SCOPE OF WORK

TO INSTALL A SOLAR PHOTOVOLTAIC (PV) SYSTEM AT THE BRUCE RESIDENCE, LOCATED AT 55 WELCOME DRIVE, FUQUAY VARINA, NORTH CAROLINA.
THE POWER GENERATED BY THE PV SYSTEM WILL BE INTERCONNECTED WITH THE UTILITY GRID THROUGH THE NEW ELECTRICAL SERVICE EQUIPMENT.
THE PV SYSTEM DOES INCLUDE STORAGE BATTERIES.

SYSTEM RATING

7.360 kW DC STC
6.080 kW AC

EQUIPMENT SUMMARY

(16) REC SOLAR REC460AA PURE-RX (460W) PV MODULES

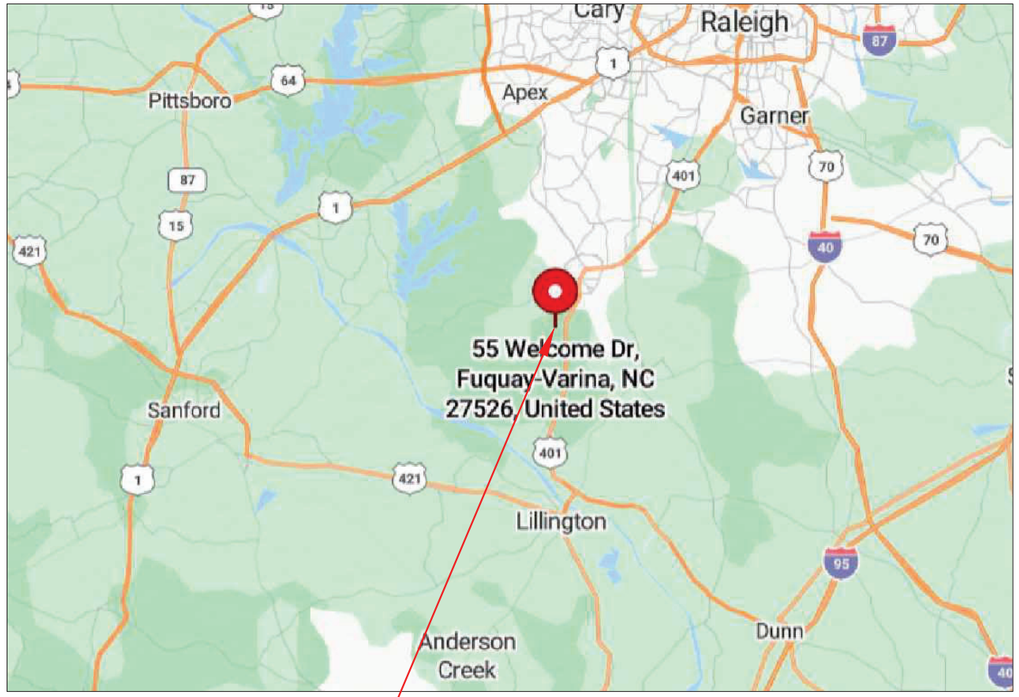
(16) ENPHASE IQ8X-80-M-US [240V] PV INVERTERS
(1) TESLA POWERWALL 3 1707000-XX-Y [240V] PV INVERTERS
(1) TESLA ENERGY GATEWAY-2

SHEET INDEX

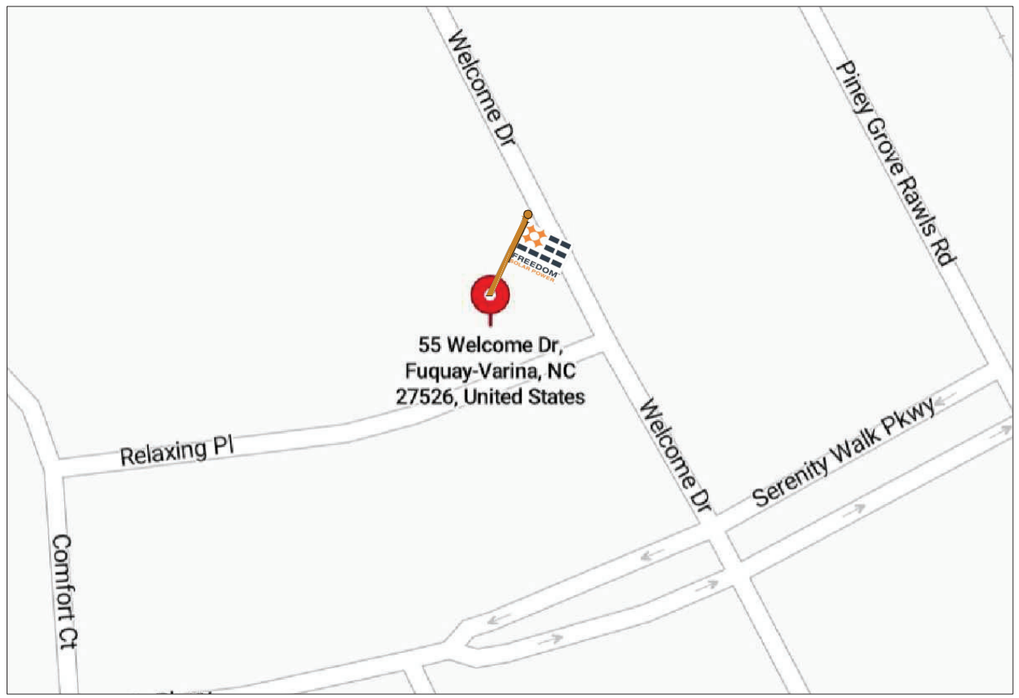
GOVERNING CODES

2017 NATIONAL ELECTRICAL CODE
2018 NORTH CAROLINA RESIDENTIAL CODE
2018 NORTH CAROLINA STATE BUILDING CODE
UNDERWRITERS LABORATORIES (UL) STANDARDS
OSHA 29 CFR 1910.269

08/10/2024 - REVISION A:
- ADDED NOTE TO PV-3 STATING THE POWERWALL IS CONFIGURED FOR STORAGE ONLY



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	08/08/2024	-
REVISION	08/10/2024	A

PE STAMP

PROJECT NAME

SHARON BRUCE
55 WELCOME DRIVE
FUQUAY VARINA, NORTH CAROLINA, 27526
(770) 820-9142
PROJECT ID: 115522

SHEET NAME
COVER

SHEET SIZE
ANSI B
11" x 17"

SHEET NUMBER
PV-0

LEAD ID: 115522

CONSTRUCTION SUMMARY

(16) (REC SOLAR REC460AA PURE-RX (460W)) SOLAR MODULES, 7.360 kW DC STC
MODULE DIMENSIONS = 47.4"x68.1"x1.2"

(16) ENPHASE IQ8X-80-M-US [240V] PV INVERTERS
COMBINED INVERTER OUTPUT = 6.080 kW AC.

(01) TESLA ENERGY GATEWAY-2

(01) TESLA POWERWALL 3 1707000-XX-Y [240V] PV INVERTERS

(01) ENPHASE IQ GATEWAY

(01) GENERATION PANEL

RACKING: PEGASUS RAIL

ATTACHMENT: PEGASUS INSTAFLASH

SITE DETAILS

ROOF TYPE: ASPHALT SHINGLE
ARRAY #1 - TILT = 27°, AZIMUTH = 242°

UTILITY SHUTDOWN REQUIRED TO INSTALL TEG BETWEEN MDP AND METER.

NOTE : PE STAMPS REQUIRED IF:
-WEIGHT OF ARRAY IS >3PSF
-MORE THAN 1-LAYER OF SHINGLE
-ROOF TYPE IS OTHER THAN COMP SHINGLES
-WIND SPEED IS GREATER THAN 140 MPH
IF DESIGN PACK IS NOT STAMPED, MUST INCLUDE EXCEPTION STATEMENT IN RED:

-PANEL WEIGHT EQUALS 2.5 LBS PER SQ FT, LESS THAN 3 LBS PER SQ FT

NO CUTTING AND COVERING PLUMBING VENTS AT ALL, PVC PIPES CAN BE RELOCATED WITH ROOF JACK

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.

MAIN DISTRIBUTION PANEL (INSIDE GARAGE WALL)

DUKE ENERGY REVENUE METER # 342 482 100
GROUNDING ELECTRODE
TESLA ENERGY GATEWAY
GENERATION PANEL
ENPHASE IQ GATEWAY
PV AC DISCONNECT
-VISIBLE
-LOCKABLE
-LABELED
-KNIFE BLADE DISCONNECT
(OUTSIDE GARAGE WALL)

(1)TESLA POWERWALL 3 1707000-XX-Y [240V] PV INVERTERS (ON CONCRETE PAD OUTSIDE GARAGE WALL)

PV ARRAY #1
(16) MODULES

CONTRACTOR
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PE STAMP

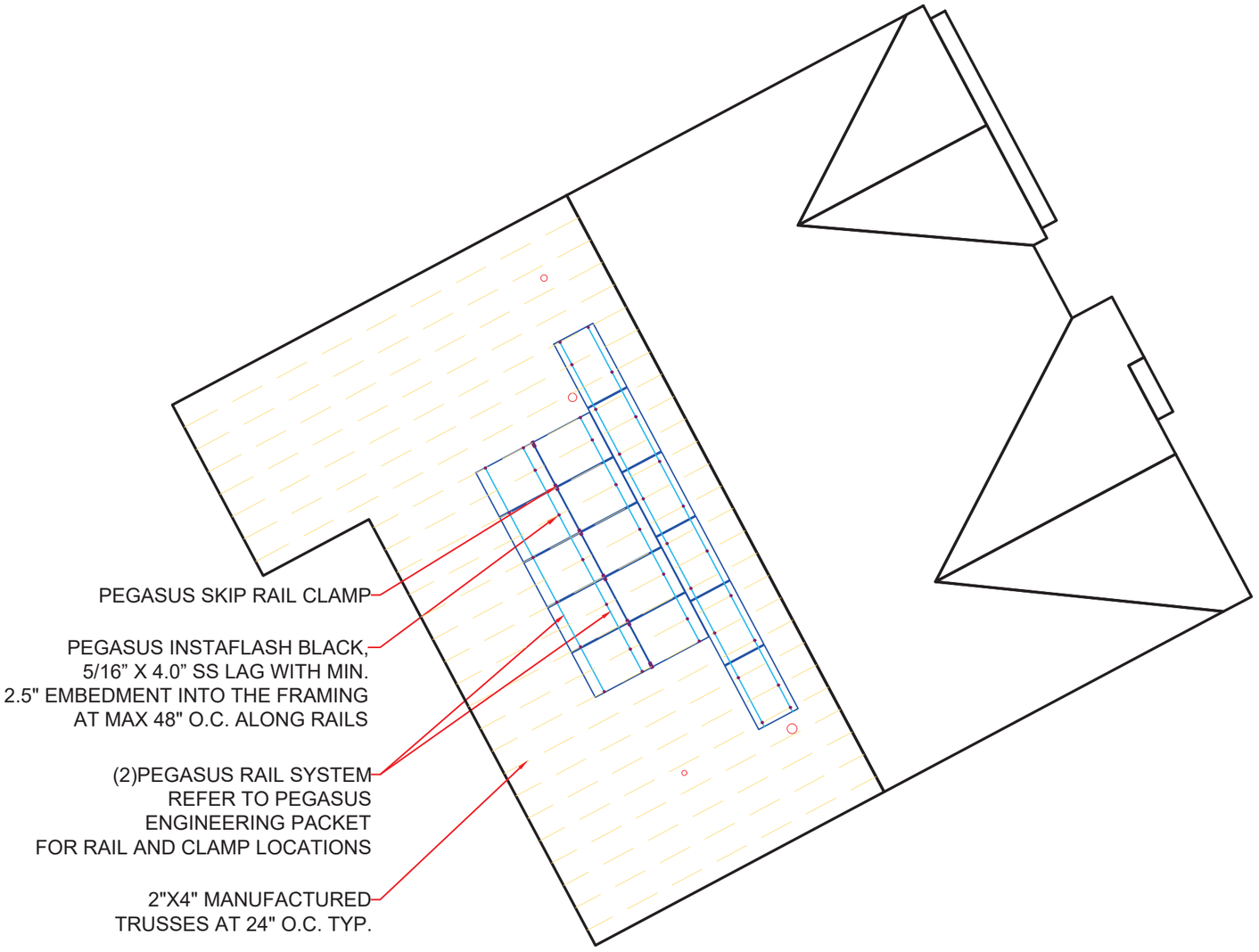
PROJECT NAME

SHARON BRUCE
55 WELCOME DRIVE
FUQUAY VARINA, NORTH CAROLINA, 27526
(770) 820-9142
PROJECT ID: 115522

SHEET NAME
SITE MAP & PV LAYOUT

SHEET SIZE
ANSI B
11" x 17"

SHEET NUMBER
PV-1



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.

CONTRACTOR

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TECL # 28621

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REVISION	08/10/2024	A

PE STAMP

PROJECT NAME

SHARON BRUCE
55 WELCOME DRIVE
FUQUAY VARINA, NORTH CAROLINA, 27526
(770) 820-9142
PROJECT ID: 115522

SHEET NAME

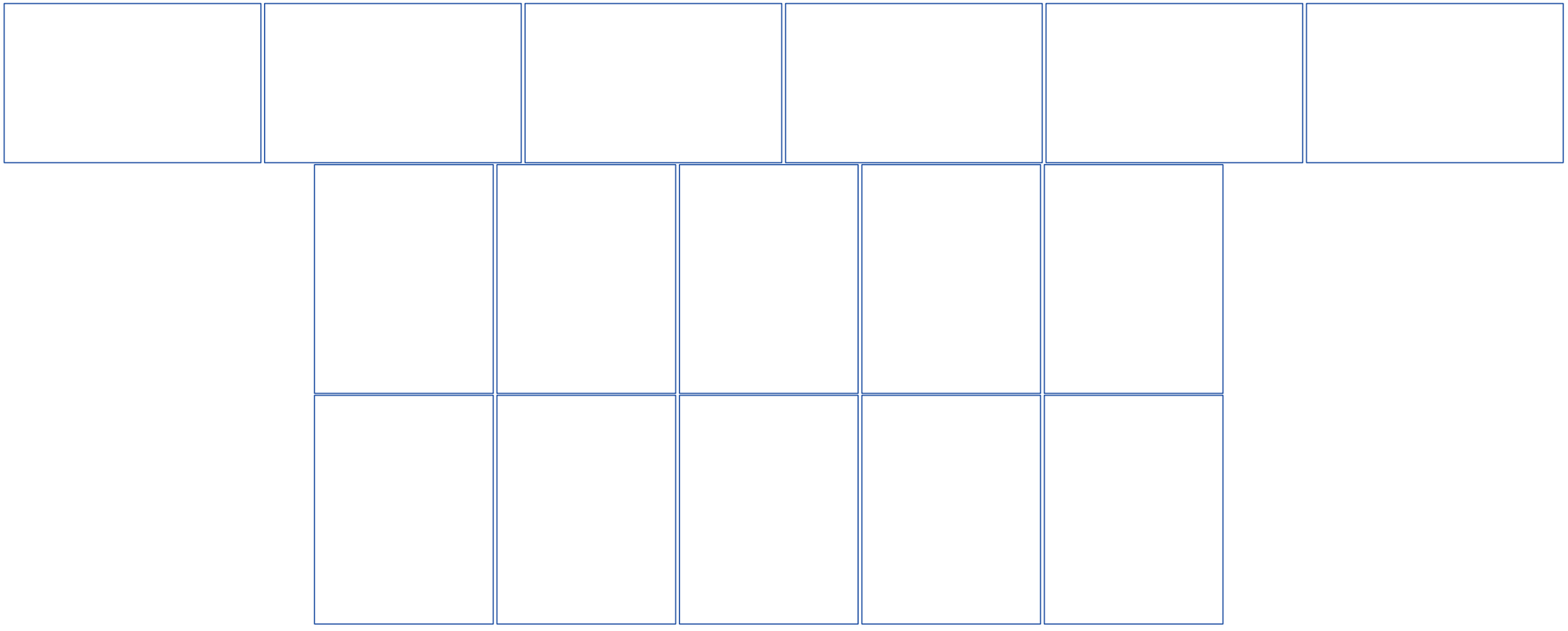
RACKING PLAN

SHEET SIZE

ANSI B
11" x 17"

SHEET NUMBER

PV-1A



ENPHASE ENVOY S/N_____

CONTRACTOR

FREEDOM™
SOLAR POWER

FREEDOM SOLAR LLC
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PE STAMP

PROJECT NAME

SHARON BRUCE
55 WELCOME DRIVE
FUQUAY VARINA, NORTH CAROLINA, 27526
(770) 820-9142
PROJECT ID: 115522

SHEET NAME

STRING MAP & MONITORING LAYOUT

SHEET SIZE

ANSI B
11" x 17"

SHEET NUMBER

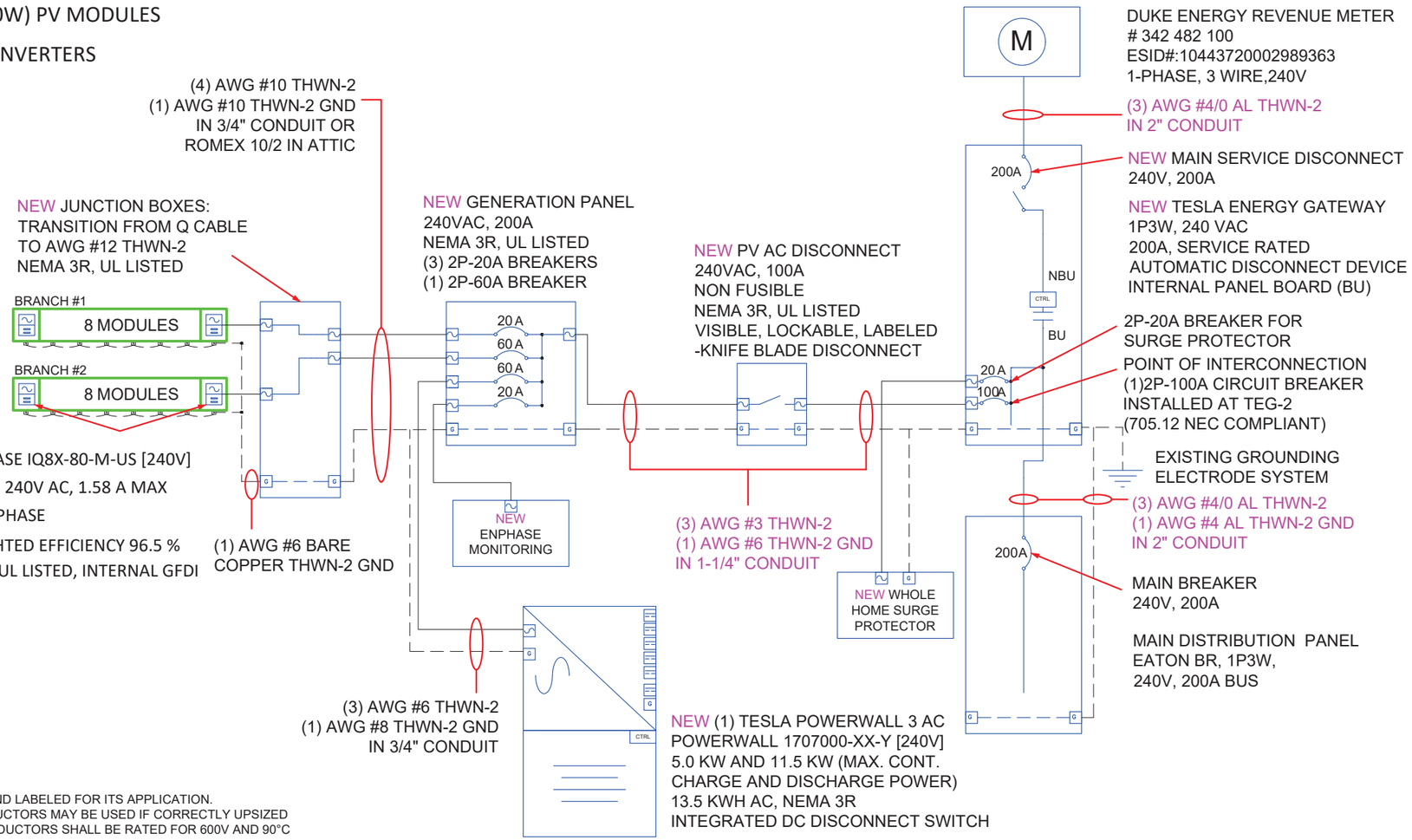
PV-2

SOLAR ARRAY - 7.360 KW DC STC, 6.080 KW AC, 1-PHASE
(16) REC SOLAR REC460AA PURE-RX (460W) PV MODULES

(16) ENPHASE IQ8X-80-M-US [240V] PV INVERTERS

- THE EXPORT OF THE POWERWALL INVERTER IS BEING CURTAILED TO BATTERY USAGE ONLY

UTILITY SHUTDOWN REQUIRED TO INSTALL TEG BETWEEN MDP AND METER.



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 ACESSORIES 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.

CALCULATIONS FOR CURRENT CARRYING CONDUCTORS
INVERTER OUTPUT WIRE AMPACITY CALCULATION [NEC 690.8(A)(3)]: 1.58A PER INVERTER ENPHASE IQ8X-80-M-US [240V] MAXIMUM INVERTER BRANCH CURRENT = (10)(1.58A) = 15.80A CONTINUOUS USE: #10 WIRE 75°C DERATED AMPACITY = (0.80)(35.0A) = 28.00A 28.00A > 15.80A CONDITIONS OF USE: #10 WIRE 90°C DERATED AMPACITY = (0.91)(0.80)(40.0A) = 29.12A 29.12A > 15.80A GENERATION PANEL OUTPUT WIRE AMPACITY CALCULATION [NEC 690.8(A)(3)]: 1.58A PER INVERTER ENPHASE IQ8X-80-M-US [240V] [NEC 690.8(A)(3)]: 48.00A PER INVERTER TESLA POWERWALL 3 1707000-XX-Y [240V] COMBINED CURRENT = (16)(1.58A) + 48.00A = 73.28A CONTINUOUS USE: #3 WIRE 75°C DERATED AMPACITY = (0.80)(100A) = 80.00A 80.00A > 73.28A CONDITIONS OF USE: #3 WIRE 90°C DERATED AMPACITY = (0.91)(115A) =104.65A 104.65A > 73.28A

CALCULATIONS FOR OVERCURRENT DEVICES
INVERTER BRANCH AC CURRENT CALCULATION [NEC 690.8(A)(3)]: 1.58A PER INVERTER ENPHASE IQ8X-80-M-US [240V] MAXIMUM BRANCH INVERTER CURRENT = (10)(1.58A) = 15.80A MINIMUM OCPD = (15.80A)(1.25) = 19.75A USE 2P-20A BREAKERS IN GENERATION PANEL FOR INVERTER BRANCH OCPD SYSTEM AC CURRENT CALCULATION [NEC 690.8(A)(3)]: 1.58A PER INVERTER ENPHASE IQ8X-80-M-US [240V] [NEC 690.8(A)(3)]: 48.00A PER INVERTER TESLA POWERWALL 3 1707000-XX-Y [240V] COMBINED CURRENT = (16)(1.58A) + 48.00A = 73.28A MINIMUM OCPD = (73.28A)(1.25) = 91.60A USE (1) 2P-100A BREAKER IN TEG-2 FOR SYSTEM OCPD

CALCULATION FOR OVERCURRENT POWERWALL DEVICES
TESLA POWERWALL 3 1707000-XX-Y [240V] OUTPUT CURRENT CALCULATION OUTPUT CURRENT = 48.00A MINIMUM OCPD = (48.00A)(1.25) = 60.00A USE (1) 2P-60A BREAKER IN GENERATION PANEL FOR POWERWALL OCPD

CONTRACTOR

FREEDOM™ SOLAR POWER

FREEDOM SOLAR LLC
4801 FREIDRICH LN, STE 100
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PE STAMP

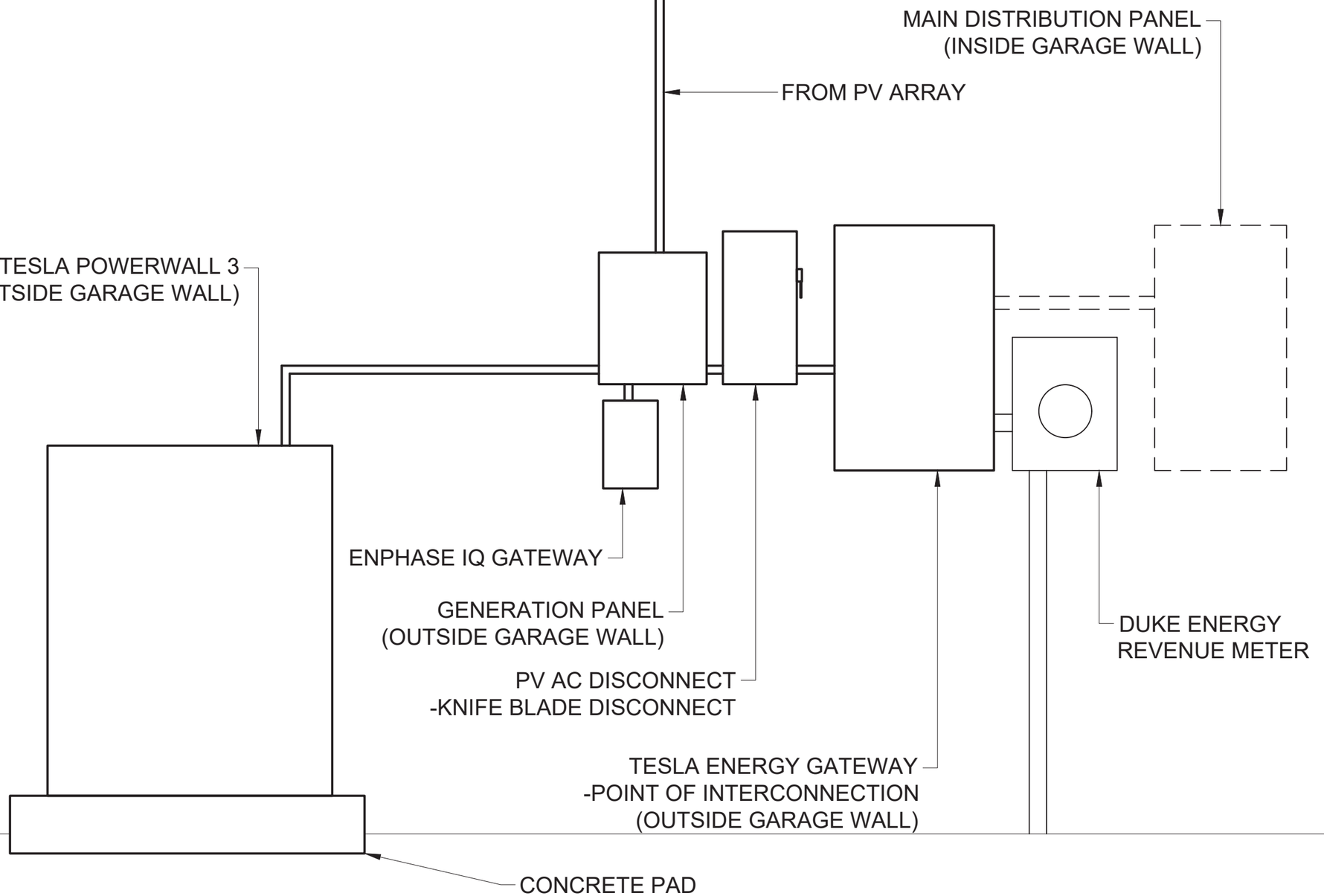
PROJECT NAME

SHARON BRUCE
55 WELCOME DRIVE
FUQUAY VARINA, NORTH CAROLINA, 27526
(770) 820-9142
PROJECT ID: 115522

SHEET NAME
ELECTRICAL DIAGRAM

SHEET SIZE
ANSI B
11" x 17"

SHEET NUMBER
PV-3



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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REVISION	08/10/2024	A

PE STAMP

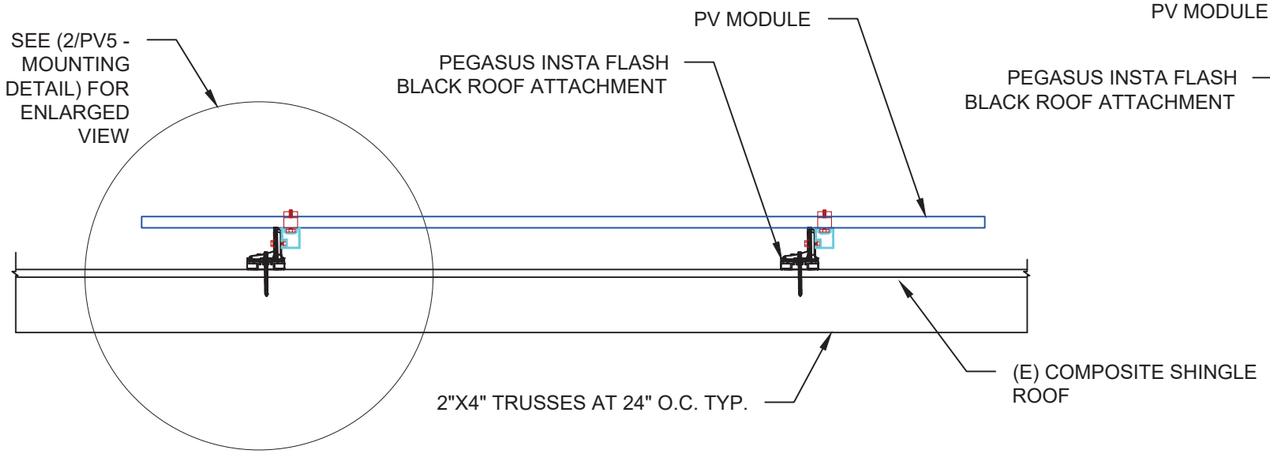
PROJECT NAME

SHARON BRUCE
55 WELCOME DRIVE
FUQUAY VARINA, NORTH
CAROLINA, 27526
(770) 820-9142
PROJECT ID: 115522

SHEET NAME
EQ.WALL

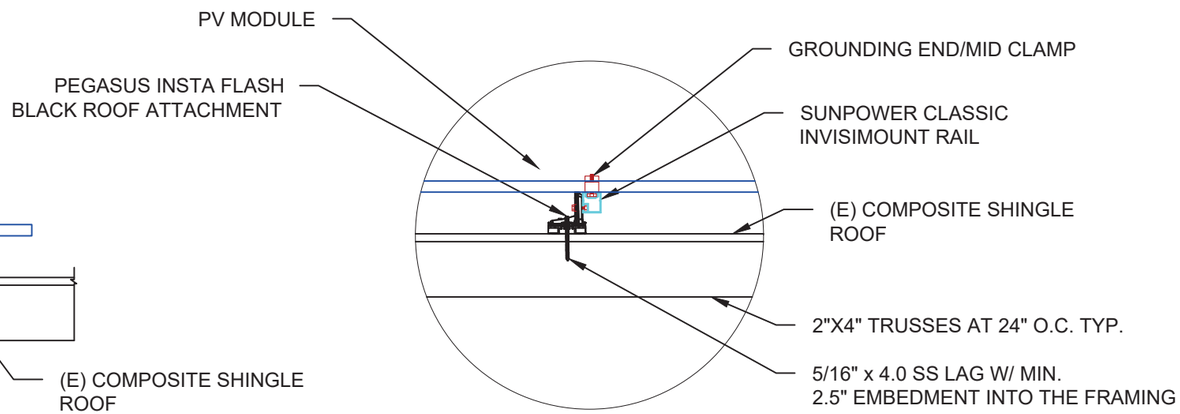
SHEET SIZE
ANSI B
11" x 17"

SHEET NUMBER
PV-4



MOUNTING METHOD 1

NTS



MOUNTING DETAIL 2

NTS

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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REVISION	08/10/2024	A

PE STAMP

PROJECT NAME

SHARON BRUCE
55 WELCOME DRIVE
FUQUAY VARINA, NORTH CAROLINA, 27526
(770) 820-9142
PROJECT ID: 115522

SHEET NAME

MOUNTING DETAIL

SHEET SIZE

ANSI B
11" x 17"

SHEET NUMBER

PV-5

NOTE: NOT ALL LABELS MAY BE APPLICABLE

SIGNAGE REQUIREMENTS

> RED BACKGROUND
> WHITE LETTERING
> MIN. 3/8" LETTER HEIGHT
> ALL CAPITAL LETTERS
> ARIAL OR SIMILAR FONT
> REFLECTIVE, WEATHER RESISTANT MATERIAL, UL 969

PV SYSTEM DISCONNECT

REQ'D BY: NEC 690.13(B) — A

APPLY TO:
PV DISCONNECT

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

REQ'D BY: NEC 690.13(B) — B

APPLY TO:
PV DISCONNECT

WARNING: PHOTOVOLTAIC POWER SOURCE

REQ'D BY: NEC 690.31(G)(3) — C

APPLY TO:
RACEWAYS, CABLE TRAYS, OTHER WIRING METHODS, AND ENCLOSURES THAN CONTAIN PV SYSTEM DC CONDUCTORS

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

REQ'D BY: NEC 705.12(B)(2)(3)(b) — D

APPLY TO:
DISTRIBUTION EQUIPMENT ADJACENT TO BACK-FED BREAKER

2" ADDRESS NUMBERS

REQ' BY: AHJ — E

APPLY TO:
REVENUE METER SOCKET (IF APPLICABLE)

REVENUE METER

REQ'D BY: AHJ — F

APPLY TO:
REVENUE METER SOCKET (IF APPLICABLE)

MONITORING

REQ'D BY: FREEDOM SOLAR — G

APPLY TO:
MONITORING DEVICE ENCLOSURE

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

REQ'D BY: NEC 690.56(C)(2) — H

APPLY TO:
PV DISCONNECT

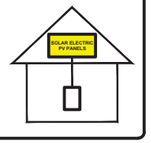
PHOTOVOLTAIC SYSTEM
AC DISCONNECT
OPERATING CURRENT: 73.28A
OPERATING VOLTAGE: 240 VAC

REQ'D BY: 690.56(1)(a) — I

APPLY TO:
PV DISCONNECT

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: NEC 690.56(C)(1)(a) — J

APPLY TO:
MAIN DISTRIBUTION PANEL

CAUTION

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 — K

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 LABELS

CONTRACTOR
FREEDOM™ SOLAR POWER
FREEDOM SOLAR LLC
4801 FREIDRICH LN, STE 100
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PE STAMP

PROJECT NAME

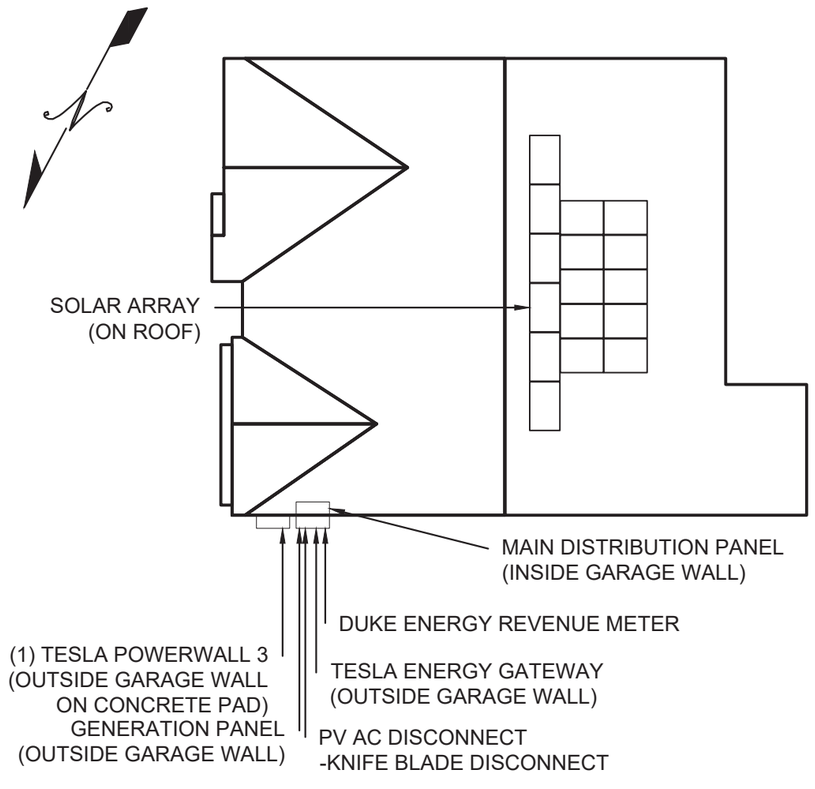
SHARON BRUCE
55 WELCOME DRIVE
FUQUAY VARINA, NORTH CAROLINA, 27526
(770) 820-9142
PROJECT ID: 115522

SHEET NAME
SYSTEM LABELING DETAIL

SHEET SIZE
ANSI B
11" x 17"

SHEET NUMBER
PV-6

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



QUESTIONS, CALL:
800-504-2337
www.freedomsolarpower.com

FREEDOM SOLAR POWER
55 WELCOME DRIVE
PROJECT ID: 115522

CONTRACTOR

FREEDOM™ SOLAR POWER

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PROJECT NAME

SHARON BRUCE
55 WELCOME DRIVE
FUQUAY VARINA, NORTH CAROLINA, 27526
(770) 820-9142
PROJECT ID: 115522

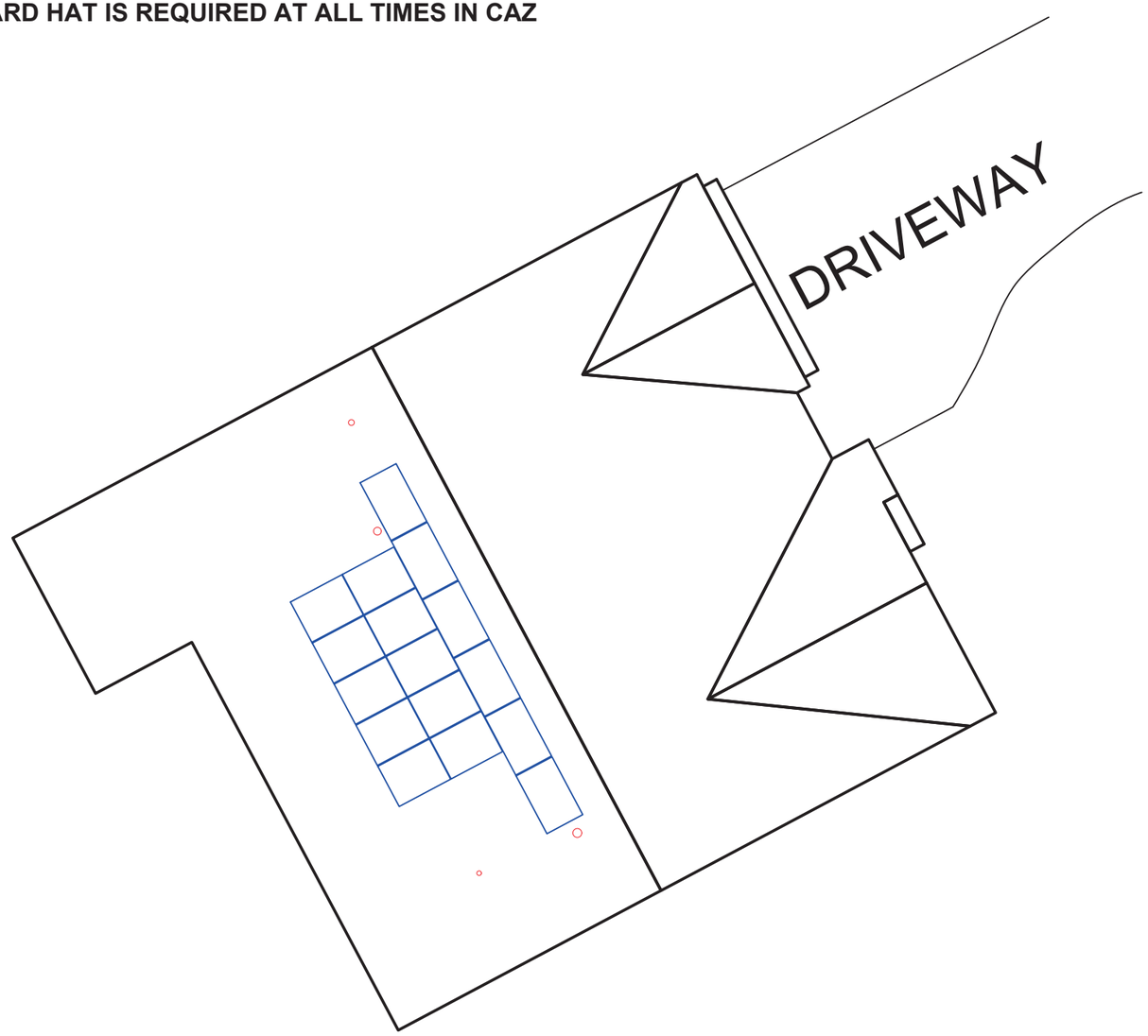
SHEET NAME
SITE DIRECTORY PLACARD

SHEET SIZE
ANSI B
11" x 17"

SHEET NUMBER
PV-7

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



COMPETENT PERSON: _____ **JOB START DATE:** _____

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. _____

CONTRACTOR

FREEDOM™ SOLAR POWER

FREEDOM SOLAR LLC
4801 FREIDRICH LN, STE 100
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PROJECT NAME

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55 WELCOME DRIVE
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(770) 820-9142
PROJECT ID: 115522

SHEET NAME

SAFETY PLAN

SHEET SIZE

ANSI B
11" x 17"

SHEET NUMBER

PV-8

SOLAR'S MOST TRUSTED

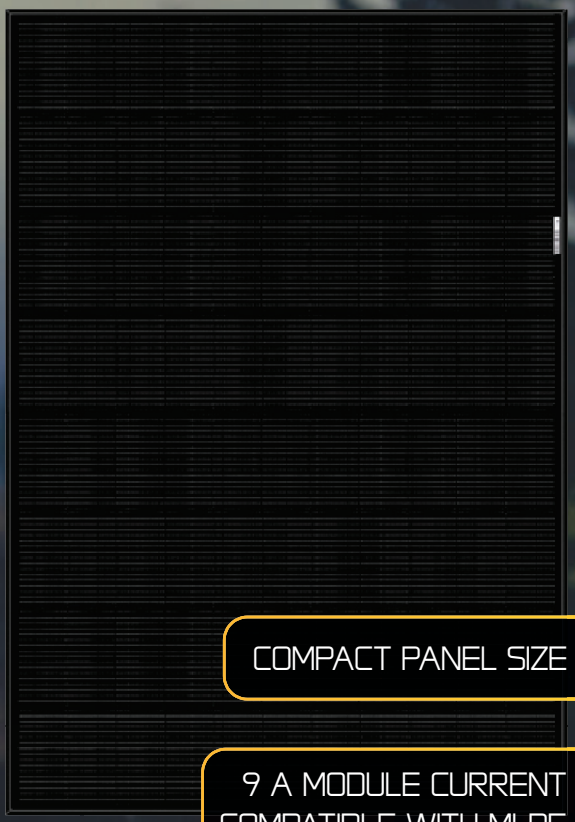
REC

REC ALPHA® PURE-RX SERIES

PRODUCT SPECIFICATIONS

470 WP

226 W/M²



COMPACT PANEL SIZE

9 A MODULE CURRENT
COMPATIBLE WITH MLPE

PRODUCT
REC
25 YEAR
PROTRUST
WARRANTY
PERFORMANCE
LABOR

ELIGIBLE

LEAD-FREE
ROHS COMPLIANT

EXPERIENCE α PERFORMANCE

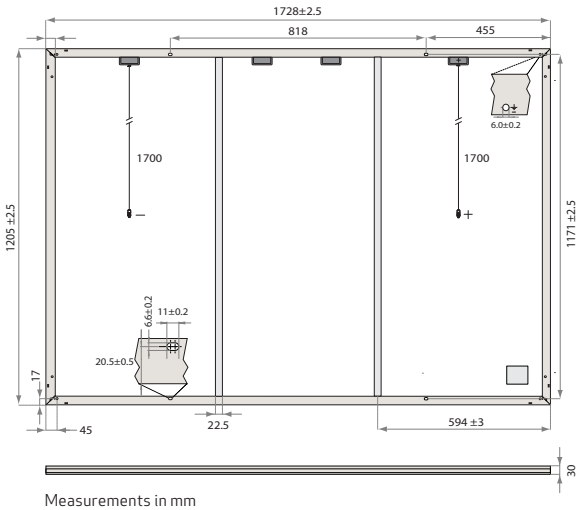
REC ALPHA PURE-RX SERIES

PRODUCT SPECIFICATIONS

REC
SOLAR'S MOST TRUSTED

GENERAL DATA

Cell type:	88 half-cut REC bifacial, heterojunction cells with lead-free, gapless technology
Glass:	3.2 mm solar glass with anti-reflective surface treatment in accordance with EN 12150
Backsheet:	Highly resistant polymer
Frame:	Anodized aluminum (black)
Junction box:	4-part, 4 bypass diodes, lead-free IP68 rated, in accordance with IEC 62790
Connectors:	Stäubli MC4 PV-KBT4/KST4 (4 mm²) in accordance with IEC 62852, IP68 only when connected
Cable:	4 mm² solar cable, 1.7 + 1.7 m in accordance with EN 50618
Dimensions:	1728 x 1205 x 30 mm (2.08 m²)
Weight:	23.4 kg
Origin:	Made in Singapore



Measurements in mm

ELECTRICAL DATA — Product Code*: RECxxxAA Pure-RX

STC			
Power Output - P_{MAX} (Wp)	450	460	470
Watt Class Sorting - (W)	0/+10	0/+10	0/+10
Nominal Power Voltage - V_{MPP} (V)	54.3	54.9	55.4
Nominal Power Current - I_{MPP} (A)	8.29	8.38	8.49
Open Circuit Voltage - V_{OC} (V)	65.1	65.3	65.6
Short Circuit Current - I_{SC} (A)	8.81	8.88	8.95
Power Density (W/m²)	216	221	226
Panel Efficiency (%)	21.6	22.1	22.6
NMOT			
Power Output - P_{MAX} (Wp)	343	350	358
Nominal Power Voltage - V_{MPP} (V)	51.2	51.7	52.2
Nominal Power Current - I_{MPP} (A)	6.70	6.77	6.86
Open Circuit Voltage - V_{OC} (V)	61.3	61.6	61.8
Short Circuit Current - I_{SC} (A)	7.11	7.17	7.23

Values at standard test conditions (STC: air mass AM 1.5, irradiance 1000 W/m², temperature 25°C), based on a production spread with a tolerance of P_{MAX}, V_{OC} & I_{SC} ±3% within one watt class. Nominal module operating temperature (NMOT: air mass AM 1.5, irradiance 800 W/m², temperature 20°C, windspeed 1 m/s). * Where xxx indicates the nominal power class (P_{MAX}) at STC above.

MAXIMUM RATINGS

Operational temperature:	-40 ... +85°C
Maximum system voltage:	1000 V
Maximum test load (front):	+7000 Pa (713 kg/m²)*
Maximum test load (rear):	-4000 Pa (407 kg/m²)*
Max series fuse rating:	25 A
Max reverse current:	25 A

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

WARRANTY

	Standard	REC ProTrust	
Installed by an REC Certified Solar Professional	No	Yes	Yes
System Size	All	≤25 kW	25-500 kW
Product Warranty (yrs)	20	25	25
Power Warranty (yrs)	25	25	25
Labor Warranty (yrs)	0	25	10
Power in Year 1	98%	98%	98%
Annual Degradation	0.25%	0.25%	0.25%
Power in Year 25	92%	92%	92%

The REC ProTrust Warranty is only available on panels purchased through an REC Certified Solar Professional installer. Warranty conditions apply. See www.recgroup.com for more details.

CERTIFICATIONS

IEC 61215:2021, IEC 61730:2016, UL 61730	
IEC 62804	PID
IEC 61701	Salt Mist
IEC 62716	Ammonia Resistance
ISO 11925-2	Ignitability (EN 13501-1 Class E)
IEC 62782	Dynamic Mechanical Load
IEC 61215-2:2016	Hailstone (35mm)
IEC 62321	Lead-free acc. to RoHS EU 863/2015
IEC 61730-2:2016	Fire Class C (as per UL 790)
ISO 14001, ISO 9001, IEC 45001, IEC 62941	

Lead-Free

take-e-way WEEE-compliant recycling scheme

Declare. Living Building Challenge Compliant

TEMPERATURE RATINGS*

Nominal Module Operating Temperature:	44°C (±2°C)
Temperature coefficient of P_{MAX}:	-0.24 %/°C
Temperature coefficient of V_{OC}:	-0.24 %/°C
Temperature coefficient of I_{SC}:	0.04 %/°C

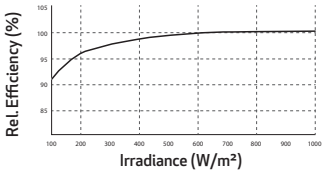
*The temperature coefficients stated are linear values

DELIVERY INFORMATION

Panels per pallet:	33
Panels per 40 ft GP/high cube container:	594 (18 pallets)
Panels per 13.6 m truck:	660 (20 pallets)

LOW LIGHT BEHAVIOUR

Typical low irradiance performance of module at STC:



Available from:

Founded in 1996, REC Group is an international pioneering solar energy company dedicated to empowering consumers with clean, affordable solar power. As Solar's Most Trusted, REC is committed to high quality, innovation, and a low carbon footprint in the solar materials and solar panels it manufactures. Headquartered in Norway with operational headquarters in Singapore, REC also has regional hubs in North America, Europe, and Asia-Pacific.

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REC
www.recgroup.com

Specifications subject to change without notice.
Ref: PM-DS-12-06-Rev- 3.1 10.23

REC
SOLAR'S MOST TRUSTED

REC TECHNICAL DOCUMENTATION

Title:	Datasheet - REC Alpha Pure-RX

VER	DATE	REASON FOR ISSUE	SOURCE	PREPARED	APPROVED
1	07.2022	First issue		Alpay	
2	03.2023	Electrical data update due to new layout, size changes, Tcoeff to -0.24%,			
2.1	04.2023	Update to module drawing (4 JB)	Mail from Eddie 14.04.23		
2.2	05.2023	Updates to weight, addition of fire class, mounting hole dimensions, removal of certifications(pending)	Mail from Adeline 30.05.23		
2.3	06.2023	Update to watt classes (460 - 480 Wp)	Mail from Adeline 13.06.23		
3	08.2023	Revision of watt classes to 470 Wp max, specific key visual added	Mail from Cem 02.08.23		
3.1	10.2023	Corrected typo and added Declare statement			

PRELIMINARY DATASHEET

IQ8X Microinverter

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

IQ8X Microinverter is the latest addition to this family, designed to support PV modules with high input DC voltage and cell counts, such as 80-half-cut cells, 88-half-cut cells and 96-cells.

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

Enphase 25 year limited warranty

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

Connect PV modules quickly and easily to the IQ8 Series Microinverters with integrated MC4 connectors.

CERTIFIED SAFETY

IQ8 Series Microinverters are UL Listed as PV rapid shutdown equipment and conform with regulations when installed according to the manufacturer's instructions.

*Meets UL 1741 only when installed with IQ System Controller 2 and 3.

Easy to install

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

High productivity and reliability

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

Microgrid-forming

- Complies with the latest advanced grid support
- Remote automatic updates for the latest grid requirements
- Configurable to support a wide range of grid profiles
- Meets CA Rule 21 (UL 1741-SA) and IEEE 1547:2018 (UL 1741-SB)

NOTE:

- IQ8 Series Microinverters cannot be mixed with previous generations of Enphase microinverters (IQ7 Series, IQ6 Series, and so on) in the same system.
- IQ Gateway is required to change the default grid profile at the time of installation to meet local Authority Having Jurisdiction (AHJ) requirements.

IQ8X Microinverter

INPUT DATA (DC)	UNIT	IQ8X-80-M-US
Commonly used module pairings [1]	W	320–540
Module compatibility	–	To meet compatibility, PV modules must be within the following maximum input DC voltage and maximum module I_{sc} Module compatibility can be checked at https://enphase.com/installers/microinverters/calculator
MPPT voltage range	V	43–60
Operating range	V	25–79.5
Minimum and maximum start voltage	V	30–79.5
Maximum input DC voltage	V	79.5
Maximum continuous operating DC current	A	10
Maximum input DC short-circuit current	A	16
Maximum module I_{sc}	A	13
Overvoltage class DC port	–	II
DC port backfeed current	mA	0
PV array configuration	–	Ungrounded array; no additional DC side protection requires maximum 20 A per branch circuit

OUTPUT DATA (AC)	UNIT	IQ8X-80-M-US @240 VAC	IQ8X-80-M-US @208 VAC
Peak output power	VA	384	366
Maximum continuous output power	VA	380	360
Nominal grid voltage (L-L)	V	240, split-phase (L-L), 180°	208, single-phase (L-L), 120° [4]
Minimum and maximum grid voltage [2]	V	211–264	183–229
Max. continuous output current	A	1.58	1.73
Nominal frequency	Hz	60	
Extended frequency range	Hz	47–68	
AC short circuit fault current over three cycles	A_{rms}	2.70	
Maximum units per 20 A (L-L) branch circuit [3]	–	10	9
Total harmonic distortion	%	<5	
Overvoltage class AC port	–	III	
AC port backfeed current	mA	18	
Power factor setting	–	1.0	
Grid-tied power factor (adjustable)	–	0.85 leading ... 0.85 lagging	
Peak efficiency	%	97.3	97.0
CEC weighted efficiency	%	96.5	96.5
Nighttime power consumption	mW	26	12

MECHANICAL DATA	
Ambient temperature range	-40°C to 65°C (-40°F to 149°F)
Relative humidity range	4% to 100% (condensing)
DC connector type	Stäubli MC4
Dimensions (H × W × D); Weight	212 mm (8.3") × 175 mm (6.9") × 30.2 mm (1.2"); 1.1 kg (2.43 lbs)
Cooling	Natural convection – no fans
Approved for wet locations; Pollution degree	Yes; PD3
Enclosure	Class II double-insulated, corrosion-resistant polymeric enclosure
Environmental category; UV exposure rating	NEMA Type 6; outdoor

COMPLIANCE	
Certifications	CA Rule 21 (UL 1741-SA), UL 62109-1, IEEE 1547:2018 (UL 1741-SB), 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 shutdown equipment and conforms with NEC 2014, NEC 2017, NEC 2020, and NEC 2023 section 690.12 and C22.1-2018 Rule 64-218 rapid shutdown of PV systems for AC and DC conductors when installed according to the manufacturer's instructions.

(1) No enforced DC/AC ratio.
(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.
(4) IQ8X is not certified for use with Enphase Three Phase Network Protection Relay (NPR-3P-208-NA) and therefore designed for single-phase operation only. Check with the local utility requirements if you wish to install single phase inverter across three phases.

IQ8X-MC4-DSH-00185-2.0-EN-US-2023-11-16

Data Sheet
Enphase Q Cable Accessories
Region: INDIA

Enphase Q Cable and Accessories

The **Enphase Q Cable™** and accessories are part of the sixth generation Enphase IQ System™. These products provide simplicity, reliability, and faster installation times.

Enphase Q Cable

- Two-wire, double-insulated Enphase Q Cable is 50% lighter than the previous generation Enphase cable
- Four-wire (three-phase) option also available
- New cable numbering and plug and play connectors speed up installation and simplify wire management
- Link connectors eliminate cable waste

Field-Wireable Connectors

- Easily connect Q cables on the roof without complex wiring
- Make connections from any open connector and center feed any section of cable within branch limits
- Available in male and female connector types

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

ENPHASE.

Enphase Q Cable Accessories

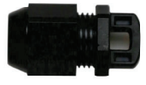
Q CABLE SPECIFICATIONS	
Voltage rating	600V (connector rating up to 250 V)
Cable temperature rating	90° C wet/dry
UV exposure rating	EN ISO 492-2
Environmental protection rating	IEC 60529 IP67
Compliance	RoHS, OIL RES I, CE, UV resistant
Cable insulator rating	H07BQ-F
Flame rating	IEC 60332-1-2

Q CABLE TYPES / ORDERING OPTIONS

Model Number	Max Nominal Voltage	Ampacity Rating	Connector Spacing	PV Module Orientation	Connector Count per Box
Q-25-10-240 (single-phase)	250 VAC	25 A	1.3 m	Portrait	240
Q-25-17-240 (single-phase)	250 VAC	25 A	2.0 m	Landscape (60-cell)	240
Q-25-20-200 (single-phase)	250 VAC	25 A	2.3 m	Landscape (72-cell)	200
Q-25-10-3P-200 (three-phase)	250 VAC	25 A	1.3 m	Portrait	200
Q-25-17-3P-160 (three-phase)	250 VAC	25 A	2.0 m	Landscape (60-cell)	160
Q-25-20-3P-160 (three-phase)	250 VAC	25 A	2.3 m	Landscape (72-cell)	160

ENPHASE Q CABLE ACCESSORIES

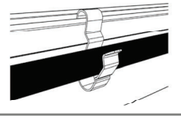
Name	Model Number	Description
Raw Q Cable (single-phase)	Q-25-RAW-300	300 meters cable with no connectors
Raw Q Cable (three-phase)	Q-25-RAW-3P-300	300 meters cable with no connectors
Field-wireable connector (male)	Q-CONN-R-10M	Make connections using single-phase cable
Field-wireable connector (male)	Q-CONN-3P-10M	Make connections using three-phase cable
Field-wireable connector (female)	Q-CONN-R-10F	Make connections from any Q Cable (single-phase) open connector
Field-wireable connector (female)	Q-CONN-3P-10F	Make connections from any Q Cable (three-phase) open connector
Cable Clip	ET-CLIP-100	Used to fasten cabling to the racking or to secure looped cabling
Disconnect tool	Q-DISC-10	Disconnect tool for Q Cable connectors, DC connectors, and AC module mount
Disconnect tool	Q-DISC-3P-10	Disconnect tool for three-phase Field wireable connectors
Q Cable sealing caps (female)	Q-SEAL-10	One needed to cover each unused connector on the cabling
Terminator (single-phase)	Q-TERM-R-10	Terminator cap for unused single-phase cable ends
Terminator (three-phase)	Q-TERM-3P-10	Terminator cap for unused three-phase cable ends
Replacement DC Adaptor (MC4)	Q-DCC-2-INT	DC adaptor to MC4 (max voltage 100 VDC)



TERMINATOR
Terminator cap for unused cable ends, sold in packs of ten (Q-TERM-R-10 / Q-TERM-3P-10))

SEALING CAPS
Sealing caps for unused cable connections, sold in packs of ten (Q-SEAL-10)

DISCONNECT TOOL
Plan to use at least one per installation, sold in packs of ten (Q-DISC-10)
Three-phase model (Q-DISC-3P-10)



CABLE CLIP
Used to fasten cabling to the racking or to secure looped cabling, sold in packs of one hundred (ET-CLIP-100)

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

2018-11-26

ENPHASE.

IQ Gateway

The IQ Gateway delivers solar production and energy consumption data to Enphase Installer Portal monitoring and analysis software for comprehensive, remote maintenance, and management of Enphase systems.

With integrated production metering and optional consumption monitoring, the IQ Gateway is the platform for total energy management. It integrates with the IQ System Controller and IQ Battery.

IQ Series Microinverters
The high-powered smart grid-ready IQ Series Microinverters (IQ6, IQ7, and IQ8 Series) dramatically simplify the installation process.

IQ System Controller
Provides microgrid interconnect device (MID) functionality by automatically detecting grid failures and seamlessly transitioning the home energy system from grid power to backup power.

IQ Battery
All-in-one AC coupled storage system that is reliable, smart, simple, and safe. It provides backup capability and installers can quickly design the right system size to meet the needs of both new and retrofit solar customers.

IQ Load Controller
Helps prioritize essential appliances during a grid outage to optimize energy consumption and prolong battery life.

Smart

- Enables web-based monitoring and control
- Provides bidirectional communications for remote upgrades
- Supports power export limiting and zero-export applications

Simple

- Easy system configuration using Enphase Installer App
- Flexible networking with Wi-Fi, Ethernet, or cellular

Reliable

- Designed for installation indoors or outdoors in a NEMA 3R rated enclosure
- 5-year limited warranty
- ENV2-IQ-AM1-240 complies with IEEE 1547:2018 (UL 1741-SB, 3rd Ed.)

Enphase 5 year limited warranty

UL LISTED

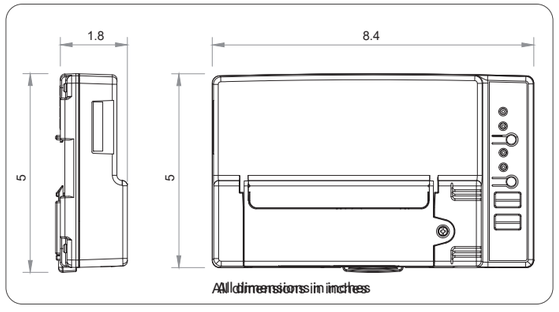
IQ Gateway

MODEL NUMBER	ENV-IQ-AM1-240, ENV2-IQ-AM1-240
IQ Gateway ENV-IQ-AM1-240 ENV2-IQ-AM1-240 (IEEE 1547:2018)	IQ Gateway integrates revenue grade PV production metering (ANSI C12.20 ±0.5%), consumption metering (±2.5%), and battery metering (+- 2.5%) with IQ Battery 5P. Includes one 200 A continuous rated Production current transformer (CT).
ACCESSORIES - ORDER SEPARATELY	
Mobile Connect COMMS-CELLMODEM-M1-06 CELLMODEM-M1-06-SP-05 CELLMODEM-M1-06-AT-05	- Includes COMMS-KIT-01 and CELLMODEM-M1-06-SP-05 with 5-year Sprint data plan - 4G based LTE-M1 cellular modem with 5-year Sprint data plan - 4G based LTE-M1 cellular modem with 5-year AT&T data plan
Consumption monitoring CT and IQ Battery 5P metering CT CT-200-SPLIT CT-200-CLAMP	Split-core and clamp style CTs with 2.5% accuracy enable whole home and IQ Battery 5P metering
Communications Kit COMMS-KIT-01 COMMS-KIT-02	Installed at the IQ Gateway. For communications with IQ Battery and IQ System Controller. Includes USB cable for connection to IQ Gateway or IQ Combiner and allows wireless communication with IQ Battery and IQ System Controller.
POWER REQUIREMENTS	
Power requirements	120/240 VAC split-phase maximum 20 A overcurrent protection required
Typical power consumption	5 W
CAPACITY	
Number of microinverters polled	Up to 300
MECHANICAL & ELECTRICAL DATA	
Dimensions (W×H×D)	21.3 cm × 12.6 cm × 4.5 cm (8.4 in × 5 in × 1.8 in)
Weight	1.09 lb
Ambient temperature range	-40°C to 65°C (-40°F to 149°F) [ENV-IQ-AM1-240] -40°C to 50°C (-40°F to 122°F) [ENV2-IQ-AM1-240] -40°C to 46°C (-40°F to 115°F) if installed in an enclosure
Environmental rating	IP30. For installation indoors or in an NRTL-certified, NEMA type 3R or better-rated enclosure, if installing outdoors.
Altitude	Up to 2,600 meters (8,530 feet)

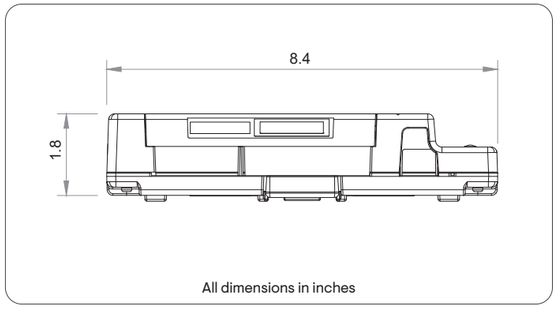
COMMUNICATION INTERFACES	
Integrated Wi-Fi	802.11b/g/n (2.4 GHz, 5 GHz), for connecting the Enphase Cloud via the internet.
Wi-Fi range (recommended)	10 m
Ethernet	Optional, 802.3, Cat5E (or Cat 6) UTP Ethernet cable (not included), for connecting to the Enphase Cloud via the internet.
Mobile Connect	CELLMODEM-M1-06-SP-05, CELLMODEM-M1-06-AT-05 (to be purchased separately, mandatory for sites with IQ Battery)
Digital I/O	Digital input/output for grid operator control
USB 2.0	For Mobile Connect and Communications Kit
Access point (AP) mode	For a connection between the IQ Gateway and a mobile device running the Enphase Installer App
Metering ports	Up to two Consumption CTs, one Production CT, and one battery CT (for IQ Battery 5P)
Power line communication (PLC)	90-110 kHz (Class B), to microinverters.
Web API	Refer to https://developer-v4.enphase.com
Local API	Refer to guide for local API
LED indicators	From top to bottom: Cloud connectivity, Wi-Fi access point mode, PV production state, PLC communications state
Configured via	Enphase Installer App and Enphase Installer Platform

IQ-G-DSH-00111-2.0-EN-US-2023-08-24

POWER PRODUCTION/EXPORT LIMITING VIA THE IQ GATEWAY'S DIGITAL IO	
Maximum relays read	4
Capabilities supported	Power production limiting (Production CT/s required), power export limiting (Production CT/s required and Consumption CT/s – "Load with Solar" configuration)
Minimum IQ Gateway version	v7.3.120
Cable configurations	18 AWG, UL-Std. 62, 600 V, 105°C, and min 0.03 inches average thickness
Signal voltage range	2.5 V–5 V (digital high), 0 V–1.9 V (digital low)
Terminal blocks	Five terminals, up to 0.002 in^2
Configuration via	Enphase Installer App, Enphase Installer Platform (site settings)
SCOPE OF DELIVERY	
Package dimensions (H × W × D)	6.3" × 10.8" × 3.9"
Package weight	2.2 lb
Aluminium DIN rail	4.9 in
Current transformers (CTs)	One CT-200-SOLID included
COMPLIANCE	
Compliance	CA Rule 21 (UL 1741-SA), IEEE 1547:2018 - UL 1741-SB, 3rd Ed.(ENV2-IQ-AM1-240), UL 61010-1 CAN/CSA C22.2 No. 61010-1 Title 47 CFR, Part 15, Class B, ICES 003 IEC/EN 61010-1:2010, EN50065-1, EN61000-4-5, EN61000-6-1, EN61000-6-2 Metering: ANSI C12.20 accuracy class 0.5 (PV production only)
COMPATABILITY	
IQ System Controller	SC200D111C240US01, SC200G111C240US01, EP200G101-M240US01, EP200G101-M240US00
IQ Battery	IQBATTERY-5P-1P-NA, ENCHARGE-3T-1P-NA, ENCHARGE-10T-1P-NA
Microinverter	IQ6, IQ7, and IQ8 Series Microinverters



All dimensions in inches



All dimensions in inches

Accessories

Enphase Mobile Connect

4G-based LTE-M1 cellular modem with a 5-year data plan
(CELLMODEM-M1-06-SP-05 for Sprint and CELLMODEM-M1-06-AT-05 for AT&T)

Circuit breakers

BRK-10A-2-240V Circuit breaker, 2-pole, 10 A, Eaton BR210
BRK-15A-2-240V Circuit breaker, 2-pole, 15 A, Eaton BR215
BRK-20A-2P-240V Circuit breaker, 2-pole, 20 A, Eaton BR220
BRK-15A-2P-240V-B Circuit breaker, 2-pole, 15 A, Eaton BR215B with hold-down kit support
BRK-20A-2P-240V-B Circuit breaker, 2-pole, 20 A, Eaton BR220B with hold-down kit support

CT-200-SOLID

200 A revenue grade solid core Production CT with <0.5% error rate (replacement SKU)

CT-200-CLAMP

200 A clamp-style consumption and battery metering CT with <2.5% error rate (replacement SKU)

Revision history

REVISION	DATE	DESCRIPTION
DSH-00111-2.0	August 2023	Updated temperature specification for ENV2-IQ-AM1-240
DSH-00111-1.0	June 2023	Updated altitude and recommended maximum microinverters on a site.

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Data subject to change.

IQ-G-DSH-00111-2.0-EN-US-2023-08-24

PEGASUS

INSTAFLASH™

Never Deal With Caulking Again!
Factory-installed, non-hardening sealant

Protective Cage
Prevents sealant from getting on hands or roof. Collapses upon lag installation.

Before **InstaFlash Installed:**
Sealant is contained above roof surface by a protective cage.

After **InstaFlash Installed:**
Sealant is compressed to fill all holes and voids.

Effortless Lifetime Roof Protection

The non-hardening sealant completely fills any missed pilot holes, shingle rips, voids, or other potential water ingress points under the entire footprint of the 4.6" wide base.

25-Year Warranty
Manufactured with advanced materials and coatings to outlast the roof itself

Code Compliant
Fully IBC/CBC Code Compliant
Exceeds ASCE 7-16 Standards
FL Cert of Approval FL41396
UL2703 Certified

Self-Healing
The proprietary non-hardening sealant will flex and reseal over years of thermal expansion and contraction

Larger Spans
The extra-large L-foot and proprietary lag screw result in larger spans between mounts

Pegasus Solar Inc | 506 West Ohio Avenue, Richmond, CA 94804 | **www.pegasussolar.com**

PEGASUS

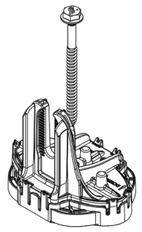
INSTAFLASH™

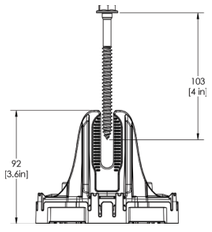
1
Drill pilot hole in the center of the rafter using a 7/32" bit.

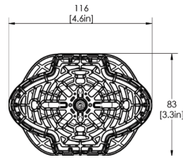
2
Place the InstaFlash over the pilot hole. **Note:** the direction of the InstaFlash Down arrows should point down the roof.

3
Insert the lag screw through the center hole into the pilot hole.

4
Drive the lag until the InstaFlash is fully seated to the roof.







SPECIFICATIONS	INSTAFLASH KITS				
	PIF-RB0	PIF-RBDT	PIF-RBSH	PIF-RM0	PIF-RMDT
Finish	Black			Mill	
Kit Contents	Black InstaFlash, 5/16" x 4.0" SS Lag	Black InstaFlash, 5/16" x 4.0" SS Lag, Dovetail T-bolt w/ Nut	Black InstaFlash, 5/16" x 4.0" SS Lag, M10 Hex Bolt w/ Nut	Mill Insta-Flash, 5/16" x 4.0" SS Lag	Mill InstaFlash, 5/16" x 4.0" SS Lag, Dovetail T-bolt w/ Nut
Attachment Type	Rafter Attached				
Roof Type	Sloped Roof: Composition Shingle, Rolled Asphalt | Flat roof: Modified Bitumen Roof, Built-Up Roof				
Sealant Application	Factory Installed				
Installation Temperature	0°F to 170° F				
Cure Time	Instantly Waterproof; Non-hardening				
Service Temperature	-40°F to 195° F				
Certifications	IBC, ASCE/SEI 7-16, FL Cert of Approval FL41396, TAS 100(A), UL2703				
Install Application	Most Railed Systems, Pegasus Tilt Leg Kit				
Kit Quantity	24				
Boxes per Pallet	36				

SCAN FOR INSTALLATION VIDEO

SCAN FOR FREE TRIAL

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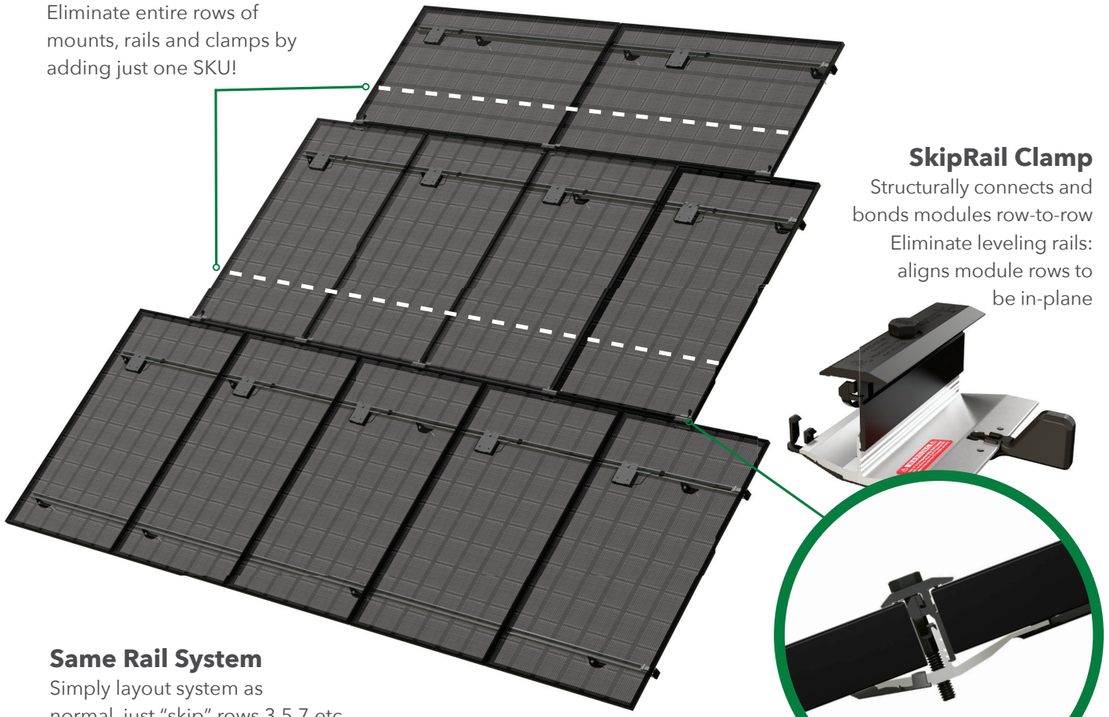
PEGASUS

SK•PRAIL

Skip Rows!

Eliminate entire rows of mounts, rails and clamps by adding just one SKU!



SkipRail Clamp

Structurally connects and bonds modules row-to-row
Eliminate leveling rails: aligns module rows to be in-plane

Same Rail System

Simply layout system as normal, just "skip" rows 3,5,7,etc. of attachments, rails, and clamps

A Revolution in Solar Installations

Lower your costs and provide your crews a faster system by eliminating entire rows of mounts, rails and clamps with just one SKU.

Dramatically Lower Costs

25% fewer rails and clamps
15% fewer roof penetrations
3500 lbs less per MW to ship, warehouse, pack, and load

Recruit the Best Crews

Less work = happier crews
300 lbs less per week to haul
Faster install
Auto-levels modules

Easy to Implement

Minimal to no training
Same layout as standard rail
Same open-channel wire management

Universal to Any Roof

Comp, Tile, Metal, other.
Low slow, steep slopes
Easily work around roof obstructions
Mixed portrait / landscape

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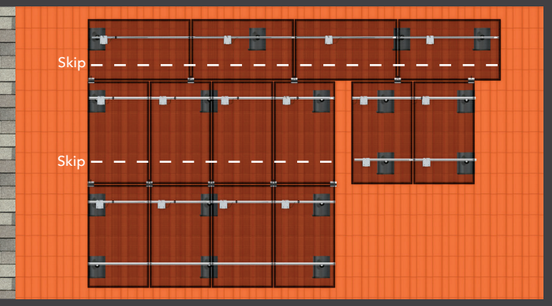
PEGASUS

SK•PRAIL

SkipRail SAVINGS | 18% fewer attachments • 32% fewer feet of rails
22% fewer pounds to ship & warehouse

Example of Comp Roof Array

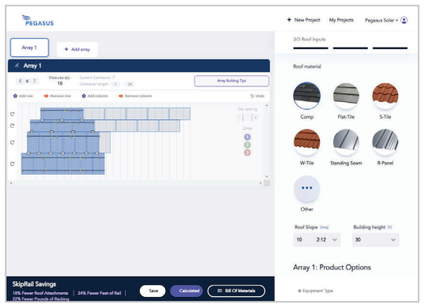
SkipRail SAVINGS | 21% fewer attachments • 30% fewer feet of rails
21% fewer pounds to ship & warehouse



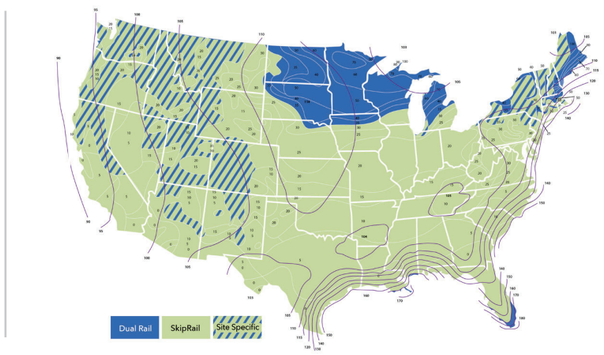
Example of Tile Roof Array

Free Design Tool:

pegasussolar.com/portal



Where SkipRail Works



Specifications	SkipRail Kits	
SKU	PSR-SRC	PSR-SRCK
Type	Floating Clamp	Extra support with Kickstand
Finish	Black	
PV module frames	30, 32, 35, 40mm	
Certifications	ASCE 7-16, IBC, CBC, UL2703	
Applicable Roof Types	Any	
Compatible Rail Systems	Pegasus Rail System	
Kit Contents	Pegasus SkipRail Clamp	Pegasus SkipRail Clamp with Kickstand
Kit Quantity	20	30

SCAN FOR VIDEO

SCAN FOR FREE TRIAL

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RAIL SYSTEM

Instant Bonding

The N-S Bonding Jumper bonds row to row with no tools.

One Clamp Anywhere

The Multi-Clamp works as mid- or end-clamp, and fits standard 30-40mm frames.

Lifetime Wire Management

Open rail channel holds and protects wires. Clamps won't pinch wires after tightening.

Bonding Structural Splice

Connect rails instantly, without tools, interference or limitations.

Next-Level Solar Mounting

A complete system for hassle-free rooftop installation, from watertight mounts to lifetime wire management.

Simplicity

1/2"socket for everything.
One clamp for mid or end.
No tool splicing and bonding.
Easy wire management.

Code Compliant

UL 2703 listed
LTR-AE-001-2012 listed
Class A fire rating for any slope
ASCE 7-16 PE Certified
FL Cert of Approval FL41396

Premium Aesthetics

The narrowest panel gap available. Optional Hidden End Clamps and End Caps provide a flush look on the edge of the array.

Watertight for Life

Secured on industry-leading Pegasus Mounts, for composite shingle and tile roofs.
Backed by a 25-year warranty.

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PEGASUS

RAIL SYSTEM

Pegasus Rail

Available in 14' and 7' lengths for easy layout and shipping.

Open-channel design holds MC4 connectors, PV wire and trunk cables.

Black and Mill finish

Pegasus Max Rail

Maximum-strength design.

Meets specifications for high snow-load and hurricane zones.

Black and Mill finish

Splice and Max Splice

Installs by hand.

Works over mounts.

Structurally connects and bonds rails automatically; UL2703 listed as reusable.

Dovetail T-bolt

Dovetail shape for extra strength.

Uses ½" socket.

Multi-Clamp

Fits 30-40mm PV frames, as mid- or end-clamp.

Twist-locks into position; doesn't pinch wires in rail.

Bonds modules to rail; UL2703 listed as reusable

Hidden End Clamp

Offers premium edge appearance.

Preinstalled pull-tab grips rail edge, allowing easy, one-hand installation.

Tucks away for reuse.

Ground Lug

Holds 6 or 8 AWG wire.

Mounts on top or side of rail.

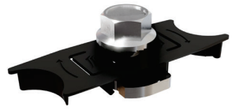
Assembled on MLPE Mount.

UL2703 listed as reusable.

N-S Bonding Jumper

Installs by hand, eliminates row-to-row copper wire.

UL2703 listed as reusable only with Pegasus Rail.



MLPE Mount

Secures and bonds most micro-inverters and optimizers to rail.

Connectors and wires easily route underneath after installation.

UL2703 listed as reusable.

Cable Grip

Secures four PV wires or two trunk cables.

Stainless-steel backing provides durable grip.

Eliminates sagging wires.

Wire Clip

Hand operable.

Holds wires in channel.

Won't slip.

End Cap and Max End Cap

Fits flush to PV module and hides raw or angled cuts.

Hidden drain quickly clears water from rail.

Certifications:

- UL 2703, Edition 1
- LTR-AE-001-2012
- ASCE 7-16 PE certified
- Class A fire rating for any slope roof
- FL Cert of Approval FL41396

FREE
PEGASUS SOLAR
Design Tool

Quickly calculate the most efficient layout, spans and materials needed to suit your job. Visit the Pegasus Customer Portal. **pegasussolar.com/portal**

LOAD		SPAN				
SNOW (psf)	WIND (MPH)	32″	48″	72″	96″	120″
0	100	PEGASUS RAIL	PEGASUS RAIL	PEGASUS RAIL	PEGASUS RAIL	PEGASUS MAX RAIL
	130	PEGASUS RAIL	PEGASUS RAIL	PEGASUS RAIL	PEGASUS MAX RAIL	
10	140	PEGASUS RAIL	PEGASUS RAIL	PEGASUS RAIL	PEGASUS MAX RAIL	
30	190	PEGASUS RAIL	PEGASUS RAIL	PEGASUS RAIL		
50		PEGASUS RAIL	PEGASUS RAIL	PEGASUS MAX RAIL		
100		PEGASUS RAIL	PEGASUS MAX RAIL			
120		PEGASUS MAX RAIL				

For reference only. Spans above are calculated using 7-16 for a Gable Roof, Exposure Category B, 0-20deg roof angle, 30ft mean roof height with non-exposed modules. For PE certified span tables, visit *www.pegasussolar.com/spans*.

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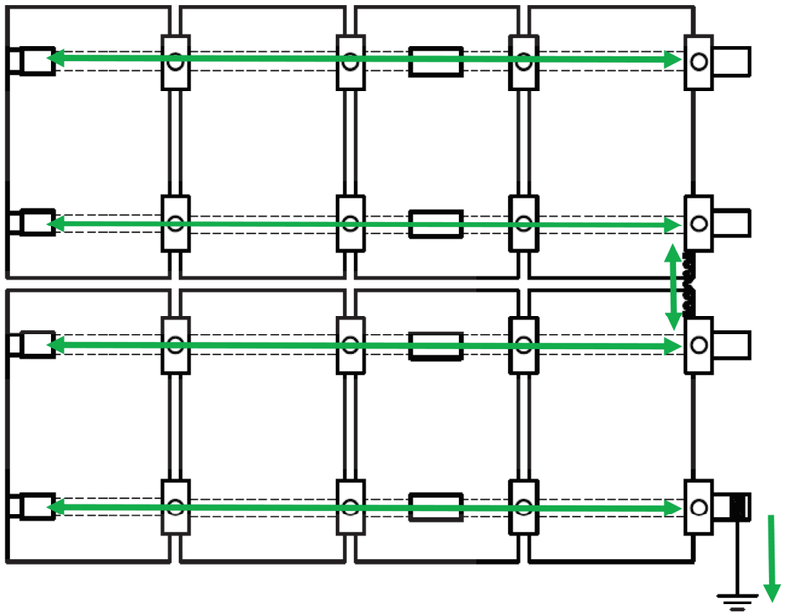
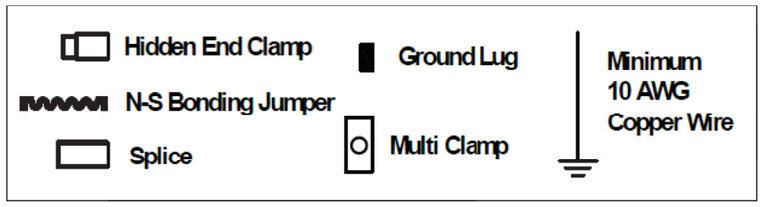
Pegasus Rail System - Bond Path to Ground

Ground Lug & N-S Bonding Jumper





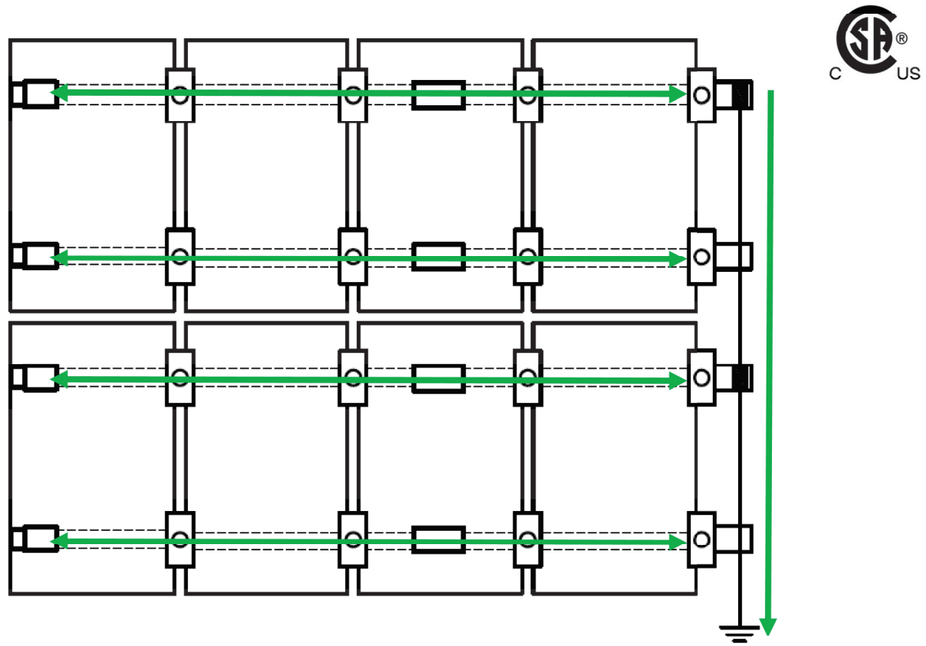
Multi-Clamps bond adjacent PV modules to one another and to the Rail. The Splice provides a bond connection between two Rail sections, including when a 1" thermal gap is utilized. The N-S Bonding Jumper will provide a bonding path between rows of PV modules, so that one Ground Lug per array is necessary for earth ground. If a thermal break is left between two sections or Rail, the Multi-Clamps will provide a bond path across the two Rails through the PV module frame.

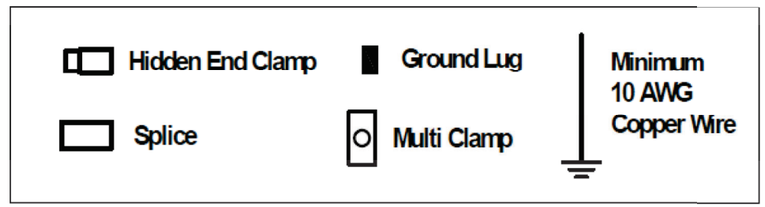
The N-S Bonding Jumper may only be used with the Pegasus Rail System, and is not certified for use with any other mounting system.

If the N-S Bonding Jumper needs to be removed during maintenance, a second N-S Bonding Jumper shall first be

Pegasus Rail System - Bond Path to Ground

Ground Lug for each PV Module Row

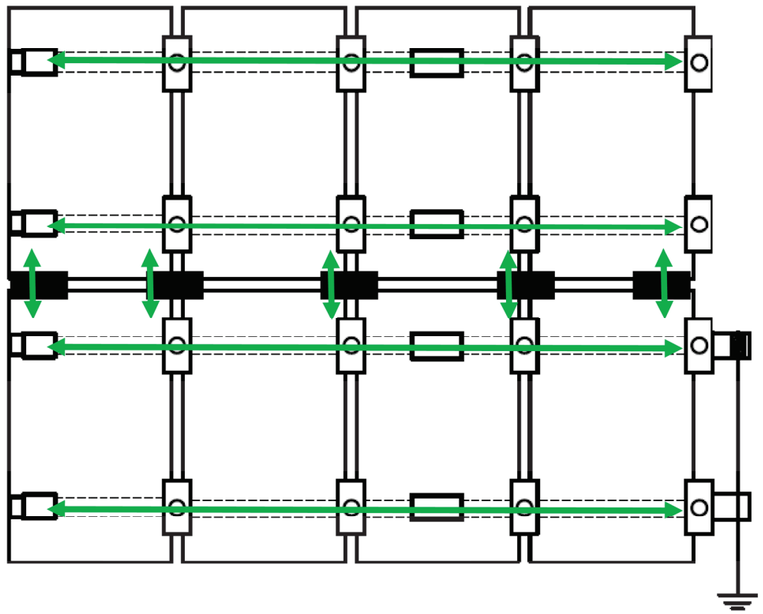


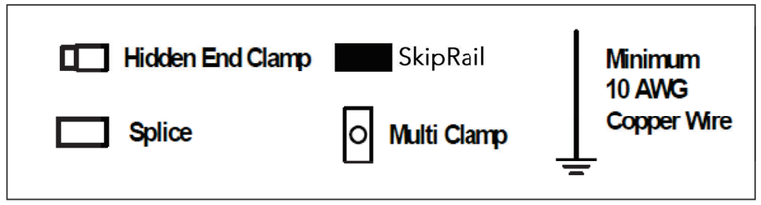


Multi-Clamps bond adjacent PV modules to one another and to the Rail. The Splice provides a bond connection between two Rail sections, including when a 1" thermal gap is utilized. One Ground Lug is required per row of PV Modules, with a final earth ground connection at the terminal end of the ground wire. If a thermal break is left between two sections or Rail, the Multi-Clamps will provide a bond path across the two Rails through the PV module frame.

Pegasus Rail System - Bond Path to Ground

SkipRail System

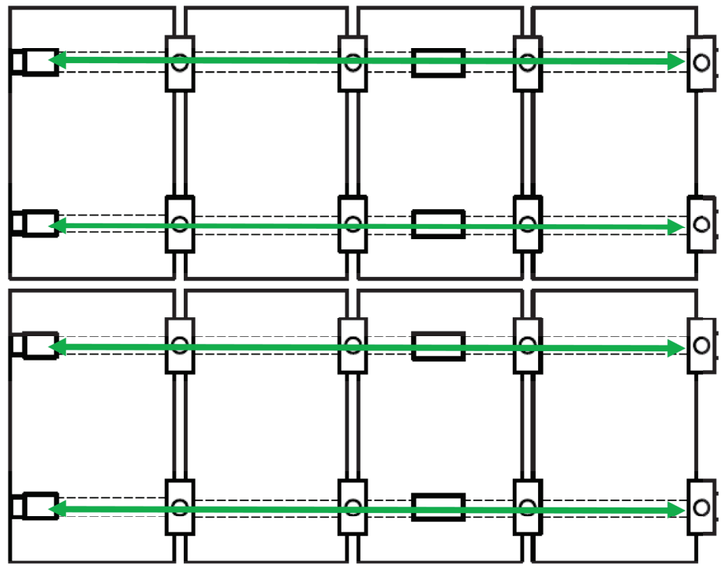


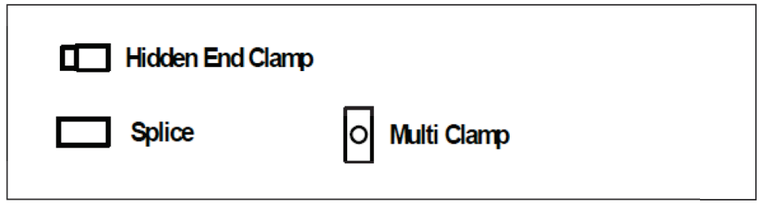


Multi-Clamps bond adjacent PV modules to one another and to the Rail. The Splice provides a bond connection between two Rail sections, including when a 1" thermal gap is utilized. The SkipRail Splices will provide a bonding path between rows of PV modules, so that one Ground Lug per array is necessary for earth ground. If a thermal break is left between two sections or Rail, the Multi-Clamps will provide a bond path across the two Rails through the PV module frame.

Pegasus Rail System - Bond Path to Ground

Using Enphase Products





Multi-Clamps bond adjacent PV modules to one another and to the Rail. The Splice provides a bond connection between two Rail sections, including when a 1" thermal gap is utilized. The MLPE Mount creates a bond connection to the MLPE. When using Enphase products, Ground Lug, N-S Bonding Jumpers, or other equipment ground conductors (EGC) are not required, and the use of the Enphase products satisfies the UL2703 bonding and grounding requirements.

Compatible Enphase products:

- Microinverters M250-72, M250-60, M215-60, C250-72; with Engage cables ETXX-240, ETXX-208, ETXX-277

Appendix A - Compatible PV Mod-

Pegasus Rail System may be used to ground a PV module complying with UL 2703 only when the specific module has been evaluated for grounding and/or mounting in compliance with this installation manual. Unless otherwise specified, "xxx" refers to the power rating of the PV module. Both black & silver frames are included in the UL2703 listing.

C US

Manufacturer	Model
Auxin	AXN6M612T-xxx
Aptos	DNA-144-BF26-xxxW; DNA-144-MF26-xxxW; DNA-120-BF26-xxxW; DNA-120-MF26-xxxW; DNA-120-MF10-xxxW; DNA-120-BF10-xxxW; DNA-108-BF10-xxxW; DNA-108-MF10-xxxW
Axitec	AC-xxxM/156-60S; AC-xxxM/60S; AC-xxxMH/120S; AC-xxxMH/144S
Boviet	BVM6610M-xxx; BVM6610P-xxx
Canadian Solar	CS1H-xxxMS; CS1K-xxxMS; CS1Y-xxxMS; CS3K-xxxMS; CS3U-xxxMS; CS6K-xxxM; CS6K-xxxMS; CS6K-xxxP; CS6U-xxxM; CS6U-xxxP; CS6X-xxxM; CS6X-xxxP; BiHiKu CS3W-xxxMB-AG; CS3L-xxxMS; CS6R-xxxMS; CS3W-xxxPB-AG; CS3W-xxxF; CS3W-xxxMS; CS3L-xxxP; CS3L-xxxMS; CS3N-xxxMS; CS6W-xxxMB-AG; CS7N-xxxMB-AG
CertainTeed	CTxxxHC11-04; CTxxxM10-02; CTxxxM11-02; CTxxxM11-03; CTxxxHC00-04; CTxxxHC12-06; CTxxxHC11-06
Chint Solar	CHSM6612M-xxx
Freedom Forever	FF-MP-BBB-xxx
Hansol	HSxxxTD-AN3
Heliene	Heliene20M xxx; Heliene36M xxx; Heliene36P xxx; Heliene60M xxx; Heliene60P xxx; Heliene72M Bifacial xxx; Heliene72P xxx; Heliene96M xxx Bifacial; Heliene96M xxx; Heliene 96P xxx; HSPE-144M M6 HC Bifacial xxx; HSPE 120M M6 HC Monofacial xxx; 144HC-M10-Bifacial; 460-144M-HC-M6
Hyundai	HiD-SxxxRG(BK); HiS-MxxxRG; HiS-SxxxRI; HiS-SxxxRG; HiS-SxxxRG(BK); HiS-SxxxRI; HiS-SxxxTI; HIA-SxxxHI
JA Solar	JAM72S01-xxx/PR; JAP72S01-xxx/SC; JAM72D20-xxx/MB
Jinko	JKMxxxM-60 JKMxxxM-60B; JKMxxxM-60BL; JKMxxxM-60HBL; JKMxxxM-60HL; JKMxxxM-60L; JKMxxxM-60-V; JKMxxxM-72; JKMxxxM-72HL-V; JKMxxxM-72H-V; JKMxxxM-72-V; JKMxxxP-60; JKMxxxPP-60; JKMxxxN-6RL3; JKMxxxM-6RL3-B; JKMxxxM-7RL3-TV
LG	LGN1K-G4; LGS1C-A5; LGxxxA1C-A5; LGxxxE1C-A5; LGxxxE1K-A5; LGxxxN1C-A3, LGxxxN1C-A5; LGxxxN1C-B3; LGxxxN1C-G3; LGxxxN1C-G4; LGxxxN1C-V5; LGxxxN1C-Z4; LGxxxN1K-A5; LGxxxN1K-G4; LGxxxN1K-V5; LGxxxN1K-Z4; LGxxxN2T-A5; LGxxxN2W-A5; LGxxxN2W-G4; LGxxxN2W-V5; LGxxxN2W-L5, LGxxxQ1C-A5; LGxxxQ1C-V5; LGxxxQ1K-A5; LGxxxQ1K-V5; LGxxxS1C-A5; LGxxxS1C-G4; LGxxxS2W-A5; LGxxxN1K-L5; LGxxxNIC-N5; LGxxxM1K-A6; LGxxxN1K-B5; LGxxxQ1C-A6; LGxxxxQAC-A6; LGxxxQAK-A6; LGxxxM1C-A6; LGxxxN2W-E6; LGxxxN2T-E6; LGxxxN1K-E6; LGxxxN3K-V6; LGxxxN1C-A6
Longi	LR6-60BP-xxx; LR6-60HPB-xxx; LR6-60HPH-xxx; LR6-60PB-xxx; LR6-60PE-xxx; LR6-60-xxx; LR4-60HPH-xxxM; LR4-HPB-xxxM; LR4-72HPH-xxxM; LR4-72HBD-xxxM; LR5-54HPH-xxxM; LR5-72HBD-xxxM
Maxeon	SPR-MAX3-xxx-COM; SPR-MAX3-xxx-BLK; SPR-MAX5-xxx-COM; SPR-MAX6-xxx-COM; SPR-X21/22-xxx-COM; SPR-MAX3-XXX-BLK-R;
Mission Solar	MSE60Axxx; MSExxxSB1A; MSExxxSQ6J; MSExxxSQ5K; MSExxxSQ5T; MSExxxSQ8K; MSExxxSQ8T; MSExxxSQ9S; MSExxxSX6S; MSExxxSX6W; MSExxxSX5T; MSExxxSX5K; MSExxxSX5R; MSExxxSX6Z; MSExxxSX9R; MSExxxSX9Z
Mitrex	Mxxx-L3H; Mxxx-I3H; Mxxx-H1H; Mxxx-B1F; Mxxx-A1F
Panasonic	VBHNxxxKA01; VBHNxxxKA03; VBHNxxxSA16; VBHNxxxSA16B; VBHNxxxSA17; VBHNxxxSA17E; EVPVxxx; EVPVxxxK; EVPVxxxPK; EVPVxxxH
Philadelphia Solar	PS-M60(BF)-xxx; PS-M72(BF)-xxx
QCells	Q.Peak 265; Q.PEAK BLK-G3.1 xxx; Q.PEAK BLK-G4.1 xxx; Q.PEAK DUO BLK-G5 xxx; Q.PEAK DUO BLK-G5/SC xxx; Q.PEAK DUO BLK-G6+ xxx; Q PEAK DUO BLK G6+ xxx AC ENP (Q7+; Q PEAK DUO BLK G9+ xxx; Q.PEAK DUO L-G5.2 xxx; Q.PEAK DUO L-G5.3 xxx; Q.Peak Duo-G5 xxx; Q.PEAK DUO-G5/SC xxx; Q.PEAK DUO-G7 xxx; Q.PEAK G4.1 xxx; Q.PEAK G4.1/ Max xxx; Q.PEAK G4.1/SC xxx; Q.PEAK G4.1/TAA xxx; Q.PEAK L-G4.2 xxx; Q.PLUS BFR G4.1 xxx; Q.PLUS BFR-G4.1/TAA xxx; Q.PLUS L-G4.1 xxx; Q.PLUS L-G4.2 xxx; Q.PLUS L-G4.2/TAA xxx; Q.PRO BFR-G4.1 xxx; Q.PEAK DUO L-G8.2 xxx; Q.PEAK DUO BLK-G8 xxx; Q.PEAK DUO BLK-G8+ xxx; Q.PEAK DUO BLK ML-G9 xxx; Q.PEAK DUO BLK ML-G9+ xxx; Q.PEAK DUO BLK-G10 xxx; Q.PEAK DUO BLK-G10+ xxx; Q.Peak DUO ML-G10+; Q.Peak DUO BLK ML-G10.a+; Q.Peak Duo XL 10.d/BFG; Q.PEAK DUO-G10 xxx; Q.PEAK DUO-G10+ xxx; Q.PEAK DUO-G10.a xxx; Q.PEAK DUO-G10.a+ xxx; Q.PEAK DUO BLK-G10.a xxx; Q.PEAK DUO BLK-G10.a+ xxx; Q.PEAK DUO ML-G10 xxx; Q.PEAK DUO ML-G10.a xxx; Q.PEAK DUO ML-G10.a+ xxx; Q.PEAK DUO BLK ML-G10 xxx; Q.PEAK DUO BLK ML-G10+ xxx; Q.PEAK DUO BLK ML-G10.a xxx; Q.Peak Duo ML-G10+/t xxx; Q.Tron BLK M-G2+ xxx; Q.Tron M-G2+ xxx;
REC	RECxxxNP; RECxxxNP Black; RECxxxPE; RECxxxPE 72; RECxxxPE(BLK); RECxxxTP; RECxxxTP BLK; RECxxxTP2; RECxxxTP2 BLK; RECxxxTP2 BLK Q2; RECxxxTP2 BLK2; RECxxxTP2M; RECxxxTP2S 72; RECxxxAA; RECxxxAA Pure; RECxxxAA Black RECxxxAA 72; RECxxxAA PURE-R;
S-Energy	SNxxxM-10; SNxxxM-10(B); SNxxxM-10T; SC20-60MBE-xxxM
SEG	SEG-xxx-BMA-HV; SEG-xxx-BMA-TB; SEG-xxx-BMA-BG; SEG-xxx-BMB-HV; SEG-xxx-BMA-BG; SEG-xxx-BMD-HV_; SEG-xxx-BMD-TB; SEG-xxx-BMB-BG, SEG-xxx-BMC-HV; SEG-xxx-BMC-TB; SEG-xxx-BMC-BG
Silfab	SILxxxBL; SILxxxNL; SLAxxxM; SLAxxxM; SLGxxxM; SSAxxxM; SIL-xxxNX; SIL-xxxHL; SIL-xxxNX; SIL-xxxBK; SIL-xxxHC; SIL-xxxHC+; SIL-xxxBG; SIL-xxxHN; SIL-xxxHM
Solar4America	S4A410-72MH5BB, S4A33-60MH5BB

Appendix B - SkipRail Compatible PV Modules

The following PV modules are structurally compatible with the SkipRail installation method.

Manufacturer	Model
Aptos	DNA-144-BF26-xxxW; DNA-144-MF26-xxxW; DNA-120-BF26-xxxW; DNA-120-MF26-xxxW; DNA-120-MF10-xxxW, DNA-120-BF10-xxxW, DNA-108-BF10-xxxW, DNA-108-MF10-xxxW
Jinko	JKMxxxM-72HL-V; JKMxxxM-72HBL-V; JKMxxxM-6RL3-V; JKMxxxM-6RL3-B
Longi	LR6-60BP-xxx; LR6-60HPB-xxx; LR6-60HPH-xxx; LR6-60PB-xxx; LR6-60PE-xxx; LR6-60-xxx; LR4-60HPH-xxxM; LR4-60HPB-xxxM; LR4-72HPH- xxxM; LR4-72HBD-xxxM; LRS-54HPH-xxxM; LRS-54HPB-xxxM; LRS-54HABB-xxxM; LRS-54HABD-xxxM; LRS-66HPH-xxxM
QCells	Q.PEAK DUO BLK-G10 xxx; Q.PEAK DUO BLK-G10+ xxx; Q.Peak DUO ML-G10+; Q.Peak DUO BLK ML-G10.a+; Q.Peak Duo XL 10.d/BFG; Q.PEAK DUO-G10 xxx; Q.PEAK DUO-G10+ xxx; Q.PEAK DUO-G10.a xxx; Q.PEAK DUO-G10.a+ xxx; Q.PEAK DUO BLK-G10.a xxx; Q.PEAK DUO BLK-G10.a+ xxx; Q.PEAK DUO ML-G10 xxx; Q.PEAK DUO ML-G10.a xxx; Q.PEAK DUO ML-G10.a+ xxx; Q.PEAK DUO BLK ML-G10 xxx; Q.PEAK DUO BLK ML-G10+ xxx; Q.PEAK DUO BLK ML-G10.a xxx; Q.Peak Duo ML-G10+/t xxx
Mission Solar	MSExxxSX6W; MSExxxSX5T; MSExxxSX5K; MSExxxSX6Z; MSExxxSX6S; MSExxxSX9R; MSExxxSX9Z
REC	RECxxxNP; RECxxxNP Black; RECxxxPE; RECxxxPE 72; RECxxxPE(BLK); RECxxxTP; RECxxxTP BLK; RECxxxTP2; RECxxxTP2 BLK; RECxxxTP2 BLK Q2; RECxxxTP2 BLK2; RECxxxTP2M; RECxxxTP2S 72; RECxxxAA; RECxxxAA Black; RECxxxAA 72; RECxxxNP3; RECxxxNP3 Black; RECxxxNP2, RECxxxNP2 Black, RECxxxAA Pure; RECxxxAA Pure-R
SEG Solar	SEG-xxx-BTB-BG; SEG-xxx-BTD-BG; SEG-xxx-BMB-HV; SEG-xxx-BMD-HV; SEG-xxx-BMB-BG; SEG-xxx-BMD-BG; SEG-xxx-BMB-TB; SEG-xxx-BMD-TB
Silfab	SIL-xxxHC
URE Co.	FBMxxxMFG; FBMxxxMFG-BB
Waaree	WSMDi-xxx
ZN Shine	ZXM7-UHLDD144-xxx/N; ZXM7-SHLDD144-xxx/M; ZXM6-NHLDD144xxx/M

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 ① Single-Phase AC 120V	Single-Phase AC 240V	Three-Phase AC 240V	DC 250V	NEMA 1 Enclosure Indoor Catalog Number	NEMA 3R Enclosure Rainproof Catalog Number
Cartridge Type—Three-Pole, Three-Wire (Three Blades, Three Fuses)—240 Vac								
	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
Cartridge Type—Four-Wire (Three Blades, Three Fuses, S/N)—120/240 Vac								
S/N	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 Single-Phase AC 120V	Single-Phase AC 240V	Three-Phase AC 240V	DC 250V	NEMA 1 Enclosure Indoor Catalog Number	NEMA 3R Enclosure Rainproof Catalog Number
Two-Pole, Two-Wire (Two Blades)—240 Vac							
	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
Three-Pole, Three-Wire (Three Blades)—240 Vac							
	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.

2

DP221NGB

DG321NRB

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

System	Ampere Rating	Fuse Type Provision	Maximum Horsepower Ratings ① Single-Phase ac 120 Volt	Single-Phase ac 240 Volt	3-Phase ac 240 Volt	dc 250 Volt	NEMA 1 Enclosure Indoor Catalog Number	NEMA 1 Enclosure Indoor Price U.S. $	NEMA 3R Enclosure Rainproof Catalog Number	NEMA 3R Enclosure Rainproof Price U.S. $
Fusible — Plug Type ② **2-Wire (One Blade, One Fuse, S/N) — 120 Vac**										
S/N	30	Plug (Type S, T or W)	1/2 – 2	—	—	—	**DP111NGB**		**—**	
3-Wire (Two Blades, Two Fuses, S/N) — 120/240 Vac										
S/N	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										
S/N	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**

Eaton CH main lug loadcenter

CH8L125RP

UPC:782114190548

Dimensions:

- **Height:** 3.69 IN
- **Length:** 13 IN
- **Width:** 11 IN

Weight:12 LB

Notes: Ground bar kits priced separately. Suitable for use as service equipment when not more than two service disconnecting mains are provided or when not used as a lighting and appliance panelboard.

Warranties:

- Limited lifetime

Specifications:

- **Special Features:** Cover included
- **Type:** Main lug only
- **Amperage Rating:** 125A
- **Box Size:** 7r
- **Bus Material:** Copper
- **Enclosure:** NEMA 3R
- **Enclosure Material:** Metallic
- **Feed Type:** Overhead
- **Main Circuit Breaker:** CH
- **Number Of Circuits:** 8
- **Number Of Wires:** Three-wire
- **Phase:** Single-phase
- **Voltage Rating:** 120/240V, 208Y/120, 240V
- **Wire Size:** #6-1/0 AWG

Supporting documents:

- Type CH Circuit Breakers and Loadcenters
- Loadcenters and Circuit Breakers
- Eatons Volume 1-Residential and Light Commercial

pe.eaton.com

Eaton CH main lug loadcenter

CH12L125R

UPC:782113097381

Dimensions:

- **Height:** 5.19 IN
- **Length:** 16.75 IN
- **Width:** 14.31 IN

Weight:15.8 LB

Notes: Suitable for use as service equipment when not more than six service disconnecting mains are provided or when not used as a lighting and appliance panelboard. Rainproof panels are furnished with hub closure plates. For rainproof hubs.

Warranties:

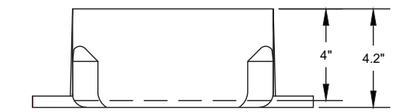
- Limited lifetime

Specifications:

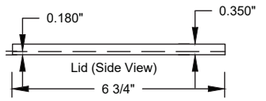
- **Special Features:** Cover included
- **Type:** Main lug only
- **Amperage Rating:** 125A
- **Box Size:** B
- **Bus Material:** Copper
- **Enclosure:** NEMA 3R
- **Enclosure Material:** Metallic
- **Feed Type:** Overhead
- **Main Circuit Breaker:** CH
- **Number Of Circuits:** 12
- **Number Of Wires:** Three-wire
- **Phase:** Single-phase
- **Voltage Rating:** 120/240V
- **Wire Size:** #6-2/0 AWG

Supporting documents:

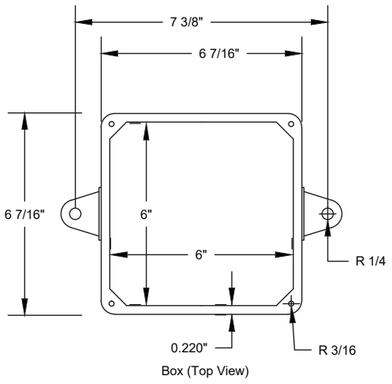
- Dimensional Drawing - CH 3/4 LOADCENTER, MAIN LUG ONLY, OUTDOOR NEMA 3R, 120/240 VAC, 1 PH



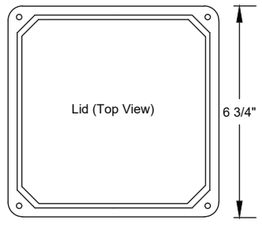
Box (Side View)



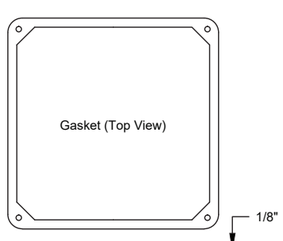
Lid (Side View)



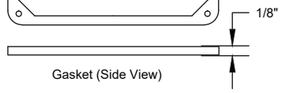
Box (Top View)



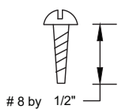
Lid (Top View)

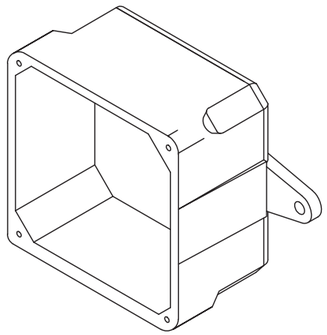


Gasket (Top View)



Gasket (Side View)





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

CANTEX INC.
Fort Worth, TEXAS

Junction Box 6 x 6 x 4

Drawn By: O.M.	Date: 6/19/17	5133710

FREEDOM SOLAR POWER

4801 Freidrich Ln, Suite 100
Austin, TX 78744
1-800-504-2337
www.freedomsolarpower.com

August, 2024

RE: SHARON BRUCE
Solar PV Installation
55 WELCOME DRIVE
FUQUAY VARINA, NORTH
CAROLINA, 27526

To Whom it May Concern,

The PV system with Tesla Powerwall 3 will have a site export limit established at the time of install. The site export limit can only be adjusted by qualified personnel, therefore the customer will not have access to these settings. Please see the attached Tesla application notes for more information on the Powerwall 3 export limiting features. Below are the specific settings that will be applied to this system.

Inverter Model: Tesla Powerwall 3 1707000-xx-y
Default Output: 11.5 kW AC, Battery utilized for storage only

Tesla Powerwall 3 Site Export Setting To Be Applied
Export Limit: 10 kW AC

Sincerely,

Josh Meade, P.E.
Lead Designer | Freedom Solar

Power Control System (PCS) Features for Powerwall Systems

1 Overview

Powerwall is managed by a software platform that allows the system to provide grid services, economic returns, and energy security while maintaining system limits. System limits can vary depending on the connection of the Powerwall, the electrical infrastructure on site, and the interconnection of the system.

Power Control System (PCS) is a type of Energy Management System (EMS) and is a term used by UL 1741, NEC, and Tesla to refer to software controls of production sources (Solar & Battery) to maintain system limits. PCS software can limit the power of a Powerwall system to safely interconnect with a variety of home electrical system ratings. As a result, PCS can help avoid expensive electrical upgrades, complicated load relocation, or a reduction in system performance.

NOTE: PCS features are on-grid controls; controls such as frequency shifting are only available during a grid outage and are not considered part of PCS, and as such are not part of the scope of this document.

UL1741 CRD for PCS and NEC 705.13 (introduced in 2020 revision) outline a variety of requirements that a system must provide to be qualified as a Power Control System (PCS). Tesla has implemented software in accordance with these standards. PCS is implemented after review of system risks to ensure that the PCS controls, when combined with traditional design methodology and overcurrent protection, will ensure safe and effective system operation. Tesla has reviewed the behavior of all parts of the system to ensure a proper response even during a loss of communication or a hardware failure.

Power Control System (PCS) methodology and implementation can be used to manage a system to enforce the following limits:

- **Site Limit**: To prevent excess Import/Export through the site meter to/from the utility connection
- **Conductor Limit**: To prevent excess current through specific monitored and controlled conductors
- **Panel Limit**: To prevent excess current experienced by a virtual panel, fed by a sum of site, solar, and batteries

NOTE: Site, Conductor, and Panel Limits are all types of PCS. These terms are distinct and specific features of Tesla's overall suite of PCS controls.

Tesla and a Nationally Recognized Testing Laboratory (NRTL) have certified the Power Control System implementation for all three of these features to standards set forth in UL1741-CRD-PCS for 240V split-phase grid services up to 200A with Backup Switch or Backup Gateway 2.

For installations in accordance with NEC 2020 or newer, this document can be shared alongside the relevant NRTL-certified PCS VoC (available on Partner Portal) to the appropriate AHJ (Authority Having Jurisdiction) to support the inspection, permitting, and interconnection process.

1.1 Glossary

Energy Management System (EMS)	Term used in NEC to refer to the software controls of production sources (Solar & Battery) to maintain system limits
Power Control System (PCS)	Term used by UL 1741, NEC, and Tesla to refer to the software controls of production sources (Solar & Battery) to maintain system limits. PCS is a type of Energy Management System (EMS)
Powerwall	Powerwall is a rechargeable home battery, also called a battery energy storage system (BESS). Powerwall has an integrated energy meter and performs its own battery metering
Qualified Personnel	A Tesla installer or Certified Installer who has the skills and knowledge related to installation and operation of electrical equipment to recognize and avoid the hazards involved
Site Limit	Prevents excess Import and/or Export through the site meter from/to the utility connection
Conductor Limit	Prevents excess current through specific monitored and controlled conductors
Panel Limit	Prevents excess current experienced by a virtual panel, fed by a sum of site, solar, and batteries
Grid	Measured by one or more physical site meters to measure the full current flowing into the virtual panel from the grid
Uncontrolled Sources	Any equipment not connected over direct communication, including standalone solar inverters or similar sources to the virtual panel
Controlled Sources	Any equipment connected over direct communication, including Tesla Powerwall 2, Tesla Powerwall+, and/or Tesla Powerwall 3 in any quantity and combination (e.g. one Powerwall+ and two Powerwall 2) that can be current limited
Virtual Panel	May include several panels and conductors, and is considered as one single panel with respect to the Panel Limit feature. As there may be more than one physical panel and conductors included, the Panel Limit is set to the rating of the smallest busbar within the “Virtual Panel”
Energy Meter	Measures voltage and current to calculate net power flow. Energy meters can be of type Site, Solar, Conductor, or Load. See the *Residential Energy Metering Guide* for more information about meter types
Current Transformer (CT)	Installed around conductors to monitor the current flowing through them. CTs are connected to an energy meter, which uses the current measurement to calculate how much power is being produced or consumed
Site Controller	Tesla’s Site Controller is the computer that coordinates site functions like charging, discharging, self-consumption, power control, etc. All Powerwall systems have a Site Controller
Meter X	Built-in meter in the Backup Gateway 2. Its CTs cannot be relocated
Meter Y	Built-in meter in the Backup Gateway 2 with three CT terminals. Tesla CTs are installed and connected to Meter Y
Meter Z	Built-in meter in Backup Switch. Its CTs cannot be relocated

Remote Energy Meter	Third party meters that can be installed and paired with the Site Controller for additional metering capability. Neurio W1 and W2 meters are both supported Remote Energy Meters

1.2 Site Controller Software

The “Panel Limits,” “Site Limits,” and “Conductor Limits” features are implemented in the Tesla Site Controller software, which operates on the Backup Gateway 2, the Powerwall+, or the Powerwall 3, depending on system configuration. Tesla’s Site Controller software is used across all Tesla Powerwall sites. Site Controller software controls the entire energy storage site and communicates over CAN and Wi-Fi. The Backup Switch or Backup Gateway and Remote Energy Meter(s) (if present) are part of a Powerwall system and contain current sensor(s) per phase as needed, to act as a Site and/or Solar meter, which measure the grid and uncontrolled power production sources.

This software is listed to the requirements in UL 1741 PCS and compliant with Article 705.13 of the 2020 and 2023 NEC, as described in *Important Notes on UL 1741 PCS Compliance on page 7*.

1.3 Feature Configuration Overview

This document introduces each of the following settings in more detail; this table provides a simple reference for which users can configure each feature.

Feature	Description	Configurable By
Panel Limit (numerical limit)	Limit on amperage flowing into an electric panel / busbar from all controlled and uncontrolled sources (Grid, Solar Inverter, and Powerwall)	Default limit is 80A for Powerwall 2, Powerwall+ or Powerwall 3. Can be configured to 10-200A by Qualified Personnel
Site Import Permissions (style of import)	Whether Powerwall can charge from solar, the grid, or both	Qualified Personnel
Site Import Limit (numerical limit)	Limit on how much the site can import from the grid	Qualified Personnel
Site Export Permissions (style of export)	Whether the Powerwall and/or solar can export to the grid	Qualified Personnel
Site Export Limit (numerical limit)	Limit on how much power can be exported to the grid	Qualified Personnel
Conductor Limits (numerical limit)	Curtails power from all Powerwalls in a system to limit the total current on a conductor, making the limit equivalent to the “power source(s) output circuit current” outlined in the requirements of Article 705.12(B) of the NEC / CEC	Qualified Personnel

2 Compliance Requirements

UL 1741 PCS compliance may be required by the interconnecting utility or Authority Having Jurisdiction (AHJ), also called the site host. If UL 1741 PCS compliance is required according to applicable site design, follow the guidance in this section.

The Powerwall and controlled solar system is UL 1741 PCS-compliant with the following nominal voltages:

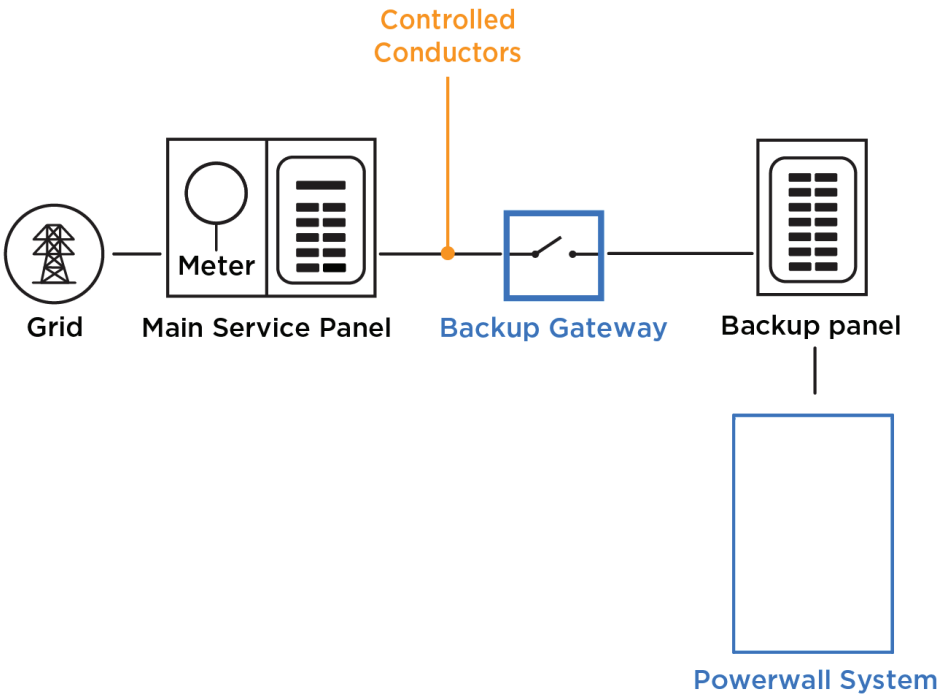
- 240V (Split Phase)

Compliance with UL 1741 PCS can be achieved for system sizes up to and including 200A with a Backup Switch or Backup Gateway 2 according to the requirements below.

2.1 Plan Set Labeling Requirements

All PCS-controlled conductors and busbars shall be indicated on the single line diagram on the plan set.

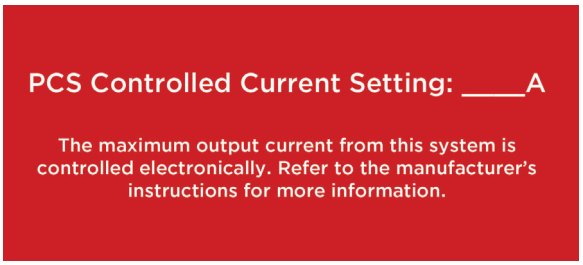
Figure 1. Controlled Conductors Labeled on Example Single Line Diagram



2.2 Panel Labeling Requirements

The PCS-controlled current setting for all panels within the controlled system shall be indicated with a field-applied marking label on the conductor or in close proximity to the panel. Refer to the label below, filling the blank with the appropriate value:

Figure 2. PCS Field Marking Label

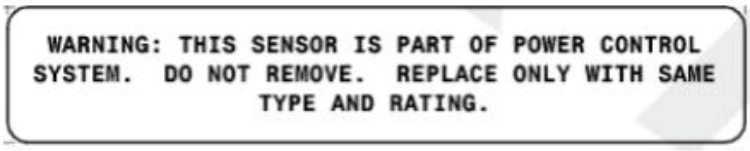


2.3 CT Labeling Requirements

The following label must be posted near the installation of CT(s):

- For **Panel Limits**, label all Site and Solar CTs (may include Backup Gateway 2 (Meter X and Meter Y) CTs, Backup Switch (Meter Z), and/or Remote Energy Meter CTs, excluding CTs installed for Revenue Grade Metering).
- For **Site Limits**, label all Site CTs (may include Backup Gateway 2 (Meter X and Meter Y) CTs, Backup Switch (Meter Z), and/or Remote Energy Meter CTs).
- For **Conductor Limits**, label all Conductor CTs (may include Backup Gateway 2 (Meter X or Meter Y) CTs or Remote Energy Meter CTs).

Figure 3. CT Field Marking Label



2.4 Important Notes on UL 1741 PCS Compliance

NOTE: A system equipped with a Power Control System (PCS) must be suitably rated to provide branch circuit overcurrent protection. The controlled current setting shall not exceed the rating of any controlled panels or conductor ampacity.

WARNING: Configuration of Power Control System settings or changes to settings shall be made by Qualified Personnel only. Incorrect configuration or setting of the power control settings may result in unsafe conditions.

NOTE: Maximum PCS Controlled Current setting: 200 A.

NOTE: The maximum operating currents in controlled busbars or conductors are limited by the settings of the Power Control System (PCS) and may be lower than the sum of the currents of the connected controlled power sources. The settings of the PCS controlled currents may be used for calculation of the design currents used in the relevant sections of NEC Article 690 and 705.

2.4.1 Monitoring (2020 NEC, 705.13 (A), UL 1741 PCS)

- Tesla Site Controller receives meter data from the Backup Switch (Meter Z) or Backup Gateway 2 (Meter X and/or Meter Y), and/or Remote Energy Meter(s).
- Tesla Site Controller receives controlled current data of the AC output of the Powerwall and controlled solar.
- Each limit is monitored by a metering device as follows:
    - Panel Limits are monitored by adding together the current flowing into the Virtual Panel (net current from Site, Solar, and Battery). The limit is enforced on the sum of all phases.
    - Site Limits are monitored by the sum of all Site meters. The limit is enforced on the sum of all phases.
    - Conductor Limits are monitored by each Conductor meter. The limit is enforced on each phase independently.
- Where communications are lost with the relevant meter(s), all controlled power production sources are curtailed.

2.4.2 Settings (2020 NEC 705.13(B), 2023 NEC 750.30(C)(1), UL 1741 PCS 201.9)

- Each default is as follows:
    - Panel Limits by default are automatically configured with an 80A Panel Limit for all Powerwall 2, Powerwall+, and Powerwall 3 installations. As 100A is the minimum allowable size for a single family dwelling per NEC 230.79 (C), this protects any main panel busbar for a single family dwelling with any quantity of Tesla Powerwalls (80A is 80% of the 100A minimum service size).

      NOTE: The minimum allowable size for multifamily dwellings is 60A, and downstream subpanels may also be smaller than 100A.

    - Site Import Permissions are by default set to allow charging from grid. However, charge from grid can only be enabled by the customer in their Tesla app. Unless the customer sets *Grid Charging* to **Yes**, the system will not charge from grid.
    - Site Export Permissions are by default set to allow solar-only export.
    - Site Limits are not set by default.

    - Conductor Limits are not set by default.

- The PCS limits can be verified by viewing the Summary page in the Setup App.

2.4.3 Overcurrent Protection (2020 NEC 705.13(C) and UL 1741 PCS 201.2)

- The Tesla Site Controller software is certified under UL 1741 PCS as secondary overcurrent protection.
- Overcurrent protection devices are still required for each circuit as required by the National Electrical Code.
- Overcurrent protection devices shall be sized in accordance with the ratings of conductors, panels, and related equipment as required by the National Electrical Code.
- Software manages the output of the battery and controlled solar in a best effort approach to prevent exceeding each of the configured limits.
    - For Panel Limits, software curtails battery and/or controlled solar to prevent exceeding the configured limits.
    - For Site Limits, software both curtails battery and/or controlled solar, and compensates by having Powerwall charge or discharge to prevent exceeding the configured limits.
    - For Conductor Limits, software both curtails battery and/or controlled solar, and compensates by having Powerwall charge or discharge to prevent exceeding the configured limits.
    - Once battery and controlled solar have been curtailed, or if they have no additional power or energy with which to compensate for loads, the balance is fed from the grid.
    - Accordingly, breakers should be sized to protect all conductors, busbars, and equipment on site, as intended prior to the addition of secondary power sources.

2.4.4 Single Power Source Rating (2020 NEC 705.13(D) and UL 1741 PCS 201.9)

- Each Powerwall 2 connection to the electrical panel requires an independent 30 A circuit breaker.
- Each Powerwall+ connection to the electrical panel requires an independent 50 A circuit breaker.
- Each Powerwall 3 connection to the electrical panel requires an independent 60 A circuit breaker.
- This breaker serves as the disconnect for the unit and must be wired in accordance with local wiring codes and regulations.
- This breaker is by design smaller than the smallest panel used within the system.
- The service disconnect overcurrent rating can remain unchanged through the use of the PCS.

2.4.5 Access to Settings (2020 NEC 705.13(E), 2023 NEC 750.30(C)(3), UL 1741 PCS 208.1(F))

- Panel Limits, Site Limits, and/or Conductor Limits can be configured by Qualified Personnel (Tesla or Certified Installers) in the Tesla Pros app, which is password-protected.
    - For Panel Limits, a limit of 80A is auto-enabled for all Powerwall 2, Powerwall+, and Powerwall 3 systems. Qualified Personnel can change this limit in the Tesla Pros app.

3 Panel Limit Feature

3.1 Feature Overview

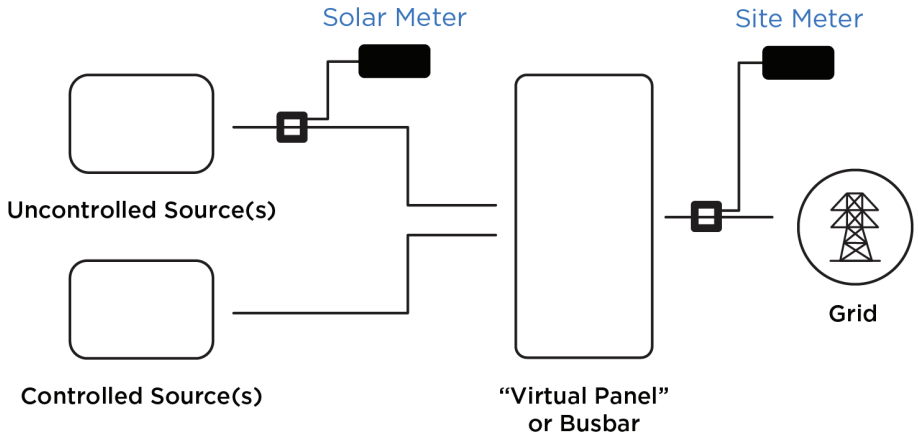
As per the requirement from NEC: 2020, 705.13, Tesla Site Controller software has implemented a Panel Limit feature that monitors the amperage flowing into and out of an electrical panel / busbar from all controlled and uncontrolled sources (Grid, Solar Inverter, and Powerwall). As the measured current approaches the configured Panel Limit, the Site Controller first reduces the current contribution of batteries (at 90% of the Limit), then limits the output of controlled solar (at 95% of the Limit). If the measured current of all sources combined exceeds the configured Panel Limit for the site, the output of all PCS-controlled power production sources will be curtailed to 0.

For the purposes of Panel Limits, the Site Controller treats all metered values as positive, including Site export and Battery charging. The result is that the Panel Limit effectively behaves like a Site Export and Import Limit, as it prevents the controlled sources from contributing to an import or export value that is greater than the Panel Limit. If this behavior presents an issue for the system, and a Panel Limit is not required for busbar protection, the Panel Limit can be disabled (see *Configuring Panel Limits* below).

As detailed in *Site Limit Feature on page 14*, Site Import and Export Limits are useful when a utility enforces restrictions on the maximum power that can be sent in one direction or the other, and requires proof that those restrictions are being followed. Site Import and Export Limits also provide the following "best-effort" behavior that is not present in Panel Limits:

- The Site Import Limit will cause Powerwalls to discharge to try to avoid exceeding the limit, if the Powerwalls are able to discharge.
- The Site Export Limit will cause Powerwalls to charge to try to avoid exceeding the limit, if the Powerwalls are able to charge.

NOTE: All current flowing to the loads will be fed from the grid supply, along with any sources uncontrolled by the Tesla Site Controller (which in turn need to be sized in accordance with the 120% rule or their own PCS controls).



NOTE: The default overcurrent protection rating for the PCS Panel Limit is 80 A. The Panel Limit can be set by Qualified Personnel to a maximum of 200 A.

WARNING: The maximum PCS operating current setting shall not exceed the panel rating of any PCS controlled panel.

3.2 Example Single Line Diagrams for Common Installation Configurations

Figure 4. Powerwall+ and Backup Switch for Whole Home Backup

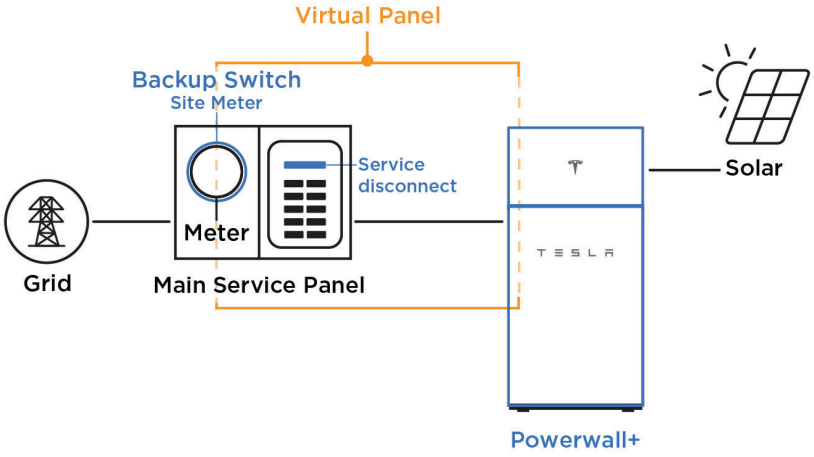


Figure 5. Powerwall+ and Gateway 2 for Whole Home Backup

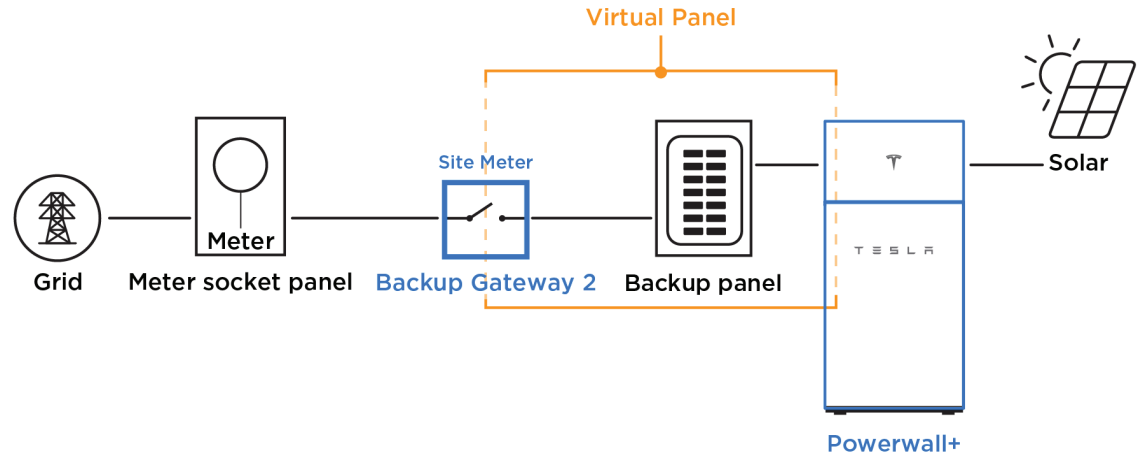


Figure 6. Powerwall 3 and Gateway 2 for Whole Home Backup

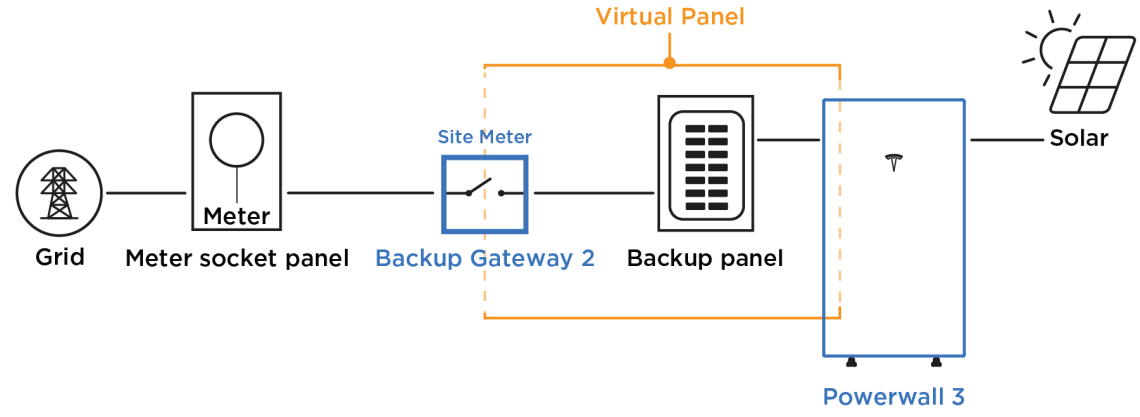
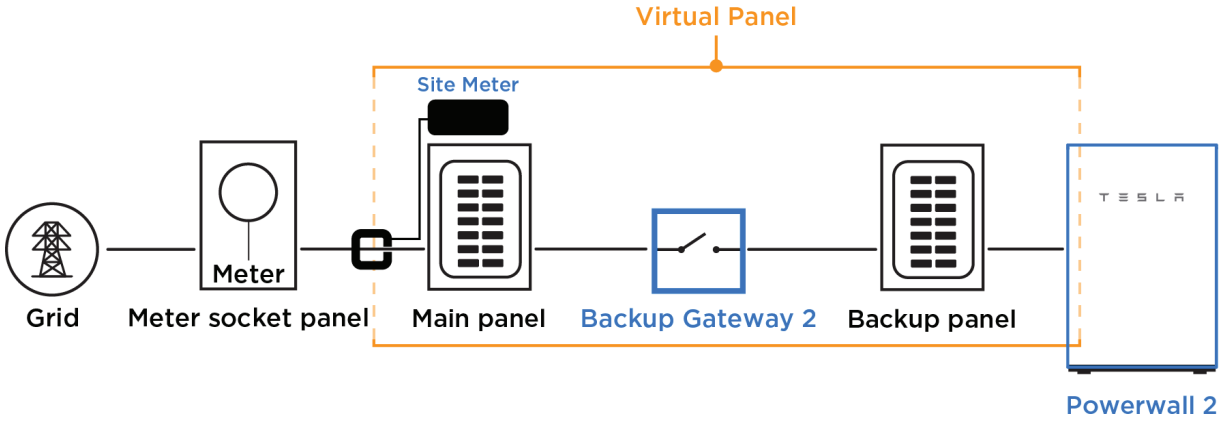


Figure 7. Powerwall 2 and Gateway 2 for Partial Home Backup



3.3 Application of the Panel Limits Feature

The Panel Limits feature is most functional when using Powerwall+ or Powerwall 3 since the solar and battery currents are “controllable.” If using Panel Limits with any standalone inverter (Tesla Solar Inverter or third-party), this solar current is not controllable. There is still benefit to using Panel Limits to limit the contribution of backfeed from the energy storage system (Powerwall 2, Powerwall+, or Powerwall 3)

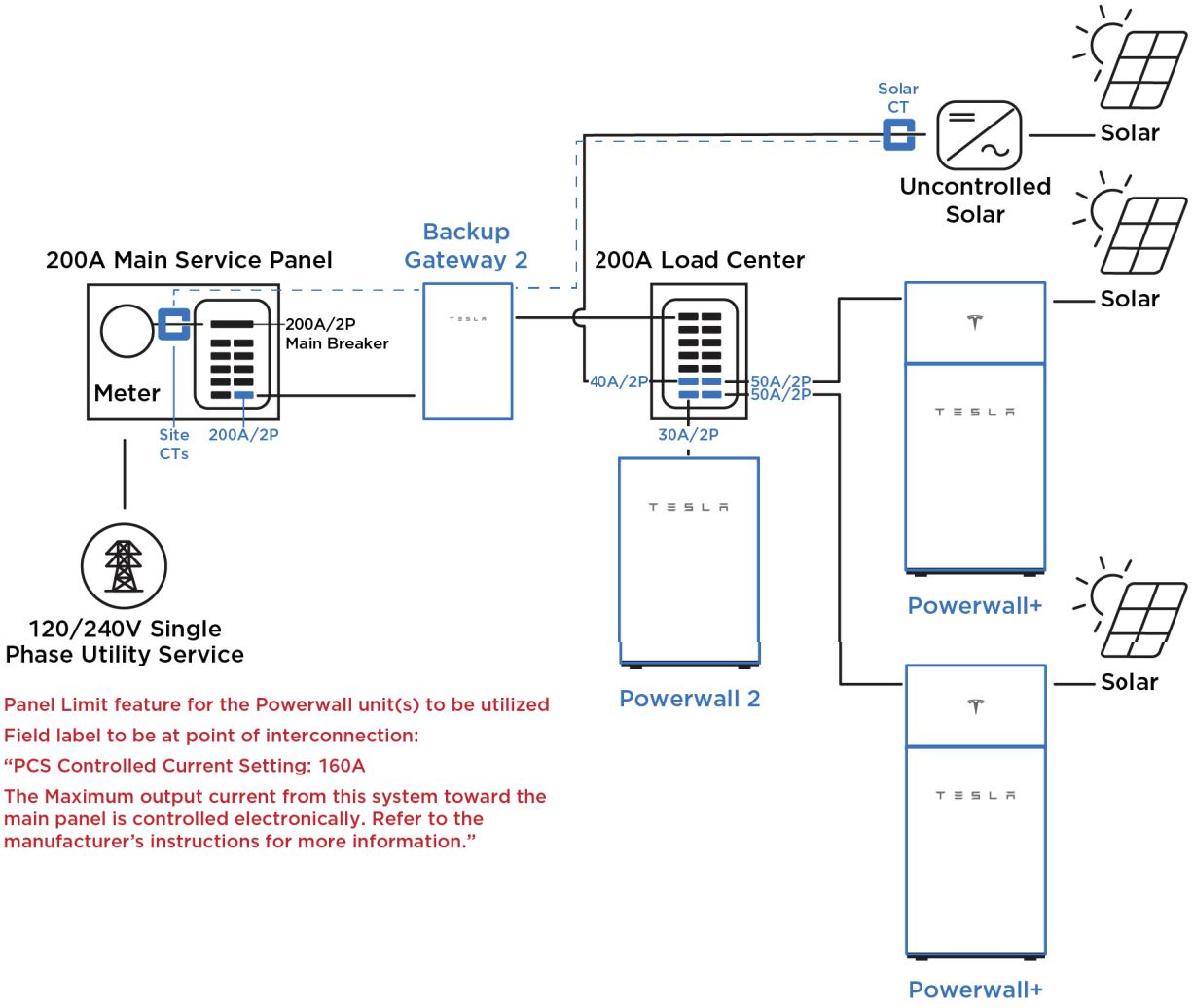
Typical Setting: Amperage of main panel rating, or any panel on site that requires protection from backfeed.

Example:

- A system has a 200A main panel rating with a 200A main breaker.
- When following the 120% rule (NEC 2020 705.12(B)(3)(2)) the 200A main panel can have 240A of combined supply source breakers, which includes the 200A main and a 40A breaker for new generation.
- The system design calls for 2 Powerwall+ units, 1 Powerwall 2, and 1 40A standalone PV inverter.

Solution:

- Backfeed breakers land in a backup load center. Panel Limit Setting: 160A.
- The 40A from uncontrolled PV is acceptable by the 120% rule. Load centers will not see >160A from controllable sources.



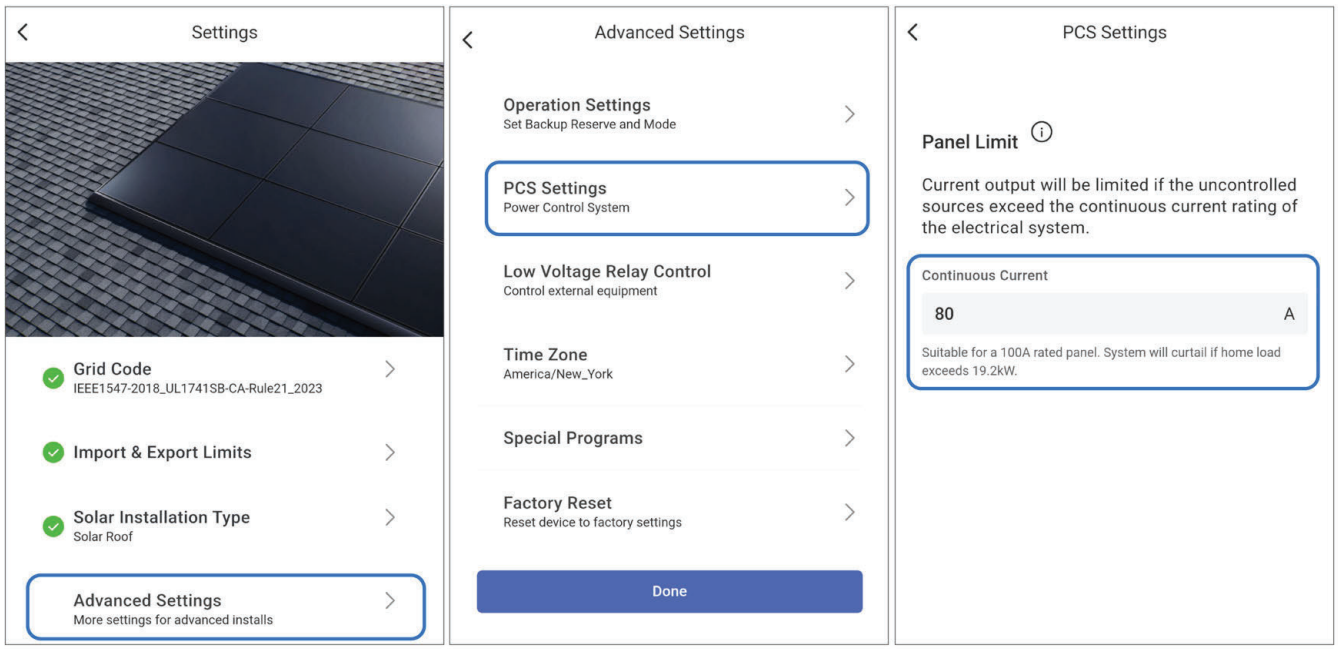
NOTE: This feature impacts the maximum contribution of backfeed from controllable sources. It will not restrict the energy that can be drawn from the utility. The setting should not be used to undersize load centers or overcurrent protection; equipment should always be sized based on loads.

NOTE: No additional CTs are required for this, other than those already needed to capture the whole site and all solar.

3.4 Configuring Panel Limits

The Panel Limit can be configured by Qualified Personnel in the Tesla Pros app; to change the default limit of 80 A (between 10 and 200 A), select **Settings** > **Advanced Settings** > **PCS Settings**.

To disable the Panel Limit, delete the value in the *Continuous Current* field.


Settings
Grid Code
IEEE1547-2018_UL1741SB-CA-Rule21_2023
Import & Export Limits
Solar Installation Type
Solar Roof
Advanced Settings
More settings for advanced installs
Advanced Settings
Operation Settings
Set Backup Reserve and Mode
PCS Settings
Power Control System
Low Voltage Relay Control
Control external equipment
Time Zone
America/New_York
Special Programs
Factory Reset
Reset device to factory settings
Done
PCS Settings
Panel Limit
Current output will be limited if the uncontrolled sources exceed the continuous current rating of the electrical system.
Continuous Current
80
A
Suitable for a 100A rated panel. System will curtail if home load exceeds 19.2kW.

4 Site Limit Feature

4.1 Feature Overview

NOTE: Maximum overcurrent protection rating for PCS Site Limits: 200 A.

Every system has a Site meter which monitors energy flow to and from the grid. For some systems there may be restrictions on the maximum power that can be sent in one direction or the other; there are a variety of reasons for these restrictions, as described below. The Site Limit feature allows Qualified Personnel to set Site Import and/or Export limits to ensure the system does not exceed the amount of power that can be imported or exported per site requirements. As described below, Site Import and Export limits can be set to restrict import / export by source (e.g. Powerwalls can only charge from Solar) or to limit import / export to a numerical value (e.g. can only export up to 10 kW).

The net site power measurement can be a virtual aggregated meter. For example, when both Gateway Meter X and Meter Y are both measuring Site, the combination of Meter X and Meter Y are considered the aggregated Site meter. Therefore, abide by all prior guidance on meters and CTs.

4.2 Site Import Permissions

Site Import Permissions can be set to configure the energy source that Powerwall can charge from (grid and solar or only solar). Site Import Permissions only apply to Powerwall systems with solar, as Powerwall systems without solar can only charge from the grid.

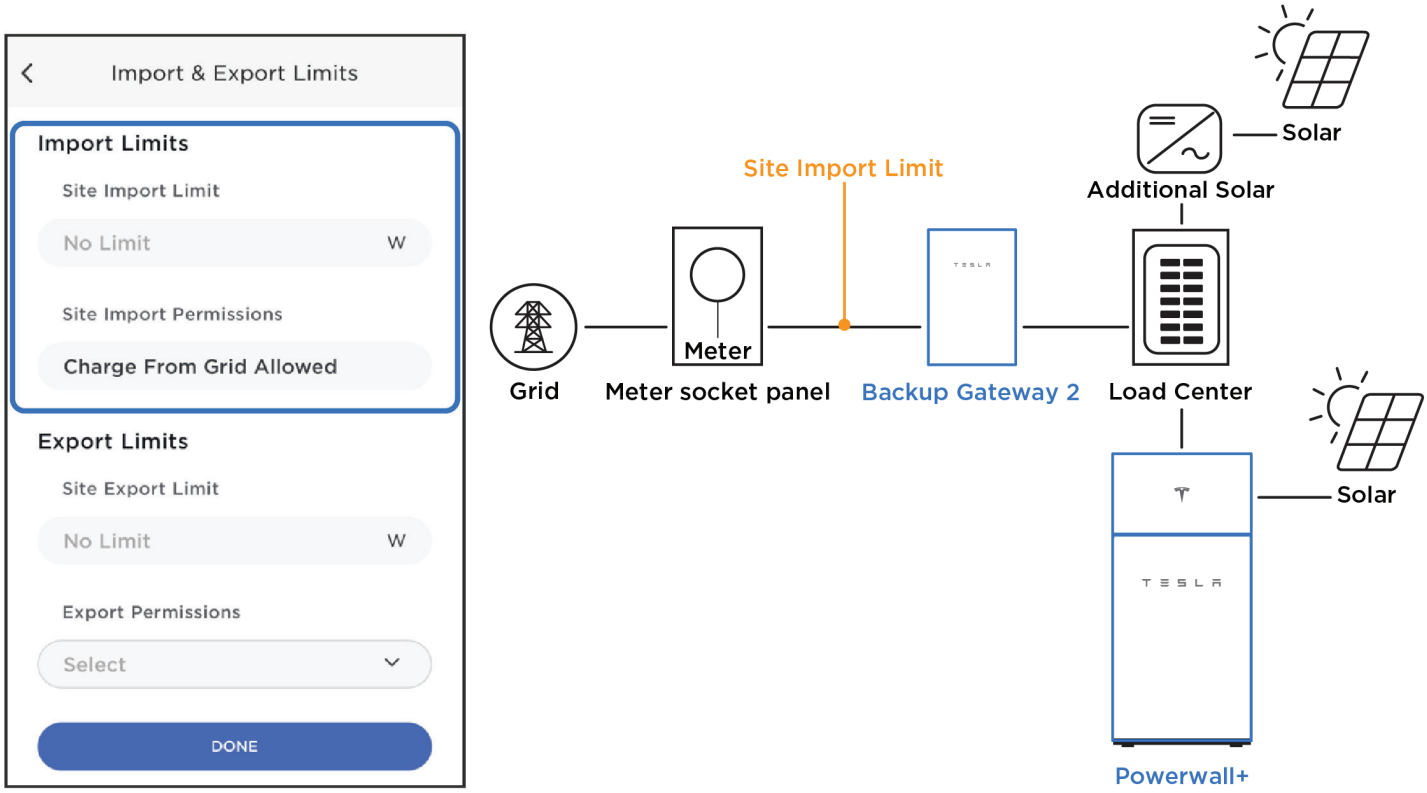
The default Site Import Permission for Powerwall systems with solar is “Charge from Grid Allowed,” which enables the customer to configure grid charging in their Tesla app (when charging from grid is allowed by the installer, the default setting in the customer app is to not charge from grid unless the customer enables it). The installer may select “Charge from Grid Disallowed” on the Import & Export Limits page in the Setup App which will prevent the customer from configuring grid charging in the Tesla app.

NOTE: To configure a system as "Export Only," set the Site Import Permission to "Charge from Grid Disallowed."

NOTE: Previous Investment Tax Credit (ITC) guidance required that Powerwall be configured to only charge from solar; customers who did not claim the ITC or who had met the 5-year requirement *could enable grid charging in the Tesla app*. For more information on ITC guidance based on system configuration and installation year, see the *Tesla Energy Incentives page*.

4.3 Site Import Limits

There may be a limit on how much power the site is allowed to import (see *Application of the Site Import Limits Feature* below for examples). In this case a *Site Import Limit* can be set to comply with that power limit. The **Site Import Limit** is set on the *Import & Export Limits* page in the Setup App. Depending on the limit set, this may result in Powerwall charging slower or discharging to keep the Site below the limit.



To stay at or below the Site Import Limit, first Powerwall reduces its charge rate. If necessary, it also discharges to the system. If the Site Import Limit is 10 kW and the system is importing 8 kW, Powerwall could charge at a max rate of 2 kW. In the same scenario, if the system is importing 12 kW then Powerwall will discharge at a rate of 2 kW to keep the overall import at 10 kW.

Notes:

- Available for Powerwall systems (with or without solar)
- Rarely used application in North American market
- Not the counterpart of Conductor Limits
- It may result in Powerwall charging at a slower rate, not charging at times of high load demand, or even discharging to keep the Site underneath the set limit

4.4 Application of the Site Import Limits Feature

Example 1: Prevent Breaker Tripping

A system has six Powerwalls which charge from the grid at up to 5 kW each, for a total of 30 kW (125A). The system has a 100A (24 kW) main breaker. To prevent the system from tripping the breaker, the installer limits site import to 80% of the main breaker, or 80A. The Site Import Limit is set as 19,200 W.

Example 2: Prevent Main Panel or Transformer Upgrade

Some jurisdictions require that Powerwall be calculated as a load. In a system that is already fully loaded, this may result in a main panel and service upgrade. In rare cases, a utility may require a transformer upgrade to accommodate the Powerwall.

A system has 10 Powerwalls which charge from the grid at up to 5 kW each, for a total of 50 kW. The system has a 10 kVA transformer (continuous power rating). To avoid a transformer upgrade, the Site Import Limit is set as 10,000 W.

4.5 Site Export Permissions

Site Export Permissions determine whether Powerwall (the battery) and/or Solar can export to the grid. Site Export Permissions are determined by the utility, the permit, and the interconnect agreement – follow the most restrictive of these three for any site.

The installer can select one of two modes of operation for the system:

1. **Default (Solar Only)**: The battery is commanded to not export beyond the site meter. The export at the site meter will be limited to the amount measured by the solar meter. Both controlled and uncontrolled solar will export.
2. **Permanent Non Export**: The battery and solar are commanded to never export beyond the site meter. See *Appendix A: Powerwall+ and Powerwall 3 Permanent Non-Export on page 25* for more information.

NOTE: Inadvertent export is possible at any given time.

NOTE: Uncontrolled solar will export unless it is separately configured not to (must be configured in that solar system's configuration interface).

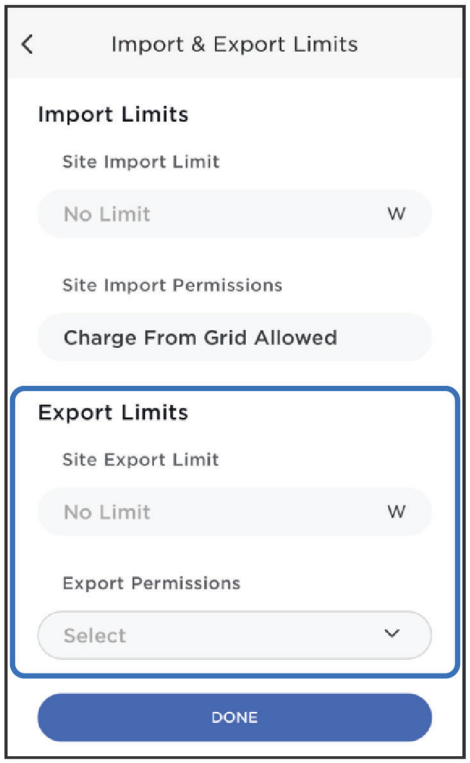
NOTE: Tesla Powerwall systems are certified to UL 1741 PCS for the energy storage system (ESS) operating modes of "Import Only" and "Export Only" when Import Permissions are configured accordingly. "Import Only" systems / interconnections prohibit batteries from exporting to the grid during normal operation. For a Tesla Powerwall system, this can be configured by setting the Export Permission to "Solar-Only" or "Non-Export," thus preventing the Powerwall from exporting battery power to the grid.

NOTE: To achieve UL 1741 PCS Import Only behavior, either PV Only Export or NO SITE EXPORT must be selected. When the selected Grid Code applies to a region that requires UL 1741 PCS, such as California UL 1741 SA, the default setting is PV Only Export. In Setup App it is possible to further restrict the system to NO SITE EXPORT; however, once set, it is not possible to change back to PV Only Export. It is not possible for the installer to configure the system to allow BATTERY EXPORT.

NOTE: Only Tesla is able to configure a system to allow battery Export, for example when a system is part of a Virtual Power Plant that permits battery export during particular events. The option to join the Virtual Power Plant is automatically made available to the customer in the Tesla app and cannot be enabled by the installer.

4.6 Site Export Limits

For systems that can export to the grid, there may be a limit on how much power the site is allowed to export. In this case a *Site Export Limit* can be set to comply with that power limit. The **Site Export Limit** is set on the *Import & Export Limits* page in the Setup App.



To stay at or below the Site Export Limit, Powerwall first reduces discharge, then charges, then solar is curtailed. Below are a few examples for a system with no loads and a 10kW Site Export Limit:

- If solar production is at 8 kW, Powerwall can discharge at a rate of up to 2 kW to keep the overall export within 10kW
- If solar production is at 13 kW, Powerwall will charge at a rate of at least 3 kW to keep the overall export within 10 kW.
- If available solar production is 18 kW, Powerwall will charge at a rate of 5 kW (its maximum), then solar will be curtailed to 15 kW to keep the overall export within 10 kW.

4.7 Application of Site Export Limits

Example 1: Utility Interconnect Requirement

The utility allows for up to 10 kW of solar export based on permit type. Rather than install only 10 kW of solar which may result in being unable to power system loads, a Site Export Limit of 10 kW allows for a larger system that adequately powers loads without violating the limit.

For example, if 15 kW of solar are installed, the Site Export Limit ensures that no more than 10 kW are exported at any time.

Example 2: Incentive Limit

A system is incentivized for exporting up to 10 kW of solar. If there is a penalty for exporting more than 10 kW, the Site Export limit can be set to 10 kW. In this instance, if 12 kW of uncontrolled solar is being produced, Powerwall will charge at a rate of 2 kW to prevent the Site Export limit from being exceeded. Any controlled solar (produced by Powerwall+) would be curtailed.

5 Conductor Limit Feature

5.1 Feature Overview

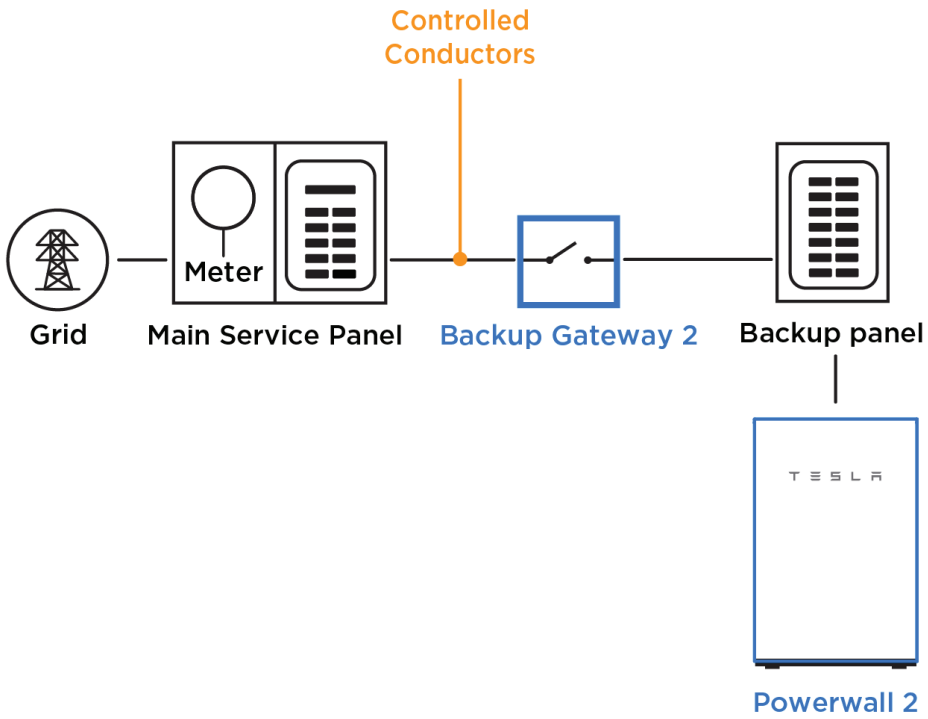
The system can be configured to curtail power from all Powerwalls to limit the total current on a conductor (for example to limit backfeeding a panel). In doing so, the Conductor Limit is equivalent to the "power-source(s) output circuit current" outlined in the requirements of Article 705.12(B) of the NEC / CEC.

NOTE: Tesla recommends using the Panel Limit feature in most cases for jurisdictions using the 2023 NEC for simplified 705.13 backfeed compliance in accordance with 750.30.

NOTE: Conductor CTs must be installed on conductors that are between the grid connection and the Powerwalls or at a location where Powerwalls have control over current.

To configure a Conductor Limit, two current transformers (CTs) are installed to measure current at the controlled conductor location. Output from these CTs is measured and the data is fed to the Powerwall system. The system then coordinates Powerwall output current amperage to not exceed the current limit in real time.

Figure 8. Controlled Conductors where Backup Gateway Meter X CTs are Configured as Conductor CTs



NOTE: This feature only limits the output contribution from all controlled sources. It does not limit output contribution from uncontrolled sources.

NOTE: This should not be used to replace overcurrent protection.

WARNING: The maximum PCS operating current setting shall not exceed the conductor ampacity of any PCS controlled conductor.

NOTE: Maximum overcurrent protection rating for PCS controlled conductor: 200 A.

5.2 Application of the Conductor Limits Feature

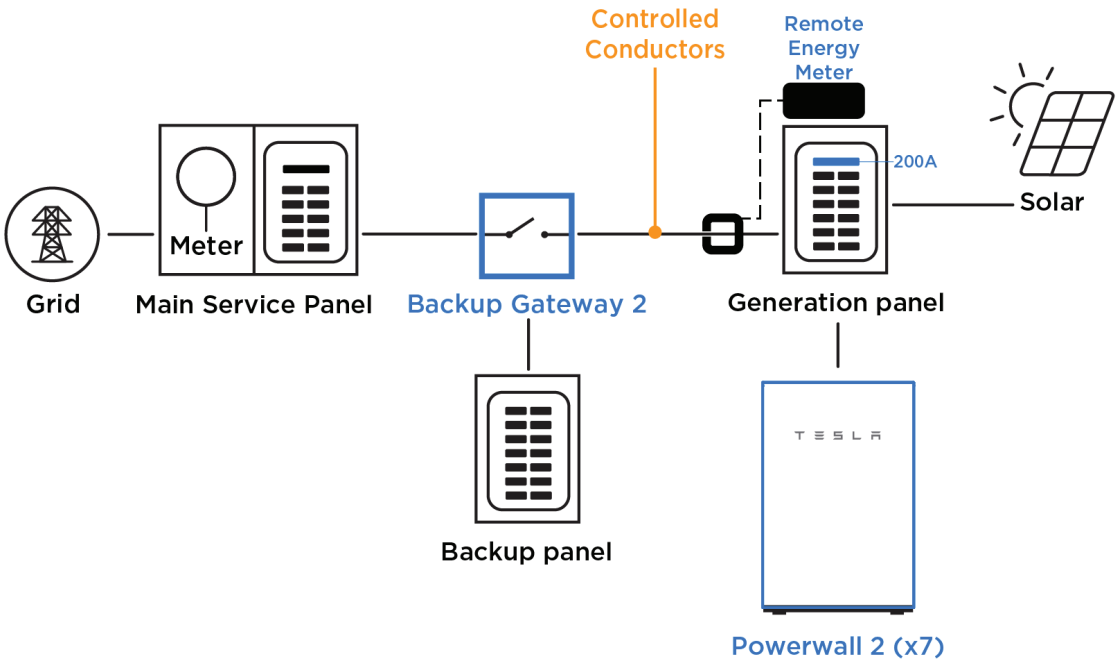
Conductor Limits can be used to reduce backfeed contributed by Powerwall to more easily meet backfeed compliance on upstream load centers. This application reduces the frequency of main breaker derates and main panel upgrades.

The typical use case for Conductor Limits is to set an amperage allowable backfeed current that is compliant with the upstream load center.

Example 1: Greater than 200A of Sources in the Generation Panel

Over 200A of Powerwalls and PV are being installed in an appropriately sized generation panel (ex: 225A or 400A). This generation panel must have a 200A main breaker to protect the Backup Gateway (200A rating). To ensure the generation panel main breaker does not trip, a Conductor Limit of 200A is set.

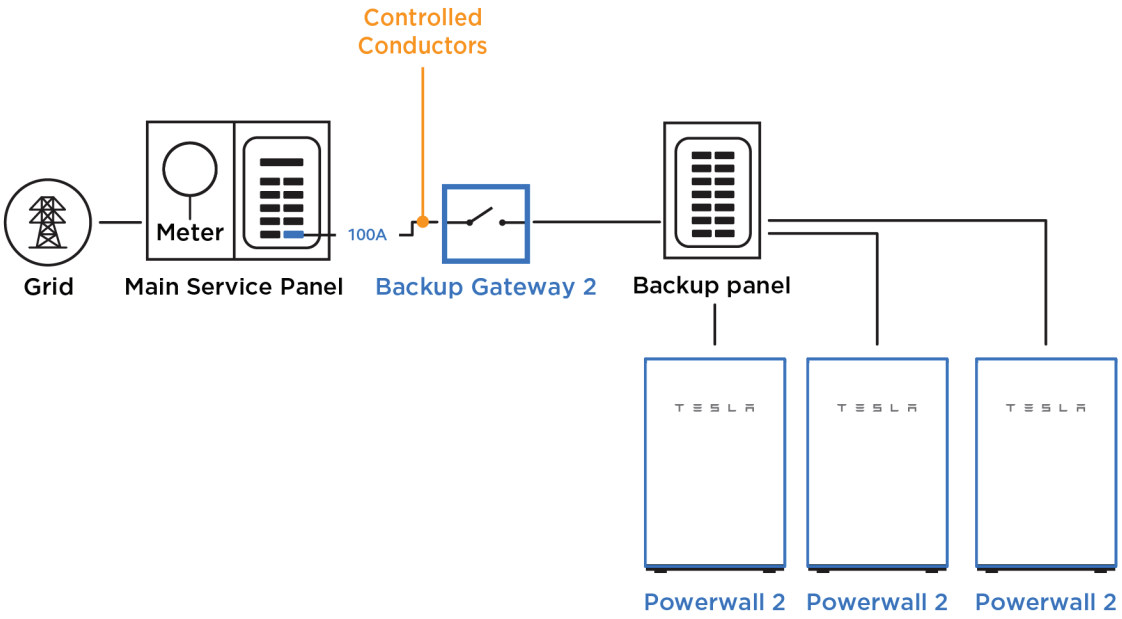
In the example below, two 200A Neurio CTs are installed with a Neurio meter and configured as Conductor CTs.



Example 2: Three Powerwalls in System with 200A Main Panel / 200A Main Breaker

A system has a 200A main panel rating and a 200A main breaker. Following the 120% rule, only 32A of backfeed would be allowed (40A breaker). The most advantageous solution would be to set a Panel Limit of 100A.

If setting a Panel Limit is not an option, install the Backup Gateway on a breaker sized for the backup panel (in this example a 100A breaker is used because the backup panel is 100A rated) and set a Conductor Limit of 32A (40A of equivalent overcurrent protection * 0.8 = 32A continuous). In this scenario, the Meter X CTs in the Backup Gateway are configured as Conductor CTs.



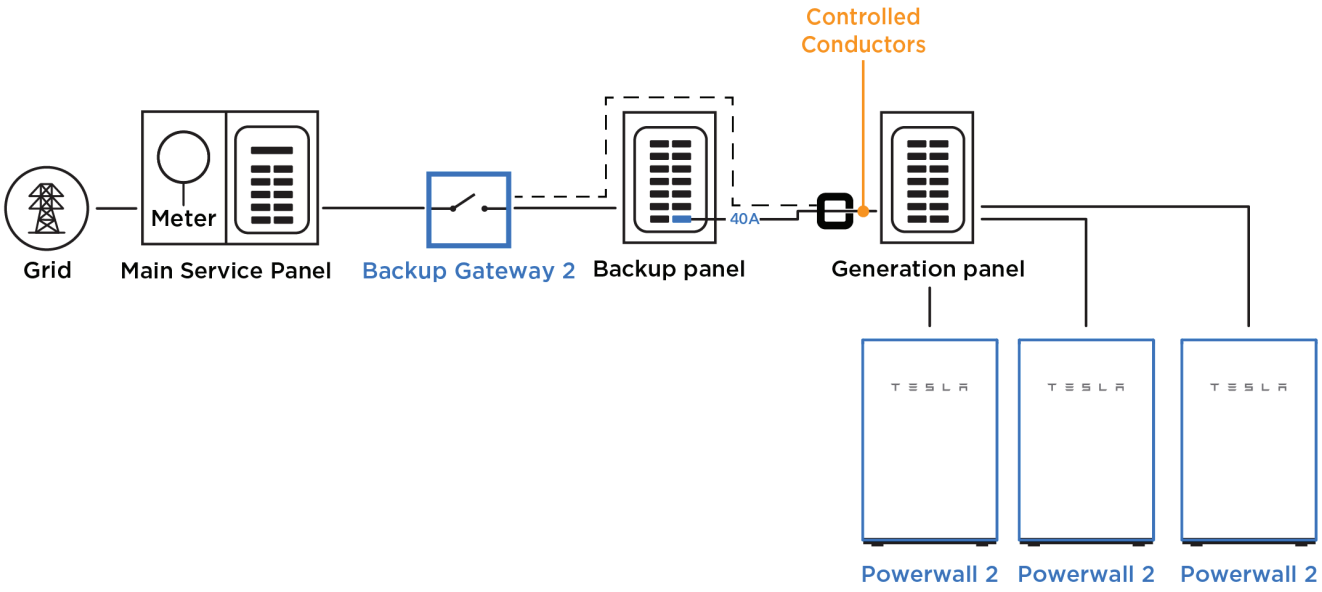
Example 3: Three Powerwalls in System with 200A Main Panel / 200A Main Breaker

In the instance that a Conductor Limit is not an option for the system as discussed in Example 1, the least advantageous solution is to install the three Powerwalls in a generation panel fed by a 40A breaker. To prevent the Powerwalls from exceeding that breaker's capability, install two Conductor CTs and set the Conductor Limit to 32A (40A of equivalent overcurrent protection * 0.8 = 32A continuous).

NOTE: A 40A breaker was selected based on this backup panel being a 200A panel fed by a 200A main; with a conservative interpretation of the 120% rule and without permitted use of software limits, a 40A breaker can be used.

NOTE: During a grid outage, the power produced by the Powerwalls is not limited to Conductor Limits; therefore, the 40A breaker may trip if loads in the upstream backup panel exceed 40A.

In the example below, two CTs are connected to Meter Y in the Backup Gateway and configured as Conductor CTs.



5.3 Installing and Configuring Conductor CTs

Install Conductor CTs on conductors that are between the grid connection and the Powerwalls, or at a location where Powerwalls have control over current. Ensure the Conductor CTs are oriented the same way as Site CTs (the label faces toward the grid).

Conductor Limits are configured using the Commissioning Wizard:

1. Scan the QR code on the product serial number label to connect to the TEG Wi-Fi network.
2. Open a browser and navigate to http://TEG-YYY where YYY are the last 3 digits of the Backup Gateway serial number.
3. Log in to the Commissioning Wizard using the email address of the installer who is carrying out the work and the password on the serial number label. See the *Powerwall Commissioning Guide* for additional instructions on connecting to the TEG Wi-Fi network and entering the Commissioning Wizard.
4. On the *Current Transformers* page, configure the CT(s) as **Conductor**.
5. On the *Operation Settings* page, enter the amperage for the Conductor Limit in the **Conductor Export Limit** field.

6 Appendix A: Powerwall+ and Powerwall 3 Permanent Non-Export

6.1 Overview

Where required by utilities, Powerwall+ and Powerwall 3 can be placed in a permanent non-export mode. This means that in the following scenarios, Powerwall+/Powerwall 3 will curtail solar to prevent power from being exported back to the grid:

- The battery is fully charged and more solar is being produced than the system is consuming
- Solar is being produced at a higher rate than the battery can charge at, e.g. 7.6kW of solar on a 5kW battery

This feature is available beginning with Powerwall software version 22.18. One important note is that, in a Powerwall+ or Powerwall 3 system, Powerwall+/Powerwall 3 is the only solar inverter capable of curtailing solar as described above. As such, Powerwall+/Powerwall 3 is referred to as “controlled solar.” Third party solar inverters cannot be controlled by the Powerwall system Site Controller in the same manner and are referred to as “uncontrolled solar.”

This document describes three possible permanent non-export configurations: one with exclusively controlled solar, one with uncontrolled (third party) solar that is allowed to export solar to the grid, and one with uncontrolled (third party) solar that is not allowed to export solar to the grid.

6.2 Install Metering for a Permanent Non-Export System

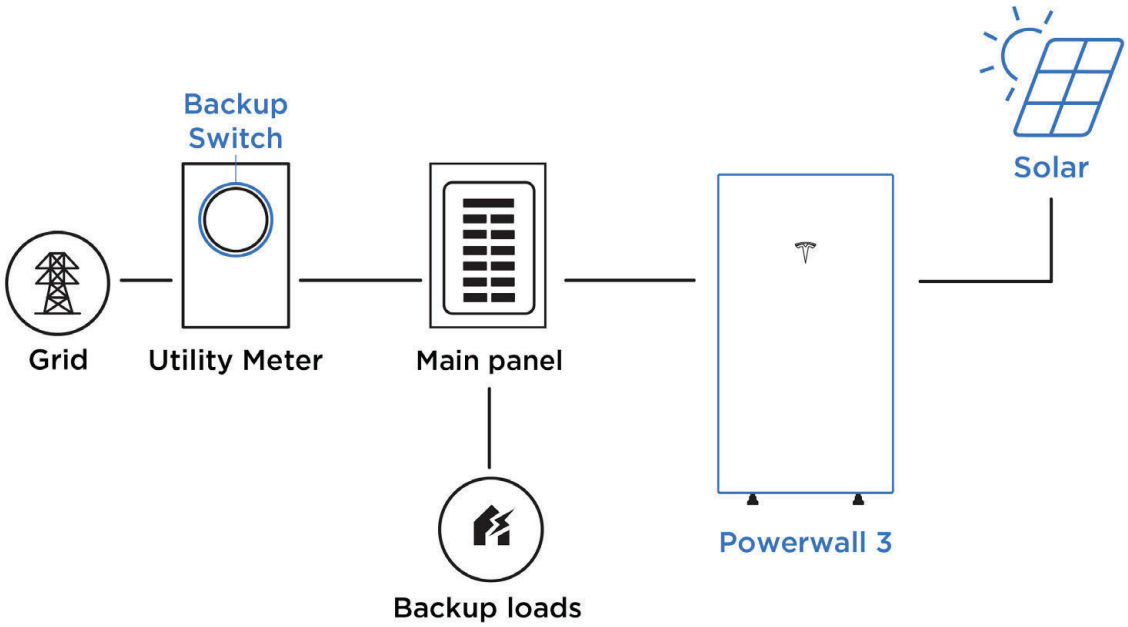
Metering in a permanent non-export system is essentially the same as in any Powerwall system:

- Site metering must capture all loads and generation, including non-backup loads
- Solar metering must capture all solar generation, including third party solar inverters

In addition to the Powerwall system metering, any third party solar inverter also requires its own Site meter if it is configured for non-export. Third party Site metering should follow the third party inverter’s installation instructions and should not be modified by the Powerwall system.

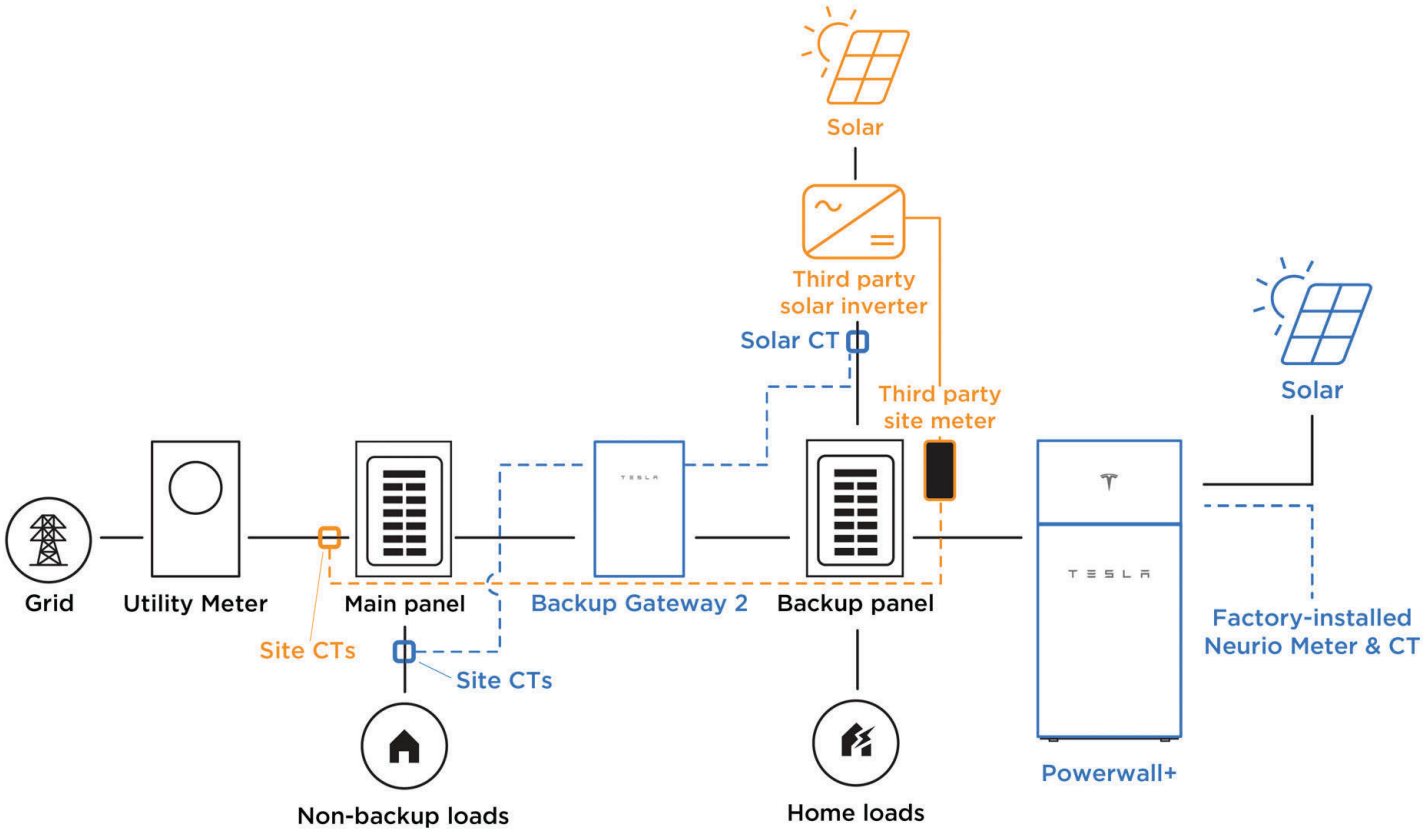
The following examples illustrate some common metering configurations for a permanent non-export system.

Example 1: Powerwall 3 Permanent Non-Export System with Only Controlled Solar



Energy to be Metered	Meter	CT(s)	Meter Configuration
Site loads	Backup Switch	Backup Switch (not shown in diagram)	Preconfigured as Meter Z: Site
Powerwall 3 Solar Generation	Powerwall 3 integrated energy meter	N/A	N/A
Powerwall+ Solar generation	Factory-installed Neurio meter	Factory-installed Neurio 200 A CT	Meter paired with Powerwall+ and CT field-configured as Neurio Meter: SolarCTx2

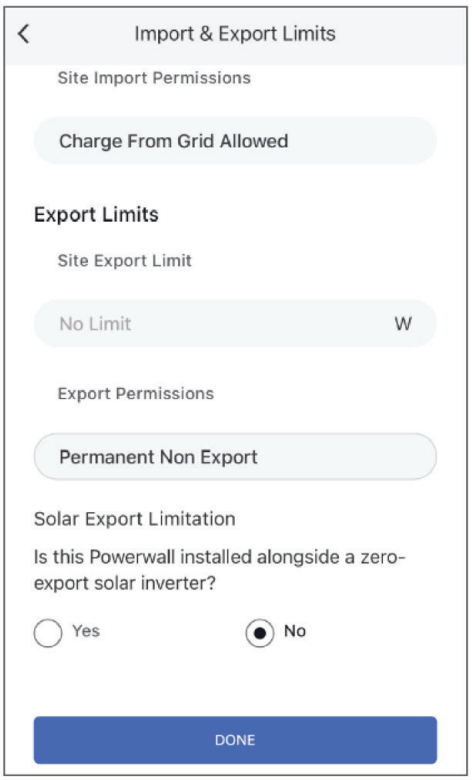
Example 2: Permanent Non-Export System with Uncontrolled Solar



Energy to be Metered	Meter	CT(s)	Meter Configuration
Site backup loads	Backup Gateway Meter X	Backup Gateway Meter X (not shown in diagram)	Preconfigured as Meter X: Site
Site non-backup loads	Backup Gateway Meter Y	Field-installed Tesla 100 A CTs	Field-configured as Meter Y: Site
Powerwall+ Solar generation	Factory-installed Neurio meter	Factory-installed Neurio 200 A CT	Meter paired with Powerwall+ and CT field-configured as Neurio Meter: SolarCTx2
Third party Solar generation	Backup Gateway Meter Y	Field-installed Tesla 100 A CT	Field-configured as Meter Y: SolarCTx2
Third party Site loads	Third party Site meter	Third party Site CTs	Configured by inverter installer to measure Site

6.3 Configure a System for Permanent Non-Export Mode

1. When commissioning the system, set *Export Permissions* to **Permanent Non Export** on the *Operation Settings* page.
2. If the system has standalone solar, uncontrolled by the Powerwall system, determine whether the solar inverter is allowed to export and if that solar inverter is configured with its own controls to prevent export.
    a. If it is allowed to export solar, toggle *Solar export limitation* to **No**.
    b. If it is not allowed to export solar, and is configured with its own non-export controls, toggle *Solar export limitation* to **Yes**.



NOTE: This provides the Powerwall system with the knowledge that it needs to regulate a small amount of import power to prevent the standalone non-export solar inverter from curtailing. This ensures the best overall system performance for these systems that have two devices both responding to site power measurements.

3. Take screenshot of this page and the system *Summary* page after completing commissioning. These will be required as part of the interconnection submission.

7 Revision History

Revision	Date	Description
1.0	2023-06-29	Initial release
1.1	2023-11-01	• Updated *Panel Limit Feature on page 9* to reflect changes to default Panel Limit and updated method of configuring a Panel Limit • Updated to include Powerwall 3 • Added *Qualified Personnel* to *Glossary on page 3*

Project information

Installer	**Freedom Solar Power**	Project Name	**Sharon W Bruce**
		Project Number	**115522**
Project Address	**55 Welcome Drive, Fuquay-Varina, NC 27526 USA**	AHJ/ASCE	**Harnett County / 7-16**
		Wind / Exp. Cat. / Snow	**120.0mph / B / 15 psf**

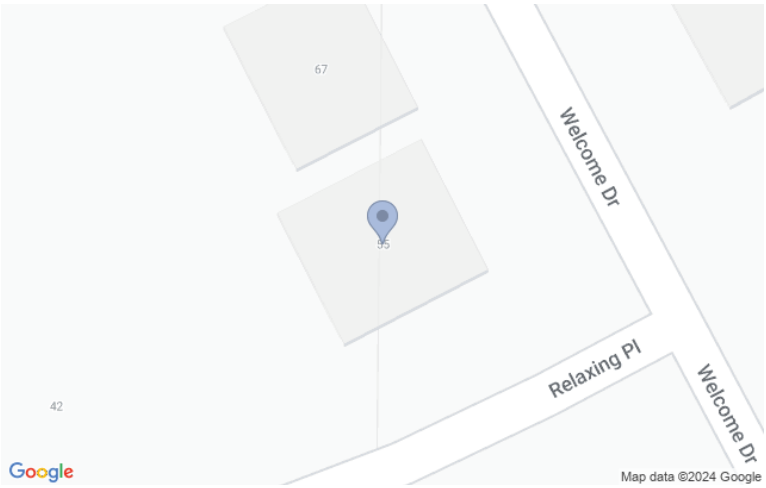
Equipment Type

Module	**REC REC460AA-Pure-RX**
Inverter	**-**
Battery	**--**

Summary

Total modules	**16**
Total watts	**7360 W**
Total Attachments	**37**

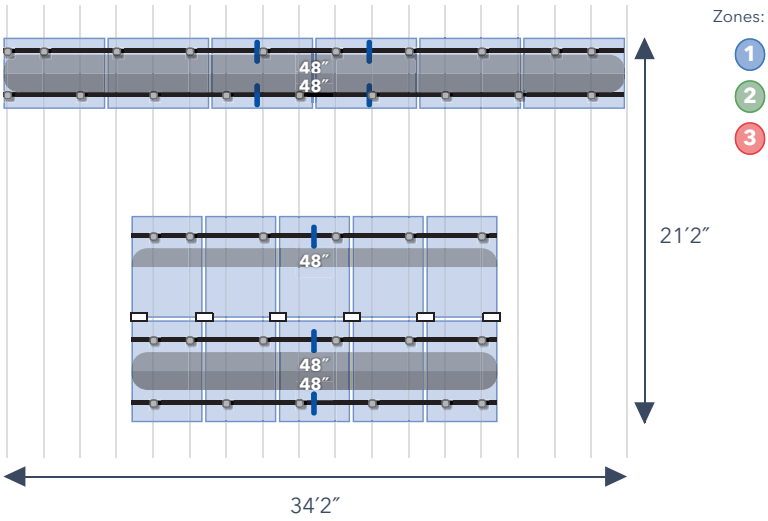
Location preview



Arrays

Array 1	Roof Type: **Gable** Roof Material: **Comp**	SkipRail: **Yes** Roof Slope: **26°**

Array 1 SkipRail



Zones:
1
2
3

Details

Roof Type: **26° Comp Gable**
Rafter Spacing: **24.0"**
SkipRail: **Yes**
Use Scrap Rail: **Yes**
Hidden End Clamp: **Yes**
Attachment Type: **Instaflash**
Rail: **2 x 7ft, 10 x 14ft**

Layout

Panels: **16**
Panel Size: **68.03″ x 48.11″ x 40mm**

Design Notes

System Weight: **955.9 lbs**
Attachments: **37**
System Weight/Attachment: **25.8 lbs**
Total Area: **364 sqft**

Engineering

Max span values for SkipRail system are displayed on the diagram

Maximum Rail Cantilever

Attachment Span	Max Rail Cantilever
72"	**28"**
64"	**25"**
48"	**19"**
32"	**12"**
24"	**9"**
Other	**40% of attachment span**

Legend

- Rail Splice
- Roof Attachment
- Thermal Break
- Module with Rails
- SkipRail Clamp
- SkipRail Clamp with Kickstand