COMBINED CURRENT = (11)(1.60A) = 17.6A CONTINUOUS USE: #6 WIRE 75°C DERATED AMPACITY = (0.80)(65A) = 52.0A <b>52.0A &gt; 17.6A</b></p> <p>CONDITIONS OF USE: #6 WIRE 90°C DERATED AMPACITY = (0.91)(70A) = 63.7A <b>63.7A &gt; 17.6A</b></p>	<p>INVERTER BRANCH AC CURRENT CALCULATION [NEC 690.8(A)(1)(e)]: 1.60A PER INVERTER (ENPHASE IQ7HS-66-M-US [240V]) MAXIMUM BRANCH INVERTER CURRENT = (10)(1.60A) = 16.0A MINIMUM OCPD = (16.0A)(1.25) = 20.0A USE 2P-20A BREAKERS IN SOLAR LOAD CENTER FOR INVERTER BRANCH OCPD</p> <p>SYSTEM AC CURRENT CALCULATION [NEC 690.8(A)(1)(e)]: 1.60A PER INVERTER (ENPHASE IQ7HS-66-M-US [240V]) COMBINED CURRENT = (11)(1.60A) = 17.6A MINIMUM OCPD = (17.6A)(1.25) = 22.0A USE 2P-40A BREAKER IN MDP FOR SYSTEM OCPD</p>

CONTRACTOR

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TECL # 28621

REVISIONS		
DESCRIPTION	DATE	REV
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PE STAMP

PROJECT NAME

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1815 N TEJON STREET  
COLORADO SPRINGS,  
COLORADO, 80907  
(719) 323-3447

SHEET NAME

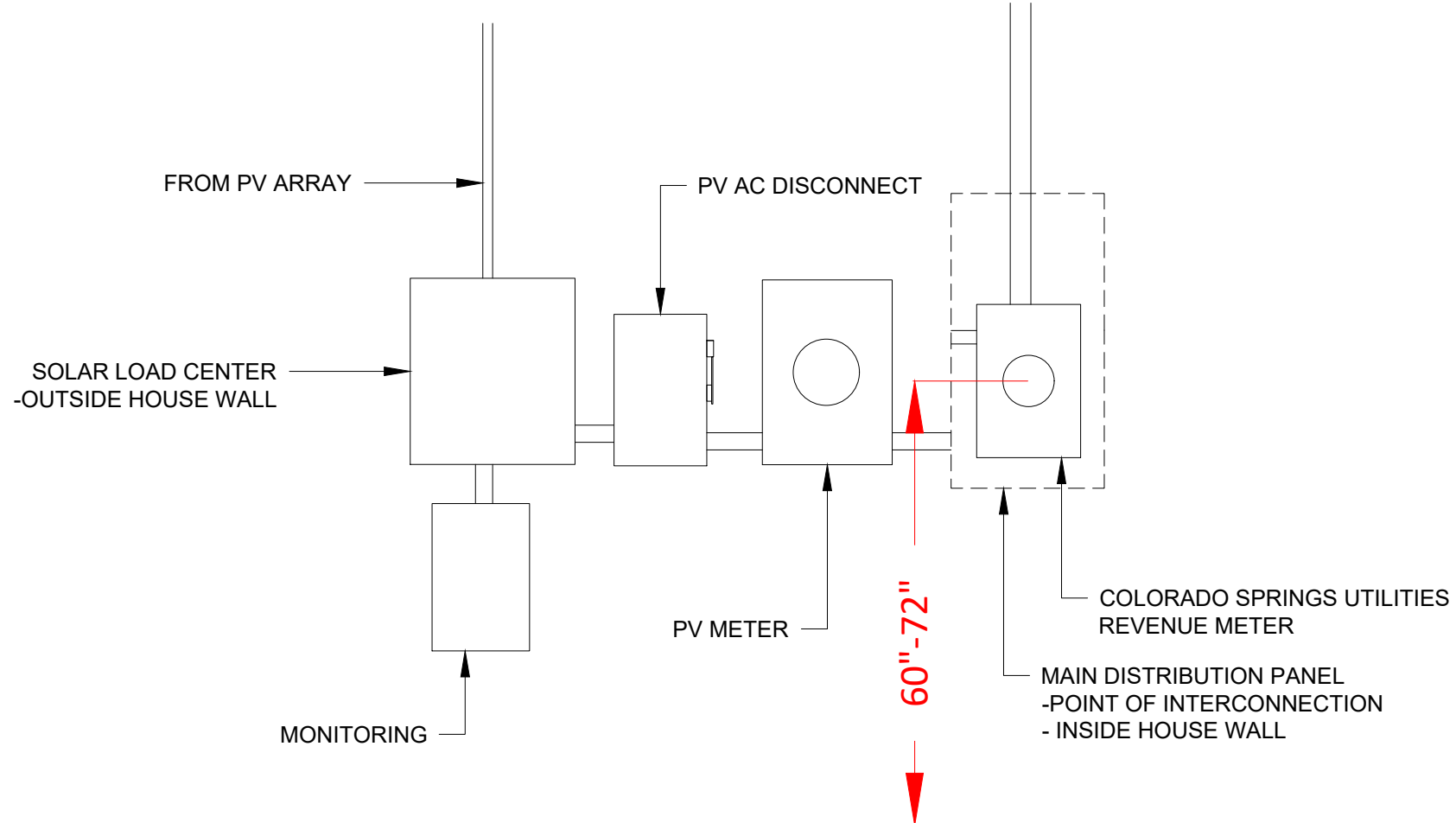
**ELECTRICAL  
DIAGRAM  
HOUSE**

SHEET SIZE

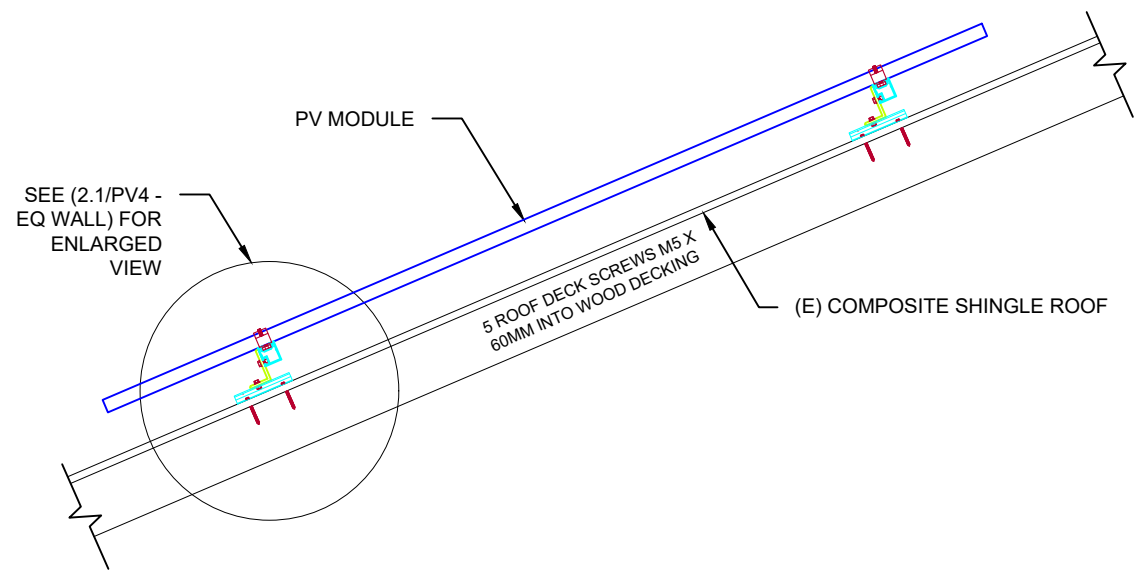
**ANSI B  
11" x 17"**

SHEET NUMBER

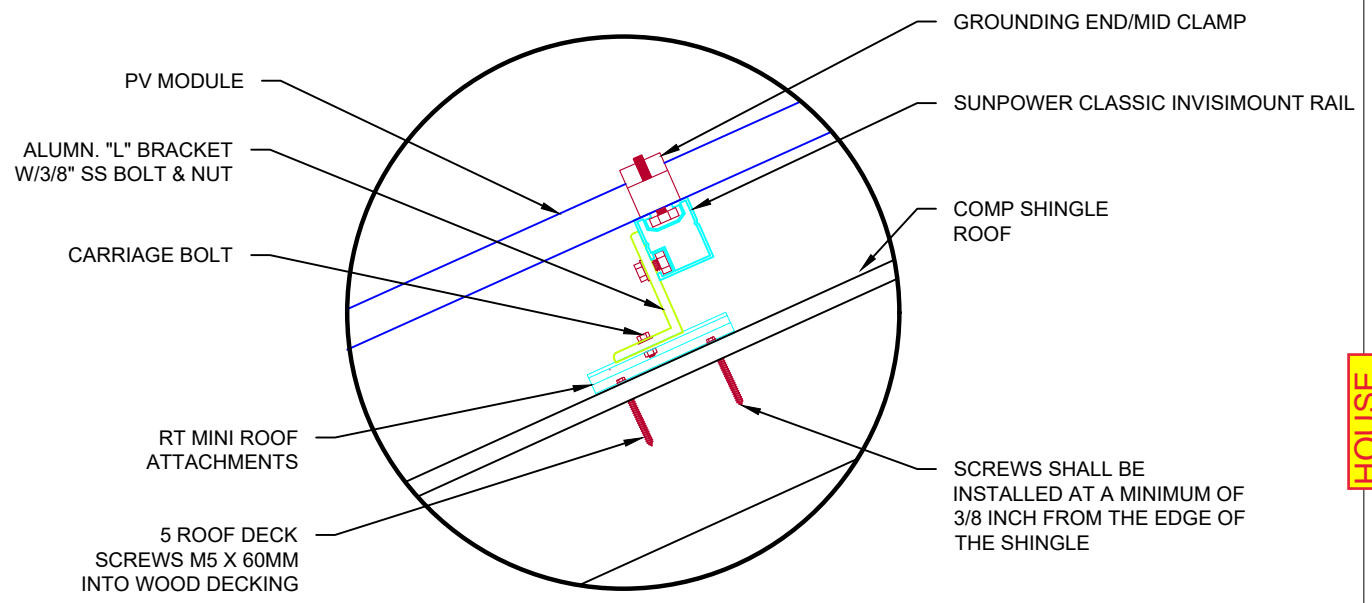
**PV-3**



EQUIPMENT ELEVATION  
NTS 1



MOUNTING METHOD  
NTS 2



MOUNTING DETAIL  
NTS 3

CONTRACTOR

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SOLAR POWER**

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512-759-8313  
TECL # 28621

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PROJECT NAME

**MICHAEL G KNAUP**  
1815 N TEJON STREET  
COLORADO SPRINGS,  
COLORADO, 80907  
(719) 323-3447

**HOUSE** SHEET NAME

**EQ.WALL &  
MOUNTING DETAIL**

SHEET SIZE

**ANSI B**  
11" x 17"

SHEET NUMBER

**PV-4**

NOTE: NOT ALL LABELS MAY BE APPLICABLE

**WARNING**  
ELECTRIC SHOCK HAZARD.  
DO NOT TOUCH TERMINALS.  
TERMINALS ON BOTH THE  
LINE AND LOAD SIDES MAY BE  
ENERGIZED IN THE OPEN  
POSITION.

REQ'D BY: NEC 690.13 (B)

A

APPLY TO:  
PV DISCONNECT

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

REQ'D BY: 705.12(B)(3)(3)

B

APPLY TO:  
SOLAR LOAD CENTER

**PV SYSTEM DISCONNECT**  
  
OPERATING CURRENT: 17.6 A  
OPERATING VOLTAGE: 240 VAC

REQ'D BY: NEC 690.13(B); 690.54

C

APPLY TO:  
PV DISCONNECT

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

REQ'D BY: NEC 705.12(B)(3)(2)

D

APPLY TO:  
PV SYSTEM BREAKER

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

REQ'D BY: NEC 705.12(C)

E

MAIN SERVICE PANEL

**WARNING: PHOTOVOLTAIC  
POWER SOURCE**

REQ' BY: NEC 690.31(D)(2)\*

F

APPLY TO:  
CONDUIT EVERY 10 FT  
(\*ONLY REQUIRED FOR RACEWAYS  
WITH PV DC CIRCUITS)

**PV METER**

REQ'D BY: AHJ

G

APPLY TO:  
PV METER SOCKET  
(IF APPLICABLE)

**SOLAR PV SYSTEM EQUIPPED  
WITH RAPID SHUTDOWN**

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN THE ARRAY.

REQ'D BY: FREEDOM SOLAR

H

APPLY TO:  
MAIN DISTRIBUTION PANEL

**CAUTION:  
MULTIPLE SOURCES OF POWER**

POWER TO THIS BUILDING IS ALSO SUPPLIED FROM THE FOLLOWING SOURCES WITH DISCONNECTS AS SHOWN:

- UTILITY SUPPLY & CUSTOMER SERVICE PANEL
- PV AC DISCONNECT
- RAPID SHUTDOWN SWITCH

FRONT

REQ'D BY: 705.10\*

I

APPLY TO:  
MAIN DISTRIBUTION PANEL  
(\*ONLY REQUIRED IF PV SYSTEM  
DISCONNECT IS NOT GROUPED  
WITH MAIN SERVICE DISCONNECT)  
**SEE SHEET PV-6 FOR SITE  
SPECIFIC LABEL**

**RAPID SHUTDOWN SWITCH  
FOR SOLAR PV SYSTEM**

REQ'D BY: NEC 690.56(D)(2)

J

APPLY TO:  
PV DISCONNECT

CONTRACTOR

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SOLAR POWER**

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COLORADO, 80907  
(719) 323-3447

SHEET NAME

SYSTEM LABELING  
DETAIL  
**HOUSE**

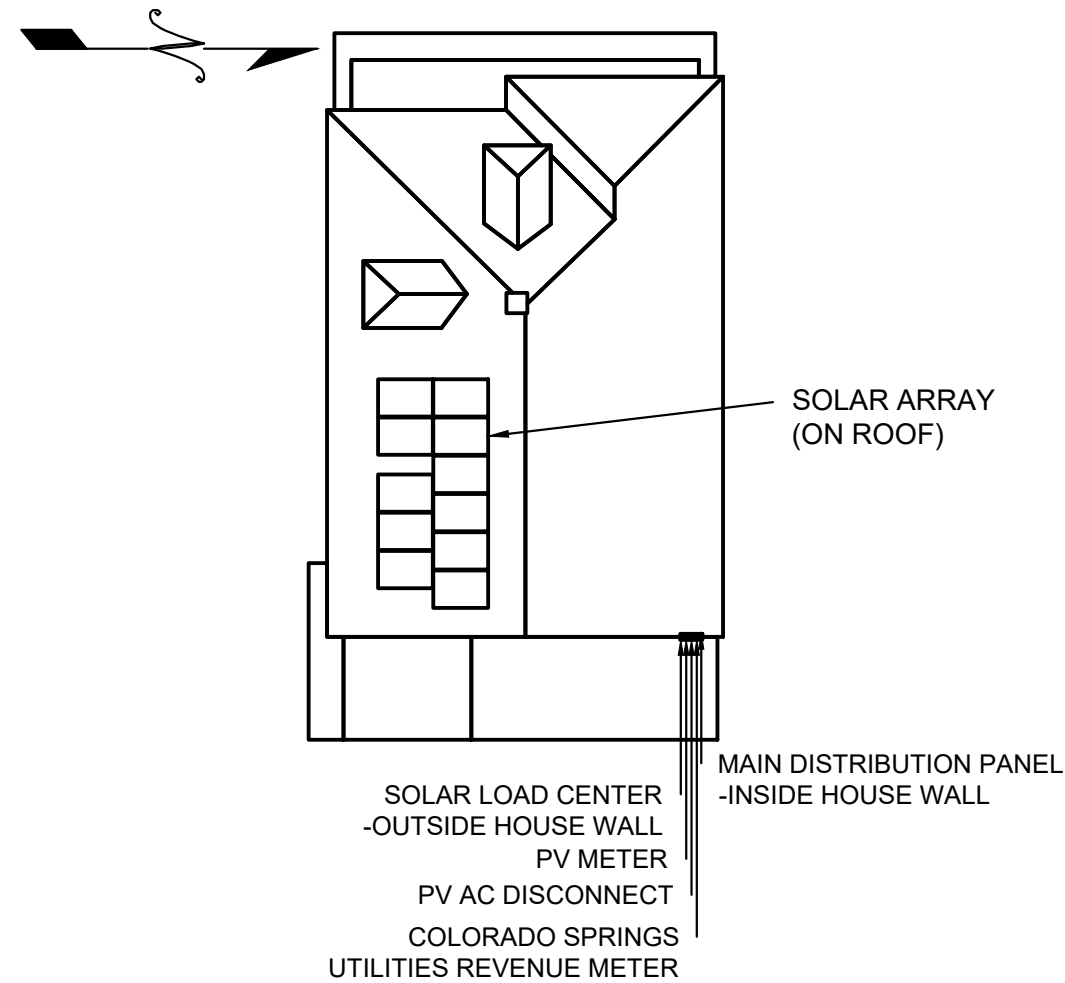
SHEET SIZE

ANSI B  
11" x 17"

SHEET NUMBER

PV-5

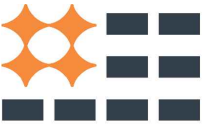
**CAUTION:**  
**MULTIPLE SOURCES OF POWER**  
**LOCATION OF EACH POWER SOURCE**  
**DISCONNECTING MEANS SHOWN BELOW**



QUESTIONS, CALL:  
 800-504-2337  
[www.freedomsolarpower.com](http://www.freedomsolarpower.com)

**FREEDOM**  
**SOLAR POWER**  
 1815 N TEJON STREET  
 PROJECT ID: 113645

CONTRACTOR



**FREEDOM**  
**SOLAR POWER**

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 AUSTIN, TX 78744  
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 TECL # 28621

REVISIONS

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PE STAMP

Blank area for PE stamp.

PROJECT NAME

MICHAEL G KNAUP  
 1815 N TEJON STREET  
 COLORADO SPRINGS,  
 COLORADO, 80907  
 (719) 323-3447

SHEET NAME

SITE  
 DIRECTORY  
 PLACARD  
**HOUSE**

SHEET SIZE

ANSI B  
 11" x 17"

SHEET NUMBER

PV-6

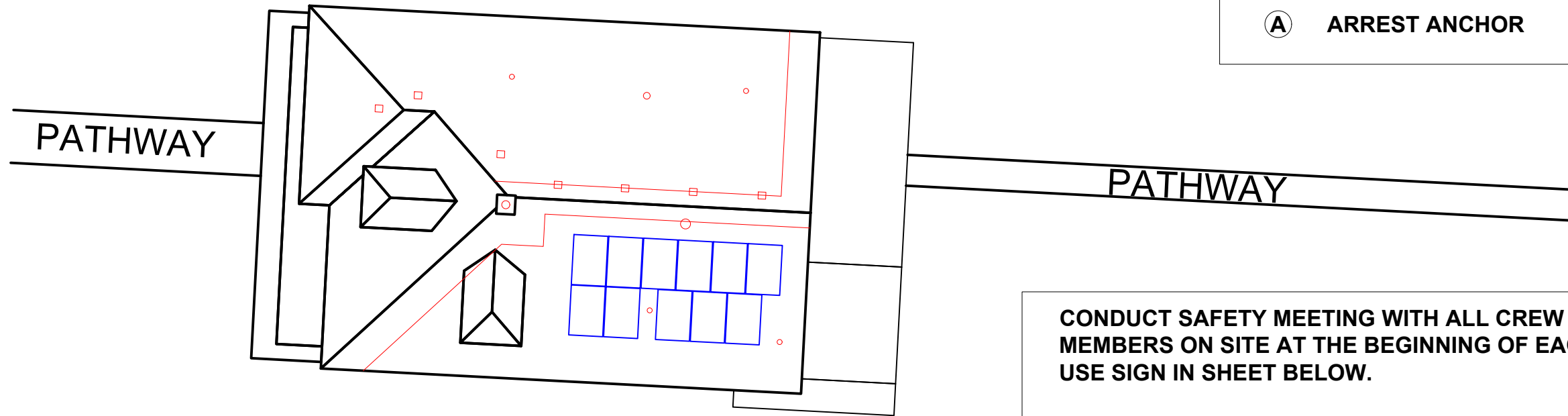


USE THE SAFETY SYMBOL KEY TO DRAW IN THE CONTROLLED ACCESS ZONE (CAZ), LADDER PLACEMENT, METER LOCATION, FALL PROTECTION ANCHOR POINT, AND ANY OTHER HAZARD.

HARD HAT IS REQUIRED AT ALL TIMES IN CAZ

**SAFETY SYMBOL KEY**

- CAZ
- L** LADDER
- M** METER
- ==== POWER LINES
- R** RESTRAINT ANCHOR
- A** ARREST ANCHOR



**CONDUCT SAFETY MEETING WITH ALL CREW MEMBERS ON SITE AT THE BEGINNING OF EACH JOB. USE SIGN IN SHEET BELOW.**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

**GUEST SIGN IN**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

COMPETENT PERSON: \_\_\_\_\_ JOB START DATE: \_\_\_\_\_

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PROJECT NAME

MICHAEL G KNAUP  
 1815 N TEJON STREET  
 COLORADO SPRINGS,  
 COLORADO, 80907  
 (719) 323-3447

SHEET NAME

SAFETY PLAN  
**HOUSE**

SHEET SIZE

ANSI B  
 11" x 17"

SHEET NUMBER

**PV-7**

LEAD ID: 113647

(N) CONSTRUCTION SUMMARY

- (8) (SUNPOWER SPR-M440-H-AC) SOLAR MODULES, 3.520 kW DC STC  
MODULE DIMENSIONS = 40.6" X 73.7" X 1.57"
- (8) ENPHASE IQ7HS-66-M-US [240V] PV INVERTERS  
COMBINED INVERTER OUTPUT = 3.072 kW AC.
- (86) (8 X 10.75') LINEAR FEET SUNPOWER UNIVERSAL INVISIMOUNT
- (48) RT-MINI ROOF ATTACHMENTS

(E) CONSTRUCTION SUMMARY

- (08) (SUNPOWER SPR-A410-G-AC) SOLAR MODULES, 3.280 kW DC STC  
MODULE DIMENSIONS = 40.0" X 72.2" X 1.57"
- (08) ENPHASE IQ7AS [240V] PV INVERTERS  
COMBINED INVERTER OUTPUT = 2.792 kW AC.
- (76) (7 X 10.75') LINEAR FEET SUNPOWER INVISIMOUNT
- (36) SPCR-CH ROOF ATTACHMENTS
- (01) SUNPOWER MONITORING
- (01) TESLA ENERGY GATEWAY
- (01) TESLA POWERWALL 2.0 BATTERY

(N) SITE DETAILS

ROOF TYPE: ASPHALT SHINGLE  
 ARRAY #1 - TILT = 30°, AZIMUTH = 272°  
 ARRAY #2 - TILT = 30°, AZIMUTH = 2°  
 ARRAY #3 - TILT = 29°, AZIMUTH = 92°

(E) SITE DETAILS

ROOF TYPE: ASPHALT SHINGLE  
 ARRAY #1 - TILT = 28°, AZIMUTH = 184°  
 ARRAY #2 - TILT = 29°, AZIMUTH = 94°

DESIGN CRITERIA:

SITE ELEVATION = 6,097 FT  
 130 MPH VULT, EXPOSURE C,  
 SNOW LOAD = 30 PSF ROOF LOAD, 43 PSF GROUND LOAD

(N) ARRAY AREA

(40.6"/12) X (73.7"/12) X 08 = 166.2 SQUARE FT

(E) ARRAY AREA

(40.0"/12) X (72.2"/12) X 08 = 160.4 SQUARE FT

DO NOT CUT AND COVER ROOF VENTS

PHASE 2 ADDITION OF (08) MODULES TO AN EXISTING SYSTEM

FALL PROTECTION REQUIRED

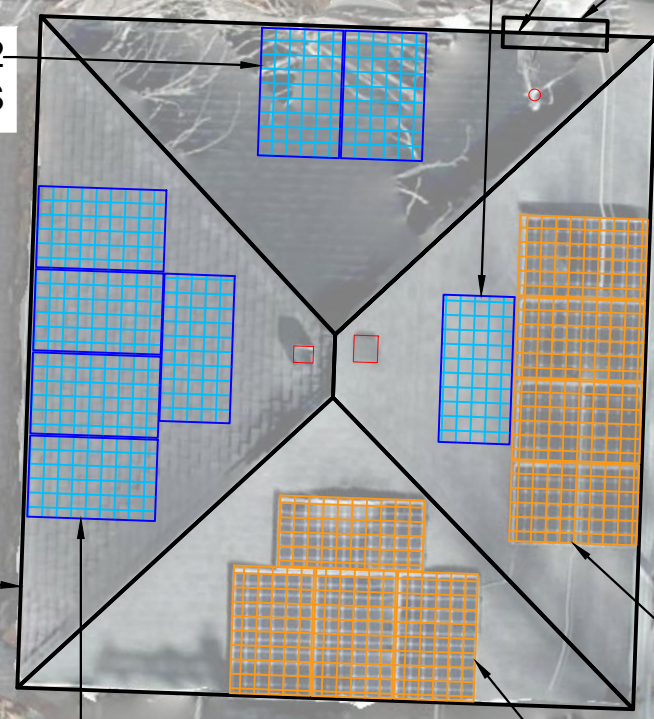
CONSTRUCTION NOTES

- 1.) ALL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.
- 2.) ALL OUTDOOR EQUIPMENT SHALL BE RAINTIGHT WITH MINIMUM NEMA 3R RATING.
- 3.) ALL LOCATIONS ARE APPROXIMATE AND REQUIRE FIELD VERIFICATION.

DETACHED GARAGE

(N) PV ARRAY #2 (02) MODULES

(N) PV ARRAY #3 (01) MODULES



(E) MAIN DISTRIBUTION PANEL  
(E) TESLA POWERWALL 2.0 BATTERY (INSIDE GARAGE WALL)

(E) COLORADO SPRINGS UTILITIES REVENUE METER #414555  
 (E) GROUNDING ELECTRODE  
 (E) SERVICE DISCONNECT  
 (E) TESLA ENERGY GATEWAY  
 (E) GENERATION PANEL  
 (E) PV METER  
 (E) MONITORING  
 (N) PV AC DISCONNECT #1  
 (N) PV AC DISCONNECT #2  
 -VISIBLE  
 -LOCKABLE  
 -LABELED  
 (OUTSIDE GARAGE WALL)

(E) PV ARRAY #2 (04) MODULES

(N) PV ARRAY #1 (05) MODULES

(E) PV ARRAY #1 (04) MODULES



CONTRACTOR

**FREEDOM SOLAR POWER**  
 FREEDOM SOLAR LLC  
 4801 FREIDRICH LN, STE 100  
 AUSTIN, TX 78744  
 512-759-8313  
 TECL # 28621

REVISIONS		
DESCRIPTION	DATE	REV
DESIGN PACKET	01/24/2024	

PE STAMP

PROJECT NAME

MICHAEL G KNAUP  
 1815N TEJON STREET  
 COLORADO SPRINGS,  
 COLORADO, 80907  
 (719) 323-3447

SHEET NAME

SITE MAP & PV LAYOUT  
**GARAGE**

SHEET SIZE

ANSI B  
 11" x 17"

SHEET NUMBER

**PV-8**

**PHASE 2 ADDITION OF (08) MODULES TO AN EXISTING SYSTEM**



CONTRACTOR

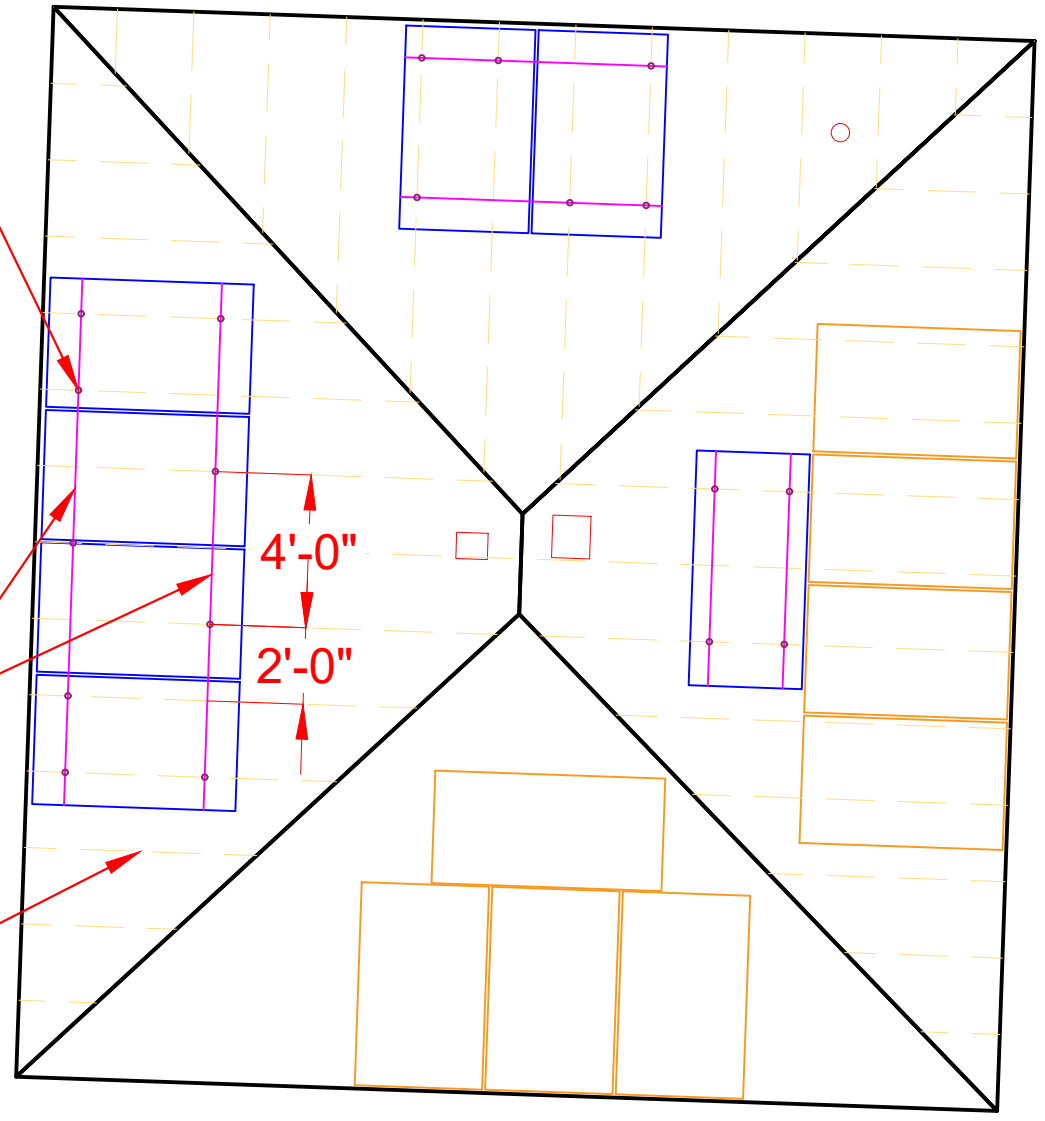
**FREEDOM SOLAR POWER**

FREEDOM SOLAR LLC  
4801 FREIDRICH LN, STE 100  
AUSTIN, TX 78744  
512-759-8313  
TECL # 28621

5-M5 X 60MM SCREWS INTO DECKING PER ATTACHMENT  
MAXIMUM ATTACHMENT SPAN IS 48" O.C. STAGGERED ALONG RAILS  
(MAX OFFSET SPAN IS 36" FROM OPPOSITE RAIL ATTACHMENT)

(2)RAILS PER ROW OF MODULES EVENLY SPACED

2"X4" MANUFACTURED TRUSSES AT 24" O.C. TYP.



REVISIONS

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DESIGN PACKET	01/24/2024	

PE STAMP

PROJECT NAME

MICHAEL G KNAUP  
1815N TEJON STREET  
COLORADO SPRINGS,  
COLORADO, 80907  
(719) 323-3447

SHEET NAME

RACKING PLAN  
**GARAGE**

SHEET SIZE

ANSI B  
11" x 17"

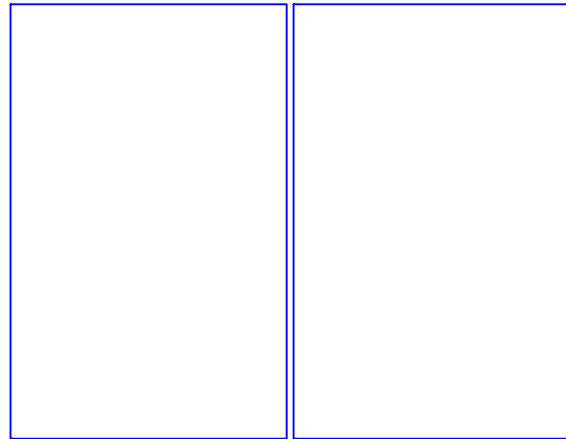
SHEET NUMBER

**PV-8A**

CONSTRUCTION NOTES

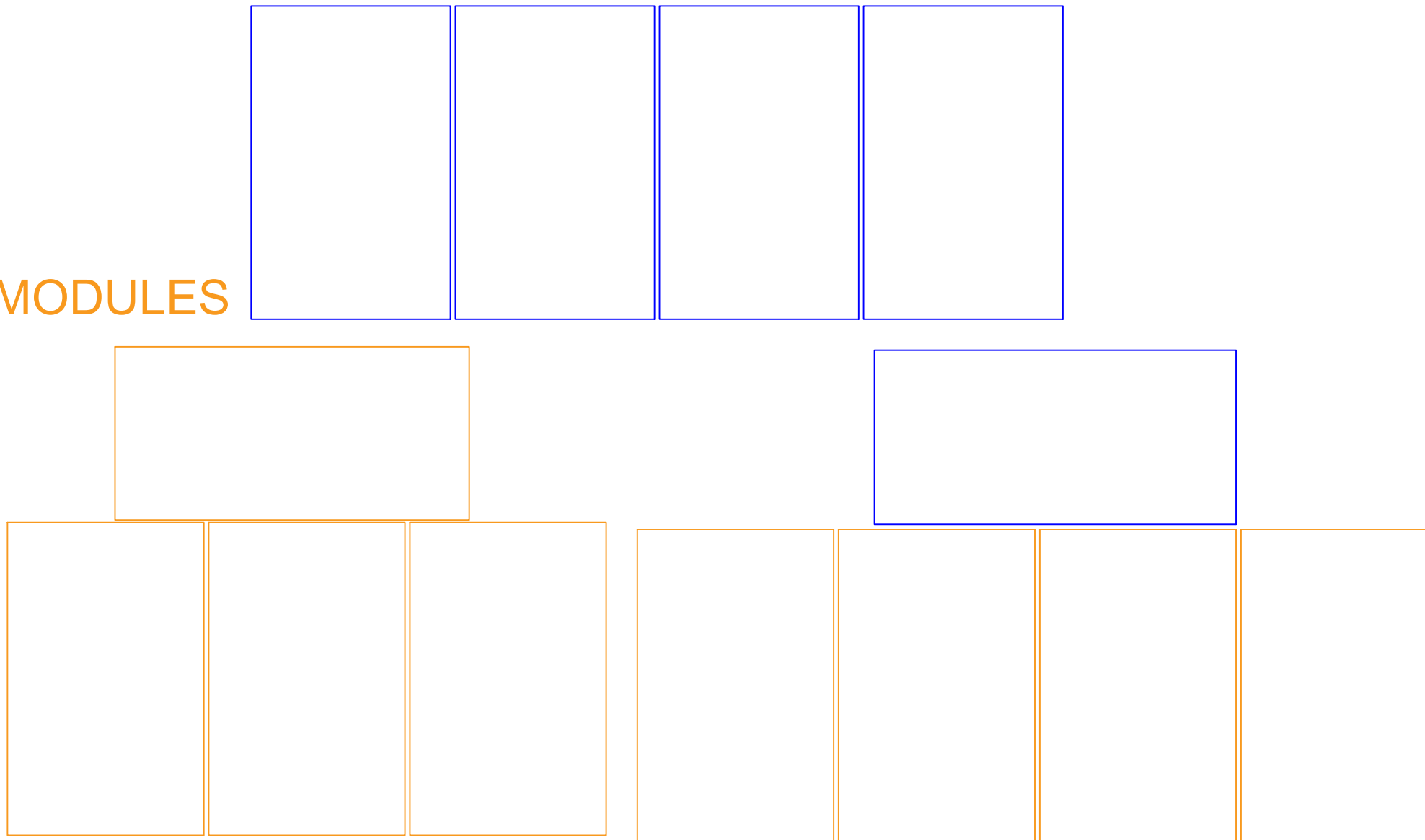
- 1.) ALL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.
- 2.) ALL OUTDOOR EQUIPMENT SHALL BE RAINTIGHT WITH MINIMUM NEMA 3R RATING.
- 3.) ALL LOCATIONS ARE APPROXIMATE AND REQUIRE FIELD VERIFICATION.

NEW MODULES



PHASE 2 ADDITION OF (08) MODULES TO AN EXISTING SYSTEM

EXISTING MODULES



SUNPOWER SUPERVISOR S/N \_\_\_\_\_

CONTRACTOR



**FREEDOM<sup>™</sup>  
SOLAR POWER**

FREEDOM SOLAR LLC  
4801 FREIDRICH LN, STE 100  
AUSTIN, TX 78744  
512-759-8313  
TECL # 28621

REVISIONS		
DESCRIPTION	DATE	REV
DESIGN PACKET	01/24/2024	

PE STAMP

PROJECT NAME

MICHAEL G KNAUP  
1815N TEJON STREET  
COLORADO SPRINGS,  
COLORADO, 80907  
(719) 323-3447

SHEET NAME

STRING MAP &  
MONITORING  
LAYOUT

**GARAGE**

SHEET SIZE

ANSI B  
11" x 17"

SHEET NUMBER

PV-9

(E) SOLAR ARRAY - 3.280kW DC STC, 2.792 kW AC  
 (08) (SUNPOWER SPR-A410-G-AC) MODULES  
 (N) SOLAR ARRAY - 3.520kW DC STC, 3.072 kW AC  
 (08) (SUNPOWER SPR-M440-H-AC) MODULES

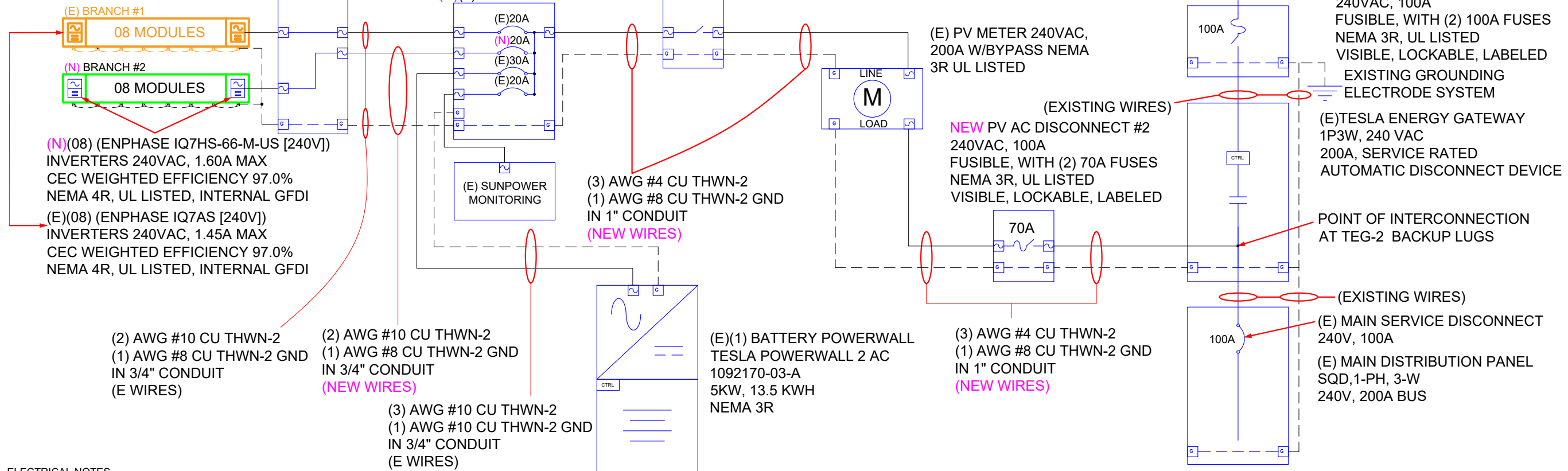
(E) ROOFTOP JUNCTION BOX:  
 TRANSITION FROM DG CABLE  
 TO AWG #10 THWN-2  
 NEMA 3R, UL LISTED

(E) GENERATION PANEL  
 240 VAC, 125A  
 NEMA 3R, UL LISTED  
 (E)(2) 2P-20A BREAKERS  
 (E)(1) 2P-30A BREAKER  
 (N)(1) 2P-20A BREAKER

(N) PV AC DISCONNECT #1  
 240VAC, 100A  
 NON-FUSIBLE,  
 NEMA 3R, UL LISTED  
 VISIBLE, LOCKABLE, LABELED

PHASE 2 ADDITION OF (08) MODULES  
 TO AN EXISTING SYSTEM

(E) COLORADO SPRINGS  
 REVENUE METER  
 #414555  
 1-PHASE, 240V



ELECTRICAL NOTES

- 1.) ALL EQUIPMENT TO BE LISTED BY UL OR OTHER NRTL, AND LABELED FOR ITS APPLICATION.
- 2.) ALL CONDUCTORS SHALL BE COPPER. ALUMINUM CONDUCTORS MAY BE USED IF CORRECTLY UPSIZED FOR AMPACITY RATING PER NEC 310.12 OR 310.16. ALL CONDUCTORS SHALL BE RATED FOR 600V AND 90°C WET ENVIRONMENT UNLESS OTHERWISE NOTED.
- 3.) WORKING CLEARANCES AROUND ALL NEW AND EXISTING ELECTRICAL EQUIPMENT SHALL COMPLY WITH NEC 110.26.
- 4.) DRAWINGS INDICATE THE GENERAL ARRANGEMENT OF SYSTEMS. CONTRACTOR SHALL FURNISH ALL NECESSARY OUTLETS, SUPPORTS, FITTINGS AND ACCESSORIES TO FULFILL APPLICABLE CODES AND STANDARDS.
- 5.) WHERE SIZES OF JUNCTION BOXES, RACEWAYS, AND CONDUITS ARE NOT SPECIFIED, THE CONTRACTOR SHALL SIZE THEM ACCORDINGLY. SPECIFIED CONDUIT AND WIRE SIZES ARE MINIMUM REQUIREMENTS AND LARGER SIZES SHALL BE PERMITTED.
- 6.) ALL WIRE TERMINATIONS SHALL BE APPROPRIATELY LABELED AND READILY VISIBLE.
- 7.) MAXIMUM MOUNTING HEIGHT FROM GRADE TO CENTER OF METER SOCKET SHALL BE 72" FOR RESIDENTIAL SINGLE PHASE METER SOCKETS 0-320 AMPS. MINIMUM MOUNTING HEIGHT IS 30" FROM FOR AUSTIN ENERGY, AND 48" FOR ALL OTHER JURISDICTIONS
- 8.) MINIMUM HORIZONTAL CLEARANCE FROM GAS REGULATOR TO ANY ELECTRICAL ENCLOSURE IS 36", EXCEPT AUSTIN ENERGY WHICH REQUIRES 48" CLEARANCE FROM GAS TO METER SOCKET
- 9.) PV DISCONNECT SHALL BE VISIBLE, LOCKABLE AND LABELED AND THE DOOR CANNOT BE OPENED WHEN HANDLE IS IN ON POSITION
- 10.) BY DEFAULT THE MONITORING DEVICE IS SHOWN CONNECTED TO A 20-AMP BREAKER IN THE SOLAR LOAD CENTER. ALTERNATIVELY, THE MONITORING DEVICE MAY BE CONNECTED TO A 20-AMP BREAKER AT THE MAIN DISTRIBUTION PANEL.
- 11.) ALL EQUIPMENT TERMINATIONS SHALL BE RATED FOR 75 DEGREES OR GREATER
- 12.) ALL CT WIRES SHALL BE CONSIDERED CLASS 1 PER NEC ARTICLE 725, AND BE MARKED AS RATED FOR 600V. PER 725.48(A) CLASS 1 CIRCUITS SHALL BE PERMITTED TO OCCUPY THE SAME RACEWAY AS OTHER CIRCUITS PROVIDED ALL CONDUCTORS ARE INSULATED FOR THE MAXIMUM VOLTAGE OF ANY CONDUCTOR IN THE RACEWAY.
- 13.) AWG #10 COPPER CONDUCTORS ARE SPECIFIED AS THE DEFAULT WIRE REQUIRED FROM THE PV ARRAY TO THE SOLAR LOAD CENTER, HOWEVER, AWG #12 COPPER CONDUCTORS MAY BE UTILIZED IF BOTH OF THE FOLLOWING CONDITIONS ARE MET: THE LENGTH OF THE CONDUCTOR IS LESS THAN 75 FT AND THERE ARE LESS THAN 8 CURRENT-CARRYING CONDUCTORS WITHIN THE RACEWAY.

VERIFY EXISTING GROUNDING ELECTRODE  
 CONDUCTOR, WIRE MUST BE SIZED PER NEC 250.66

EXISTING & NEW CALCULATIONS FOR CURRENT CARRYING CONDUCTORS	EXISTING & NEW CALCULATIONS FOR OVERCURRENT DEVICES
<p>INVERTER OUTPUT WIRE AMPACITY CALCULATION            [NEC 690.8(A)(1)(e)]: (E)1.45A PER INVERTER ( ENPHASE IQ7AS [240V])            [NEC 690.8(A)(1)(e)]: (N)1.60A PER INVERTER ( ENPHASE IQ7HS-66-M-US [240V])            MAXIMUM INVERTER BRANCH CURRENT = (10)(1.60A) = 16.0A            CONTINUOUS USE:            #10 WIRE 75°C DERATED AMPACITY = (0.80)(35.0A) = 28.0A  <b>28.0A &gt; 16.0A</b></p> <p>CONDITIONS OF USE:            #10 WIRE 90°C DERATED AMPACITY = (0.91)(1.0)(40.0A) = 36.4A  <b>36.4A &gt; 16.0A</b></p> <p>GENERATION PANEL OUTPUT WIRE AMPACITY CALCULATION            [NEC 690.8(A)(1)(e)]: (E)1.45A PER INVERTER ( ENPHASE IQ7AS [240V])            [NEC 690.8(A)(1)(e)]: (N)1.60A PER INVERTER ( ENPHASE IQ7HS-66-M-US [240V])            (E)COMBINED CURRENT = (08)(1.45A)+(24.0A) = 35.6A            (N)COMBINED CURRENT = (08)(1.60A) = 12.8A  <b>TOTAL COMBINED CURRENT = (35.6)+(12.8A) = 48.4A</b>            CONTINUOUS USE:            #4 WIRE 75°C DERATED AMPACITY = (0.80)(85A) = 68.0A  <b>68.0A &gt; 48.4A</b></p> <p>CONDITIONS OF USE:            #4 WIRE 90°C DERATED AMPACITY = (0.91)(95A) = 86.5A  <b>86.5A &gt; 48.4A</b></p>	<p>INVERTER BRANCH AC CURRENT CALCULATION            [NEC 690.8(A)(1)(e)]: (E)1.45A PER INVERTER ( ENPHASE IQ7AS [240V])            [NEC 690.8(A)(1)(e)]: (N)1.60A PER INVERTER ( ENPHASE IQ7HS-66-M-US [240V])            MAXIMUM BRANCH INVERTER CURRENT = (10)(1.60A) = 16.0A            MINIMUM OCPD = (16.0A)(1.25) = 20.0A            USE 2P-20A BREAKERS IN GENERATION PANEL CENTER FOR INVERTER BRANCH OCPD</p> <p>SYSTEM AC CURRENT CALCULATION            [NEC 690.8(A)(1)(e)]: (E)1.45A PER INVERTER ( ENPHASE IQ7AS [240V])            [NEC 690.8(A)(1)(e)]: (N)1.60A PER INVERTER ( ENPHASE IQ7HS-66-M-US [240V])            (E)COMBINED CURRENT = (08)(1.45A)+(24.0A) = 35.6A            (N)COMBINED CURRENT = (08)(1.60A) = 12.8A  <b>TOTAL COMBINED CURRENT = (35.6A)+(12.8A) = 48.4A</b>            MINIMUM OCPD = (48.4A)(1.25) = 60.5A            USE (N)2) 70A FUSES IN PV AC DISCONNECT FOR SYSTEM OCPD  <b>NOTE : AWG #4 CONDUCTORS ARE ADEQUATELY PROTECTED BY (N)70A FUSES</b></p> <p>EXISTING CALCULATION FOR OVERCURRENT POWERWALL DEVICES</p> <p>TESLA POWERWALL OUTPUT CURRENT CALCULATION            (E) 24.0A PER TESLA POWERWALL 2.0 BATTERY INVERTER            COMBINED CURRENT = (24.0)(1) = 24.0A            MINIMUM OCPD = (24.0)(1.25) = 30.0A            USE (E)(1) 2P-30A BREAKER IN GENERATION PANEL FOR POWERWALL OCPD</p>

CONTRACTOR

**FREEDOM SOLAR POWER**  
 FREEDOM SOLAR LLC  
 4801 FREIDRICH LN, STE 100  
 AUSTIN, TX 78744  
 512-759-8313  
 TECL # 28621

REVISIONS

DESCRIPTION	DATE	REV
DESIGN PACKET	01/24/2024	

PE STAMP

PROJECT NAME

**MICHAEL G KNAUP**  
 1815N TEJON STREET  
 COLORADO SPRINGS,  
 COLORADO, 80907  
 (719) 323-3447

SHEET NAME

**ELECTRICAL  
 DIAGRAM  
 GARAGE**

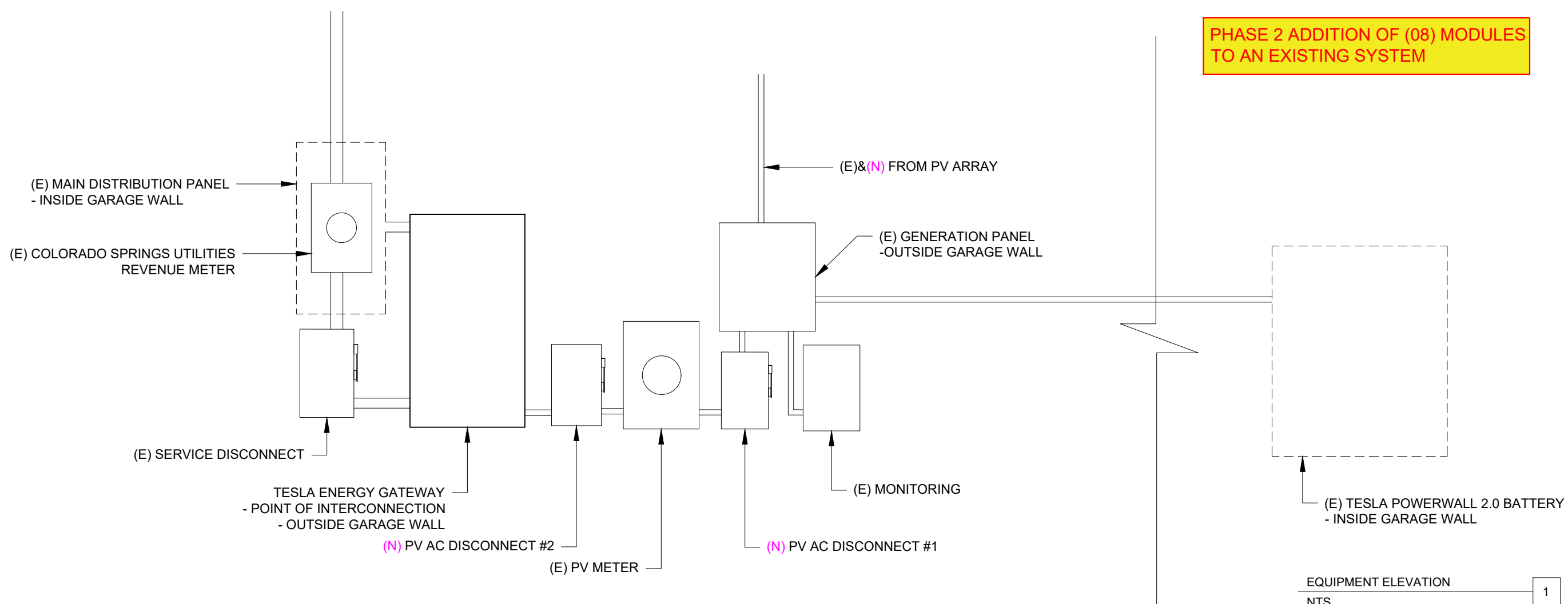
SHEET SIZE

**ANSI B  
 11" x 17"**

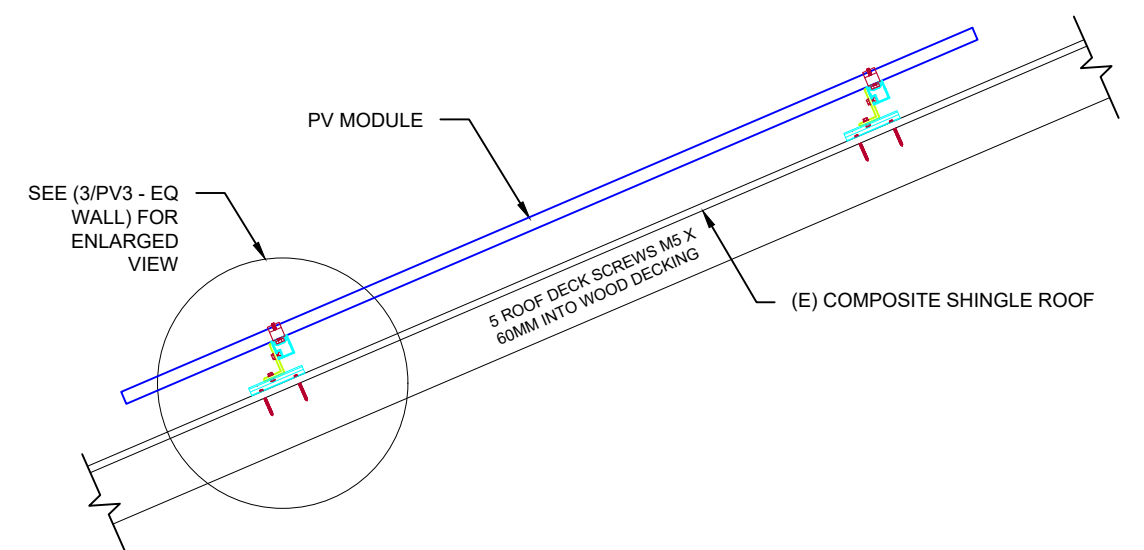
SHEET NUMBER

**PV-10**

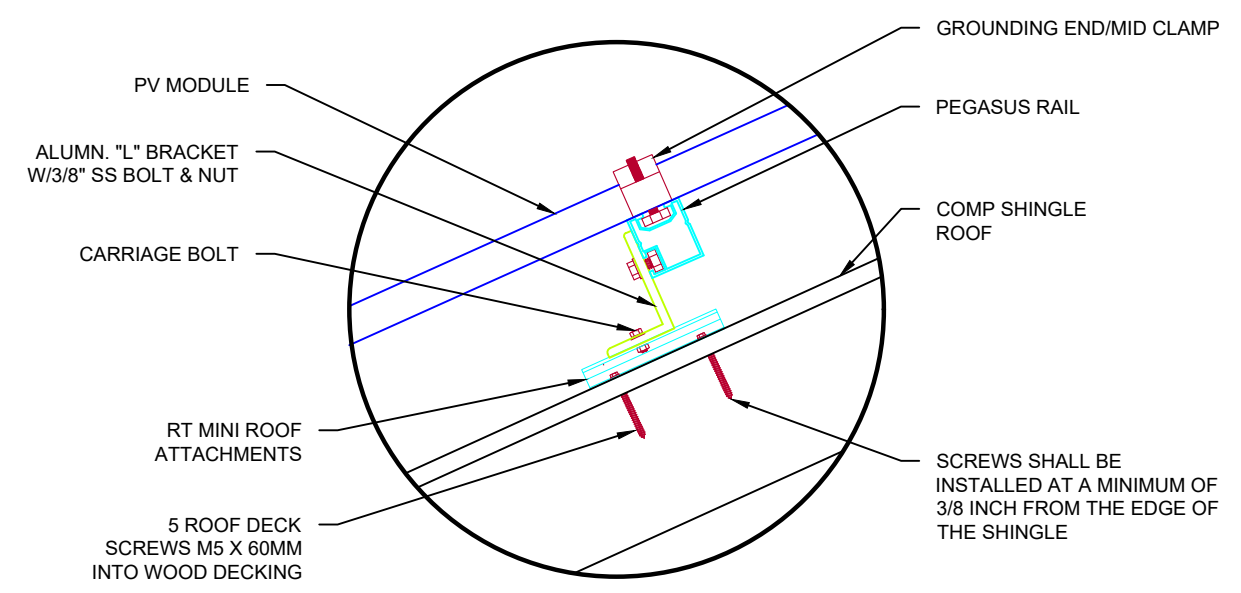
**PHASE 2 ADDITION OF (08) MODULES TO AN EXISTING SYSTEM**



EQUIPMENT ELEVATION  
NTS 1



MOUNTING METHOD  
NTS 2



MOUNTING DETAIL  
NTS 3

CONTRACTOR

**FREEDOM SOLAR POWER**

FREEDOM SOLAR LLC  
4801 FREIDRICH LN, STE 100  
AUSTIN, TX 78744  
512-759-8313  
TECL # 28621

REVISIONS

DESCRIPTION	DATE	REV
DESIGN PACKET	01/24/2024	

PE STAMP

PROJECT NAME

**MICHAEL G KNAUP**  
1815N TEJON STREET  
COLORADO SPRINGS,  
COLORADO, 80907  
(719) 323-3447

**GARAGE** SHEET NAME

**EQ.WALL**

SHEET SIZE

**ANSI B**  
11" x 17"

SHEET NUMBER

**PV-11**

NOTE: NOT ALL LABELS MAY BE APPLICABLE

**WARNING**  
ELECTRIC SHOCK HAZARD.  
DO NOT TOUCH TERMINALS.  
TERMINALS ON BOTH THE  
LINE AND LOAD SIDES MAY BE  
ENERGIZED IN THE OPEN  
POSITION.

REQ'D BY: NEC 690.13 (B)  
APPLY TO:  
PV DISCONNECT

A

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

REQ'D BY: 705.12(B)(3)(3)  
APPLY TO:  
SOLAR LOAD CENTER

B

**PV SYSTEM DISCONNECT**  
OPERATING CURRENT: 48.4 A  
OPERATING VOLTAGE: 240 VAC

REQ'D BY: NEC 690.13(B); 690.54  
APPLY TO:  
PV DISCONNECT

C

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

REQ'D BY: NEC 705.12(B)(3)(2)  
APPLY TO:  
PV SYSTEM BREAKER

D

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

REQ'D BY: NEC 705.12(C)  
MAIN SERVICE PANEL

E

**WARNING: PHOTOVOLTAIC  
POWER SOURCE**

REQ' BY: NEC 690.31(D)(2)\*  
APPLY TO:  
CONDUIT EVERY 10 FT  
(\*ONLY REQUIRED FOR RACEWAYS  
WITH PV DC CIRCUITS)

F

**PV METER**

REQ'D BY: AHJ  
APPLY TO:  
PV METER SOCKET  
(IF APPLICABLE)

G

**SOLAR PV SYSTEM EQUIPPED  
WITH RAPID SHUTDOWN**

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN THE ARRAY.

REQ'D BY: FREEDOM SOLAR  
APPLY TO:  
MAIN DISTRIBUTION PANEL

H

**CAUTION:  
MULTIPLE SOURCES OF POWER**

POWER TO THIS BUILDING IS ALSO SUPPLIED FROM THE FOLLOWING SOURCES WITH DISCONNECTS AS SHOWN:

- UTILITY SUPPLY & CUSTOMER SERVICE PANEL
- PV AC DISCONNECT
- RAPID SHUTDOWN SWITCH

FRONT

REQ'D BY: 705.10\*  
APPLY TO:  
MAIN DISTRIBUTION PANEL  
(\*ONLY REQUIRED IF PV SYSTEM DISCONNECT IS NOT GROUPED WITH MAIN SERVICE DISCONNECT)  
**SEE SHEET PV-6 FOR SITE SPECIFIC LABEL**

I

**RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM**

REQ'D BY: NEC 690.56(C)(2)  
APPLY TO:  
PV DISCONNECT

J

CONTRACTOR

**FREEDOM SOLAR POWER**  
FREEDOM SOLAR LLC  
4801 FREIDRICH LN, STE 100  
AUSTIN, TX 78744  
512-759-8313  
TECL # 28621

REVISIONS

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PE STAMP

PROJECT NAME

MICHAEL G KNAUP  
1815N TEJON STREET  
COLORADO SPRINGS,  
COLORADO, 80907  
(719) 323-3447

SHEET NAME

SYSTEM LABELING DETAIL  
**GARAGE**

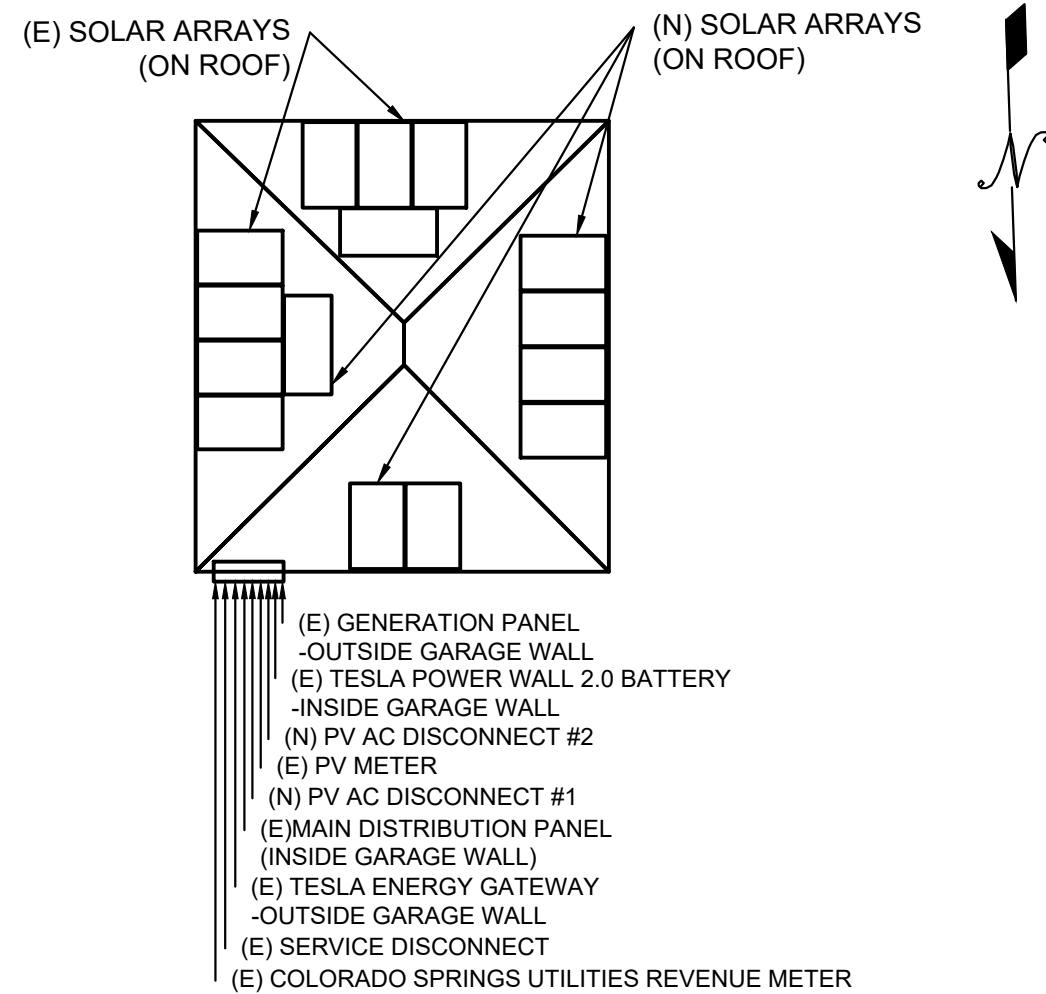
SHEET SIZE

ANSI B  
11" x 17"

SHEET NUMBER

PV-12

# CAUTION: MULTIPLE SOURCES OF POWER LOCATION OF EACH POWER SOURCE DISCONNECTING MEANS SHOWN BELOW



QUESTIONS, CALL:  
800-504-2337  
[www.freedomsolarpower.com](http://www.freedomsolarpower.com)

**FREEDOM**  
**SOLAR POWER**  
1815N TEJON STREET  
PROJECT ID: 113647

CONTRACTOR



**FREEDOM**  
**SOLAR POWER**  
FREEDOM SOLAR LLC  
4801 FREDRICH LN, STE 100  
AUSTIN, TX 78744  
512-759-8313  
TECL # 28621

REVISIONS		
DESCRIPTION	DATE	REV
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PE STAMP

PROJECT NAME

MICHAEL G KNAUP  
1815N TEJON STREET  
COLORADO SPRINGS,  
COLORADO, 80907  
(719) 323-3447

SHEET NAME

SITE  
DIRECTORY  
PLACARD  
**GARAGE**

SHEET SIZE

ANSI B  
11" x 17"

SHEET NUMBER

**PV-13**



USE THE SAFETY SYMBOL KEY TO DRAW IN THE CONTROLLED ACCESS ZONE (CAZ), LADDER PLACEMENT, METER LOCATION, FALL PROTECTION ANCHOR POINT, AND ANY OTHER HAZARD.

HARD HAT IS REQUIRED AT ALL TIMES IN CAZ

**SAFETY SYMBOL KEY**

- CAZ
- L LADDER
- M METER
- ==== POWER LINES
- R RESTRAINT ANCHOR
- A ARREST ANCHOR



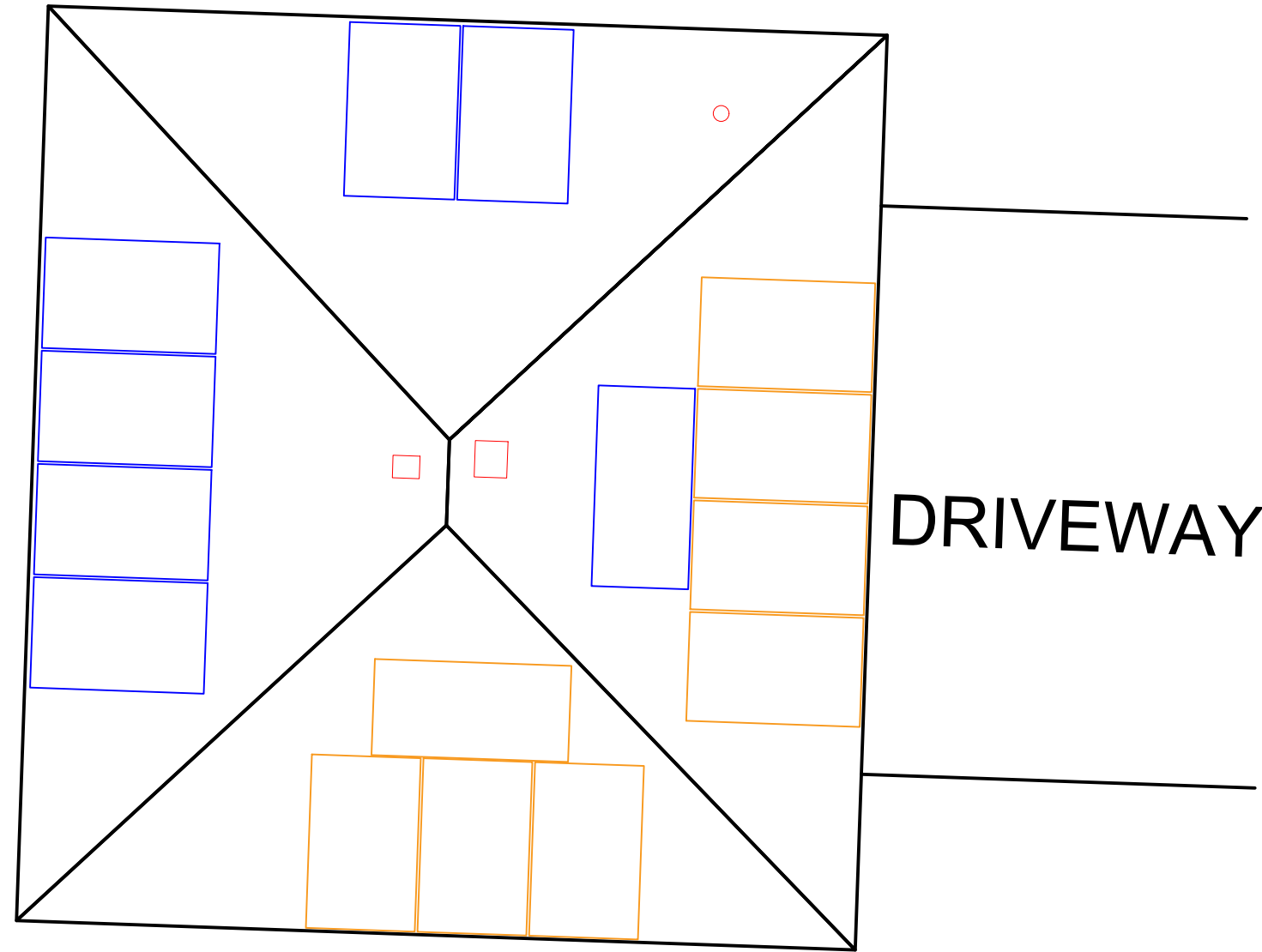
CONTRACTOR

**FREEDOM<sup>™</sup>  
SOLAR POWER**

FREEDOM SOLAR LLC  
4801 FREIDRICH LN, STE 100  
AUSTIN, TX 78744  
512-759-8313  
TECL # 28621

REVISIONS		
DESCRIPTION	DATE	REV
DESIGN PACKET	01/24/2024	

PE STAMP



DRIVEWAY

**CONDUCT SAFETY MEETING WITH ALL CREW MEMBERS ON SITE AT THE BEGINNING OF EACH JOB. USE SIGN IN SHEET BELOW.**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

**GUEST SIGN IN**

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

COMPETENT PERSON: \_\_\_\_\_ JOB START DATE: \_\_\_\_\_

PROJECT NAME

MICHAEL G KNAUP  
1815N TEJON STREET  
COLORADO SPRINGS,  
COLORADO, 80907  
(719) 323-3447

SHEET NAME

SAFETY  
PLAN  
GARAGE

SHEET SIZE

ANSI B  
11" x 17"

SHEET NUMBER

PV-14



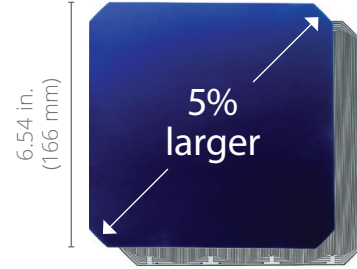
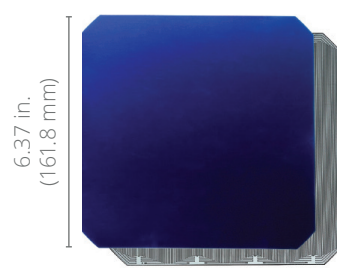
### 420–440 W Residential AC Panel

Built specifically for use with the SunPower Equinox® system, a fully integrated solar solution that's designed, engineered, and warranted by one company.



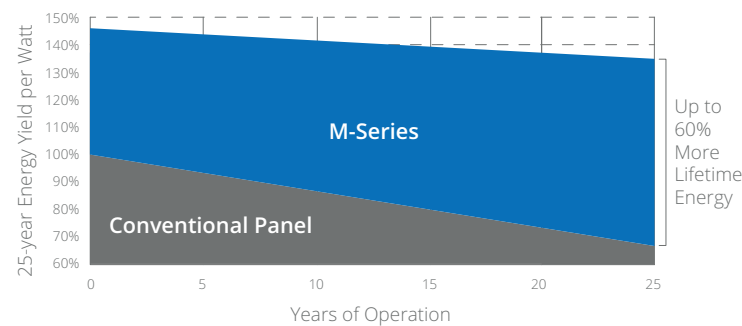
#### Highest Power AC Density Available

The patented, solid-copper foundation Gen 6 cell is over 5% larger than prior generations, delivering the highest-efficiency AC solar panel available.<sup>1</sup>



#### Highest Lifetime Energy and Savings

Designed to deliver 60% more energy over 25 years in real-world conditions like partial shade and high temperatures.<sup>2</sup>



#### SunPower Complete Confidence Warranty

Every part of the SunPower Equinox® system is designed and built by one company. We stand behind our panels and microinverters with an industry-leading 25-year Combined Power and Product Warranty.

#### Part of the SunPower Equinox® Solar System

- Compatible with mySunPower® for system performance monitoring



- Sleek design and low-profile mounting system for a streamlined appearance
- Panels tested for reliability up to three times more than the industry standard to ensure long-term performance<sup>3</sup>



#### Factory-integrated Microinverter

- Highest-power integrated AC panel in solar
- Engineered and calibrated by SunPower for SunPower AC panels

AC Electrical Data		
	@240 VAC	@208 VAC
Inverter Model: Type H (Enphase IQ7HS)		
Peak Output Power (VA)	384	369
Max. Continuous Output Power (VA)	384	369
Nom. (L-L) Voltage/Range <sup>4</sup> (V)	240 / 211–264	208 / 183–229
Max. Continuous Output Current (Arms)	1.60	1.77
Max. Units per 20 A (L-L) Branch Circuit <sup>5</sup>	10	9
CEC Weighted Efficiency	97.0%	96.5%
Nom. Frequency	60 Hz	
Extended Frequency Range	47–68 Hz	
AC Short Circuit Fault Current Over 3 Cycles	4.82 A rms	
Overvoltage Class AC Port	III	
AC Port Backfeed Current	18 mA	
Power Factor Setting	1.0	
Power Factor (adjustable)	0.85 (inductive) / 0.85 (capacitive)	

DC Power Data					
	SPR-M440-H-AC	SPR-M435-H-AC	SPR-M430-H-AC	SPR-M425-H-AC	SPR-M420-H-AC
Nom. Power <sup>7</sup> (Pnom) W	440	435	430	425	420
Power Tolerance	+5/-0%				
Module Efficiency	22.8%	22.5%	22.3%	22.0%	21.7%
Temp. Coef. (Power)	-0.29% / °C				
Shade Tolerance	Integrated panel-level max. power point tracking				

Tested Operating Conditions	
Operating Temp.	-40° F to +185°F (-40°C to +85°C)
Max. Ambient Temp.	122°F (50°C)
Max. Test Load <sup>9</sup>	Wind: 125 psf, 6000 Pa, 611 kg/m <sup>2</sup> back Snow: 187 psf, 9000 Pa, 917 kg/m <sup>2</sup> front
Max. Design Load	Wind: 75 psf, 3600 Pa, 367 kg/m <sup>2</sup> back Snow: 125 psf, 6000 Pa, 611 kg/m <sup>2</sup> front
Impact Resistance	1 inch (25 mm) diameter hail at 52 mph (23 m/s)

Mechanical Data	
Solar Cells	66 Maxeon Gen 6
Front Glass	High-transmission tempered glass with anti-reflective coating
Environmental Rating	Outdoor rated
Frame	Class 1 black anodized (highest AAMA rating)
Weight	48 lb (21.8 kg)
Recommended Max. Module Spacing	1.3 in. (33 mm)

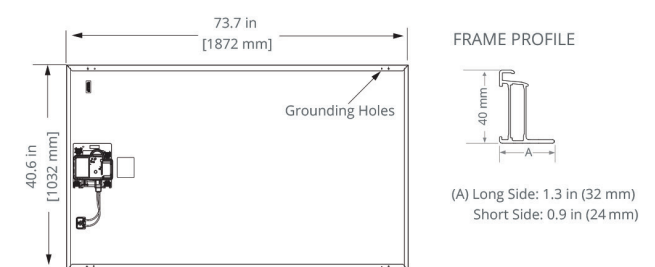
- SunPower M-440 panels offer the highest efficiency of any commercially available solar panel based on the top 20 manufacturers by market share in the U.S. (per Wood Mackenzie US PV Leaderboard Q3 2022 report).
- SunPower 435 W, 22.5% efficient, compared to a Conventional Panel on same-sized arrays (260 W, 16% efficient, approx. 1.6 m<sup>2</sup>), 7.9% more energy per watt (based on PV Syst pan files for avg. US climate), 0.5%/yr slower degradation rate (Jordan, et. al. "Robust PV Degradation Methodology and Application." PVSC 2018).
- SunPower works with third-party laboratories and companies to complete testing on panels they offer. Standard testing, as defined by those third parties, includes reliability tests of Damp Heat (DH1000), Humidity Freeze (HF10) and Thermal Cycling (TC200).
- Voltage range can be extended beyond nominal if required by the utility.
- Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.
- Factory set to IEEE 1547-2018 default settings. CA Rule 21 default settings profile set during commissioning.
- Standard Test Conditions (1000 W/m<sup>2</sup> irradiance, AM 1.5, 25°C). All DC voltage is fully contained within the module.
- UL Listed as PVRSE and conforms with NEC 2017, NEC 2020, and NEC 2023 690.12 and C22.1-2015 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors; when installed according to manufacturer's instructions.
- Please read the safety and installation instructions for more information regarding load ratings and mounting configurations.

See [www.sunpower.com/company](http://www.sunpower.com/company) for more reference information. Specifications included in this datasheet are subject to change without notice.

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Warranties, Certifications, and Compliance	
Warranties	<ul style="list-style-type: none"> <li>25-year limited power warranty</li> <li>25-year limited product warranty</li> </ul>
Certifications and Compliance	<ul style="list-style-type: none"> <li>UL 1741 AC Module (Type 2 fire rated)</li> <li>UL 61730</li> <li>UL 62109-1 / IEC 62109-2</li> <li>FCC Part 15 Class B</li> <li>ICES-0003 Class B</li> <li>CAN/CSA-C22.2 NO. 107.1-01</li> <li>CA Rule 21 (UL 1741 SA) (includes Volt/Var and Reactive Power Priority)</li> <li>UL Listed PV Rapid Shutdown Equipment<sup>8</sup></li> <li>IEEE 1547-2018 (UL 1741-SB)<sup>6</sup></li> </ul> <p>Enables installation in accordance with:</p> <ul style="list-style-type: none"> <li>NEC 690.6 (AC module)</li> <li>NEC 690.12 Rapid Shutdown (inside and outside the array)</li> <li>NEC 690.15 AC Connectors, 690.33(A)-(E)(1)</li> </ul> <p>When used with AC module Q Cables and accessories (UL 6703 and UL 2238)<sup>8</sup>:</p> <ul style="list-style-type: none"> <li>Rated for load break disconnect</li> </ul>
PID Test	1000 V; IEC 62804

Packaging Configuration	
Panels per pallet	25
Packaging box dimensions	75.4 × 42.2 × 48.0 in. (1915 × 1072 × 1220 mm)
Pallet gross weight	1300.7 lb (590 kg)
Pallets per container	32
Net weight per container	41,623 lb (18,880 kg)



Please read the safety and installation instructions for details.



539973 RevE  
September 2023

# Enphase IQ7HS Microinverter

The high-powered smart grid-ready **Enphase IQ7HS Microinverter™** with integrated MC4 connectors dramatically simplify the installation process while achieving the highest system efficiency.

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



### Easy to Install

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

### Efficient and Reliable

- Optimized for high powered 66-cell\* modules
- Highest CEC efficiency of 97.0%
- 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 IQ7HS is required to support 66-cell modules.

## Enphase IQ7HS Microinverter

INPUT DATA (DC)		IQ7HS-66-M-US	
Commonly used module pairings <sup>1</sup>	320 W - 460 W +		
Module compatibility	66-cell PV modules		
Maximum input DC voltage	59 V		
Peak power tracking voltage	38 V - 43 V		
Operating range	20 V - 59 V		
Min/Max start voltage	30 V / 59 V		
Max DC short circuit current (module Isc)	15 A		
Overvoltage class DC port	II		
DC port backfeed current	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)		@240 VAC	@208 VAC
Peak output power	384 VA	369 VA	
Maximum continuous output power	384 VA	369 VA	
Nominal (L-L) voltage/range <sup>2</sup>	240 V / 211-264 V	208 V / 183-229 V	
Maximum continuous output current	1.60 A (240V)	1.77 A (208V)	
Nominal frequency	60 Hz	60 Hz	
Extended frequency range	47 to 68 Hz	47 to 68 Hz	
AC short circuit fault current over 3 cycles	4.82 A	4.82 A	
Maximum units per 20 A (L-L) branch circuit <sup>3</sup>	10	9	
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
CEC weighted efficiency	97.0 %	96.5 %	
MECHANICAL DATA			
Ambient temperature range	-40°C to +60°C		
Relative humidity range	4% to 100% (condensing)		
Connector type	Staubli made MC4		
Dimensions (WxHxD)	212 mm x 175 mm x 30.2 mm (without bracket)		
Weight	1.08 kg (2.38 lbs)		
Cooling	Natural convection - No fans		
Approved for wet locations	Yes		
Pollution degree	PD3		
Enclosure	Class II, corrosion resistant polymeric enclosure		
Environmental category / UV exposure rating	NEMA type 6 / outdoor		
Altitude	2000m		
FEATURES			
Communication	Power Line Communication (PLC)		
Disconnecting means	The AC and DC connectors have been evaluated and approved by UL for use as the load-break disconnect means required by NEC 690 and C22.1-2018 Rule 64-220.		
Compliance	CA Rule 21 (UL 1741-SA), HECO v1.1 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 section 690.12, NEC 2020 and C22.1-2015 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://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](https://enphase.com)



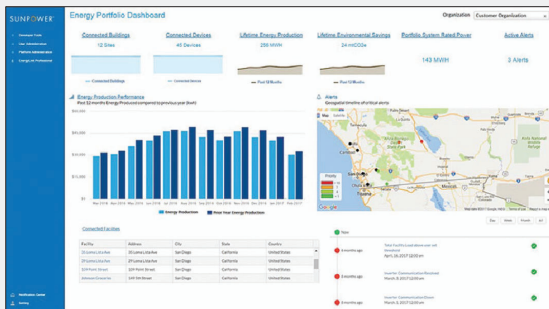


# SunPower® EnergyLink™ | Residential and Commercial PVS6

## Improve Support, Reduce Maintenance Costs

An intuitive monitoring website enables you to:

- See a visual map of customer sites
- Remotely manage hundreds of sites
- Receive elective system reports
- Locate system issues and remotely diagnose
- Diagnose issues online
- Drill down for the status of individual devices



## Add Value for Customers

With the SunPower Monitoring System customers can:

- See what their solar system produces each day, month, or year
- Optimize their solar investment and save on energy expenses
- See their energy use and estimated bill savings
- See their solar system's performance using the SunPower monitoring website or mobile app



## SunPower EnergyLink—Plug-and-Play Installation

This complete solution for residential and commercial monitoring and control includes the SunPower® PV Supervisor 6 (PVS6) which improves the installation process, overall system reliability, and customer experience.

- Compact footprint for improved aesthetics
- Robust cloud connectivity and comprehensive local connectivity
- Flexible configuration of devices during installation
- Consumption metering
- Revenue-grade production metering (pending)
- Web-based commissioning
- Remote diagnostics of PVS6 and inverters
- Durable UL Type 3R enclosure reduces maintenance costs
- Easy integration with SunPower eBOS



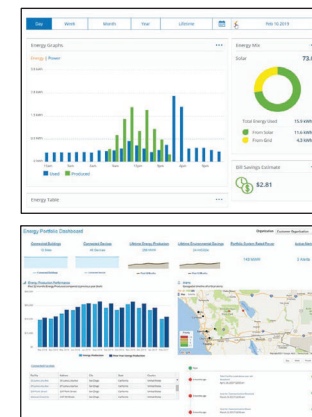
## Robust Cloud Connectivity

Multiple options to maintain optimal connectivity:

- Hardwired Ethernet
- Wi-Fi
- Cellular backup

# SunPower® EnergyLink™ | Residential and Commercial PVS6

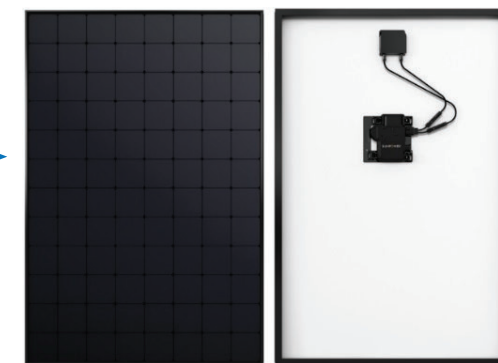
## SunPower Monitoring Websites



## PVS6



## SunPower AC Modules



Multiple communication options include Ethernet, Wi-Fi, and cellular.

Site Requirements	
Number of SunPower AC modules supported per PVS6	85
Internet access	High-speed internet access via accessible router or switch
Power	<ul style="list-style-type: none"> <li>• 100–240 VAC (L–N), 50 or 60 Hz</li> <li>• 208 VAC (L–L in 3-phase), 60 Hz</li> </ul>

Operating Conditions	
Temperature	–22°F to +140°F (–30°C to +60°C)
Humidity (maximum)	95%, non-condensing

Mechanical	
Weight	5.5 lbs (2.5 kg)
Dimensions	11.8 × 8.0 × 4.2 in. (30.5 × 20.5 × 10.8 cm)
Enclosure rating	UL50E Type 3R

Communication	
RS-485	Inverters and meters
Integrated Metering	<ul style="list-style-type: none"> <li>• One channel of revenue-grade production metering</li> <li>• Two channels of consumption metering</li> </ul>
Ethernet	1 LAN (or optional WAN) port
PLC	PLC for SunPower AC modules
Wi-Fi	802.11b/g/n 2.4 GHz and 5 GHz
Cellular	LTE Cat-M1/3G UMTS
ZigBee	IEEE 802.15.4 MAC, 2.4GHz ISM band
Data Storage	60 days
Upgrades	Automatic firmware upgrades

Web and Mobile Device Support	
Customer site	<a href="http://monitor.us.sunpower.com">monitor.us.sunpower.com</a>
Partner site	<a href="http://pvs6gmt.us.sunpower.com">pvs6gmt.us.sunpower.com</a>
Browsers	Firefox, Safari, and Chrome
Mobile devices	iPhone®, iPad®, and Android™
Customer app	<ol style="list-style-type: none"> <li>1. Create account online at: <a href="http://monitor.us.sunpower.com">monitor.us.sunpower.com</a>.</li> <li>2. On a mobile device, download the SunPower Monitoring app from Apple App Store™ or Google Play™ store.</li> <li>3. Sign in using account email and password.</li> </ol>

Warranty and Certifications	
Warranty	10-year Limited Warranty
Certifications	UL, cUL, CE, UL 61010-1 and -2, FCC Part 15 (Class B)



# SunPower® InvisiMount™ | Residential Mounting System

## Simple and Fast Installation

- Integrated module-to-rail grounding
- Pre-assembled mid and end clamps
- Levitating mid clamp for easy placement
- Mid clamp width facilitates consistent, even module spacing
- UL 2703 Listed integrated grounding

## Flexible Design

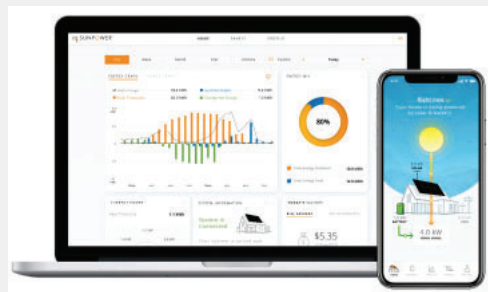
- Addresses sloped and low-sloped residential roofs
- Design in landscape and portrait with up to 8' rail span
- Pre-drilled rails and rail splice
- Rails enable easy obstacle management

## Customer-Preferred Aesthetics

- Best-in-class system aesthetics
- Black anodized components
- Low-profile mid clamps and capped, flush end clamps

## Part of Superior System

- Best-in-class system reliability and aesthetics
- Optional rooftop transition flashing, rail-mounted J-box, and wire management rail clips
- Combine with SunPower modules and mySunPower® monitoring app



## Elegant Simplicity

SunPower® InvisiMount™ is a SunPower-designed rail-based mounting system. The InvisiMount system addresses residential sloped roofs and combines faster installation time, design flexibility, and superior aesthetics.

Classic InvisiMount is specifically envisioned and engineered to pair with SunPower modules; Universal InvisiMount is compatible with a wide range of modules. The resulting system-level approach amplifies the installation and aesthetic benefits—for homeowners and for installers.



**Intertek**  
5024883  
Conf. To UL STD 2703  
Class A Fire Rating

sunpower.com

# SunPower® InvisiMount™ | Residential Mounting System

## InvisiMount Components



InvisiMount Component Details		
Classic mid clamp	Black oxide stainless steel 300 series	63 g (2.2 oz)
Universal mid clamp	Black anodized aluminum 6000 series	60 g (2.1 oz)
Classic end clamp	Black anodized aluminum 6000 series	110 g (3.88 oz)
Universal end clamp	Black anodized aluminum 6000 series	103 g (3.63 oz)
Rail	Black anodized aluminum 6000 series	830 g/m (9 oz/ft)
Rail splice	Aluminum alloy 6000 series	830 g/m (9 oz/ft)
Rail bolt	M10-1.5 x 25 mm; custom T-head SS304	18 g (0.63 oz)
Rail nut	M10-1.5; DIN 6923 SS304	nominal
Ground lug assembly	SS304; A2-70 bolt; tin-plated copper lug	106.5 g (3.75 oz)
Row-to-row grounding clip	SS 301 with SS 304 M6 bolts	75 g (2.6 oz)
Row-to-row grounding jumper	Stainless steel 300 series	10 g (0.35 oz)
Row-to-row spacer	Black POM-grade plastic	5 g (0.18 oz)

Roof Attachment BOM	
• InvisiMount Comp Shingle Attachment with Pegasus	
• InvisiMount Flat Tile Replacement Attachment with Pegasus	
• InvisiMount S-Tile Replacement Attachment with Pegasus	
• InvisiMount W-Tile Replacement Attachment with Pegasus	

InvisiMount Warranties And Certifications	
Warranties	<ul style="list-style-type: none"> <li>• 25-year product warranty</li> <li>• 5-year finish warranty</li> </ul>
Certifications	<ul style="list-style-type: none"> <li>• UL 2703 Listed</li> <li>• Class A Fire Rated</li> </ul>

InvisiMount Operating Conditions	
Temperature	-40°C to 90°C (-40°F to 194°F)

Roof Attachment Hardware Warranties	
Refer to roof attachment hardware manufacturer's documentation.	

InvisiMount Component LRFD Capacities <sup>2</sup>		
Classic Mid clamp	Uplift	664 lbf
	Shear	540 lbf
Universal Mid clamp	Uplift	962 lb
	Shear	437 lb
Classic End clamp	Uplift	899 lbf
	Shear	220 lbf
Universal End clamp	Uplift	605 lb
	Shear	242 lb
Rail	Moment: upward	548 lbf-ft
	Moment: downward	580 lbf-ft
Rail splice	Moment: upward	548 lbf-ft
	Moment: downward	580 lbf-ft
L-foot	Uplift	1000 lbf
	Shear	390 lbf

<sup>1</sup> With Classic InvisiMount, a module frame that is compatible with the InvisiMount system is required for hardware interoperability; modules without this frame may be used with Universal InvisiMount.

<sup>2</sup> SunPower recommends that all Equinox™, InvisiMount™, and AC module systems always be designed using the InvisiMount Span Tables #524734. If a designer decides to instead use the component capacities listed in this document to design a system, note that the capacities shown are Load and Resistance Factor Design (LRFD) design loads, and are NOT to be used for Allowable Stress Design (ASD) calculations; and that a licensed Professional Engineer (PE) must then stamp all calculations. If you have any questions please contact SunPower Technical Support at 1-855-977-7867.

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sunpower.com  
509506 RevH

# RT-MINI

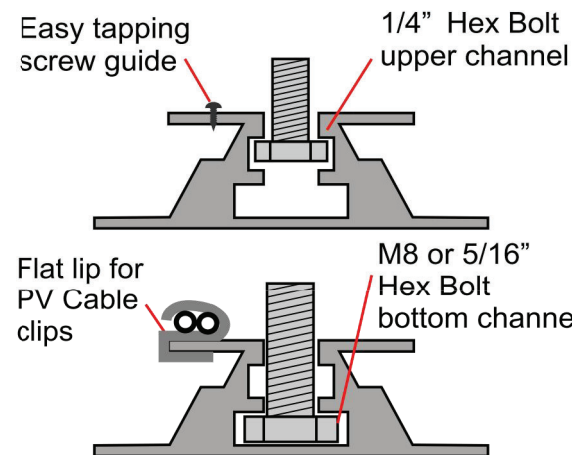
Self-flashing base for asphalt & metal roof-top PV mounting systems

RT-MINI is suitable for mounting any rail system with a conventional L-Foot.



**Dual bolt design:**  
**M8 or 5/16" for L-Foot**  
**& 1/4" for EMC**

Call Now for more detail  
 619-551-7029



# RT-MINI

Flexible Flashing certified by the International Code Council (ICC)

**Engineered to ASTM D 1761** (Standard Test Methods for Mechanical Fasteners in Wood)

## Components

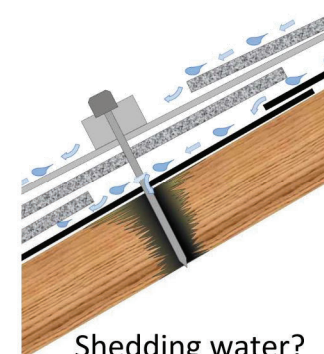
RT2-00-MINIBK  
 PAT : PENDING



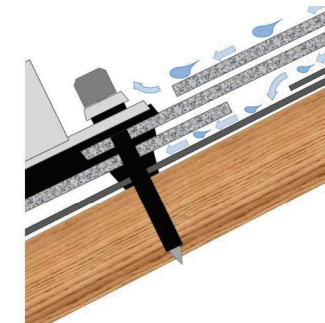
MINI base : 20 ea.  
 Screw : 40 ea.  
 Extra RT-Butyl : 10 ea.

RT-Butyl is Roof Tech's flexible flashing used in 550,000 residential PV systems for the last 20 years. It is the first PV mounting system with Flexible Flashing certified by the ICC.

## Metal Flashing Retrofit



## Flexible Flashing



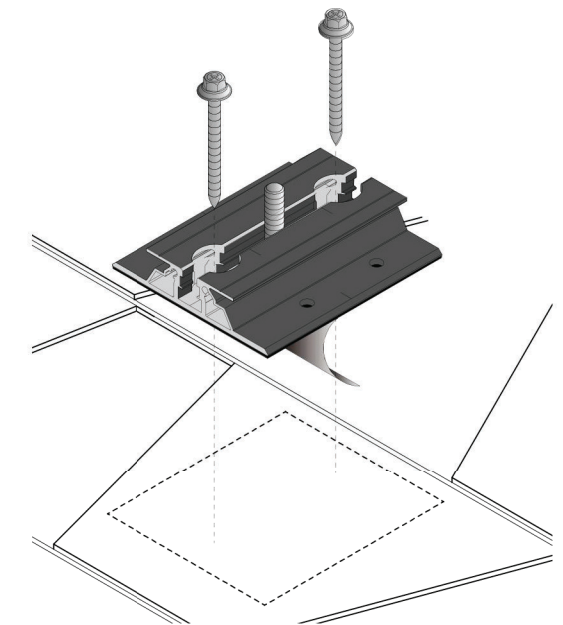
Shedding water?

**100% Waterproof**

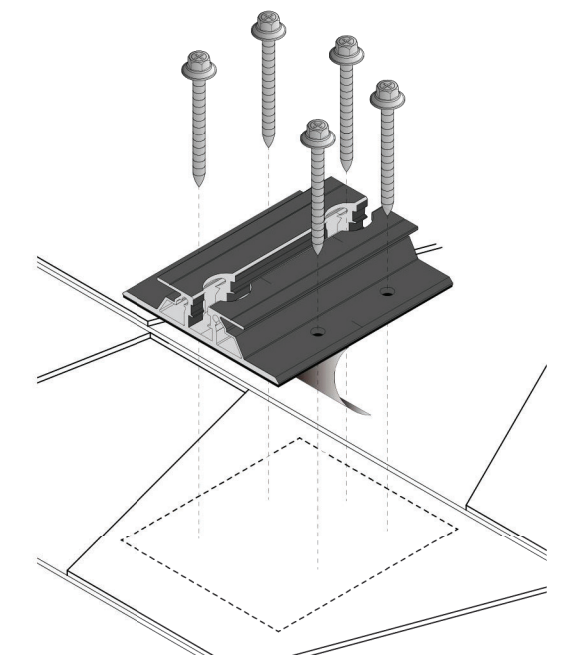
ICC ESR-3575    ASTM2140 testing    UV testing (7500 hrs.)



## Rafter installation



## Deck installation



P.E. Stamped Letters available at [www.roof-tech.us/support](http://www.roof-tech.us/support)

# Non-Fusible Switching Devices & Safety Switches

## Product Selection

UL listed File No. E5239

1

DG321NRB

### 120/240 Vac General-Duty, Fusible, Single-Throw, continued



System	Ampere Rating	Fuse Type Provision	Maximum Horsepower Ratings <sup>①</sup>			NEMA 1 Enclosure Indoor Catalog Number	NEMA 3R Enclosure Rainproof Catalog Number
			Single-Phase AC 120V	240V	Three-Phase AC 240V		
<b>Cartridge Type—Three-Pole, Three-Wire (Three Blades, Three Fuses)—240 Vac</b>							
	30	—	—	—	—	②	②
	60	—	—	—	—	②	②
	100	—	—	—	—	②	②
	200	H	—	15	25-60	DG324FGK ③④	②
	400	H	—	—	50-125	DG325FGK ③④	DG325FRK ③④
	600	H	—	—	75-200	DG326FGK ③④	DG326FRK ③④
<b>Cartridge Type—Four-Wire (Three Blades, Three Fuses, S/N)—120/240 Vac</b>							
	30	H	—	1-1/2-3	3-7-1/2	DG321NGB	DG321NRB
	60	H	—	3-10	7-1/2-15	DG322NGB	DG322NRB
	100	H	—	7-1/2-15	15-30	DG323NGB	DG323NRB
	200	H	—	15	25-60	DG324NGK	DG324NRK
	400	H	—	—	50-125	DG325NGK	DG325NRK
	600	H	—	—	75-200	DG326NGK	DG326NRK

DG322URB

### 120/240 Vac General-Duty, Non-Fusible, Single-Throw



System	Ampere Rating	Maximum Horsepower Ratings			NEMA 1 Enclosure Indoor Catalog Number	NEMA 3R Enclosure Rainproof Catalog Number	
		Single-Phase AC 120V	240V	Three-Phase AC 240V			DC 250V
<b>Two-Pole, Two-Wire (Two Blades)—240 Vac</b>							
	30	2	3	—	—	DG221UGB ④	DG221URB ④
	60	3	10	—	—	DG222UGB ④	DG222URB ④
	100	—	15	—	—	DG223UGB ④	DG223URB ④
	200	—	15	—	—	④⑤	DG224URK ④
<b>Three-Pole, Three-Wire (Three Blades)—240 Vac</b>							
	30	2	3	7-1/2	—	DG321UGB ④	DG321URB ④
	60	3	10	15	—	DG322UGB ④	DG322URB ④
	100	—	15	30	—	DG323UGB ④	DG323URB ④
	200	—	15	60	—	DG324UGK ④	DG324URK ④
	400	—	—	125	—	DG325UGK ④	DG325URK ④
	600	—	—	200	—	DG326UGK ④	DG326URK ④

#### Notes

- ① Maximum hp ratings apply only when dual element time delay fuses are used.
- ② Use four-wire catalog numbers below.
- ③ Solid neutral bars are not included. Order separately from table on Page V2-T1-13.
- ④ **WARNING!** Switch is not approved for service entrance unless a neutral kit is installed.
- ⑤ Use three-wire catalog numbers below.

All general-duty safety switches are individually packaged.

Accessories are limited in scope on general-duty safety switches. See Page V2-T1-13 for availability. In addition, clear line shields are available as an accessory on 200-600A general-duty switches. Catalog Numbers: 200A = 70-7759-11, 400A = 70-8063-8, 600A = 70-8064-8.

# Fusible Switching Devices & Safety Switches



## Product Selection

### 120/240 Vac General-Duty, Fusible, Single Throw

#### Specifications

- 30 – 600 amperes.
- Suitable for service entrance applications unless otherwise noted.
- Horsepower rated.
- Bolt-on hub provision. Provided for general-duty switches in a NEMA 3R enclosure. See Page 8-7 for selection.
- UL listed File No. E5239. Meets UL 98 for enclosed switches and NEMA Std. KS-1.
- 200 – 600 ampere switches incorporate K-Series design.



DP221NGB



DG321NRB

2

Table 8-40. 120/240 Vac General-Duty, Fusible, Single Throw

System	Ampere Rating	Fuse Type Provision	Maximum Horsepower Ratings <sup>①</sup>				NEMA 1 Enclosure Indoor		NEMA 3R Enclosure Rainproof	
			Single-Phase ac		3-Phase ac	dc	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$
			120 Volt	240 Volt	240 Volt	250 Volt				

#### Fusible — Plug Type <sup>②</sup>

##### 2-Wire (One Blade, One Fuse, S/N) — 120 Vac

	30	Plug (Type S, T or W)	1/2-2	—	—	—	DP111NGB	—	—
--	----	-----------------------	-------	---	---	---	----------	---	---

##### 3-Wire (Two Blades, Two Fuses, S/N) — 120/240 Vac

	30	Plug (Type S, T or W)	1/2-2	1-1/2-3	—	—	DP221NGB	—	Use cartridge-type fuse catalog number DG221NRB
--	----	-----------------------	-------	---------	---	---	----------	---	---

#### Fusible — Cartridge Type

##### 2-Pole 2-Wire (Two Blades, Two Fuses) — 240 Vac

	30	—	—	1-1/2-3	3-7-1/2	—	③	—	③
	60	—	—	3-10	7-1/2-15	—	③	—	③
	100	—	—	7-1/2-15	15-30	—	③	—	③
	200	—	—	15	25-60	—	③	—	③
	400	H	—	—	50-125	—	DG225FGK ④⑤	—	DG225FRK ④⑤
	600	H	—	—	75-200	—	DG226FGK ④⑤	—	DG226FRK ④⑤

##### 3-Wire (Two Blades, Two Fuses, S/N) — 120/240 Vac

	30	H	—	1-1/2-3	3-7-1/2 ⑥	—	DG221NGB	—	DG221NRB
	60	H	—	3-10	7-1/2-15 ⑥	—	DG222NGB	—	DG222NRB
	100	H	—	7-1/2-15	15-30 ⑥	—	DG223NGB	—	DG223NRB
	200	H	—	15	25-60 ⑥	—	DG224NGK	—	DG224NRK
	400	H	—	—	50-125 ⑥	50	DG225NGK	—	DG225NRK
	600	H	—	—	75-200 ⑥	—	DG226NGK	—	DG226NRK

① Maximum hp ratings apply only when dual element time delay fuses are used.

② These switches do not have an interlock which prevents door from being opened when switch is in the ON position.

③ Use 3-wire catalog numbers below.

④ Solid neutral bars are not included. Order separately from Table 8-1 on Page 8-5.

⑤ **WARNING!** Switch is not approved for service entrance unless a neutral kit is installed.

⑥ Grounded B phase rating, UL listed.

**Note:** All general-duty safety switches are individually packaged.

**Note:** Accessories are limited in scope on general-duty safety switches. See Page 8-5 for availability. In addition, clear line shields are available as an accessory on 200 – 600 ampere general-duty switches. Catalog Numbers: 200 A = 70-7759-11, 400 A = 70-8063-8, 600 A = 70-8064-8.

Discount Symbol ..... 22CD

# 1.1

## Loadcenters and Circuit Breakers

### Type CH Loadcenters and Circuit Breakers

1

CH42L225G



#### Single-Phase Three-Wire—120/240 Vac—Insulated/Bondable Split Neutral—Factory-Installed Ground Bar

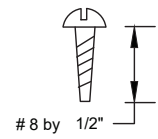
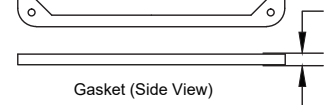
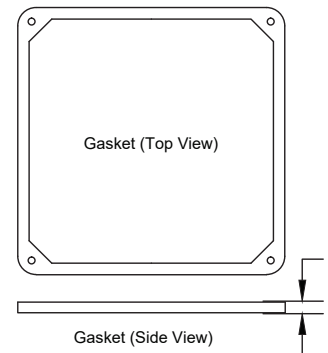
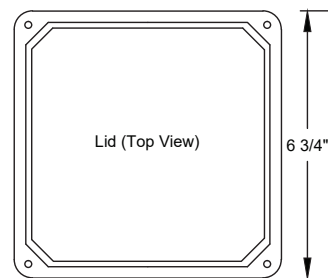
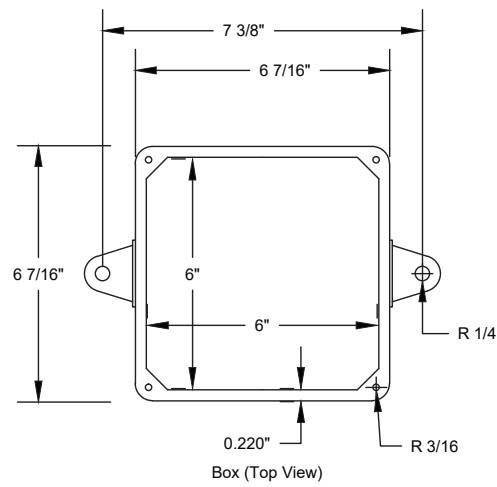
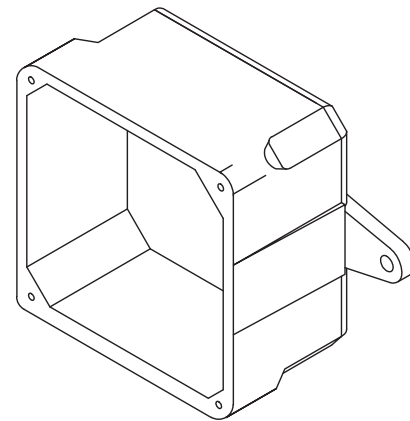
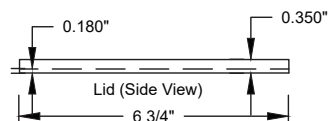
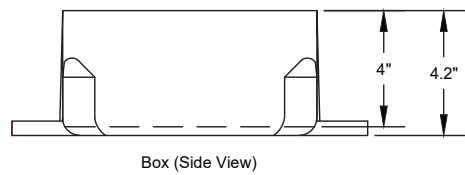
Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Poles	Enclosure Type	Box Size	Wire Size Range Cu/Al 60 °C or 75 °C for Main Lugs	Loadcenter Catalog Number	Loadcenter Cover Catalog Number	Surface
125	12	Indoor	B	#6–2/0	CH12L125B ①	CH8BF	CH8BS
	12	Outdoor	B	#6–2/0	CH12L125R ①②	—	—
	16	Indoor	B	#6–2/0	CH16L125B ①	CH8BF	CH8BS
	16	Outdoor	B	#6–2/0	CH16L125R ①②	—	—
	20	Indoor	C	#6–2/0	CH20L125C ①	CH8CF	CH8CS
	20	Outdoor	C	#6–2/0	CH20L125R ①②	—	—
	24	Indoor	C	#6–2/0	CH24L125C ①	CH8CF	CH8CS
	24	Outdoor	C	#6–2/0	CH24L125R ①②	—	—
150	24	Indoor	D	#4–300 kcmil	CH24L150D ①	CH8DF	CH8DS
	24	Outdoor	D	#4–300 kcmil	CH24L150R ②③	—	—
	32	Indoor	D	#4–300 kcmil	CH32L150D ①	CH8DF	CH8DS
	32	Outdoor	D	#4–300 kcmil	CH32L150R ②③	—	—
200	12	Indoor	D	#4–300 kcmil	CH12L200D ①	CH8DF	CH8DS
	12	Outdoor	D	#4–300 kcmil	CH12L200R ②③	—	—
	16	Indoor	D	#4–300 kcmil	CH16L200D ①	CH8DF	CH8DS
	16	Outdoor	D	#4–300 kcmil	CH16L200R ②③	—	—
225	24	Indoor	D	#4–300 kcmil	CH24L225D ①	CH8DF	CH8DS
	24	Outdoor	D	#4–300 kcmil	CH24L225R ②③	—	—
	32	Indoor	D	#4–300 kcmil	CH32L225D ①	CH8DF	CH8DS
	32	Outdoor	D	#4–300 kcmil	CH32L225R ②③	—	—
	42	Indoor	G	#4–300 kcmil	CH42L225G ③	CH8GF	CH8GS
	42	Outdoor	G	#4–300 kcmil	CH42L225R ②③	—	—
400	42	Indoor	P	(2) 1/0–300 kcmil (1) 750 kcmil	CH42PL400 ④	CH7PF ⑤	CH7PS

#### Notes

- ① Suitable for use as service equipment when not more than six disconnecting means are provided and when not used as a lighting and appliance panelboard (see Article 408.34 of the NEC).
- ② Rainproof panels are furnished with hub closure plates. For rainproof hubs, refer to **Page V1-T1-25**.
- ③ Suitable for use as service equipment when a circuit breaker is used as a main breaker. The main breaker is backfed and requires hold-down bracket kit catalog number **CH125RB**.
- ④ Suitable for use as service equipment when a circuit breaker is used as a main breaker. The main breaker is backfed and must be a Type CHB.  
**The breaker cannot be a Type CH.**
- ⑤ This cover is for flush application only (not combination).

Box sizes **Pages V1-T1-27** and **V1-T1-28**.



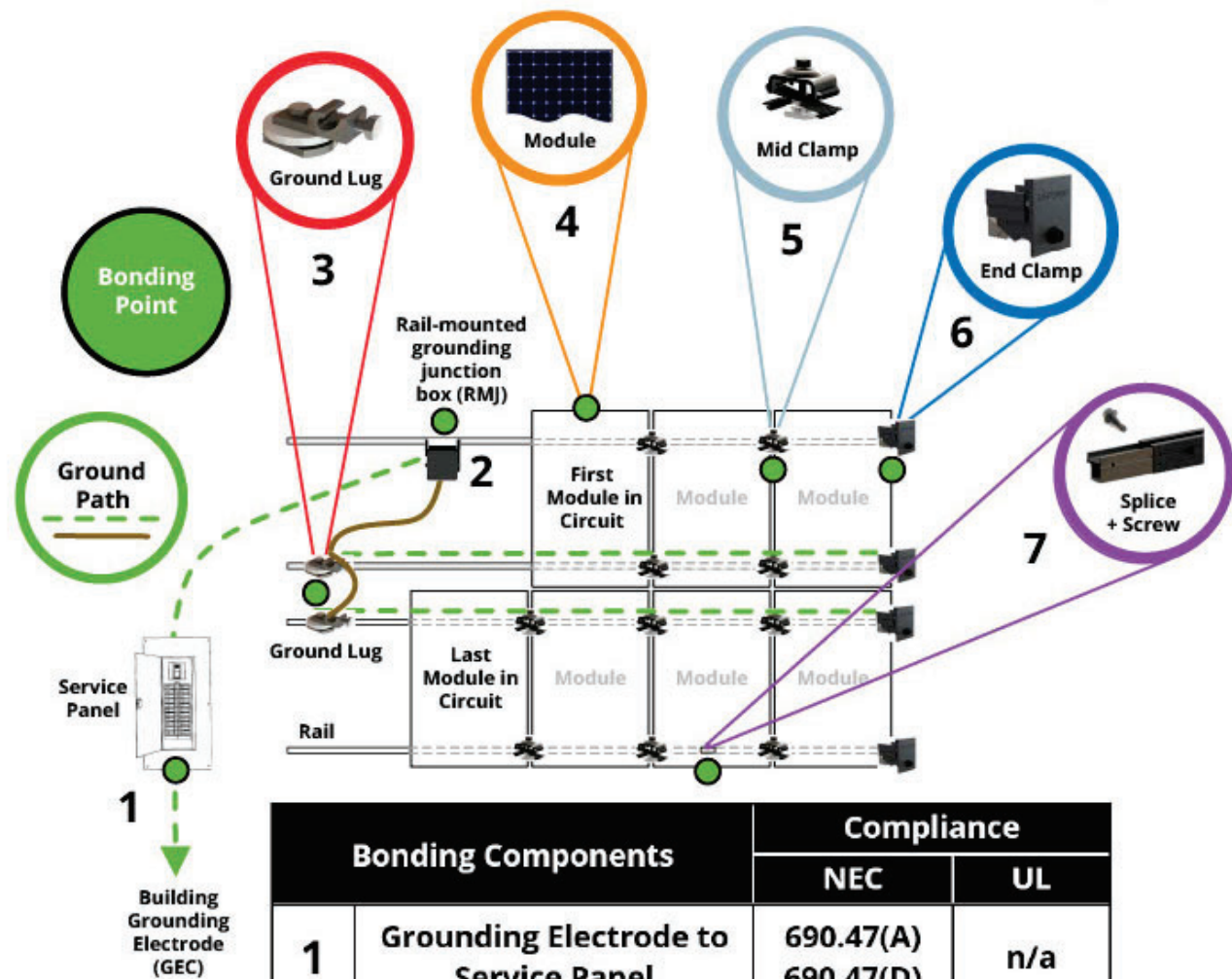


UL Listed  
 Marine Listed  
 UL File # E205935 (QCUP)  
 UL Control # 92CM  
 Material is Rigid PVC  
 132 cu in Volume (2163 cu cm)  
 Screws are Zinc Plated Steel  
 Gasket is neoprene



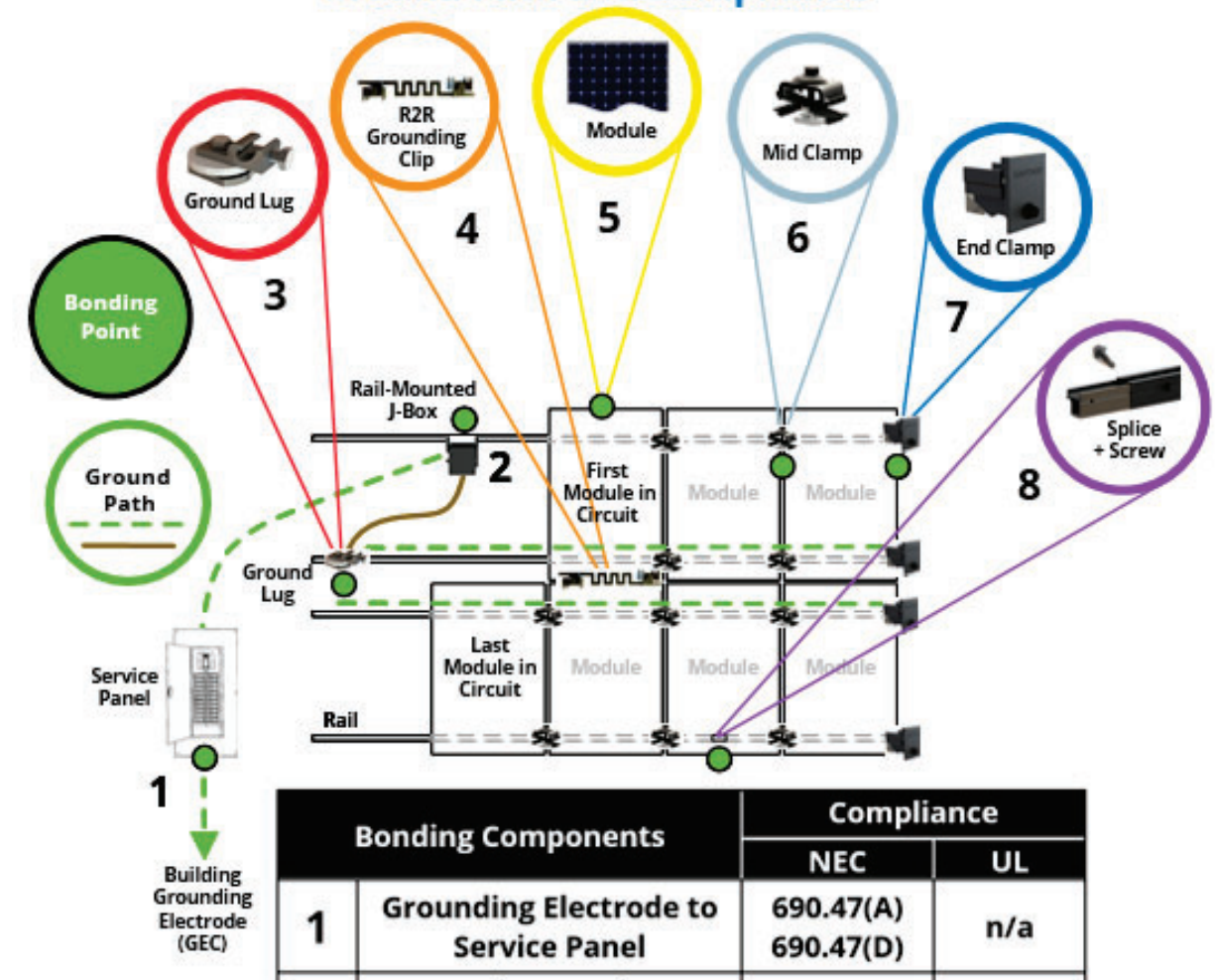
<b>CANTEX</b> INC. Fort Worth, TEXAS		
<b>Junction Box 6 x 6 x 4</b>		
Drawn By: O.M.	Date: 6/19/17	5133710

## SunPower Classic InvisiMount™ Ground Path and Compliance



	Bonding Components	Compliance	
		NEC	UL
1	Grounding Electrode to Service Panel	690.47(A) 690.47(D)	n/a
2	Service Panel to Ground Wire	690.43(C)	1741
3	Ground Wire to Ground Lug to Rail	690.43(C)	2703
4	Module Frame	n/a	1703
5	Rail to Mid Clamp to Module Frame	690.43(A) 690.43(C) 690.43(D)	2703
6	Module Frame to End Clamp to Rail	690.43(A) 690.43(C) 690.43(D)	2703
7	Rail to Splice	690.43(A) 690.43(C) 690.43(D)	2703

## SunPower Classic InvisiMount™ with R2R Grounding Clip Ground Path and Compliance



	Bonding Components	Compliance	
		NEC	UL
1	Grounding Electrode to Service Panel	690.47(A) 690.47(D)	n/a
2	Service Panel to Ground Wire	690.43(C)	1741
3	Ground Wire to Ground Lug to Rail	690.43(C)	2703
4	Module Frame to Module Frame	690.43(C)	2703
5	Module Frame	n/a	1703
6	Rail to Mid Clamp to Module Frame	690.43(A) 690.43(C) 690.43(D)	2703
7	Module Frame to End Clamp to Rail	690.43(A) 690.43(C) 690.43(D)	2703
8	Rail to Splice	690.43(A) 690.43(C) 690.43(D)	2703

## 1.4 Listings, Compatibility, and Classification

The SunPower InvisiMount Residential Mounting System is UL 2703 Listed. The InvisiMount Listing **includes** the following modules, which have been tested for grounding and mechanical load with the InvisiMount system.

For Classic InvisiMount certification information, refer to UL at their site <https://www.ul.com> or the at the UL portal <https://www.ul.com/resources/apps/myul-client-portal> and view *File E314938* and *File E466981*. For Universal InvisiMount certification information, refer to Intertek at [https://ramuk.intertekconnect.com/WebClients/ITS/DLP/products.nsf/\\$\\$Search?OpenForm](https://ramuk.intertekconnect.com/WebClients/ITS/DLP/products.nsf/$$Search?OpenForm) and view *Control Number 5024883*.

SunPower DC Modules	SunPower AC Modules	
<ul style="list-style-type: none"> <li>• SPR-A400-BLK-DC</li> <li>• SPR-A400-DC</li> <li>• SPR-A410-DC</li> <li>• SPR-E19-320</li> <li>• SPR-E20-327</li> <li>• SPR-X21-335-BLK</li> <li>• SPR-X21-350-BLK</li> <li>• SPR-X21-345</li> <li>• SPR-X22-360</li> <li>• SPR-X22-370</li> </ul>	<ul style="list-style-type: none"> <li>• SPR-A400-BLK-G-AC</li> <li>• SPR-A390-G-AC</li> <li>• SPR-A400-G-AC</li> <li>• SPR-A410-G-AC</li> <li>• SPR-A415-G-AC</li> <li>• SPR-A425-G-AC</li> <li>• SPR-M415-BLK-H-AC</li> <li>• SPR-M425-BLK-H-AC</li> <li>• SPR-M420-H-AC</li> <li>• SPR-M435-H-AC</li> <li>• SPR-M440-H-AC</li> </ul>	<ul style="list-style-type: none"> <li>• SPR-X22-370-E-AC</li> <li>• SPR-X22-360-E-AC</li> <li>• SPR-X21-350-BLK-E-AC</li> <li>• SPR-X21-335-BLK-E-AC</li> <li>• SPR-X20-327-BLK-E-AC</li> <li>• SPR-X21-345-E-AC</li> <li>• SPR-X21-335-E-AC</li> <li>• SPR-X20-327-E-AC</li> <li>• SPR-E20-327-E-AC</li> <li>• SPR-E19-320-E-AC</li> </ul>

With Universal InvisiMount:

Manufacturer	Module Model / Series
SunPower	<ul style="list-style-type: none"> <li>• SPR-Axxx-COM (may be followed by -BLK), where xxx can be 380–460.</li> <li>• SPR-Axxx-yyy-MLSD, where xxx can be 350–460 and where yyy can be -COM and/or -300 V.</li> </ul>
Aptos	<ul style="list-style-type: none"> <li>• DNA-120-MF26-xxxW, where xxx is wattage.</li> <li>• DNA-108-BF10-xxxW, where xxx is wattage.</li> <li>• DNA-120-BF26-xxxW where xxx is 350–370.</li> </ul>
Hanwha	<ul style="list-style-type: none"> <li>• Q.PEAK DUO BLK ML-G10.a+ xxx, where xxx can be 370–425.</li> </ul>

REC	<ul style="list-style-type: none"> <li>• RECxxxNP2, where xxx can be 350–380.</li> <li>• RECxxxNP2 Black, where xxx can be 350–380.</li> <li>• RECxxxTP4, where xxx can be 350–380.</li> <li>• RECxxxTP4 Black, where xxx can be 350–380.</li> <li>• RECxxxAA, where xxx can be 340–385.</li> <li>• RECxxxAA Black, where xxx can be 340–385.</li> <li>• RECxxxAA Pure, where xxx can be 380–415.</li> </ul>
Trina	<ul style="list-style-type: none"> <li>• TSM-xxxDE06X.05(II), where xxx can be 355–380.</li> </ul>
Jinko	<ul style="list-style-type: none"> <li>• JKMxxxM-6RL3-B, where xxx can be 365–400.</li> </ul>
Canadian Solar	<ul style="list-style-type: none"> <li>• Canadian Solar: CS3NxxxMS where xxx is 380–405.</li> </ul>
Waaree	<ul style="list-style-type: none"> <li>• WSMDi-xxx where xxx is 395–415.</li> </ul>

System Design Load Rating: 10 PSF downward, 5 PSF upward, 5 PSF lateral. Actual system structural capacity is defined by the *InvisiMount Span Tables 524734*.

Grounding from the module to the rail is accomplished through the clamps. See Section 1.5 for more information. The Listing also includes the following components, which have been evaluated for both mounting and bonding in accordance with UL 2703:

- End clamp
- Mid clamp
- Rail
- Splice and splice screw
- Ground lug assembly
- L-foot
- Row-to-row (R2R) grounding clip
- Row-to-row (R2R) grounding jumper
- Row-to-row (R2R) spacer
- Rail-mounted grounding junction box (RMJ)

July 29, 2022

To whom it may concern,

This letter confirms and attests that:

SPWR-A5 is equivalent to Enphase Models:

IQ7HS-66-ACM-US, 369 VA, 208Vac Grid Support Utility Interactive Inverter  
IQ7HS-66-E-ACM-US, 369 VA, 208Vac Grid Support Utility Interactive Inverter  
IQ7HS-66-M-US, 369 VA, 208Vac Grid Support Utility Interactive Inverter  
IQ7HS-66-ACM-US, 384 VA, 240Vac Grid Support Utility Interactive Inverter  
IQ7HS-66-E-ACM-US, 384 VA, 240Vac Grid Support Utility Interactive Inverter  
IQ7HS-66-M-US, 384 VA, 240Vac Grid Support Utility Interactive Inverter

Regards,



Aranjit Sangha  
Senior Staff Engineer  
Enphase Energy Inc.  
1420 North McDowell Blvd.  
Petaluma, CA 94954  
v: (707) 763-4784 x7098  
asangha@enphaseenergy.com



**MILBANK**  
ENERGY AT WORK

# U4801-XL-5T9



Catalog Number	U4801-XL-5T9
Marketing Product Description	5 Terminal Ringless Small Closing Plate Lever Bypass 5th Terminal 9 Oclock Position
UPC	784572288218
Length (IN)	4.844
Width (IN)	13
Height (IN)	19
Brand Name	Milbank
Type	Ringless Meter Socket
Application	Meter Socket
Standard	UL Listed;Type 3R
Voltage Rating	600 Volts Alternating Current
Amperage Rating	200 Continuous Ampere
Phase	1 Phase
Frequency Rating	60 Hertz
Size	4.844L x 13W x 19H
Number Of Cutouts	0
Cutout Size	No Main Breaker
Cable Entry	Overhead or Underground
Terminal	Lay in
Insulation	Glass Polyester
Mounting	Surface Mount

Enclosure	G90 Galvanized Steel with Powder Coat Finish
Jaw Quantity	5 Terminal
Bypass Type	Lever Bypass
Number of Meter Positions	1 Position
Equipment Ground	Bonded Ground Strap
Hub Opening	Small Closing Plate
Line Side Wire Range	6 AWG - 350 kcmil
Load Side Wire Range	6 AWG - 350 kcmil
Number Of Receptacles	0

Please consult serving utility for their requirements prior to ordering or installing, as specifications and approvals vary by utility and may require local electrical inspector approval. All installations must be installed by a licensed electrician and must comply with all national and local codes, laws and regulations. Milbank reserves the right to make changes in specifications and features shown without notice or obligation.