WYSSLING CONSULTING
CORPORATE EXPERIENCE WITH SMALL BUSINESS VALUE
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May 29, 2025

Southern Energy Management
5908 Triangle Drive,
Raleigh, NC, 27617

Scott Wyssling, PE

Digitally signed by Scott Wyssling, PE
DN: C=US, S=Utah, L=Alpine, O=Wyssling Consulting, OU=Engineering, CN="Scott Wyssling, PE", E=swyssling@wysslingconsulting.com
Reason: I am the author of this document
Location:
Date: 2025.05.29 12:56:36-06'00'
Foxit PDF Editor Version: 13.0.1

Re: Engineering Services
Szabo Residence
213 Windswept Way, Fuquay-Varina NC
12.880 kW System

To Whom It May Concern:

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

A. Site Assessment Information

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

B. Description of Structure:

Roof Framing:	Prefabricated wood trusses at 24" on center. The top chord truss members are constructed of 2x6 dimensional lumber and all other members of 2x4 dimensional lumber.
Roof Material:	Composite Asphalt Shingles
Roof Slopes:	27 degrees
Attic Access:	Accessible
Foundation:	Permanent

C. Loading Criteria Used

- **Dead Load**
  - Existing Roofing and framing = 7 psf
  - New Solar Panels and Racking = 3 psf
  - TOTAL = 10 PSF
- **Live Load** = 20 psf (reducible) – 0 psf at locations of solar panels
- **Ground Snow Load** = 15 psf
- **Wind Load** based on ASCE 7-10
  - Ultimate Wind Speed = 116 mph (based on Risk Category II)
  - Exposure Category C

Analysis performed of the existing roof structure utilizing the above loading criteria is in accordance with the 2018 North Carolina Residential Code. This analysis indicates that the existing framing will support the additional panel loading without damage, if installed correctly.

D. Solar Panel Anchorage

1. The solar panels shall be mounted in accordance with the most recent IronRidge installation manual. If during solar panel installation, the roof framing members appear unstable or deflect non-uniformly, our office should be notified before proceeding with the installation.
2. The maximum allowable withdrawal force for a #14 lag screw is 194 lbs per inch of penetration as identified in the National Design Standards (NDS) of timber construction specifications. Based on two screws with a minimum penetration depth of 2", the allowable capacity per connection is greater than the design withdrawal force (demand). Considering the variable factors for the existing roof framing and installation tolerances, the connection using two # 14 lag screw with a minimum of 2" embedment will be adequate and will include a sufficient factor of safety.
3. Considering the wind speed, roof slopes, size and spacing of framing members, and condition of the roof, the panel supports shall be placed no greater than 48" on center.

Based on the above evaluation, this office certifies that with the racking and mounting specified, the existing roof system will adequately support the additional loading imposed by the solar system. This evaluation is in conformance with the 2018 North Carolina Residential Code, current industry standards and practice, and is based on information supplied to us at the time of this report.

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

Very truly yours,

Scott E. Wyssling, PE
North Carolina License No. 46546
North Carolina Firm No. P-2308

NORTH CAROLINA PROFESSIONAL SEAL 046546 ENGINEER SCOTT E. WYSSLING

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North Carolina COA # P-2308

Signed 5/29/2025

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PHOTOVOLTAIC ROOF MOUNT SYSTEM
12.880kWDC,11.500kWAC
13.500kWh ENERGY STORAGE SYSTEM
213 WINDSWEPT WAY, FUQUAY-VARINA, NC 27526

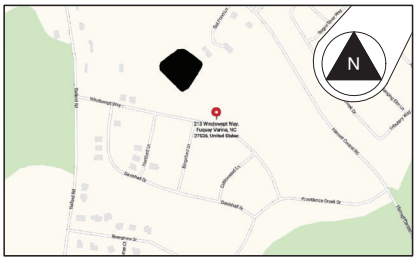
AHJ:
HARNETT COUNTY

UTILITY:
DUKE ENERGY PROGRESS

GOVERNING CODES WITH NC AMENDMENTS:
2018 NORTH CAROLINA BUILDING CODE
2018 NORTH CAROLINA RESIDENTIAL CODE
2018 NORTH CAROLINA FIRE CODE
2017 NORTH CAROLINA ELECTRICAL CODE

WIND SPEED:116 MPH
SNOW LOAD: 15 PSF

SCOPE OF WORK
(N) 12.880kWDC,(N) 11.500kWAC ROOF MOUNTED PV SYSTEM
(N) 13.500kWh ENERGY STORAGE SYSTEM
(N) (28) REC SOLAR REC460AA PURE-RX SOLAR MODULES
(N) (16) MID-CIRCUIT INTERRUPTER
(N) (1) TESLA POWERWALL 3 - 1707000-XX-Y (240V) BATTERY WITH INTEGRATED INVERTER
(N) (1) TESLA BACKUP SWITCH
(N) (1) ESS DISCONNECT SWITCH
(N) (1) 200A/175A NON SECURE PANEL

VICINITY MAP


GENERAL NOTES
1. MODULES ARE LISTED UNDER UL 61730 / UL 1703 AND CONFORM TO THE STANDARDS.
2. INVERTERS ARE LISTED UNDER UL 1741 AND CONFORM TO THE STANDARDS.
3. DRAWINGS ARE DIAGRAMMATIC, INDICATING GENERAL ARRANGEMENT OF THE PV SYSTEM AND THE ACTUAL SITE CONDITIONS MAY VARY.
4. WORKING CLEARANCES AROUND THE NEW PV ELECTRICAL EQUIPMENT SHALL BE MAINTAINED IN ACCORDANCE WITH NEC 110.26 .
5. ALL GROUND WIRING CONNECTED TO THE MAIN SERVICE GROUNDING IN MAIN SERVICE PANEL/ SERVICE EQUIPMENT.
6. ALL CONDUCTORS SHALL BE 600V, 90°C STANDARD COPPER UNLESS OTHERWISE NOTED.
7. WHEN REQUIRED, A LADDER SHALL BE IN PLACE FOR INSPECTION IN COMPLIANCE WITH OSHA REGULATIONS.
8. THE SYSTEM WILL NOT BE INTERCONNECTED BY THE CONTRACTOR UNTIL APPROVAL FROM THE UTILITY IS RECEIVED.
9. ROOF ACCESS POINT SHALL BE LOCATED IN AREAS THAT DO NOT REQUIRE THE PLACEMENT OF GROUND LADDERS OVER OPENINGS SUCH AS WINDOWS OR DOORS, AND LOCATED AT STRONG POINTS OF BUILDING CONSTRUCTION WHERE THE ACCESS POINT DOES NOT CONFLICT WITH OVERHEAD OBSTRUCTIONS SUCH AS TREES, WIRES OR SIGNS.
10. PV ARRAY COMBINER/JUNCTION BOX PROVIDES TRANSITION FROM ARRAY WIRING TO CONDUIT WIRING.
11. RACKING SYSTEM SHALL BE LISTED TO UL 2703.
12. FIRE RATING OF EXISTING ROOF ASSEMBLY SHALL BE MAINTAINED WITH ADDITION OF PHOTOVOLTAIC SYSTEM.

SHEET INDEX

CONTRACTOR INFORMATION

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5908 TRIANGLE DR, RALEIGH, NC 27617
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LICENSE#
TYPE-ELECTRICAL

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13.500kWh **ENERGY STORAGE**
STEVE SZABO RESIDENCE
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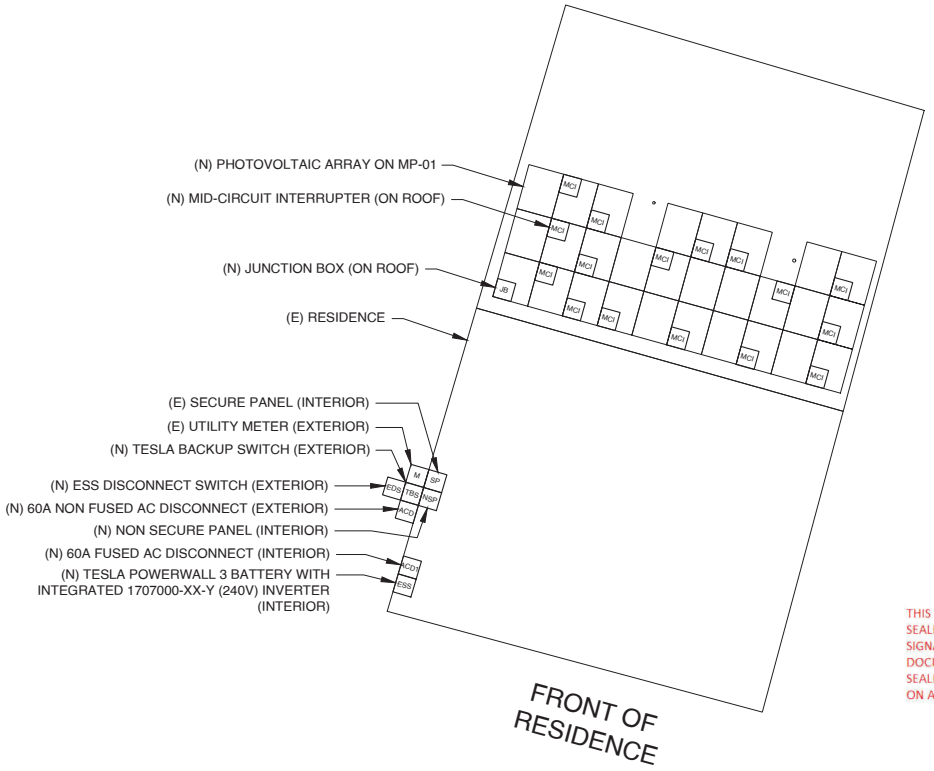
DATE	5/24/2025
CREATED BY	ART
SCALE	NTS

COVER SHEET

PV-1

LEGEND

M	(E) UTILITY METER
SP	(E) 225A SECURE PANEL (E) 200A MAIN BREAKER
ESS	(N) TESLA POWERWALL 3 - 1707000-XX-Y (240V) ENERGY STORAGE SYSTEM,EQUIPMENT WITH INTEGRATED INVERTER
NSP	(N) 200A NON SECURE PANEL (N) 175A MAIN BREAKER
ACD	(N) 60A NON FUSED AC DISCONNECT VISIBLY OPEN, LOCKABLE 240V NEMA-3R
ACD1	(N) 60A FUSED AC DISCONNECT VISIBLY OPEN, LOCKABLE 240V NEMA-3R
EDS	(N) ESS DISCONNECT SWITCH
TBS	(N) TESLA BACKUP SWITCH
JB	(N) JUNCTION BOX 240V, NEMA 4X (ON ROOF)
MCI	(N) 16 MID-CIRCUIT INTERRUPTER
	(N) 28 REC SOLAR REC460AA PURE-RX SOLAR MODULES
○	(E) ROOF OBSTRUCTIONS



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DATE	5/24/2025
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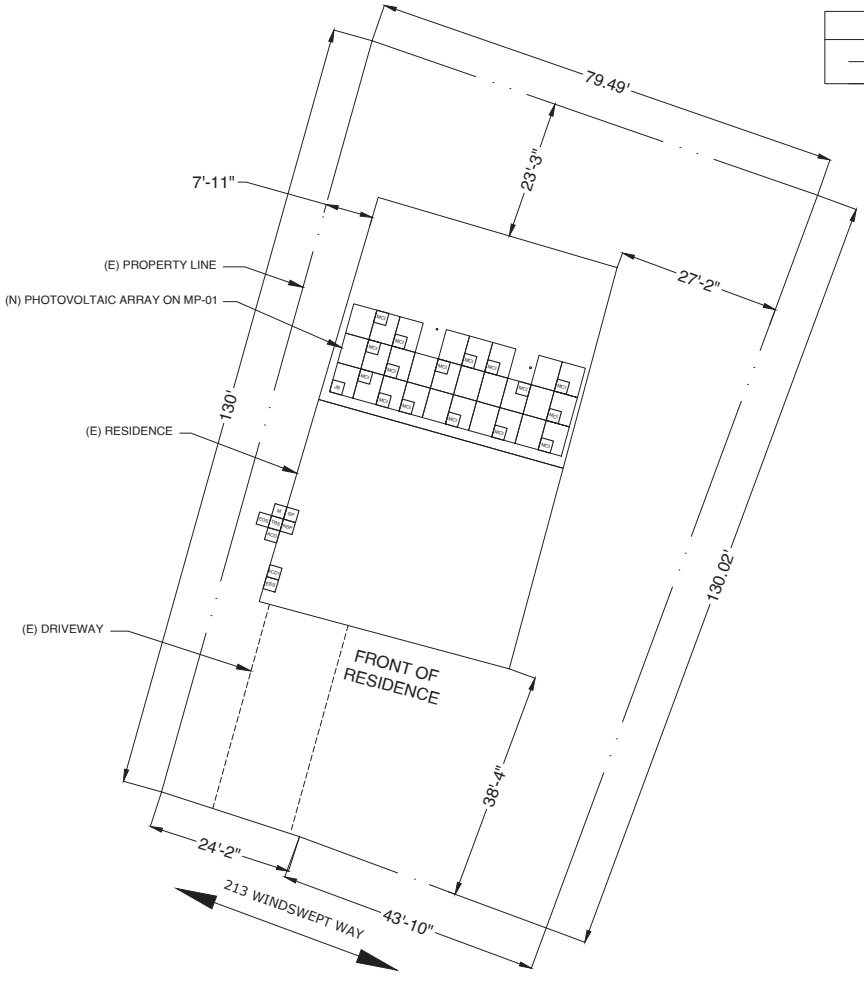
SCALE	3/32" = 1'-0"

SITE PLAN

PV-2



LEGEND

PROPERTY LINE

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DATE	5/24/2025
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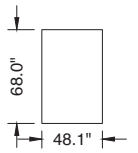
SCALE	1/16" = 1'-0"

PROPERTY PLAN

PV-3

MODULE TYPE, DIMENSION & WEIGHT
NUMBER OF MODULES = 28 MODULES
MODULE TYPE = REC SOLAR: REC460AA PURE-RX MODULES
MODULE WEIGHT = 51.2 LBS / 23.22KG
MODULE DIMENSIONS = 68.0"X 48.1" = 22.71 SF

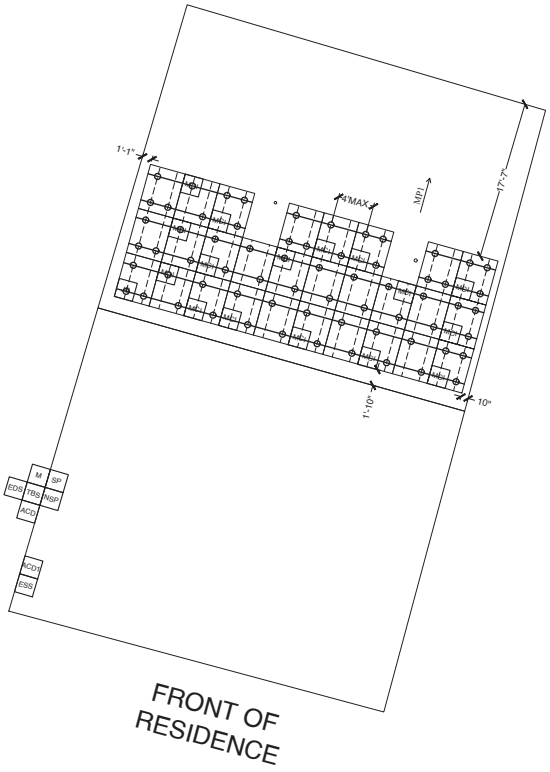
66 ATTACHMENTS INSTALLED @ 48" O.C. MAX (TYP)
TOTAL RAIL LENGTH: 224'-4"
NOTE: ATTACHMENTS ARE STAGGERED.



REC SOLAR
REC460AA PURE-RX
MODULES

ARRAY & ROOF AREA CALC'S		
TOTAL PV ARRAY AREA (Sq. Ft.)	TOTAL ROOF AREA (Sq. Ft.)	ROOF AREA COVERED BY ARRAY (%)
635.99	3300.5	19.27

ROOF DESCRIPTION						
ROOF LAYER	1 LAYER					
ROOF	# OF MODULES	ROOF PITCH	AZIMUTH	TRUSS SIZE	TRUSS SPACING	ROOF TYPE
1	28	27°	16°	2" X 6"	24"	COMPOSITION SHINGLE



LEGEND

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ESS	(N) TESLA POWERWALL 3 - 1707000-XX-Y (240V) ENERGY STORAGE SYSTEM,EQUIPMENT WITH INTEGRATED INVERTER
NSP	(N) 200A NON SECURE PANEL (N) 175A MAIN BREAKER
ACD	(N) 60A NON FUSED AC DISCONNECT VISIBLY OPEN, LOCKABLE 240V NEMA-3R
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MCI	(N) 16 MID-CIRCUIT INTERRUPTER
	(N) 28 REC SOLAR REC460AA PURE-RX SOLAR MODULES
	(E) ROOF OBSTRUCTIONS
	(N) ROOF ATTACHMENTS
	(E) TRUSS
	(N) RAIL

N

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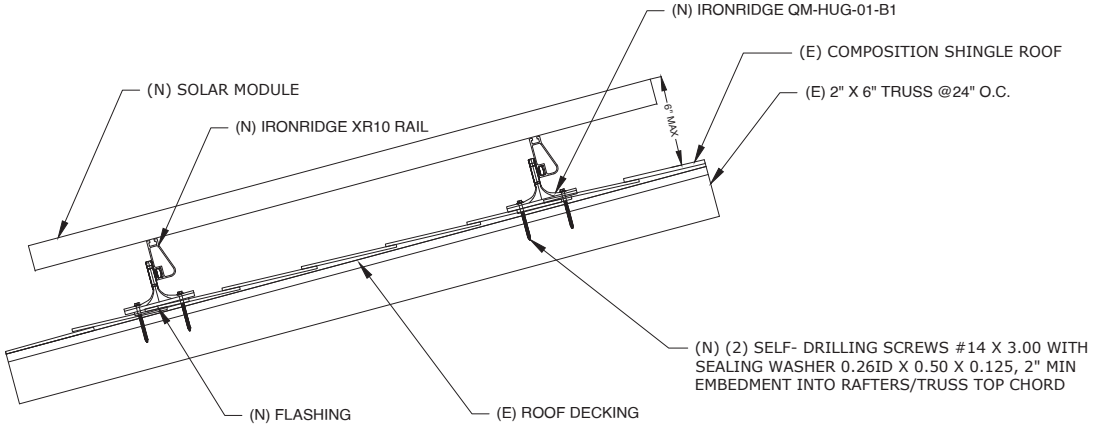
ROOF PLAN

PV-4



ATTACHMENT DETAIL:
SCALE: NTS

DEAD LOAD CALCULATION			
BOM	QUANTITY	LBS/UNIT	TOTAL WEIGHT (LBS)
MODULES	28	51.2	1433.60
MID-CLAMP	46	0.09	4.14
END-CLAMP	20	0.15	3.00
RAIL LENGTH	224.47	0.68	152.64
SPLICE BAR	6	0.50	3.00
IRONRIDGE QM HUG	66	0.57	37.62
MCI	16	0.26	4.16
TOTAL WEIGHT OF THE SYSTEM (LBS)			1638.16
TOTAL ARRAY AREA ON THE ROOF (SQ. FT.)			635.99
WEIGHT PER SQ. FT.(LBS)			2.58
WEIGHT PER PENETRATION (LBS)			24.82

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ATTACHMENT DETAIL

PV-5

WIRE SIZE CALCULATION

MAX BRANCH DC REQUIRED CONDUCTOR AMPACITY
(17)(1.25) = 21.25A

AWG #10, DERATED AMPACITY:
(40)x(0.91)x(0.7) = 25.48A

FROM TABLE 310.15(B)(16),90°C COLUMN

25.48A>21.25A , THEREFORE DC WIRE SIZE IS VALID

COMBINED SYSTEM AC REQUIRED CONDUCTOR AMPACITY
(1)(48)(1.25) = 60.00A PER NEC §690.8(A)

AWG #6, DERATED AMPACITY: 65.00A

FROM TABLE 310.15(B)(16),75°C COLUMN

65.00A>60.00A , THEREFORE AC WIRE SIZE IS VALID

NOTE: CONDUIT SHALL BE INSTALLED MIN 7/8" ABOVE ROOF SURFACE

OCPD CALCULATION

ALLOWABLE BACKFEED:
MAIN SERVICE PANEL RATING = 200A
MAIN BREAKER RATING = 175A
120% = (MAIN SERVICE PANEL RATING * 1.2) - MAIN BREAKER RATING
= (200x1.2) - 175 = 65A
ALLOWABLE BACKFEED = 65A

INVERTER OVERCURRENT PROTECTION:
INVERTER OVERCURRENT PROTECTION = INVERTER O/P CURRENT * CONTINUOUS LOAD(1.25)
= 48.00 * 1.25
= 60.00 A
PV OVERCURRENT PROTECTION = 60A

ALLOWABLE BACKFEED 65 A ≥ 60A PV OVERCURRENT PROTECTION

THE DESIGNED INTERCONNECTION MEETS THE 705.12(B)(2)(3)(b) REQUIREMENTS.

ASHRAE 2021 -
HIGHEST MONTHLY 2% D.B. DESIGN TEMP.: 35.9°C
LOWEST MIN. MEAN EXTREME D.B.: -8.5°C

INTERCONNECTION NOTES:
1. INTERCONNECTION SIZING, LIMITATIONS AND COMPLIANCE DETERMINED IN ACCORDANCE WITH [NEC 705.12], AND [NEC 690.64].
2. GROUND FAULT PROTECTION IN ACCORDANCE WITH [NEC 215.9], [NEC 230.95] AND [NEC 690.5]
3. ALL EQUIPMENT TO BE RATED FOR BACKFEEDING.
4. PV BREAKER TO BE POSITIONED AT THE OPPOSITE END OF THE BUSBAR RELATIVE TO THE MAIN BREAKER.

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

RACKING NOTE:
1. BOND AND GROUND RACKING AND MODULES IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS. MINIMUM ONE CONNECTION PER ARRAY

GROUNDING & GENERAL NOTES:
1. A SECOND FACILITY GROUNDING ELECTRODE IS NOT REQUIRED PER [NEC 690.47(C)(3)]
2. PV INVERTER IS UNGROUNDED, TRANSFORMER-LESS TYPE.
3. DC GEC AND AC EGC TO REMAIN UNSPLICED, OR SPLICED TO EXISTING ELECTRODE
4. ANY EXISTING WIRING INVOLVED WITH PV SYSTEM CONNECTION THAT IS FOUND TO BE INADEQUATE PER CODE SHALL BE CORRECTED PRIOR TO FINAL INSPECTION.
5. SOLADECK OR JUNCTION BOX QUANTITIES, AND PLACEMENT SUBJECT TO CHANGE IN THE FIELD - SOLADECK OR JUNCTION BOX DEPICTED ON ELECTRICAL DIAGRAM REPRESENT WIRE TYPE TRANSITIONS.
6. AC DISCONNECT NOTED IN EQUIPMENT SCHEDULE OPTIONAL IF OTHER AC DISCONNECTING MEANS IS LOCATED WITHIN 10' OF SERVICE DISCONNECT
7. RACEWAYS AND CABLES EXPOSED TO SUNLIGHT ON ROOFTOPS SHOULD BE INSTALLED MORE THAN 7/8" ABOVE THE ROOF USING CONDUIT SUPPORTS.
8. TEMPERATURE RATINGS OF ALL CONDUCTORS, TERMINATIONS, BREAKERS, OR OTHER DEVICES ASSOCIATED WITH THE SOLAR PV SYSTEM SHALL BE RATED FOR AT LEAST 75 DEGREE C.
9. WIRE IS SIZED PER NEC 310.15(B)(16), 310.15(B)(2)(a) and NEC 310.15(B)(3)(a)
10. ALL ROOF CONDUIT WILL HAVE A HEIGHT OF 7/8"

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SCALE	NTS

ELECTRICAL CALC. AND NOTES

PV-7

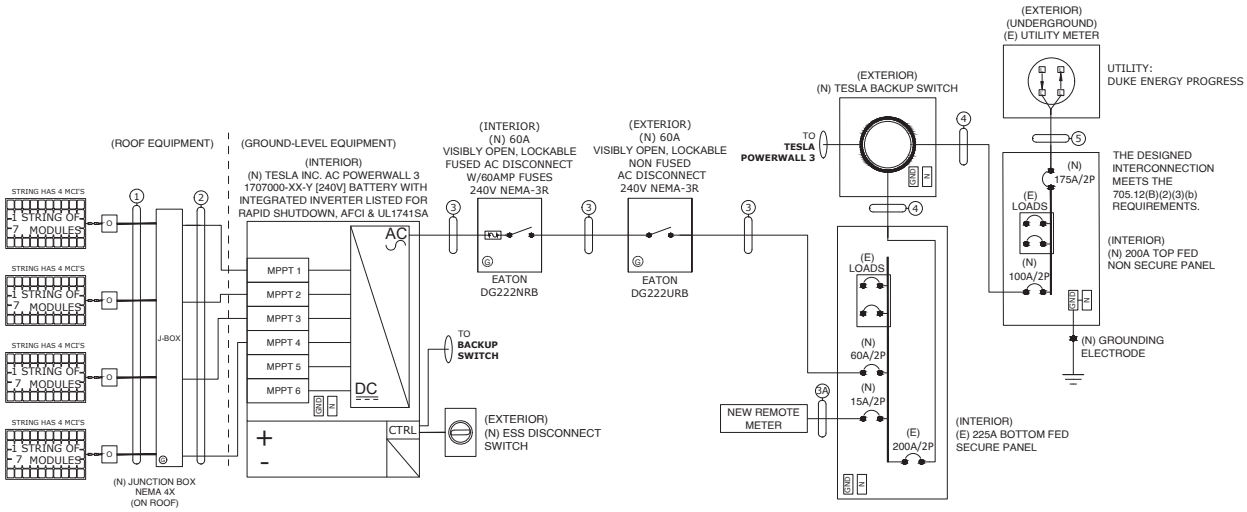
DC SYSTEM SIZE: 12.880kW DC
AC SYSTEM SIZE: 11.500kW AC
ENERGY STORAGE SYSTEM SIZE: 13.500kWh AC

(28) REC SOLAR: REC460AA PURE-RX MODULES
(16) MID-CIRCUIT INTERRUPTER
(1) TESLA POWERWALL 3 - 1707000-XX-Y (240V) BATTERY WITH INTEGRATED 11500W INVERTER EQUIPPED WITH RAPID SHUTDOWN

BRANCHES
(4) BRANCH CIRCUIT OF 7 MODULES CONNECTED IN SERIES

INVERTER SPEC			
MODEL:	TESLA POWERWALL 3 BATTERY WITH INTEGRATED 1707000-XX-Y (240V) INVERTER EQUIPPED WITH RAPID SHUTDOWN		
MAX O/P VOLTAGE:	240V		
MAX O/P CURRENT:	48A		
DISCHARGE POWER:	11500W	CHARGE POWER:	5000W
CEC EFF:	97.5%	QTY.	1

MODULE SPEC	
MODEL: REC460AA PURE-RX	
QTY: 28	WATT. : 460
Voc: 65.3	Isc: 8.88
Vmp: 54.9	Imp: 8.38



CONDUCTOR SCHEDULE				
TAG ID	CONDUIT SIZE	CONDUCTOR	NEUTRAL	GROUND
1	OPEN AIR	(8) 10 AWG PV WIRE	NONE	(1) 6 AWG BARE COPPER, EGC
2	3/4"EMT	(8) 10 AWG THHN/THWN-2, Cu	NONE	(1) 10 AWG THHN/THWN-2, EGC
3	3/4"EMT	(2) 6 AWG THHN/THWN-2, Cu	(1) 6 AWG THHN/THWN-2, Cu	(1) 10 AWG THHN/THWN-2, EGC
3A	3/4"EMT	(2) 14 AWG THHN/THWN-2, Cu	(1) 14 AWG THHN/THWN-2, Cu	(1) 14 AWG THHN/THWN-2, EGC
4	N/A	(2) 1 AWG (1-1-1-3 SER CABLE) THHN/THWN-2, Al	(1) 1 AWG (1-1-1-3 SER CABLE) THHN/THWN-2, Al	(1) 3 AWG, EGC (1-1-1-3 SER CABLE)
5	2" EMT	(2) 4/0 AWG XHHW, AL	(1) 4/0 AWG XHHW, AL	NONE

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SINGLE LINE DIAGRAM

PV-6

WARNING:PHOTOVOLTAIC POWER SOURCE

LABEL 1
AT DIRECT-CURRENT EXPOSED RACEWAYS, CABLE TRAYS, COVERS AND ENCLOSURES OF JUNCTION BOXES, AND OTHER WIRING METHODS; SPACED AT MAXIMUM 10FT SECTION OR WHERE SEPARATED BY ENCLOSURES, WALLS, PARTITIONS, CEILINGS, OR FLOORS.
NEC 690.31(G)(3&4)

PHOTOVOLTAIC
DC DISCONNECT

LABEL 2
AT EACH PV DISCONNECTING MEANS
NEC 690.13(B)

MAXIMUM VOLTAGE 600V
MAXIMUM CIRCUIT CURRENT 68.00A
MAX RATED OUTPUT CURRENT OF THE CHARGE CONTROLLER OR DC-TO-DC CONVERTER (IF INSTALLED) 17A

LABEL 3
AT DC PV SYSTEM DISCONNECTING MEANS NEC 690.53

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

LABEL 8
AT AC DISCONNECT NEC 690.56(C)(3)

PHOTOVOLTAIC
AC DISCONNECT

LABEL 1
AT AC DISCONNECT MEANS NEC 690.13(B)

PHOTOVOLTAIC AC DISCONNECT
RATED AC OUTPUT CURRENT: 48A
NOMINAL OPERATING AC VOLTAGE: 240V

LABEL 5 (FOR TESLA 1707000-XX-Y (240V) INVERTER)
AT AC DISCONNECTING MEANS
NEC 690.54

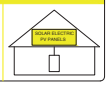
1 INVERTER X 48 AMP/INVERTER = 48.00AMP

⚠ WARNING
INVERTER OUTPUT CONNECTION
DO NOT RELOCATE THIS OVERCURRENT DEVICE

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

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

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



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

⚠ WARNING: DUAL POWER SOURCE
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM

PHOTOVOLTAIC POWER SOURCE
OPERATING AC VOLTAGE: 240 V
MAXIMUM OPERATING AC OUTPUT CURRENT: 48.00 AMPS

LABEL FOR MAIN SERVICE PANEL COVER

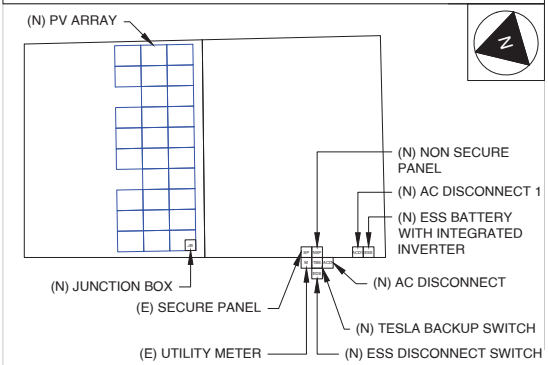
THIS IS THE COMBINED AMPERAGE OF INVERTER AND BATTERY

ENERGY STORAGE SYSTEM
NOMINAL ESS VOLTAGE: 240 VAC
OPERATING CURRENT: 48.00 AAC

LABEL FOR ESS BATTERY , QTY-1

CAUTION

POWER TO THIS BUILDING IS ALSO SUPPLIED FROM MULTIPLE SOURCES OF POWER WITH SAFETY DISCONNECTS AS SHOWN:



213 WINDSWEPT WAY,FUQUAY-VARINA, NC 27526

DIRECTORY
PERMANENT PLAQUE OR DIRECTORY PROVIDING THE LOCATION OF THE SERVICE DISCONNECTING MEANS AND THE PHOTOVOLTAIC SYSTEM. (ALL PLAQUES AND SIGNAGE WILL BE INSTALLED AS OUTLINED WITHIN: NEC 690.56(B)&(C), [NEC 705.10])

CONTRACTOR INFORMATION

SOUTHERN ENERGY MANAGEMENT
5908 TRIANGLE DR, RALEIGH, NC 27617
PHONE: +1 919 306 9537
LICENSE#
TYPE-ELECTRICAL

PHOTOVOLTAIC ROOF MOUNT SYSTEM & ENERGY STORAGE SYSTEM
12.880 kWDC, 11.500 kWAC **PV SYSTEM**
13.500kWh **ENERGY STORAGE**
STEVE SZABO RESIDENCE
213 WINDSWEPT WAY,
FUQUAY-VARINA, NC 27526

NORTH CAROLINA PROFESSIONAL SEAL 046546 ENGINEER SCOTT E. WYSSLING

Wyssling Consulting, PLLC
76 N Meadowbrook Drive Alpine UT 84004
North Carolina COA # P-2308
Signed 5/29/2025

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

DATE	5/24/2025
CREATED BY	ART
SCALE	NTS

LABELS AND PLACARD

PV-8

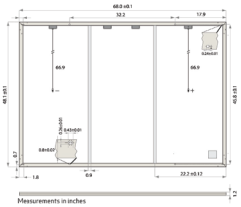
REC ALPHA PURE-RX SERIES

PRODUCT SPECIFICATIONS

REC SOLAR'S MOST TRUSTED

GENERAL DATA

Cell type:	88 half-cut REC heterojunction cells with lead-free, gapless technology
Glass:	0.12 in 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 (12 AWG) in accordance with IEC 62852, IP68 only when connected
Cable:	12 AWG solar cable, 66.9 + 66.9 in in accordance with EN 50618
Dimensions:	68.0 x 48.1 x 1.2 in (22.4 sq-ft)
Weight:	51.2 lbs
Origin:	Made in Singapore



Measurements in inches

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/sq-ft)	20.1	20.5	21.0
	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 77°F (25°C)), based on a production spread with a tolerance of P_{MPP}, V_{OC} & I_{SC} ±3% within one watt class. Nominal module operating temperature (NMOT: air mass AM 1.5, irradiance 800 W/m², temperature 68°F (20°C), windspeed 3.3 ft/s (1 m/s)). ^Where xxx indicates the nominal power class (P_{MPP}) at STC above.

CERTIFICATIONS

IEC 61215:2016, 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
UL 61730	Fire Type 2

ISO 14001, ISO 9001, IEC 45001, IEC 62941

TEMPERATURE RATINGS*

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

*The temperature coefficients stated are linear values

MAXIMUM RATINGS

Operational temperature:	40...+185°F (-40...+85°C)
System voltage:	1000 V
Test load (front):	+7000 Pa (146.2 lbs/sq-ft)^
Test load (rear):	-4000 Pa (83.5 lbs/sq-ft)^
Series fuse rating:	25 A
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
System Size	All	<25 kW 25-500 kW
Product Warranty (yrs)	20	25
Power Warranty (yrs)	25	25
Labor Warranty (yrs)	0	25
Power in Year 1	98%	98%
Annual Degradation	0.25%	0.25%
Power in Year 25	92%	92%

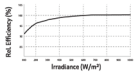
The REC ProTrust Warranty is only available on panels purchased through an REC Certified Solar Professional installer. Warranty conditions apply. See www.recgroup.com for more details.

DELIVERY INFORMATION

Panels per pallet:	33
Panels per 40 ft GP/highcube container:	594 (18 pallets)
Panels per 53 ft truck:	792 (24 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.

REC Solar PTE. LTD.
20 Tuas South Ave 14
Singapore 637312
post@recgroup.com

REC www.recgroup.com

Specifications subject to change without notice

Ref: PM-O25-AAPRX-Rev-3 08.23

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DATE	5/24/2025
CREATED BY	ART
SCALE	NTS

MODULE SPEC SHEET

PV-9

Powerwall 3

Power Everything

—

Powerwall 3 is a fuly integrated solar and battery system, designed to accelerate the transition to sustainable energy. Customers can receive whole home backup, cost savings, and energy independence by producing and consuming their own energy while participating in grid services. Once installed, customers can manage their system using the Tesla App to customize system behavior tc meet their energy goals.

Powerwall 3 achieves this by supporting up to 20 kW DC of solar and providing 11.5 kW AC of continuous power per unit. It has the ability to start heavy loads up to 150 A LRA, meaning a single unit can support the power needs of most homes. Powerwall 3 is designed for mass production, fast and efficient installations, easy system expansior, and simple connection to any electrical service.

2023

Powerwall 3 Technical Specifications

System Technical Specifications	**Model Number**	1707000-xx-y
	Nominal Grid Voltage (Input & Output)	120/240 VAC
	Grid Type	Split phase
	Frequency	60 Hz
	Overcurrent Protection Device	Configurable up to 60 A
	Solar to Battery to Grid Round Trip Efficiency	89% [1,2]
	Solar to Grid Efficiency	97% [3]
	Supported Islanding Devices	Backup Gateway 2, Backup Switch
	Connectivity	Wi-Fi (2.4 and 5 GHz), Dual-port switched Ethernet, Cellular (LTE/4G [4])
	Hardware Interface	Dry contact relay, Rapid Shutdown (RSD) certified switch and 2-pin connector, RS-485 for meters
	AC Metering	Revenue Grade (+/- 0.5%)
	Protections	Integrated arc fault circuit interrupter (AFCI), Isolation Monitor Interrupter (IMI), PV Rapid Shutdown (RSD) using Tesla Mid-Circuit Interrupters
	Customer Interface	Tesla Mobile App
	Warranty	10 years
Solar Technical Specifications	**Maximum Solar STC Input**	20 kW
	Withstand Voltage	600 V DC
	PV DC Input Voltage Range	60 — 550 V DC
	PV DC MPPT Voltage Range	150 — 480 V DC
	MPPTs	6
	Maximum Current per MPPT (I_{mp})	13 A [5]
	Maximum Short Circuit Current per MPPT (I_{sc})	15 A [5]
Battery Technical Specifications	**Nominal Battery Energy**	13.5 kWh AC [2]
	Maximum Continuous Discharge Power	11.5 kW AC
	Maximum Continuous Charge Power	5 kW AC
	Output Power Factor Rating	0 - 1 (Grid Code configurable)
	Maximum Continuous Current	48 A
	Maximum Output Fault Current	10 kA
	Load Start Capability (1 s)	150 A LRA
	Power Scalability	Up to 4 Powerwall 3 units supported

[1] Typical solar shifting use case.
[2] Values provided for 25°C (77°F), at beginning of life. 13 kW charge/discharge power.
[3] Tested using CEC weighted efficiency methodology.
[4] Cellular connectivity subject to network service covenge and signal strength.
[5] Where the DC input current exceeds the MPPT rating, a jumper can be used to combine two MPPTs into a single input to intake DC current up to 26 A I_{mp} / 30 A I_{sc}.

2023 Powerwall 3 Datasheet 2

CONTRACTOR INFORMATION

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13.500kWh **ENERGY STORAGE**
STEVE SZABO RESIDENCE
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FUQUAY-VARINA, NC 27526

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SCALE	NTS

BATTERY & INVERTER SPEC SHEET

PV-10

Powerwall 3 Technical Specifications

Environmental Specifications

Operating Temperature	-20°C to 50°C (-4°F to 122°F) [6]
Operating Humidity (RH)	Up to 100%, condensing
Storage Temperature	-20°C to 30°C (-4°F to 86°F), up to 95% RH, non-condensing, State of Energy (SOE): 25% initial
Maximum Elevation	3000 m (9843 ft)
Environment	Indoor and outdoor rated
Enclosure Rating	NEMA 3R
Ingress Rating	IPX7 (Battery & Power Electronics) IPX5 (Wiring Compartment)
Pollution Rating	PD3
Operating Noise @ 1 m	≤ 50 db(A) typical <62 db(A) maximum

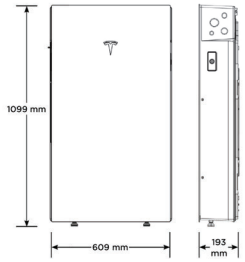
[6] Performance may be de-rated at operating temperatures above 40°C (104°F).

Compliance Information

Certifications	UL 1642, UL 1699B, UL 1741, UL 1741 SA, UL 1741 SB, UL 3741, UL 1973, UL 1998, UL 9540, IEEE 1547-2018, IEEE 1547.1, UN 38.3
Grid Connection	United States
Emissions	FCC Part 15 Class B
Environmental	RoHS Directive 2011/65/EU
Seismic	AC156, IEEE 693-2005 (high)
Fire Testing	Meets the unit level performance criteria of UL 9540A

Mechanical Specifications

Dimensions	1099 x 609 x 193 mm (43.25 x 24 x 7.6 in)
Weight	130 kg (287 lb)
Mounting Options	Floor or wall mount



Solar Shutdown Device Technical Specifications

The Solar Shutdown Device is a Mid-Circuit Interrupter (MCI) and is part of the PV system rapid shutdown (RSD) function in accordance with Article 690 of the applicable NEC. When paired with Powerwall 3, solar array shutdown is initiated by any loss of AC power.

Electrical Specifications

Model	MCI-1	MCI-2
Nominal Input DC Current Rating (I_{mp})	12 A	13 A
Maximum Input Short Circuit Current (I_{sc})	19 A	17 A
Maximum System Voltage (PVHCS)	600 V DC	1000 V DC [7]

[7] Maximum System Voltage is limited by Powerwall to 600 V DC.

RSD Module Performance

Maximum Number of Devices per String	5	5
Control	Power Line Excitation	Power Line Excitation
Passive State	Normally Open	Normally Open
Maximum Power Consumption	7 W	7 W
Warranty	25 years	25 years

Environmental Specifications

Operating Temperature	-40°C to 50°C (-40°F to 122°F)	-45°C to 70°C (-49°F to 158°F)
Storage Temperature	-30°C to 70°C (-22°F to 158°F)	-30°C to 70°C (-22°F to 158°F)
Enclosure Rating	NEMA 4X / IP65	NEMA 4X / IP65

Mechanical Specifications

Electrical Connections	MC4 Connector	MC4 Connector
Housing	Plastic	Plastic
Dimensions	125 x 150 x 22 mm (5 x 6 x 1 in)	173 x 45 x 22 mm (6.8 x 1.8 x 1 in)
Weight	350 g (0.77 lb)	120 g (0.26 lb)
Mounting Options	ZEP Home Run Clip M4 Screw (#10) M8 Bolt (5/16") Nail / Wood screw	Wire Clip

Compliance Information

Certifications	UL 1741 PVRSE, UL 3741, PVRSA (Photovoltaic Rapid Shutdown Array)
RSD Initiation Method	External System Shutdown Switch or Powerwall 3 Enable Switch

UL 3741 PV Hazard Control (and PVRSA) Compatibility

The following categories of solar module meet the UL 3741 PVHCS listing when installed with Powerwall 3 and Solar Shutdown Devices.

Tesla Solar Roof	PV Hazard Control System: BIPV compliance document
Tesla or Hanwha (Q.Peak Duo BLK or BLK-G6+) Modules certified for use with ZEP racking	PV Hazard Control System: ZS PVHCS compliance document
Other module and racking combinations	PV Hazard Control System: Generic PV Array compliance document

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CREATED BY	ART
SCALE	NTS

BATTERY & INVERTER SPEC SHEET
PV-10.1

Backup Switch

The Tesla Backup Switch controls connection to the grid in a Powerwall system, and can be easily installed behind the utility meter or in a standalone meter panel downstream of the utility meter.
The Backup Switch automatically detects grid outages, providing a seamless transition to backup power. It communicates directly with Powerwall, allowing home energy usage monitoring from any mobile device with the Tesla app.

Performance Specifications

Model Number	1624171-xx-y
Continuous Load Rating	200 A, 120/240 V split phase
Maximum Supply Short Circuit Current	22 kA with breaker [16]
Communication	CAN
AC Meter	+/- 0.5%
Expected Service Life	21 years
Warranty	10 years

[16] Breaker maximum supply short circuit current rating must be equal to or greater than the available fault current.

Environmental Specifications

Operating Temperature	–40°C to 50°C (–40°F to 122°F)
Storage Temperature	–40°C to 85°C (–40°F to 185°F)
Enclosure Rating	NEMA 3R
Pollution Rating	PD3

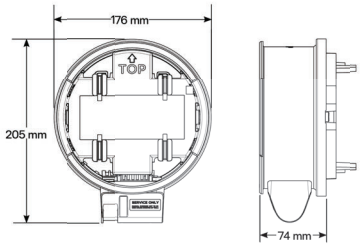
Compliance Information

Safety Standards	USA: UL 414, UL 414 SB, UL 2735, UL 916, CA Prop 65
Emissions	FCC Part 15, Class B, ICES 003

Mechanical Specifications

Dimensions	176 x 205 x 74 mm (6.9 x 8.1 x 2.9 in)
Weight	2.8 lb
Meter and Socket Compatibility	ANSI Type 2S, ringless or ring type
External Service Interface	Contactor manual override [17] Reset button
Conduit Compatibility	1/2-inch NPT

[17] Manually overrides the contactor position during a service event.



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TESLA BACKUP SWITCH SPEC SHEET

PV-10.2

Tech Brief

IRONRIDGE

QuickMount® HUG

The Respect Your Roof Deserves

When integrating with a home, solar attachments must be dependable for the lifetime of the rooftop. Due to recent innovations, many asphalt shingles have bonded courses. A mount that protects without the need to pry shingles can really speed things up.

Halo UltraGrip®(HUG®) is here to respect the roof. Its Halo is a cast-aluminum barrier that encases the UltraGrip, our industrial-grade, foam-and-mastic seal. This allows HUG to accelerate the installation process and provide the utmost in waterproofing protection. Give your roof a HUG.®

Multi-Tiered Waterproofing
HUG® utilizes a multi-tiered stack of components to provide revolutionary waterproofing protection. The Halo cast-aluminum, raised-perimeter foundation surrounds the UltraGrip base—a foam-backed mastic seal combination that prevents water intrusion by adhering and sealing with the shingle surface.

Halo UltraGrip™ is part of the QuickMount® product line.

UltraGrip® Seal Technology
HUG UltraGrip utilizes a state-of-the-art seal design that uses a unique, foam-and-mastic combination. The foam-backed adhesive provides an entirely new flashing system that conforms and adheres to every nook and cranny of composition shingles, filling gaps and shingle step-downs (up to 1/8" in height).

Rafter & Deck Mounting Options
Mount HUG® to the roof rafters, the roof deck, or both with our custom-engineered RD (rafter-or-deck) Structural Screw. The RD Structural Screw anchors HUG to the roof with an EPDM sealing washer, completing the stack of waterproofing barriers. See backside for more installation information.

Triple Rated & Certified to Respect the Roof™
UL 2703, 441 (27)
TAS 100(A)-95
Intertek

Tech Brief

Adaptive, Rafter-Friendly Installation

Hit the rafter? Good to go!
When you find a rafter, you can move on. Only 2 RD Structural Screws are needed.

Miss the rafter? Try it again.
Place another screw to the left or right. If rafter is found, install 3rd and final screw.

Still no luck? Install the rest.
If more than 3 screws miss the rafter, secure six screws to deck mount it.

Trusted Strength & Less Hassle

25-Year Warranty
Product guaranteed free of impairing defects.

Structural capacities of HUG® were reviewed in many load directions, with racking rail running cross-slope or up-slope in relation to roof pitch.

For further details, see the HUG certification letters for attaching to rafters and decking.

IronRidge designed the HUG, in combination with the RD Structural Screw to streamline installs, which means the following:

- No prying shingles
- No roof nail interference
- No pilot holes necessary
- No sealant (in most cases)
- No butyl shims needed

Attachment Loading

The rafter-mounted HUG has been tested and rated to support 1004 (lbs) of uplift and 368 (lbs) of lateral load.

Structural Design

Parts are designed and certified for compliance with the International Building Code & ASCE/SEI-7.

Water Seal Ratings

HUG passed both the UL 441 Section 27 "Rain Test" and TAS 100(A)-95 "Wind Driven Rain Test" by Intertek.

UL 2703 System

Systems conform to UL 2703 mechanical and bonding requirements. See Flush Mount Manual for more info.

CONTRACTOR INFORMATION

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SCALE	NTS

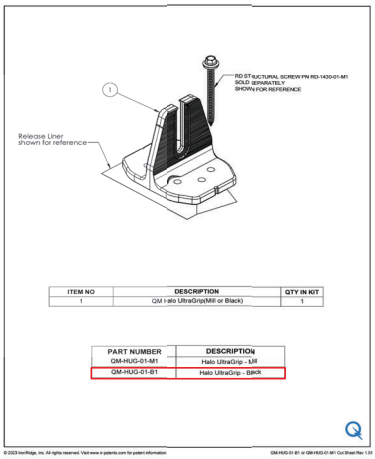
MOUNT SPEC SHEET

PV-11

Cut Sheet

IRONRIDGE

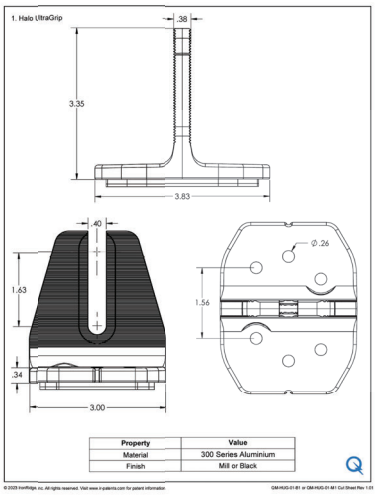
QuickMount® Halo UltraGrip®



ITEM NO	DESCRIPTION	QTY IN KIT
1	QM Halo UltraGrip(Mill or Black)	1

PART NUMBER	DESCRIPTION
QM-HUG-01-M1	Halo UltraGrip - MI
QM-HUG-01-B1	Halo UltraGrip - BLACK

Cut Sheet

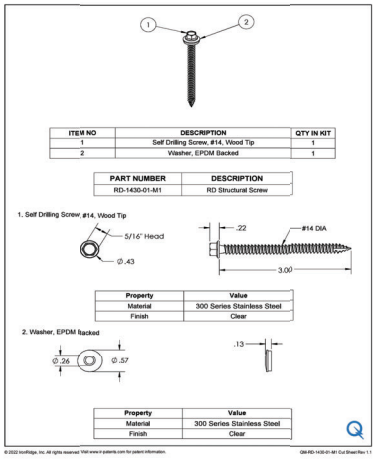


Property	Value
Material	300 Series Aluminium
Finish	Mill or Black

Cut Sheet

IRONRIDGE

QuickMount® RD Structural Screw



ITEM NO	DESCRIPTION	QTY IN KIT
1	Self Drilling Screw, #14, Wood Tip	1
2	Washer, EPDM Backed	1

PART NUMBER	DESCRIPTION
RD-1430-01-M1	RD Structural Screw

1. Self Drilling Screw #14, Wood Tip

Property	Value
Material	300 Series Stainless Steel
Finish	Clear

2. Washer, EPDM Backed

Property	Value
Material	300 Series Stainless Steel
Finish	Clear

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LICENSE#
TYPE-ELECTRICAL

PHOTOVOLTAIC ROOF MOUNT SYSTEM & ENERGY STORAGE SYSTEM
12.880 kWDC, 11.500 kWAC **PV SYSTEM**
13.500kWh **ENERGY STORAGE**
STEVE SZABO RESIDENCE
213 WINDSWEPT WAY,
FUQUAY-VARINA, NC 27526

DATE	5/24/2025
CREATED BY	ART
SCALE	NTS

MOUNT SPEC SHEET

PV-12

Tech Brief

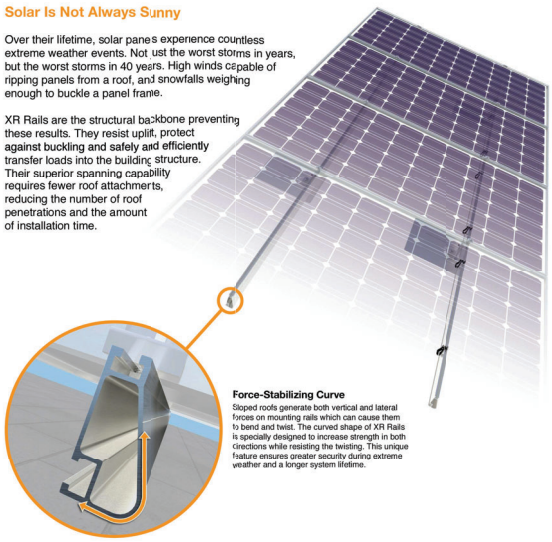
IRONRIDGE

XR Rail Family

Solar Is Not Always Sunny

Over their lifetime, solar panels experience countless extreme weather events. Not just the worst storms in years, but the worst storms in 40 years. High winds capable of ripping panels from a roof, and snowfalls weighing enough to buckle a panel frame.

XR Rails are the structural backbone preventing these results. They resist uplift, protect against buckling and safely and efficiently transfer loads into the building structure. Their superior spanning capability requires fewer roof attachments, reducing the number of roof penetrations and the amount of installation time.



Force-Stabilizing Curve

Sloped roofs generate both vertical and lateral forces on mounting rails which can cause them to bend and twist. The curved shape of XR Rails is specially designed to increase strength in both directions while resisting the twisting. This unique feature ensures greater security during extreme weather and a longer system lifetime.

Compatible with Flat & Pitched Roofs

XR Rails are compatible with FlashFoot and other pitched roof attachments.

IronRidge offers a range of tilt leg options for flat roof mounting applications.

Corrosion-Resistant Materials

All XR Rails are made of marine-grade aluminum alloy, then protected with an anodized finish. Anodizing prevents surface and structural corrosion, while also providing a more attractive appearance.

Tech Brief

XR Rail Family

The XR Rail Family offers the strength of a curved rail in three targeted sizes. Each size supports specific design loads, while minimizing material costs. Depending on your location, there is an XR Rail to match.

XR10

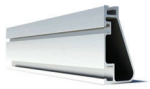
XR10 is a sleek, low-profile mounting rail, designed for regions with light or no snow. It achieves 6 foot spans, while remaining light and economical.

- 6' spanning capability
- Moderate load capability
- Clear anodized finish
- Internal splices available

XR100

XR100 is the ultimate residential mounting rail. It supports a range of wind and snow conditions, while also maximizing spans up to 8 feet.

- 8' spanning capability
- Heavy load capability
- Clear & black anodized finish
- Internal splices available



XR1000

XR1000 is a heavyweight among solar mounting rails. It's built to handle extreme climates and spans 12 feet or more for commercial applications.

- 12' spanning capability
- Extreme load capability
- Clear anodized finish
- Internal splices available

Rail Selection

The following table was prepared in compliance with applicable engineering codes and standards. Values are based on the following criteria: ASCE 7-10, Roof Zone 1, Exposure B, Roof Slope of 7 to 27 degrees and Mean Building Height of 30 ft. Visit IronRidge.com for detailed span tables and certifications.

Load		Rail Span					
Snow (PSF)	Wind (MPH)	4'	5' 4"	6'	8'	10'	12'
None	100						
	120						
	140	XR10		XR100		XR1000	
	160						
10-20	100						
	120						
	140						
	160						
30	100						
	160						
40	100						
	160						
50-70	160						
80-90	160						

CONTRACTOR INFORMATION

SOUTHERN ENERGY MANAGEMENT
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RAIL SPEC SHEET

PV-13

MODULE COMPATIBILITY

Phono Solar	Phono Solar modules with 30, 35 and 40 mm frames PSxxxY-ZZ/A Where "Y" can be M, M1, MH, M1H, M4, M4H, M5GF, M5GFH, M6, M6H, M8, M8H, M8GF, M8GFH or P; "ZZ" can be 18, 20 or 24; and "A" can be F, T, TH, THB, U, UH, UHB, VH or VHB
Prism Solar	Prism Solar modules with 35 mm frames PST-xxxW-M72Y Where "Y" can be H, HB or HBI
Rayzon Solar	Rayzon Solar modules with 35 and 40 mm frames RSxxxWC
Recom	Recom modules with 35 and 40 mm frames RCM-xxx-6yy Where "yy" can be MA, MB, ME or MF
REC Solar	REC modules with 30 and 38 mm frames RECxxxYYZZ Where "YY" can be AA, M, NP, NP2, NP3, PE, PE72, TP, TP2, TP2M, TP2SM, TP2S, TP3M or TP4; and "ZZ" can be blank, Black, BLK, BLK2, SLV, 72, Pure, Pure-R, Pure-RX or Pure 2
Renesola	Renesola modules with 35 and 40 mm frames AAxxxY-ZZ Where "AA" can be SPM(SLP) or JC; "Y" can be blank, F, M or S; and "ZZ" can be blank, Ab, Ab-b, Abh, Abh-b, Abv, Abv-b, Bb, Bb-b, Bbh, Bbh-b, Bbv, Bbv-b, Db, Db-b, or 24/Bb
Renogy	Renogy Modules with 35 and 40 mm frames RZZ-xxxY-AAA Where "ZZ" can be NG or SP; "Y" can be D or P; and "AAA" can be blank, 144, BB-108, BB-120 or BK-120
Risen	Risen Modules with 30, 35 and 40 mm frames RSMyy-a-xxxZZ Where "yy" can be 60, 72, 110, 120, 132 or 144; "a" can be 6, 7 or 8; and "ZZ" can be M, P or BMDG
Saatvik	Saatvik Modules with 35 mm frames SGExxx-YYYZZZ Where "YYY" can be 108 or 144; and "ZZZ" can be MHC, MBHC or MHCB
S-Energy	S-Energy modules with 35 and 40 mm frames SABB-CCYYY-xxxZ Where "A" can be C, D, L or N; "BB" can be blank, 20, 25, 40 or 45; "CC" can be blank, 60 or 72; "YYY" can be blank, BDE, MAE, MAI, MBE, MBI, MCE or MCI; and "Z" can be V, M-10, P-10 or P-15
SEG Solar	SEG Solar with 30, 35 and 40 mm frames SEG-aYY-xxxZZ Where "a" can be blank, 6 or B; "YY" can be blank, MA, MB, PA, or PB; and "ZZ" can be blank, BB, BG, BW, HV, WB, WW, BMB, BMA-HV, BMA-BG, BMA-TB, BMB-TB, BMB-HV, BMD-HV, BME-BG, BTA-BG or BMD-TB
Seraphim USA	Seraphim modules with 30, 35 and 40 mm frames SRP-xxx-YYY-ZZ Where "xxx" is the module power rating; and "YYY" can be BMA, BMD, 6MA, 6MB, 6PA, 6PB, 6QA-XX-XX, and 6QB-XX-XX; ZZ is blank, BB, BG or HV
Sharp	Sharp modules with 35 and 40 mm frames NUYYxxx Where "YY" can be SA or SC
Shinsung E&G	Shinsung Modules with 35 mm frames SSVxxx-144MH
Silfab	Silfab Modules with 35 and 38 mm frames SYY-Z-xxxAb Where "YY" can be IL, SA, LA, SG or LG; "Z" can be blank, M, P, or X; "A" can be blank, B, H, M, N; and "b" can be A, C, C+, G, K, L, M, N, P, U or X

MODULE COMPATIBILITY

Sirius PV	Sirius PV Modules with 35 mm frames ELNSMzzM-HC-xxx Where "zz" can be 54 or 72
Solar4America	Solar4America modules with 30, 35 and 40 mm frames S4Axxx-YYzzAA Where "YY" can be 60, 72, 108 or 144; "zz" can be MH5 or MH10; and "AA" can be blank or B3, BW, SW or STT
Solarever	Solarever modules with 35 mm frames SE-zzz*yy-xxxM-aaa Where "zzz" can be 166 or 182; "yy" can be 83 or 91; and "aaa" can be 108, 144 or 144N
Solaria	Solaria modules with 35 and 40 mm frames PowerA-xxxY-ZZ Where "A" can be X or XT, "Y" can be R or C; and "ZZ" can be blank, AC, BD, BX, BY, PD, PL, PM, PM-AC, PX, PZ, WX or WZ
Solarcity (Tesla)	Solarcity modules with 40 mm frames SCxxxYY Where "YY" can be blank, B1 or B2
SolarTech	SolarTech modules with 40 mm frames AAA-xxxYY Where "AAA" can be PERCB-B, PERCB-W, HJTB-B, HJTB-W or STU; "YY" can be blank, PERC or HJT
SolarWorld AG	SolarWorld Sunmodule Plus, Protect, Bisun, XL, Bisun XL, may be followed by mono, poly, duo, black, bk, or clear; modules with 31 and 33 mm frames SW-xxx
SolarWorld Americas	SolarWorld Sunmodule Plus, Protect, Bisun, XL, Bisun XL, may be followed by mono, poly, duo, black, bk, or clear; modules with 33 mm frames SWA-xxx
Sonali	Sonali Modules with 35 and 40 mm frames SS-M-xxx Where "M" can be blank or M
Star Solar	Star Solar modules with 35 mm frames Star-xxxyI-YYY-ZZZ Where "YYY" can be M60H or M60HB; and "ZZZ" can be blank or M10
Stion	Stion Thin film modules with 35 mm frames STO-xxx or STO-xxxA
SunEdison	SunEdison Modules with 35 and 40 mm frames SE-YxxxZABCDE Where "Y" can be B, F, H, P, R, or Z; "Z" can be 0 or 4; "A" can be B,C,D,E,H,I,J,K,L,M, or N ; "B" can be B or W; "C" can be A or C; "D" can be 3, 7, 8, or 9; and "E" can be 0, 1 or 2
Suniva	Suniva modules with 35, 38 and 40 mm frames OPTxxx-AA-B-YYY-Z MVXxxx-AA-B-YYY-Z Where "AA" is either 60 or 72; "B" is either 4 or 5; "YYY" is either 100,101,700,180, or 181; and "Z" is blank or B
Sunmac Solar	Sunmac modules with 30 and 35 mm frames SMxxxMaaaZZ-YY Where "aaa" can be 660, 754 or 772; "ZZ" can be NH or SH; and "YY" can be BB or TB
Sunpower	Sunpower standard (G3 or G4) or InvisiMount (G5) 35 and 40 mm frames SPR-Zb-xxx-YY Where "Z" can be A, E, M, P or X; "b" can be blank, 17, 18, 19, 20, 21, or 22; and "YY" can be blank, BLK, COM, C-AC, D-AC, E-AC, BLK-E-AC, G-AC, BLK-G-AC, H-AC, BLK-H-AC, BLK-C-AC, or BLK-D-AC

CONTRACTOR INFORMATION

SOUTHERN ENERGY MANAGEMENT
ENERGY EFFICIENCY & SOLAR POWER

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INSTALLATION MANUAL
PV-14

Tech Brief

IRONRIDGE

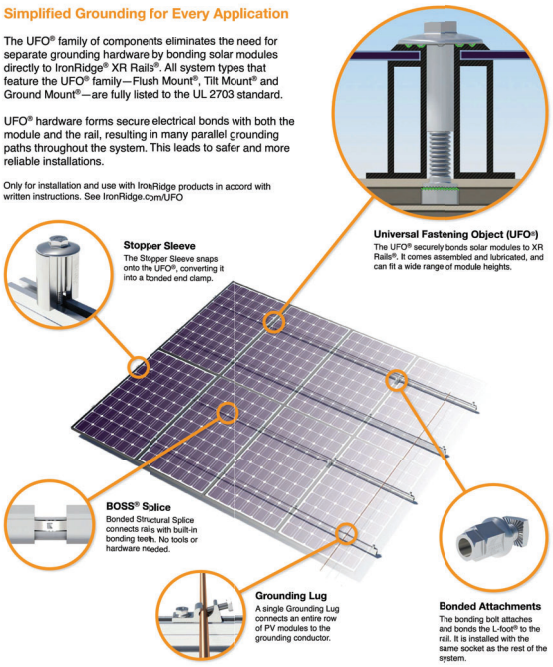
UFO® Family of Components

Simplified Grounding for Every Application

The UFO® family of components eliminates the need for separate grounding hardware by bonding solar modules directly to IronRidge® XR Rails®. All system types that feature the UFO® family—Flush Mount®, Tilt Mount® and Ground Mount®—are fully listed to the UL 2703 standard.

UFO® hardware forms secure electrical bonds with both the module and the rail, resulting in many parallel grounding paths throughout the system. This leads to safer and more reliable installations.

Only for installation and use with IronRidge products in accord with written instructions. See IronRidge.com/UFO



Universal Fastening Object (UFO®)
The UFO® securely bonds solar modules to XR Rails®. It comes assembled and lubricated, and can fit a wide range of module heights.

Stopper Sleeve
The Stopper Sleeve snaps onto the UFO®, converting it into a bonded end clamp.

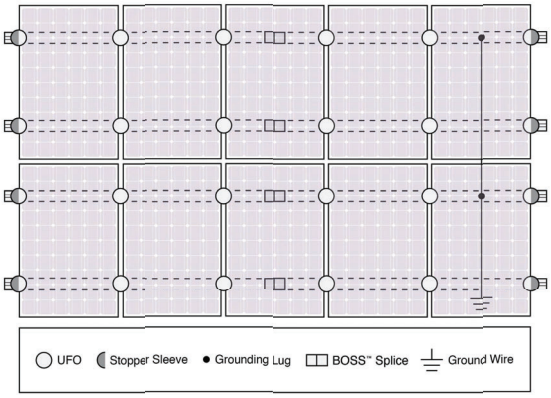
BOSS® Splice
Bonded Structural Splice connects rails with built-in bonding teeth. No tools or hardware needed.

Grounding Lug
A single Grounding Lug connects an entire row of PV modules to the grounding conductor.

Bonded Attachments
The bonding bolt attaches and bonds the L-foot® to the rail. It is installed with the same socket as the rest of the system.

Tech Brief

System Diagram



Approved Enphase microinverters can provide equipment grounding of IronRidge systems, eliminating the need for grounding lugs and field installed equipment ground conductors (EGC). A minimum of two microinverters mounted to the same rail and connected to the same Engage cable is required. Refer to installation manuals for additional details.

UL Certification

The IronRidge® Flush Mount®, Tilt Mount®, and Ground Mount Systems have been listed to UL 2703 by Intertek Group plc.

UL 2703 is the standard for evaluating solar mounting systems. It ensures these devices will maintain strong electrical and mechanical connections over an extended period of time in extreme outdoor environments.

Go to IronRidge.com/UFO

Cross-System Compatibility			
Feature	**Flush Mount**	**Tilt Mount**	**Ground Mount**
XR Rails®	✔	✔	XR100 & XR1000
UFO®/Stopper	✔	✔	✔
BOSS® Splice	✔	✔	N/A
Grounding Lugs	1 per Row	1 per Row	1 per Array
Microinverters & Power Optimizers	Compatible with most MLPE manufacturers. Refer to system installation manual.		
Fire Rating	Class A	Class A	N/A
Modules	Tested or Evaluated with over 400 Framed Modules Refer to installation manuals for a detailed list.		

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INSTALLATION MANUAL

PV-15

Product datasheet

Specifications

Green Premium

Control station, Harmony XALD, XALK, plastic, yellow, 1 red mushroom head push button 40mm, emergency stop push pull 1 NC, unmarked

XALK198

Main

Range Of Product	Harmony XALK
Product Or Component Type	Complete control station
Device Short Name	XALK
Product Destination	For XB5 Ø 22 mm control and signalling units
Control Station Application	Emergency stop function Emergency switching off function
Colour Of Base Of Enclosure	Light grey (RAL 7035)
Colour Of Cover	Yellow (RAL 1021)
Material	Polycarbonate
Operator Profile	1 mushroom head push-button
Operators Description	Red unmarked 1 NC
Reset	Push-pull
Control Station Composition	1 mushroom head Ø 40 mm push-button, red 1 NC unmarked marking
Contact Operation	Slow-break

Complementary

Cable Entry	1 knock-out for cable entry 0...14 mm 2 knock-outs for Pg 13 cable gland and ISO M20 f...12 mm
Net Weight	0.183 kg
Resistance To High Pressure Washer	7000000 Pa at 55 °C, distance : 0.1 m
Positive Opening	With conforming to EN/IEC 60947-5-1 appendix K
Operating Travel	1.5 mm (NC changing electrical state) 4.3 mm (total travel)
Operating Force	50 N
Mechanical Durability	300000 cycles
Connections - Terminals	Screw clamp terminals, <= 2 x 1.5 mm² with cableend conforming to EN/IEC 60947-1 Screw clamp terminals, >= 1 x 0.22 mm² without cable end conforming to EN/IEC 60947-1
Tightening Torque	0.8...1.2 N.m conforming to EN/IEC 60947-1
Shape Of Screw Head	Cross compatible with Philips no 1 screwdriver Cross compatible with pozidriv No 1 screwdriver Slotted compatible with flat Ø 4 mm screwdriver Slotted compatible with flat Ø 5.5 mm screwdriver
Contacts Material	Silver alloy (Ag/Ni)

Short-Circuit Protection	10 A cartridge fuse type gG conforming to EN/IEC 60947-5-1
[Ith] Conventional Free Air Thermal Current	10 A conforming to EN/IEC 60947-5-1
[Ui] Rated Insulation Voltage	600 V (pollution degree 3) conforming to EN/IEC 60947-1
[Uimp] Rated Impulse Withstand Voltage	6 kV conforming to EN/IEC 60947-1
[Ie] Rated Operational Current	3 A at 240 V, AC-15, A600 conforming to EN/IEC 60947-5-1 6 A at 120 V, AC-15, A600 conforming to EN/IEC 60947-5-1 0.1 A at 600 V, DC-13, Q600 conforming to EN/IEC 60947-5-1 0.27 A at 250 V, DC-13, Q600 conforming to EN/IEC 60947-5-1 0.55 A at 125 V, DC-13, Q600 conforming to EN/IEC 60947-5-1 1.2 A at 600 V, AC-15, A600 conforming to EN/IEC 60947-5-1
Electrical Durability	1000000 cycles, AC-15, 2 A at 230 V, operating rate <3600 cyc/h, load factor: 0.5 conforming to EN/IEC 60947-5-1 appendix C 1000000 cycles, AC-15, 3 A at 120 V, operating rate <3600 cyc/h, load factor: 0.5 conforming to EN/IEC 60947-5-1 appendix C 1000000 cycles, AC-15, 4 A at 24 V, operating rate <3600 cyc/h, load factor: 0.5 conforming to EN/IEC 60947-5-1 appendix C 1000000 cycles, DC-13, 0.2 A at 110 V, operating rate <3600 cyc/h, load factor: 0.5 conforming to EN/IEC 60947-5-1 appendix C 1000000 cycles, DC-13, 0.5 A at 24 V, operating rate <3600 cyc/h, load factor: 0.5 conforming to EN/IEC 60947-5-1 appendix C
Electrical Reliability	Λ < 10exp(-6) at 5 V, 1 mA conforming to EN/IEC 60947-5-4 Λ < 10exp(-8) at 17 V, 5 mA conforming to EN/IEC 60947-5-4

Environment

Protective Treatment	TH
Ambient Air Temperature For Storage	-40...70 °C
Ambient Air Temperature For Operation	-40...70 °C
Overvoltage Category	Class II conforming to IEC 60536
Ip Degree Of Protection	IP66 conforming to IEC 60529 IP67 IP69 IP69K
Nema Degree Of Protection	NEMA 13 NEMA 4X
Ik Degree Of Protection	IK03 conforming to EN 50102
Standards	EN/IEC 60947-5-5 EN/IEC 60947-1 CSA C22.2 No 14 EN/IEC 60947-5-1 JIS C 4520 UL 508 EN/IEC 60947-5-4 IEC 60364-5-53
Vibration Resistance	5 gn (f= 12...500 Hz) conforming to IEC 60068-2-6
Shock Resistance	30 gn (duration = 18 ms) for half sine wave acceleration conforming to IEC 60068-2-27 50 gn (duration = 11 ms) for half sine wave acceleration conforming to IEC 60068-2-27

Packing Units

Unit Type Of Package 1	PCE
Number Of Units In Package 1	1
Package 1 Height	9.7 cm
Package 1 Width	7.1 cm
Package 1 Length	7.1 cm

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ESS DISCONNECT SWITCH SPEC SHEET

PV-16