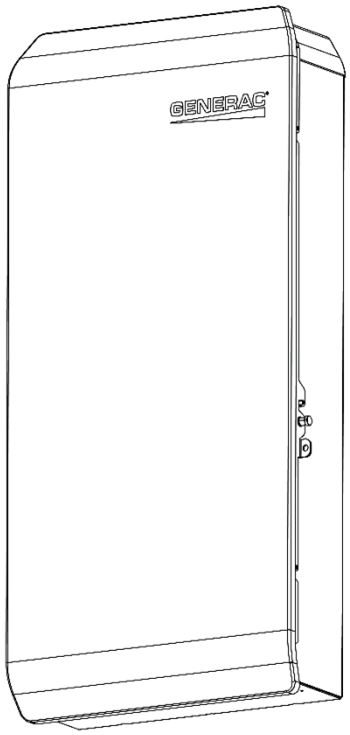
Installation Manual

Smart Disconnect Switch

APKE00067



⚠WARNING

Loss of life. This product is not intended to be used in a critical life support application. Failure to adhere to this warning could result in death or serious injury.

(W000209)

Register your Generac product at:
https://pwrfleet.generac.com
1-888-GENERAC
(888-436-3722)

Para español, visita: https://www.generac.com/dealers-installers/solar-battery-installer-support/manuals-spec-sheets/

SAVE THIS MANUAL FOR FUTURE REFERENCE

Use this page to record important information about your PWRcell 2 system

Record the information found on your data label on this page.

When contacting an Independent Authorized Service Dealer (IASD) or Generac Customer Service, always supply the complete model number and serial number of the unit.

Table 1. PWRcell 2 System Table

Smart Disconnect Switch Serial Number	
Date Purchased	
Commissioning Date	
Inverter Serial Number	
PWRcell 2 Battery Serial Number	
PWRcell 2 Battery Size	
PV Array Size	

⚠ CALIFORNIA WARNING

This product can expose you to chemicals including titanium dioxide, which is known to the State of California to cause cancer, and bisphonel-A, which is known to the State of California to cause birth defects or other reproductive harm. For more information, go to:
www.p65warnings.ca.gov

(W000833)

Table of Contents

Section 13: Grid Support Functions and Range

Section 1: Safety Rules & General Information

Introduction

Thank you for purchasing a Generac PWRcell 2 product.

This manual provides instructions for installing the PWRcell 2 Smart Disconnect Switch (SDS).

The information in this manual is accurate based on products produced at the time of publication. The manufacturer reserves the right to make technical updates, corrections, and product revisions at any time without notice.

Read This Manual Thoroughly

⚠WARNING

Consult Manual. Read and understand manual completely before using product. Failure to completely understand manual and product could result in death or serious injury.

(W000100)

If any section of this manual is not understood, contact the nearest Independent Authorized Service Dealer (IASD) or Generac Customer Service at 1-888-436-3722 (1-888-GENERAC), or visit ***www. generac. com*** for starting, operating, and servicing procedures. The owner is responsible for correct maintenance and safe use of the unit.

This manual must be used in conjunction with all other supporting product documentation supplied with the product.

IMPORTANT SAFETY INSTRUCTIONS. SAVE THESE INSTRUCTIONS for future reference. This manual contains important instructions that must be followed during placement, operation, and maintenance of the unit and its components. Always supply this manual to any individual that will use this unit, and instruct them on how to correctly start, operate, and stop the unit in case of emergency.

Safety Rules

The manufacturer cannot anticipate every possible circumstance that might involve a hazard. The alerts in this manual, and on tags and decals affixed to the unit, are not all inclusive. If using a procedure, work method, or operating technique that the manufacturer does not specifically recommend, verify that it is safe for others and does not render the equipment unsafe.

Throughout this publication, and on tags and decals affixed to the unit, DANGER, WARNING, CAUTION, and NOTE blocks are used to alert personnel to special instructions about a particular operation that may be hazardous if performed incorrectly or carelessly. Observe them carefully. Alert definitions are as follows:

⚠DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

(D000001)

⚠WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

(W000002)

⚠CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

(C000003)

NOTE: Notes contain additional information important to a procedure and will be found within the regular text of this manual.

These safety alerts cannot eliminate the hazards that they indicate. Common sense and strict compliance with the special instructions while performing the action or service are essential to preventing accidents.

How to Obtain Service

When the unit requires servicing or repairs, contact Generac Customer Service at 1-888-GENERAC (1-888-436-3722) or visit ***www.generac.com*** for assistance.

When contacting Generac Customer Service about parts and service, always supply the complete model and serial number of the unit as given on its data decal located on the unit. Record the model and serial numbers in the spaces provided on the front cover of this manual.

General Rules

⚠DANGER

Loss of life. Property damage. Installation must always comply with applicable codes, standards, laws and regulations. Failure to do so will result in death or serious injury.

(D000190)

⚠WARNING

Loss of life. Only qualified personnel may install this battery. Installation of a PWRcell Battery by a homeowner is prohibited. Installation by unqualified personnel may result in death, serious injury, equipment or property damage.

(W000638)

- Follow all safety precautions in the installation & owner's manual and other documents included with the equipment.
- Always consult local code for additional requirements for where unit is being installed.
- Incorrect installation can result in personal injury and damage to the unit. It may also result in the warranty being suspended or voided. All instructions listed below must be followed including location clearances and conduit sizes.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

General Hazards

⚠DANGER

Electrocution. Do not wear jewelry while working on this equipment. Doing so will result in death or serious injury.

(D000188)

⚠WARNING

Electrocution. Potentially lethal voltages are generated by this equipment. Render the equipment safe before attempting repairs or maintenance. Failure to do so could result in death or serious injury.

(W000187)

⚠WARNING

Risk of injury. Do not operate or service this machine if not fully alert. Fatigue can impair the ability to service this equipment and could result in death or serious injury.

(W000215)

⚠WARNING

Loss of life. This product is not intended to be used in a critical life support application. Failure to adhere to this warning could result in death or serious injury.

(W000209)

⚠WARNING

Equipment damage. Connecting inverter to electric utility grid must only be done after receiving prior approval from utility company. Failure to do so could result in equipment or property damage.

(W000640)

⚠WARNING

Electric Shock. Only a trained and licensed electrician should perform wiring and connections to unit. Failure to follow proper installation requirements could result in death, serious injury, and equipment or property damage.

(W000155)

⚠WARNING

Equipment damage. Only qualified service personnel may install, operate, and maintain this equipment. Failure to follow proper installation requirements could result in death, serious injury, and equipment or property damage.

(W000182)

⚠CAUTION

Equipment Damage. Connect only to REbus-compatible devices to the DC bus. Never connect to any other DC power source.Connecting to other DC power sources could result in equipment damage.

(C000598)

- Connecting Generac PWRcell 2 to the electric utility grid must only be done after receiving prior approval from the utility company.
- If this installation is in Canada, the installation shall be in accordance with the Canadian Electrical Code, Part I.
- Only competent, qualified personnel should install, operate, and service this equipment. Strictly comply to local, state, and national electrical and building codes. When using this equipment, comply with regulations established by the National Electrical Code (NEC), CSA Standard, and the Occupational Safety and Health Administration (OSHA), or the local agency for workplace health and safety.
- Protection against lightning surges in accordance with local electric codes is the responsibility of the installer.

NOTE: Lightning damage is not covered by warranty.

- Never work on this equipment while physically or mentally fatigued.
- Any voltage measurements should be performed with a meter that meets UL3111 safety standards and meets or exceeds overvoltage class CAT III.

This equipment must be installed according to the manufacturer's installation instructions. Follow all instructions included in this manual and use appropriate practices for all product wiring and installation.

Electrical Hazards

⚠DANGER

Electrocution. Water contact with a power source, if not avoided, will result in death or serious injury.

(D000104)

⚠DANGER

Electrocution. Front cover should be removed by a qualified technician only. Removing the front cover could result in death, serious injury, equipment or property damage.

(D000604)

⚠DANGER

Electrocution. Verify all system voltages are safe before wiring. Disconnect all AC and DC sources of power before touching conductors or terminals. Failure to do so will result in death or serious injury.

(D000642)

⚠DANGER

Electrocution. Verify electrical system is properly grounded before applying power. Failure to do so will result in death or serious injury.

(D000152)

⚠DANGER

Electrocution. In the event of electrical accident, immediately shut power OFF. Use non-conductive implements to free victim from live conductor. Apply first aid and get medical help. Failure to do so will result in death or serious injury.

(D000145)

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Section 2: General Information

PWRcell 2 SDS Specifications

Description	Units	Value
AC Voltage (Nominal)	V	120/240
Grid Type	—	Single Phase
Grid Frequency	Hz	60
Current Rating	A	200
Short Circuit Current Rating	kA	22
Automatic Transfer Time	ms	<50
Primary Connectivity	—	Wi-Fi
Secondary Connectivity	—	Cellular (LTE CAT-M1), Ethernet
System Control Method	—	24 V CAN
Warranty	—	10 Years
Dimensions (L x W x H)	in (cm)	17 x 7.1 x 36.4 (43.18 x 18.03 x 92.45)
Weight	lb (kg)	59 (26.76)
Operating Temperature	°F (°C)	-4 to 122 (-20 to 50)
Rated Humidity (RH) Condensing	%	Up to 100
Maximum Elevation	ft (m)	6,561.7 (2,000)
Environment	—	Indoor and Outdoor Rated
Enclosure Type	—	Type 3R
Maximum Backup Loads Panel	A	200
Maximum Non-Backup Loads Panel	A	100
Generac Generator	kW	Up to 26
AC PV	A	100[1]
ESS 2	A	60
ESS 1	A	60
Overcurrent Protection Device	Main Breaker (EATON 2-pole series only): CSR2100N (100A), CSR2125N (125A), CSR2150N (150A), CSR2200N (200A)	
Measurement and Calculation Accuracy	See ***Measurement and Calculation Accuracy***	
Trip Voltage and Frequency Limits	See ***Power Control System (PCS)***	

[1] Supported AC PV system size will may based on application. Reference the PWRcell 2 application note Designing for AC PV with PWRcell 2.

PWRcell 2 SDS Compliance and Standards Certification

Compliance Category	Standard Certified
Safety	UL 1741:2021 Ed.3 Inverters, Converters, Controllers and Interconnection System Equipment for use with Distributed Energy Resources
	UL 67 Panelboards [UL 67:2018 Ed.13+R:22Aug2023]
	UL 869A Standard for Reference Standard for Service Equipment [UL 896A:2006 Ed.4 +R:24Jun2020]
Grid Interoperability	UL 1741SB Inverters, Converters, Controllers and Interconnection System Equipment for use with Distributed Energy Resources
	IEEE 1547: 2018 - IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces Generac PWRcell 2 SDS with Generac PWRcell 2 Inverter: is certified to • Normal Operating Performance Category B • Abnormal Operating Performance Category III
	IEEE 1547.1:2020 IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces
	IEEE 1547a-2020 - IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces–Amendment 1: To Provide More Flexibility for Adoption of Abnormal Operating Performance Category III
	UL 1741 SA 11.2 Normal ramp rate - Inverters, Converters, Controllers, and Interconnection System Equipment for use with Distributed Energy Resources [UL 1741:2021 Ed.3+ R:23Oct2024]
	With the Hawaiian Electric (HECO) source requirements document (SRD) v2.0–Hawaii Rule No. 14H Interconnection of Distributed Generating Facilities with the Company's Distribution System Effective: 07/01/2020
	Electric Rule No.21 Generating Facility Interconnections Effective: June 30, 2018
	Default New England Bulk System Area Settings Requirement
	PRC-024-3 Frequency and Voltage Protection Settings for Generating Resources
	Regulation for the Interconnection of Generators with the Distribution System of the Puerto Rico Electric Power Authority and to Participate in Net Metering Program, Regulation No. 8915, February 2017 as modified by LUMA Smart Inverter Settings Sheet Technical Bulletin 2024-001, November 2024
	IEEE 2030.5-2023 IEEE Approved Draft Standard for Smart Energy Profile Application Protocol
	SunSpec Common Smart Inverter Profile (CSIP)
Emissions	FCC Part 15 Class B

Component Locations

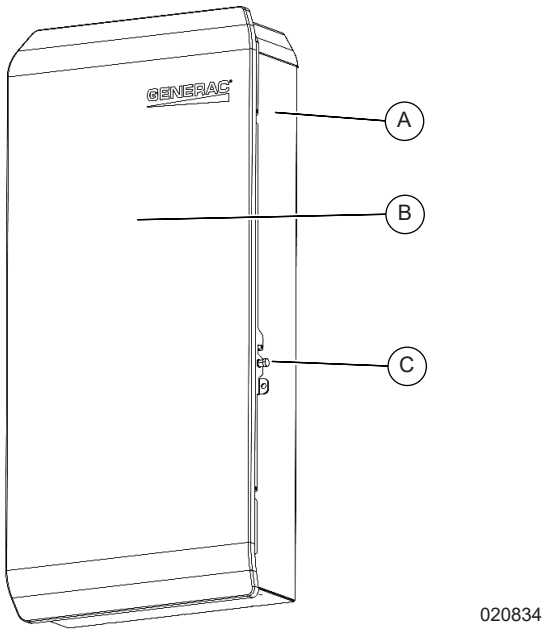

Figure 2-1. Component Locations

A	Nameplate
B	Front Cover
C	Fastener w/Locking Clasp

Removing the Lid

Proceed as follows to remove SDS lid:

1. See ***Figure 2-2***. Remove the front cover (A) on SDS by loosening the captive fasteners (B) left and right.

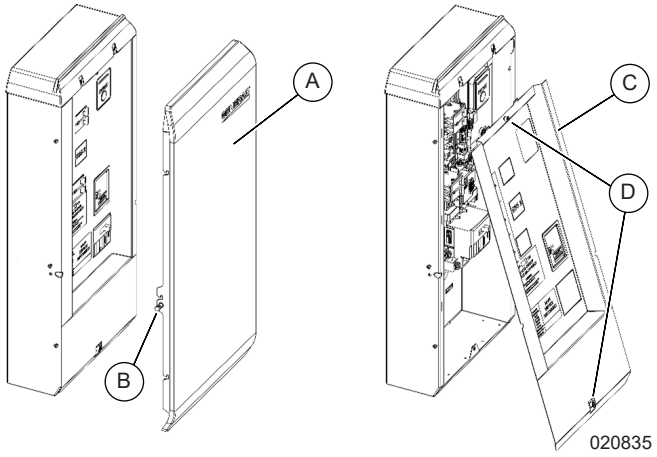

Figure 2-2. Removing the lid and dead front

2. Remove the dead front (C) by loosening the fasteners (D) at the top and bottom.

About SDS

The PWRcell 2 SDS is a microgrid interconnection device (MID) with a power control system (PCS) for seamless energy management. Several parallel power sources can be connected to the various inputs at SDS, allowing for ultimate resiliency during utility grid outages.

See ***Figure 2-3***. SDS allows for one PWRcell 2 Energy Storage System (ESS), AC-coupled PV, and a Generac generator to be connected for energy independence and backup resiliency. SDS can be connected as the service equipment directly after the utility meter for whole home backup, or it can be connected downstream of a main service panel for partial home backup. It has a set of lugs for backup loads, and it has a set of lugs for non-backup loads, making it versatile to install for a variety of configurations.

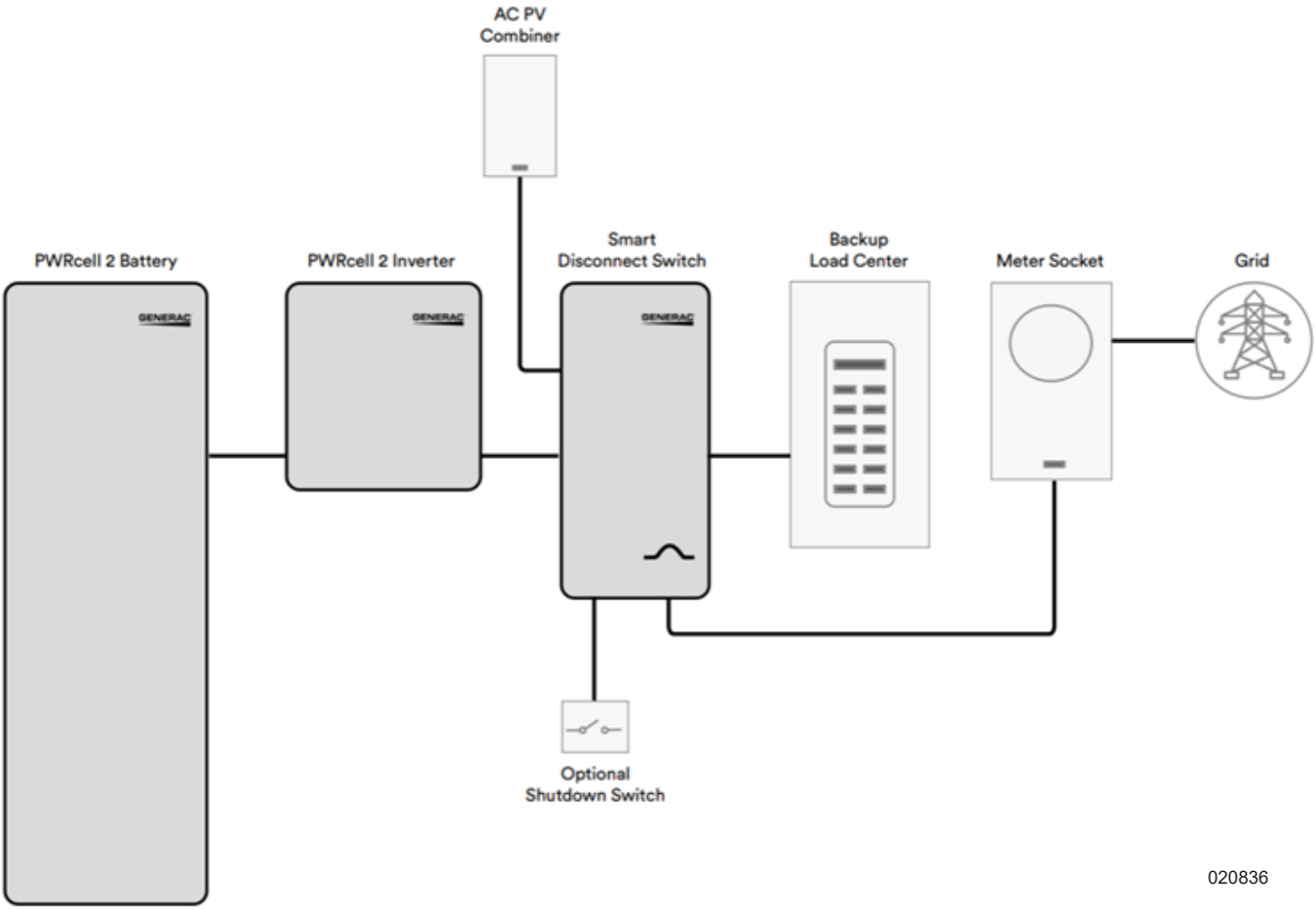

Figure 2-3. The PWRcell 2 System

Section 3: Location Requirements and Dimensions

Consider the following when installing the PWRcell 2 SDS:

- The SDS installation must meet the working space requirements in NEC Article 110.26.
- The unit can be installed indoors or outdoors.
- Install the unit close to the utility meter or main service panel.
- Installation of SDS must account for Rapid Shutdown and ESS Emergency Shutdown.
- The maximum distance for the control circuit between SDS, inverter, and battery is 262.5 ft (80 m).
- Survey the scene to determine the most suitable place for mounting SDS in relation to the PWRcell 2 Inverter and Battery.
- If possible, avoid mounting locations where SDS may be subject to direct sunlight.
- Do not mount where liquids may be prone to drip or collect upon the equipment.

Rapid Shutdown

See ***Figure 3-1***. If SDS will be installed outdoors near the service entrance, or another marked, readily accessible location for first responders, the AC PV breaker may be used as the compliant Rapid Shutdown initiator. Turning the breaker to the OFF position and locking the front cover of SDS will satisfy the requirements for Rapid Shutdown. Rapid Shutdown may also be achieved using the third-party manufacturer's AC PV initiation device.

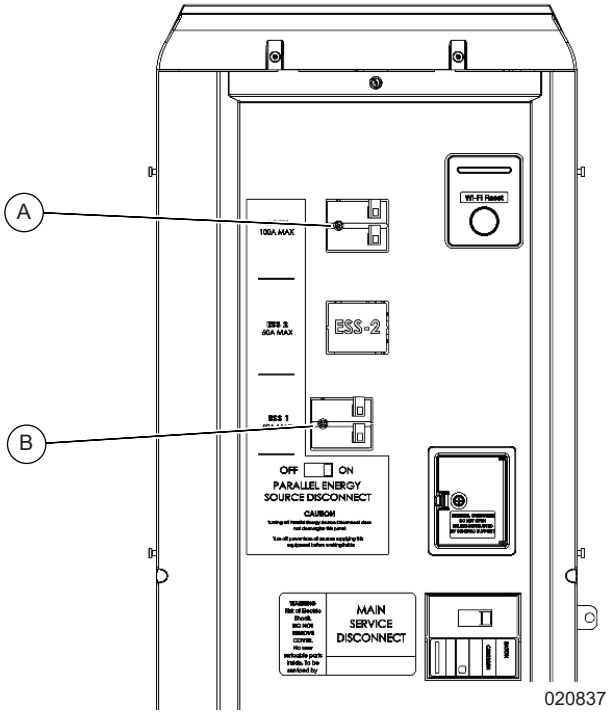

Figure 3-1. Shutting Down at SDS

ESS Shutdown

See ***Figure 3-1***. If SDS will be installed outdoors near the service entrance, or another marked, readily accessible location for first responders, the ESS breaker (B) may be used as the compliant ESS Emergency Shutdown. Turning the breaker to the OFF position and locking the front cover will verify the ESS cannot move power through SDS. Turn off the battery disconnect switch to break the connection between the battery stack and the battery management unit (BMU).

Optional Shutdown Switch

If SDS will be installed indoors or if otherwise desired, a suitably-rated switch or disconnect may be wired to the E-Stop terminals on the SDS control board. The E-Stop circuit is a normally closed circuit. Opening this circuit will shut down the PWRcell 2 ESS and cause SDS to open parallel power source relays for AC PV and a Generac generator (if equipped). See ***Shutdown Switch Wiring (if equipped)*** for more information.

Unit Dimensions

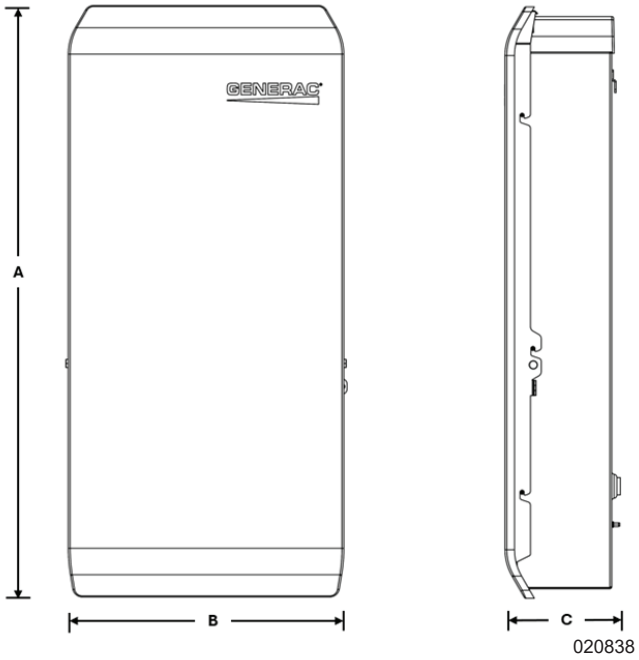

Figure 3-2. Unit Dimensions

A	36 1/2 in or 925.80 mm
B	17 7/8 in or 424.28 mm
C	7 1/8 in or 180.90 mm

Minimum Mounting Clearances

See ***Figure 3-3***. These are the minimum mounting clearances. Survey the mounting location for these minimum clearances, and see ***Table 3-1***.

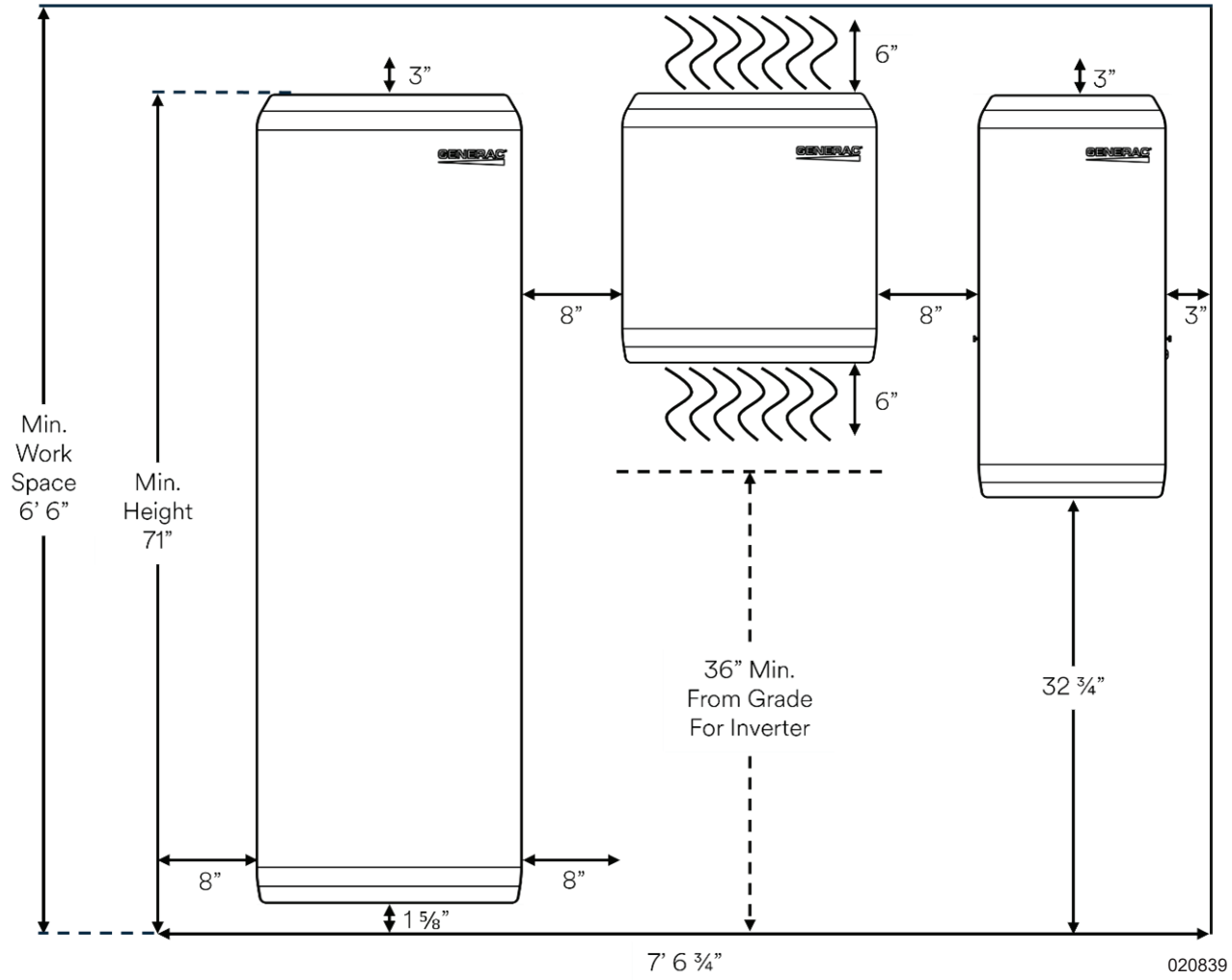

Figure 3-3. Minimum Clearances

Table 3-1. Minimum Equipment Clearances

Measurement	Description
77 in (195.58 cm)	Minimum workspace height (NEC 110.26)
69 1/4 in (175.89 cm)	Minimum mounting height for battery cabinet
3 in (76.20 mm)	Minimum space above battery cabinet/SDS
1 5/8 in (41.28 mm)	Minimum from Grade to service air filter
8 in (20.32 cm)	Tool clearance for front covers
6 in (15.24 cm)	Minimum space below inverter for passive cooling
36 in (91.44 cm)	Minimum from Grade to inverter
32 3/4 in (83.19 mm)	Minimum from Grade to SDS
3 in (76.20 mm)	Minimum clearance for SDS padlock operation

Knockout Locations

See ***Figure 3-4***. Knockouts may be punched in the shaded areas only.

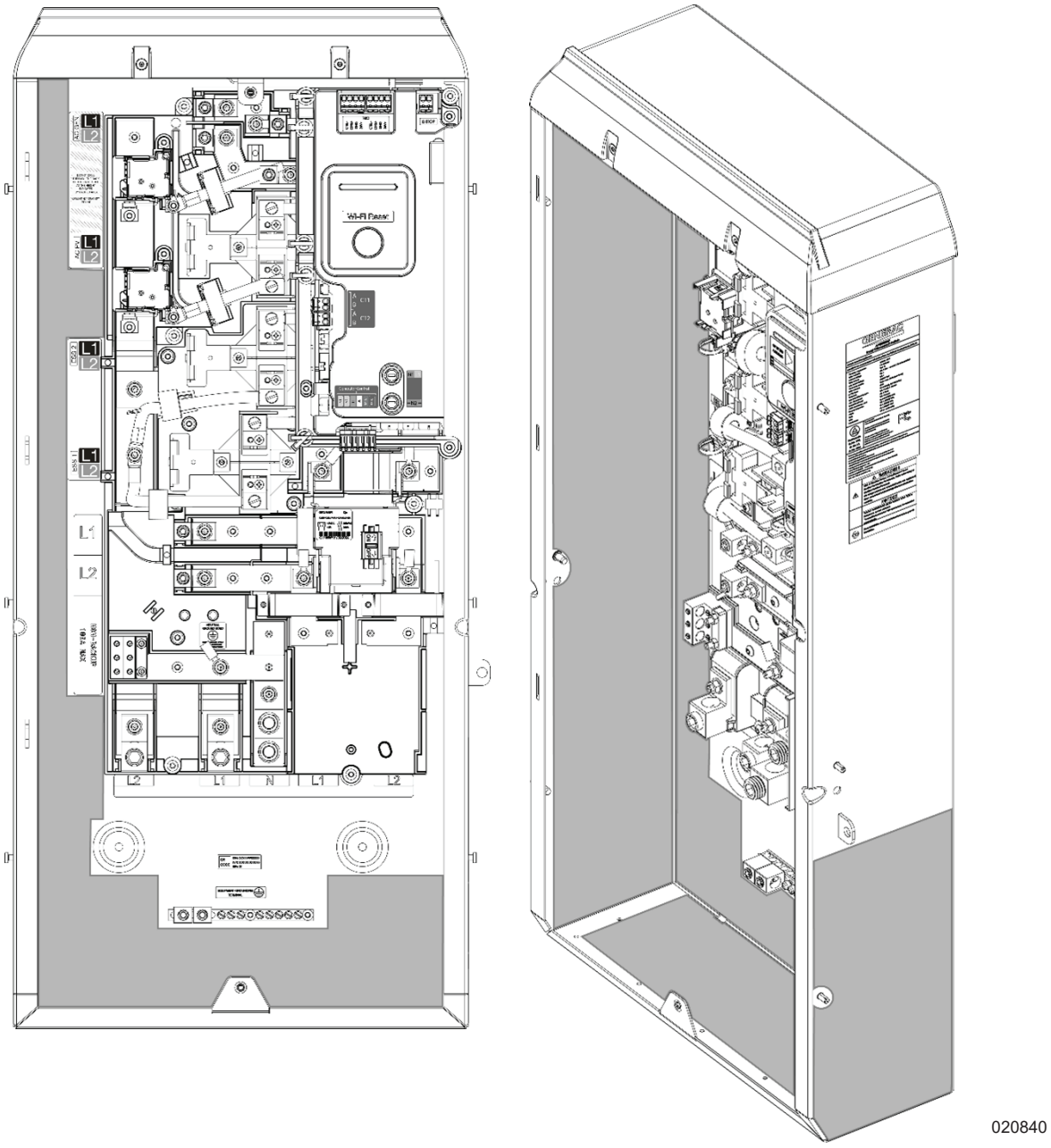

Figure 3-4. Knockout Locations

Section 4: Mounting

Mounting Guidelines

⚠WARNING

Falling Object. Mount equipment in a safe secure manner in alignment with all state and local codes. Failure to mount equipment securely could result in death or serious injury.

(W000825)

⚠CAUTION

Property Damage. Mount equipment to a strong, stable surface. Never mount to drywall, plaster, or other non-structural wall treatments.Failure to mount equipment to a strong, stable surface could result in equipment or property damage.

(C000641)

- Verify mounting location adheres to ***Location Requirements*** listed in Section 3 of this manual.
- SDS must be mounted upright on a vertical wall.
- Observe all mounting clearances.
- Secure mounting bracket and enclosure.
- Fasteners must adequately secure the 59 lb (26.76 kg) SDS to the wall.
- Fasteners must be suitable for the mounting surface.
- Fasteners must engage at least two studs or other structural members.
- Install blocking or channel strut as needed.

Determining a Top Line

If mounting SDS on the same wall with the PWRcell 2 Inverter and Battery, top-align the enclosures for best aesthetics. Otherwise, if mounting SDS on a separate wall space, mind the SDS unit dimensions and minimum clearances to establish an appropriate top line.

Proceed as follows to mount battery, inverter, and SDS (L–R) on the same wall.

1. Start with the battery cabinet, as the largest enclosure, to establish the top line.
2. Cut out the battery cabinet template from the inside of the battery cabinet box to use for general planning and placement.
3. See ***Figure 4-1***. The maximum height for the battery cabinet is 84 1/2 in (214.63 cm) from grade to keep the battery disconnect switch at 79 in (200.66 cm) to the center of the switch.

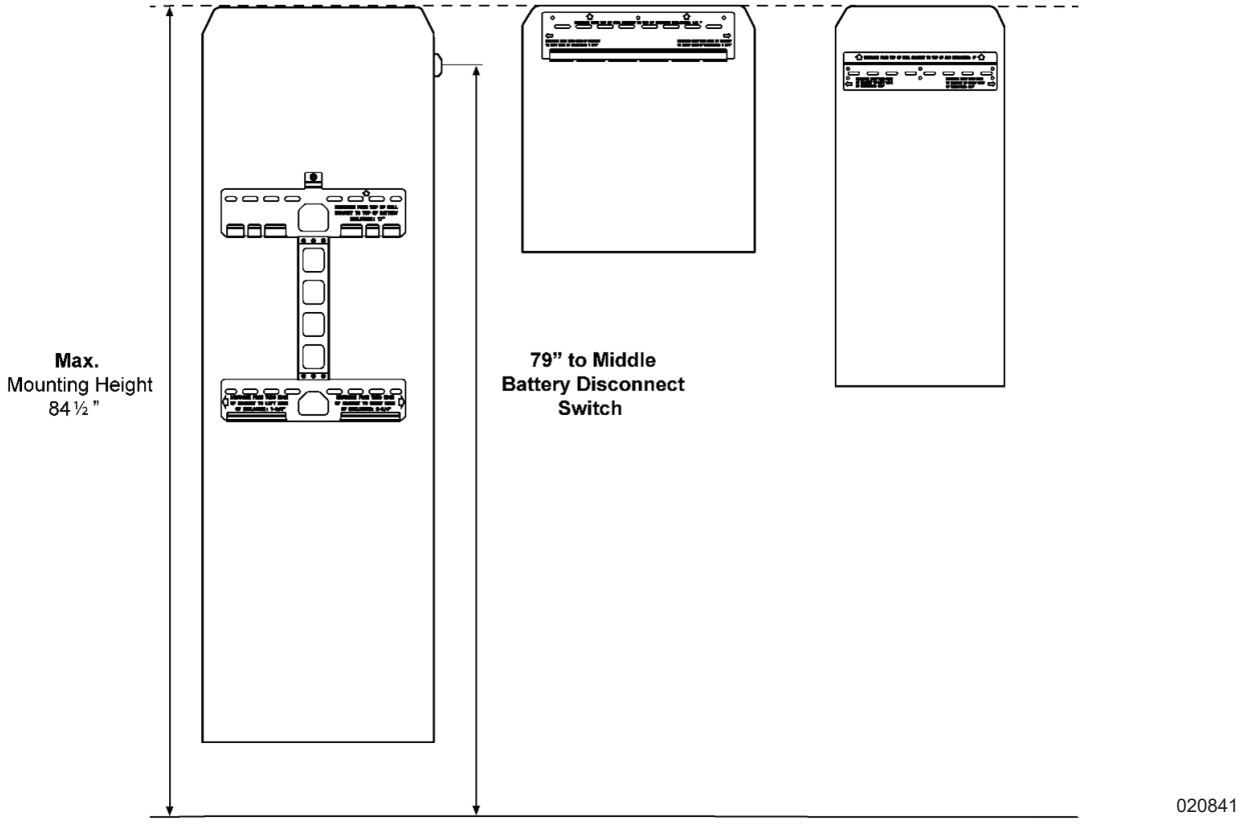

Figure 4-1. Max. Mounting Height for Battery

NOTE: If mounting the battery indoors, the minimum mounting height off the floor is 1 5/8 in (41.28 mm). If mounting outdoors, the minimum mounting height is 6 in (152.4 mm) from grade.

NOTE: The battery must be installed in a suitably rated space. See the *PWRcell 2 Battery Installation and Owner's Manual* for more information.

Fastening the Mounting Bracket

Proceed as follows to fasten the SDS mounting bracket to the wall:

1. See ***Figure 4-2***. Measure from the top line 4 in (10.16 cm) down to the top of the SDS mounting bracket and place a mark for reference.

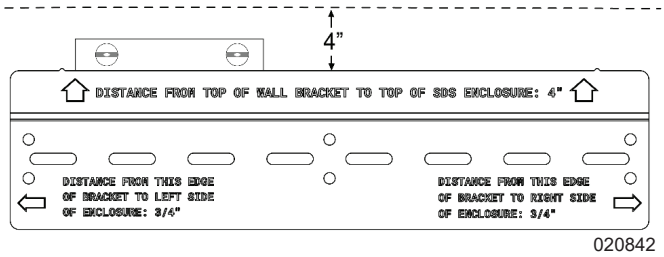

Figure 4-2. Measuring From Top Line

2. Use a level on the bracket to mark holes.
3. Pre-drill holes.
4. See ***Figure 4-3***. Fasten bracket to the wall.

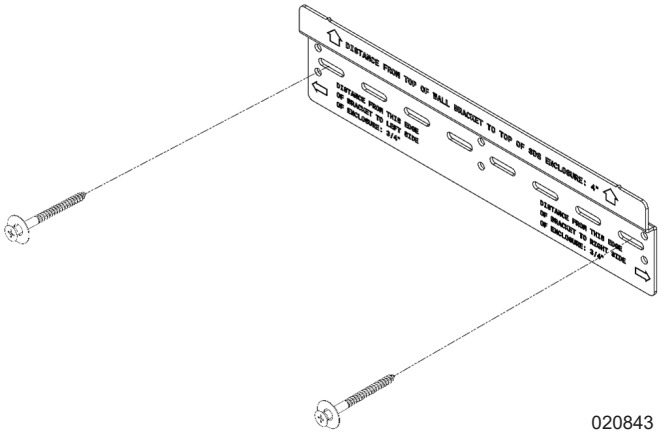

Figure 4-3. Fastening the Bracket

Punching Conduit Holes

It may be advantageous to punch conduit holes in the SDS enclosure before hanging it on the wall. Depending on how close SDS will be mounted to other equipment, tool access may be limited. For best results and to limit metal shavings, use a punch tool for the diameter conduit to be installed.

Proceed as follows to mount battery, inverter, and SDS (L–R) on the same wall:

1. See ***Figure 4-4***. Locate center punch dimple (A) on SDS. Dimples exist on three enclosures to align

conduit holes across the equipment if all three enclosures are top aligned on the same wall.

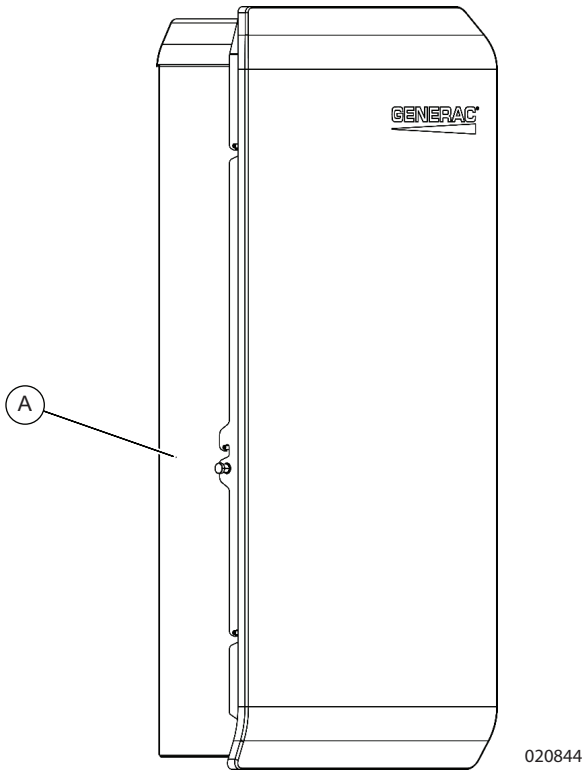

Figure 4-4. Center Punch Dimple

2. Select the correct punch tool die for the diameter conduit to be installed.
3. Drill a pilot hole for the punch tool.
4. Use the punch tool to punch hole(s) in SDS. See ***Knockout Locations*** for more information.

Mounting and Fastening SDS

1. See ***Figure 4-5***. Hang SDS on the mounting bracket. Leave SDS loose on the bracket to fit conduit in between SDS and other enclosures.

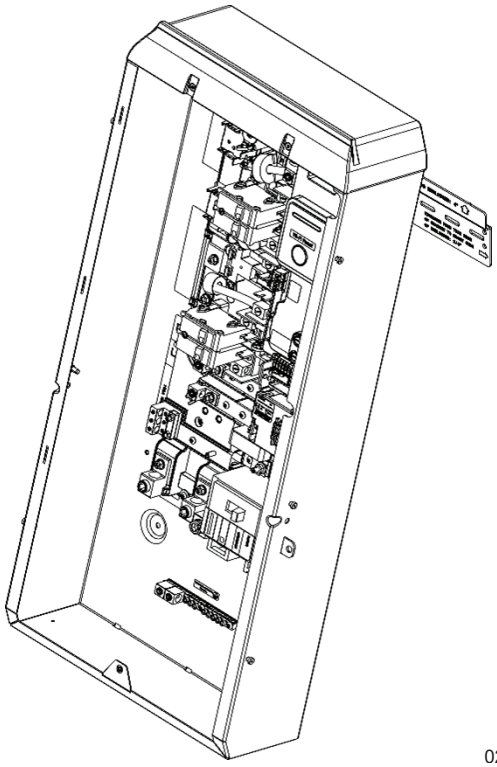

Figure 4-5. Hanging SDS on the Mounting Bracket

2. See ***Figure 4-6***. Fasten the enclosure to the wall through the wiring compartment.

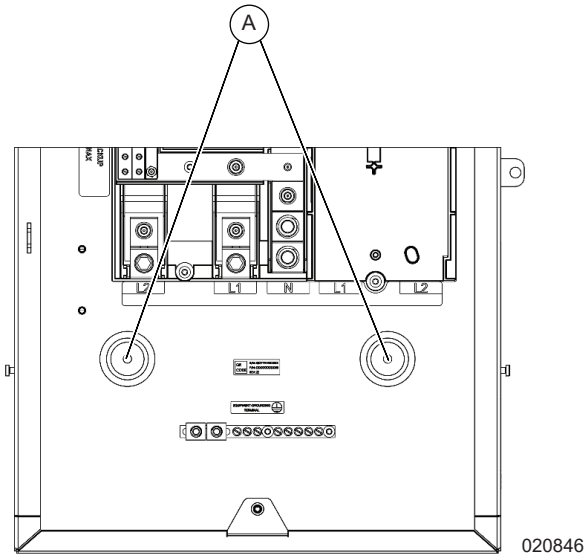

Figure 4-6. Fastening the Enclosure to the Wall

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Section 5: Wiring

Wiring Guidelines

DANGER

Electrocution. Verify all system voltages are safe before wiring. Disconnect all AC and DC sources of power before touching conductors or terminals. Failure to do so will result in death or serious injury.

(D000642)

WARNING

Electric Shock. Only a trained and licensed electrician should perform wiring and connections to unit. Failure to follow proper installation requirements could result in death, serious injury, and equipment or property damage.

(W000155)

WARNING

Equipment damage. Only qualified service personnel may install, operate, and maintain this equipment. Failure to follow proper installation requirements could result in death, serious injury, and equipment or property damage.

(W000182)

- SDS shall be installed in accordance with NEC Articles 702, 705, and 750.
- Always use wiring methods in accordance with National Electrical Code (NEC) (ANSI/NFPA 70) and other applicable codes.
- All field installed conductors are to be sized in compliance with NEC Article 310.
- Tighten all terminals as specified in this section.

PWRcell 2 SDS Wiring Compartment

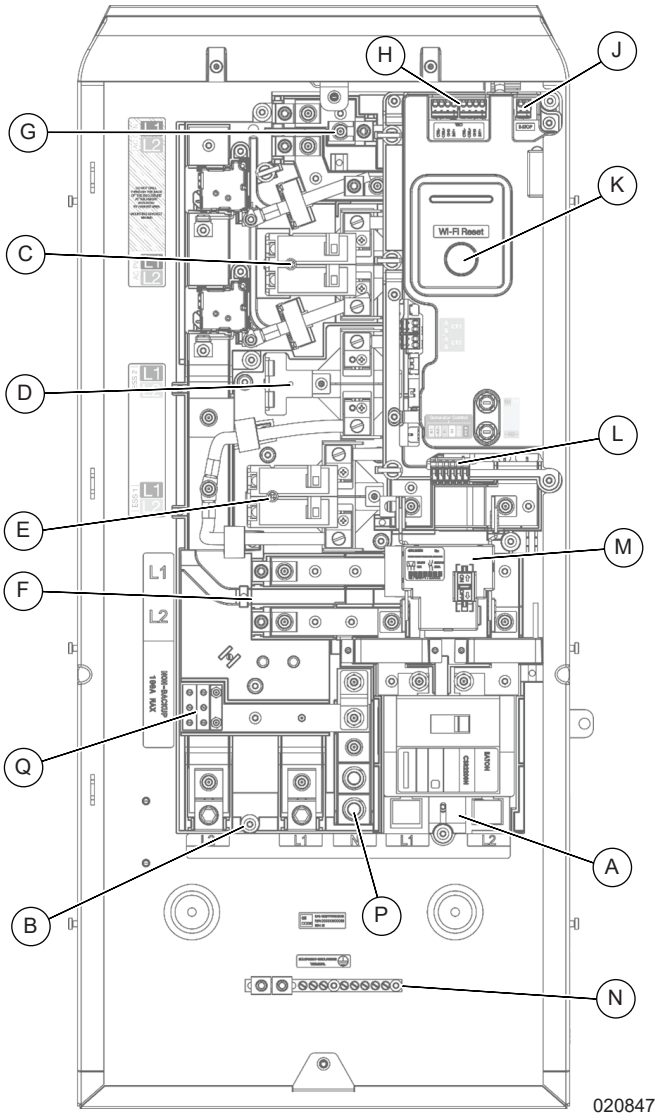

Figure 5-1. SDS Wiring Compartment

A	Utility Connection L1, L2
B	Backup Loads Connection L1, L2
C	AC PV Breaker (up to 100 A[1])
D	ESS 2 - Not Used at This Time
E	ESS 1 Breaker (60 A)
F	Non-Backup Loads Connection L1, L2 (100 A Rated Bus)
G	Generator Connection L1, L2
H	Control Circuit Wiring Terminals

J	Remote Stop Terminals
K	Wi-Fi Reset Button
L	Gen Control Wiring Terminals
M	Main Relay Manual Override
N	Ground Bar
P	Utility/Backup Loads Neutral Lugs
Q	Neutral Terminals

[1] Supported AC PV system size will may based on application. Reference the PWRcell 2 application note Designing for AC PV with PWRcell 2.

Installing Circuit Breakers

See ***Figure 5-2***. SDS comes with a lug kit (A) included in the box for the utility connection. Use the lug kit if SDS will not be installed as service equipment but will instead be fed by a feeder breaker from an upstream panel board. Install an Eaton main breaker (B) if SDS will be installed as service equipment.

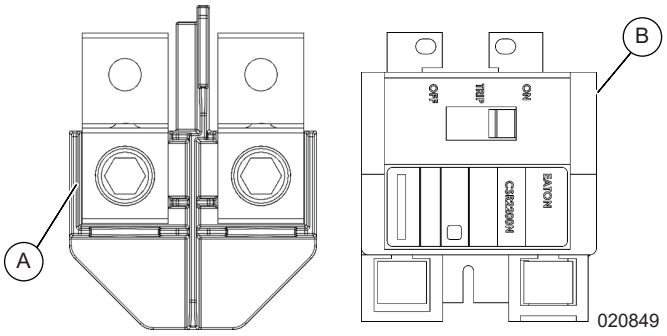

Figure 5-2. Lug Kit and Eaton Main Breaker

See ***Figure 5-3***. Install the Lug Kit at the utility position (C) using lock nuts provided in the SDS hardware kit. Alternatively, install the Eaton Main Breaker (B) with the nuts and bolt that come with the breaker.

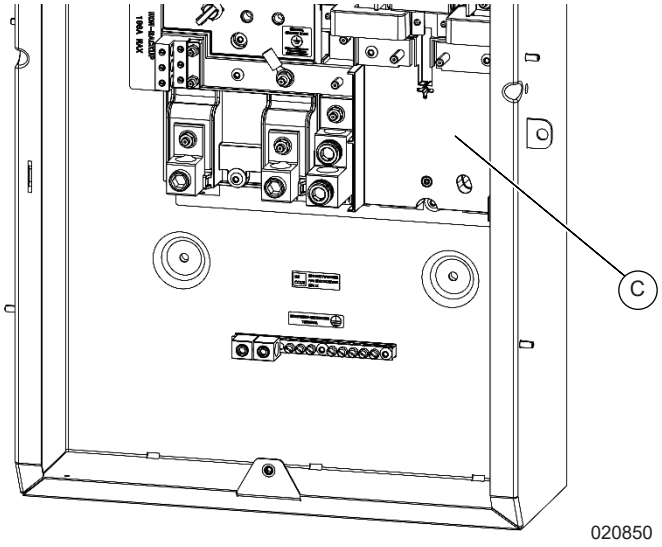

Figure 5-3. Utility Position

See ***Table 5-1***. If SDS will be installed as service equipment, install a 100 A or 200 A Eaton circuit breaker depending on the service size.

Table 5-1. Compatible Main Breakers

Description	Eaton Part No.
100 A Main Breaker	CSR2100N
125 A Main Breaker	CSR2125N
150 A Main Breaker	CSR2150N
175 A Main Breaker	CSR2175N
200 A Main Breaker	CSR2200N

IMPORTANT NOTE: See *Figure 5-4*. If installing SDS as service entrance equipment, the bonding strap included in the SDS hardware package must be installed to bond neutral to ground using the two lock nuts provided. Do not install the bonding strap if SDS will not be installed as service equipment.

IMPORTANT NOTE: When SDS is installed as service entrance equipment, the service bond strap must be installed. Equipment wiring shall comply with NEC Article 250 Parts I through VII.

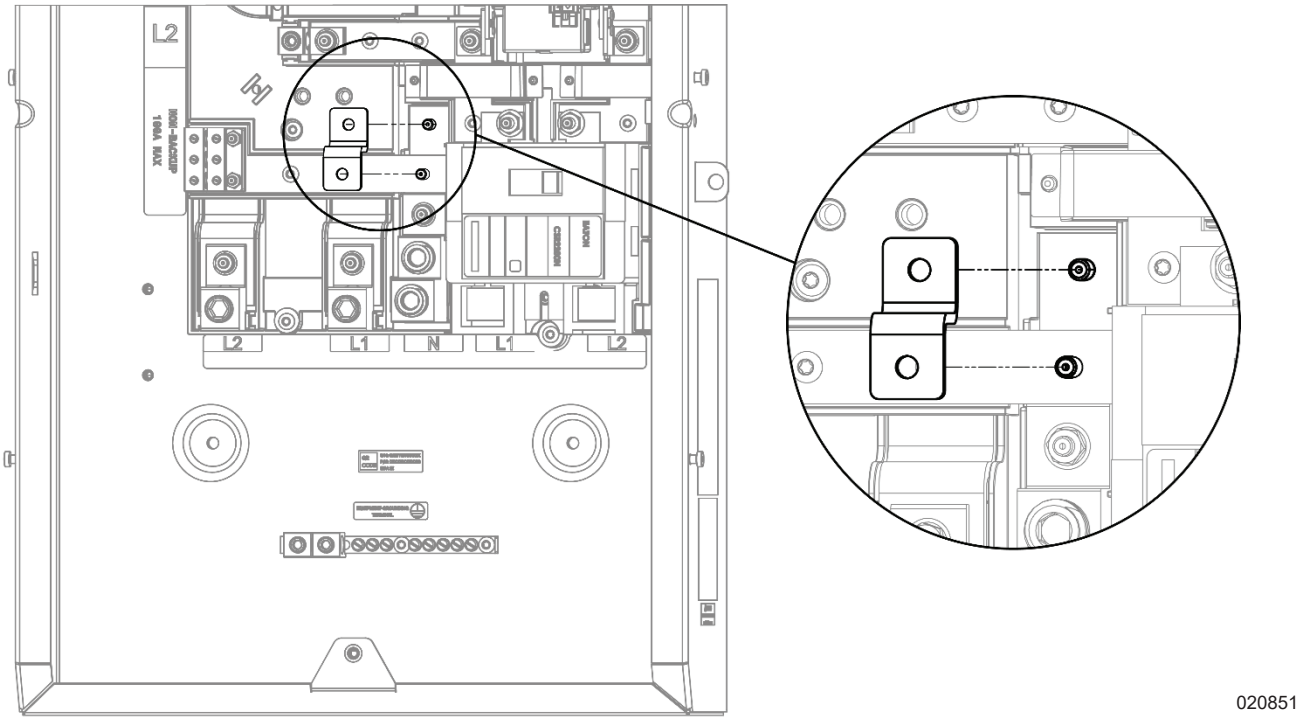

Figure 5-4. Installing the Bonding Strap

See ***Table 5-2***. Tighten lug kit or main breaker and bonding strap to specified torque value when fastening to SDS.

Table 5-2. Torque Specifications

Description	Torque
Lug Kit	48 **in-lb** (5.42 Nm)
Main Breaker	48 **in-lb** (5.42 Nm)
Bonding Strap	48 **in-lb** (5.42 Nm)

See ***Table 5-3***. Install compatible circuit breakers as needed for AC PV and PWRcell 2 ESS.

Table 5-3. Compatible Circuit Breakers

Description	Range	Eaton Part No.
AC PV Breaker	20 A – 100 A[1]	BR220 – BR2100
PWRcell 2 ESS Breaker	60 A	BR260

[1] Supported AC PV system size will may based on application. Reference the PWRcell 2 application note Designing for AC PV with PWRcell 2.

See ***Figure 5-5***. There are three bolts included in the SDS hardware kit to bolt down the circuit breakers for AC PV and PWRcell 2 ESS. Install bolts on all parallel source circuit breakers as shown below.

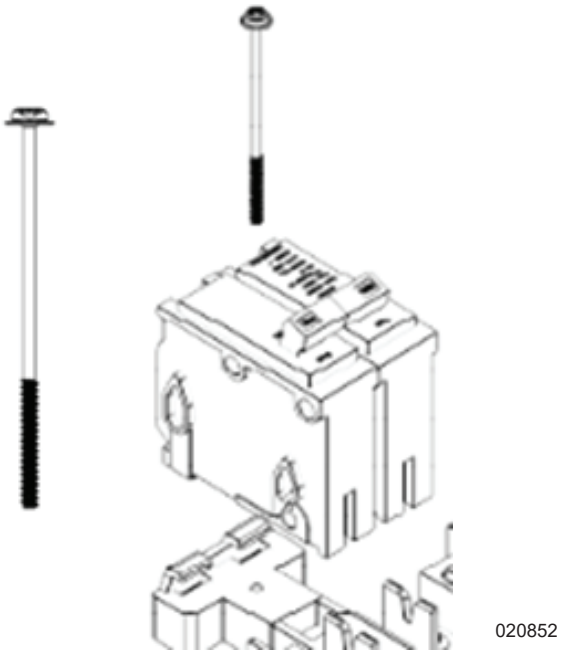

Figure 5-5. Installing Breaker Hold-Down Bolts

Utility Wiring

DANGER

Electrocution. Verify all system voltages are safe before wiring. Disconnect all AC and DC sources of power before touching conductors or terminals. Failure to do so will result in death or serious injury.

(D000642)

Proceed as follows to connect the utility to SDS:

1. Turn off utility power before handling conductors, either by removing the utility meter or by turning off the main utility disconnect.

   NOTE: The utility must be contacted to come remove the meter if necessary.

2. Route conductors from a feeder breaker in the main panel or the load-side of the utility meter to the utility connection in SDS- either the lug kit or an Eaton main breaker respectively.
3. Verify conductors are sized correctly based on the size of the feeder breaker or the size of the service.
4. Terminate conductors for L1 and L2 at the lug kit or main breaker.

   NOTE: L1 and L2 cross over internally inside of Eaton main breakers. If terminating to the lug kit, L2 will be terminated on the left, and L1 will be terminated on the right.

5. Terminate the neutral conductor at one of the double-stacked neutral lugs left of L1 and L2.
6. Terminate the grounding conductor to one of the grounding lugs provided on the ground bar.
7. See ***Table 5-4***. Tighten all connections according to table.

Table 5-4. Torque Specifications for SDS Terminals

Description	Wire Size	Torque (in-lb)
Utility L1/L2 (Circuit Breaker)	See Circuit Breaker Specifications	
Utility L1/L2 (Lug kit) Backup Loads L1/L2	250 kcmil – 2 AWG	375 (42.37 Nm)
	2 – 6 AWG	275 (31.07 Nm)
Neutral Lugs (Utility, Backup)	300 kcmil – 6 AWG	275 (31.07 Nm)
Generator L1/L2 Non-Backup Loads Lugs L1/L2	1/0 – 3 AWG	50 (5.6 Nm)
	4 – 6 AWG	45 (5.08 Nm)
	8 AWG	40 (4.52 Nm)
	10 – 14 AWG	35 (3.95 Nm)
AC PV Circuit Breaker ESS circuit Breaker(s)	See Circuit Breaker Specifications	
Neutral Bar (AC PV, ESS, Gen, Non-Backup Loads)	2 – 4 AWG	50 (5.6 Nm)
	6 – 10 AWG	40 (4.52 Nm)
	12 – 14 AWG	15 (1.69 Nm)
Lugs on Ground Bar	2/0 AWG	50 (5.6 Nm)
Ground Bar Terminals	4 – 6 AWG	35 (3.95 Nm)
	8 AWG	25 (2.82 Nm)
	10 – 14 AWG	20 (2.26 Nm)

Backup Loads Wiring

Proceed as follows to connect a backup loads subpanel to SDS:

1. Route appropriately sized conductors for L1 and L2 from the backup loads lugs in SDS along with a neutral conductor and a ground conductor to a main-breaker subpanel. The main breaker subpanel must be rated for 200 A or less.
2. Terminate L2 (L) and L1 (R) at SDS backup loads lugs.
3. Terminate the neutral conductor at one of the double-stacked neutral lugs (shared w/utility neutral).
4. Terminate the grounding conductor to one of the large ground lugs provided on the ground bar.
5. See ***Table 5-4***. Tighten all connections according to table.
6. Terminate the other end of the backup loads wiring at the subpanel where L1 and L2 should terminate (L-R) on a main breaker installed on the panelboard.
7. Terminate the neutral and ground conductors respectively in the panelboard.
8. Calculate the load going into the backup loads subpanel and load accordingly.
9. Verify all conductors (hots, neutrals, grounds) for branch circuits in backup loads are terminated in the backup loads subpanel according to the specifications of the panelboard.

Generator Wiring (if equipped)

Proceed as follows to connect a Generac generator to SDS for extra resiliency:

1. Route appropriately sized generator power and control wiring to SDS (size conductors based on the size of the generator).
2. Terminate the ground conductor from the generator to the ground bar in SDS.
3. Terminate the neutral conductor from the generator to the neutral bar in SDS.
4. Terminate L1 and L2 to the generator lugs in SDS.
5. Terminate the generator control wiring to the gen control wiring terminals.
6. See ***Table 5-4***. Tighten all connections according to table.

AC PV Wiring

Compatible 3rd-party AC PV systems are limited to Enphase IQ 7 and Enphase IQ 8 Microinverters for operation with the PWRcell 2 System.

Proceed as follows to connect AC PV to SDS:

1. See ***Table 5-3***. Select the appropriate size Eaton branch circuit breaker for the PV array and install in SDS.
2. Route appropriately sized conductors for L1, L2, Neutral and Ground from the 3rd-party PV equipment to the AC PV circuit breaker in SDS.
3. Terminate the ground conductor at the ground bar in SDS.
4. Terminate the neutral conductor at the neutral bar in SDS
5. Terminate L1 and L2 at the AC PV circuit breaker in SDS.

ESS Wiring

SDS has two inputs for a PWRcell 2 ESS to be installed. However, currently only one PWRcell 2 ESS is compatible for operation with SDS.

Proceed as follows to connect a PWRcell ESS to SDS.

1. See ***Table 5-3***. Install a two-pole 60 A Eaton circuit breaker type BR260 in SDS at the ESS 1 input location.
2. Route a minimum of #6 AWG THHN or THWN-2 from SDS to the PWRcell 2 Inverter for L1, L2, Neutral, and Ground.
3. Terminate the ground conductor at the ground bar in SDS.
4. Terminate the neutral conductor at the neutral bar in SDS.
5. Terminate L1 and L2 at the ESS 1 circuit breaker in SDS.
6. Terminate the other end of this wiring at the appropriate terminals in the inverter wiring compartment. See the *PWRcell 2 Inverter Installation and Owner's Manual* for more information.

Non-Backup Loads Wiring

SDS provides additional lugs to connect a non-backup loads subpanel for convenience. Use these lugs to connect a subpanel with loads that are not necessary or desired for backup during a utility grid outage.

NOTE: If wiring SDS for partial home backup using a feeder breaker from an upstream panelboard, consider whether it will be more convenient to use the panelboard to house non-backup loads. Non-backup loads are not required to be connected to SDS.

NOTE: Connect only main-breaker subpanels for non-backup loads at SDS.

Proceed as follows to connect a non-backup loads subpanel to SDS:

1. Route L1, L2, Neutral, and Ground from a main-breaker subpanel to the non-backup loads lugs at SDS. The main-breaker subpanel must be rated for 100 A or less.
2. Terminate L1 and L2 to the lugs labeled Non-Backup Loads.
3. Terminate the neutral conductor to the neutral bar in SDS.
4. Terminate the ground conductor to the ground bar in SDS.
5. See ***Table 5-4***. Tighten all connections according to table.

Control Circuit Wiring

Reference the following details to ensure proper installation:

- The SDS controls the flow of power in the system between devices
- The control circuit can be no longer than 262.5 ft (80 m) total, across all devices — from SDS to inverter to battery.

Proceed as follows to wire the PWRcell 2 control circuit:

1. Use 600 Volt-rated #18 AWG shielded 4-conductor cable.
2. Terminate blue CNTRL -, orange CNTRL +, black GND, red 24 V + at SDS.
3. Route cable to the inverter and terminate the other in one of the two control circuit terminal sets following the same color pattern.
4. Route another length of the same cable to the battery from the second set of control circuit terminals at the inverter and terminate at one of the

two control circuit terminal sets at the BMU, maintaining the same color pattern.

NOTE: A terminating resistor must be present at both the beginning and the end of the CANbus. A CAN connector with a terminating resistor will come standard with this device. This terminating resistor cannot be moved to a different connector. If terminating the CANbus in a different device, fully remove the connector with the installed resistor.

External CTs Wiring (if equipped)

DANGER

Electrocution. Service conductors are live and high voltage is present at main disconnect input terminals in main panel. Use caution when installing or servicing equipment around service conductors. Contact with live terminals will result in death or serious injury.

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External CTs are sold separately for systems where SDS will not be the service entrance equipment. See below and refer to the instruction sheet included in the External CTs kit for more information.

See ***Figure 5-6***. CTs should be installed above the point of interconnection and all house loads.

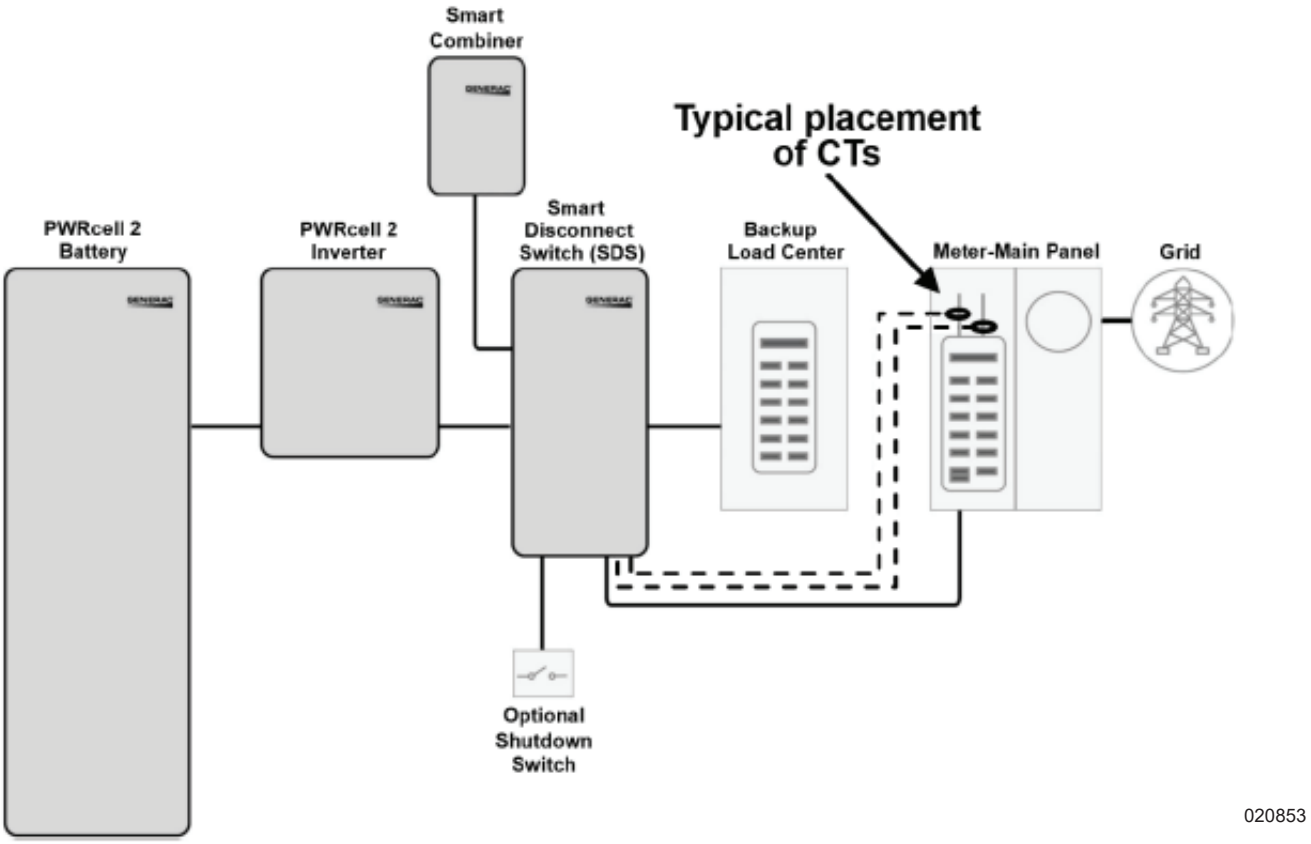

Figure 5-6. External CTs Placement

Proceed as follows to install external CTs:

1. Set equipment power to OFF.
2. Set the main service disconnect to OFF.
3. See ***Figure 5-7***. Orient CTs where SOURCE THIS SIDE (A) is pointed toward the utility service.

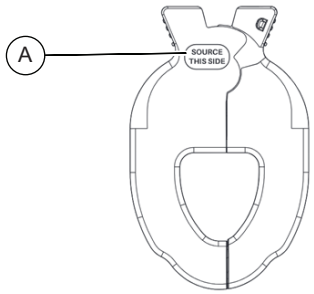

Figure 5-7. SOURCE THIS SIDE

4. See ***Figure 5-8***. Clamp CT1 around the Line 1 service conductor and clamp CT2 around the Line 2 service conductor.

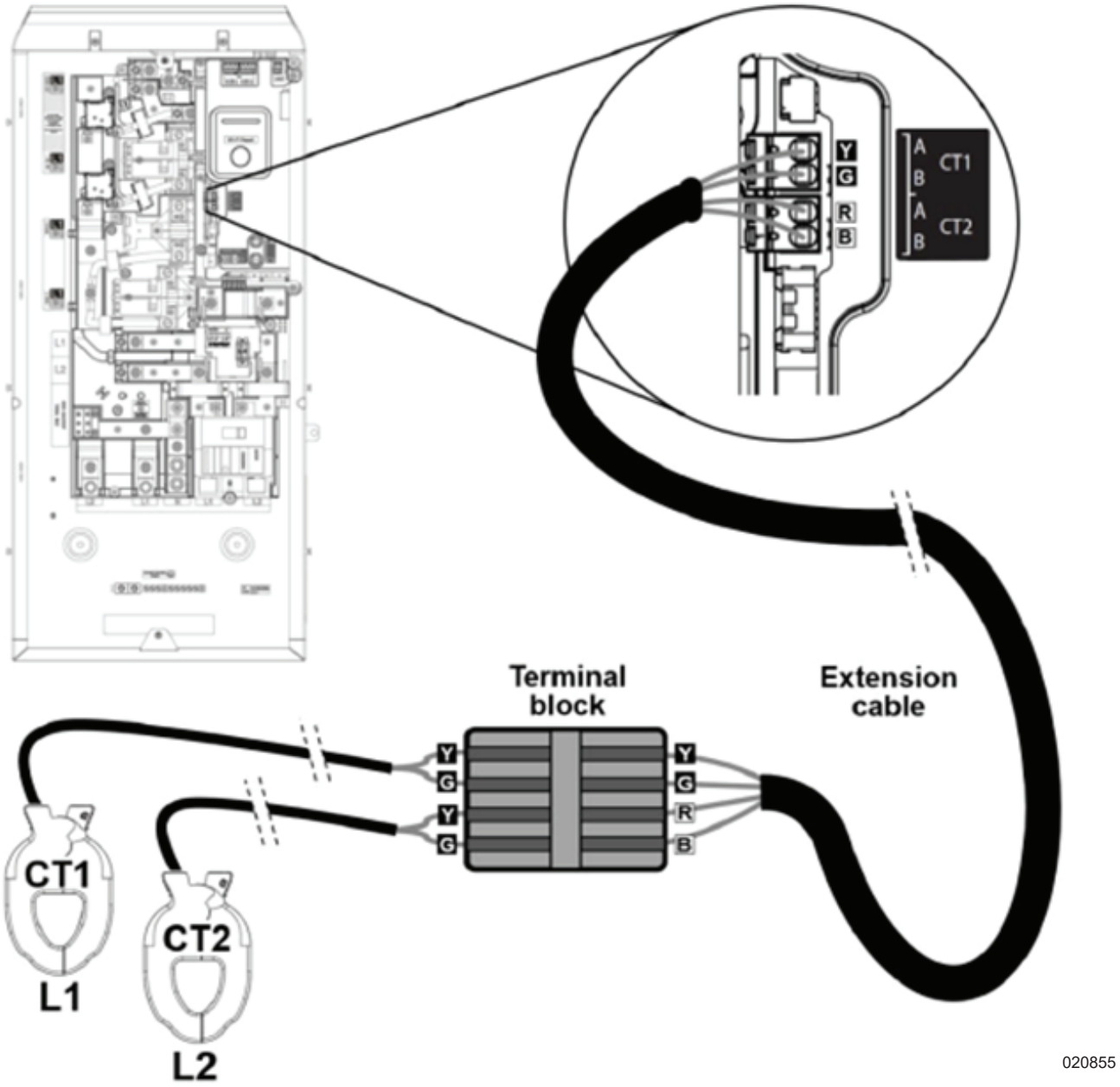

Figure 5-8. Wiring External CTs

5. Connect CTs to extension cable inside of the main panel using the terminal block included in the package. Terminate CTs leads one end and the extension cable on the other end. Match wire colors using the following:

- CT1 A = yellow (Y)
- CT1 B = green (G)
- CT2 A = red (R)
- CT2 B = black (B)

NOTE: If unable to install CTs on the service entrance conductors above the point of interconnection and all house loads, L1 and L2 branch circuit conductors may be bundled separately in each respective CT. If bundling branch circuit conductors, verify directionality of each conductor is consistent, and note the system export will be limited to the Main Service Panel Backfeed Limit. See ***Power Control System (PCS)*** for more information.

Shutdown Switch Wiring (if equipped)

An optional shutdown switch can be wired to SDS to shut down the entire system.

NOTE: The E-STOP circuit at SDS is a normally closed circuit.

Proceed as follows to wire a remote E-Stop to SDS:

1. Verify the E-Stop device clearly indicates ON/OFF and is lockable in the OFF position.
2. Route an appropriately rated two-conductor from the E-Stop device to SDS capable of supplying 3.3 VDC.
3. See ***Figure 5-9***. Remove the factory jumper from the E-STOP terminal at SDS.

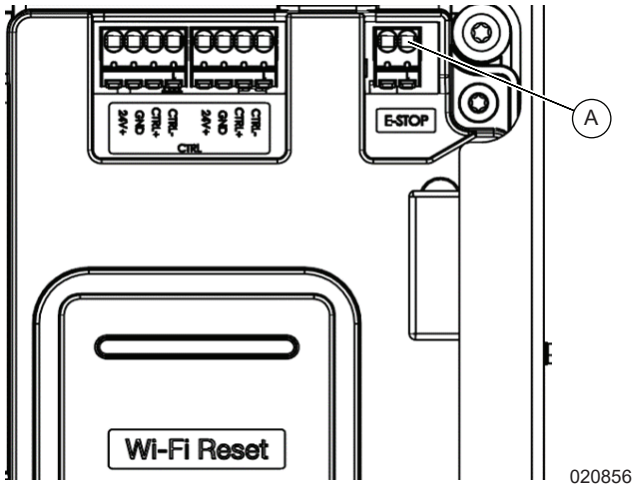

Figure 5-9. Wiring Shutdown Switch at SDS Control Board

4. Terminate the two-conductor at the E-STOP terminals on the SDS control board.

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Section 6: Commissioning

The steps in this section may only be performed by Qualified Persons as defined by the NEC.

NOTE: This section describes the majority of circumstances for which the defaults built into the Generac Field Pro app are typically appropriate for the system being commissioned.

Pre-Commissioning Steps

Proceed as follows to complete the pre-commissioning steps:

1. Download the Field Pro app from the app store.
2. Verify all connections are correctly tightened and perform tug tests.
3. Check isolation resistance of each AC and DC circuit.
4. Verify polarity of DC wiring and phasing of AC wiring is correct.
5. Verify AC voltage before turning on power to SDS.
6. Turn ON the main breaker in SDS (if present); or turn ON the breaker feeding SDS.
7. Turn ON the **ESS 1** breaker in SDS.
8. Turn ON the **BATTERY DISCONNECT** switch on right side of battery cabinet.

Once pre-commissioning steps are completed, sign into the Field Pro app and follow the instructions for commissioning a PWRcell 2 system.

Configure Grid Settings

1. See ***Figure 6-1***. From the **Grid settings** screen, tap **Grid Profile**. The **Recommended** profile(s) for a particular site will display automatically based on the site address. Tap a blue circle for any profile to view information about it. Select a profile, then tap **Done**.

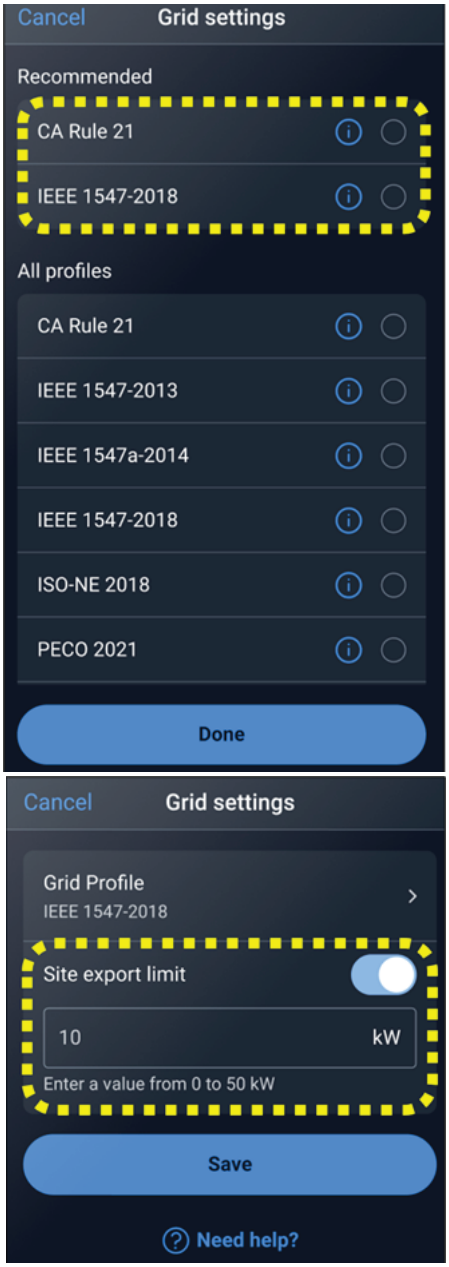

Figure 6-1. Selecting Grid Settings

2. See ***Figure 6-1***. If the local utility requires a limit to be placed on export to the grid for the interconnection agreement, turn on **Site export limit** and enter a value from 0 to 50 kW; then tap **Save**.

Configure PCS

See ***Power Control System (PCS)*** for more information about PCS functionality.

IMPORTANT NOTE: Only qualified personnel shall be permitted to set or change the setting of the maximum operating current of the PCS. The maximum PCS operating current setting shall not exceed the busbar rating or conductor ampacity of any PCS controlled busbar or conductor.

NOTE: The maximum operating currents in the 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 Articles 690 and 705.

3. See ***Figure 6-2***. If SDS is the service entrance equipment, the **SDS busbar overload control** and **SDS feeder overload control** are each set to 160 A and cannot be changed. Tap **Continue**.

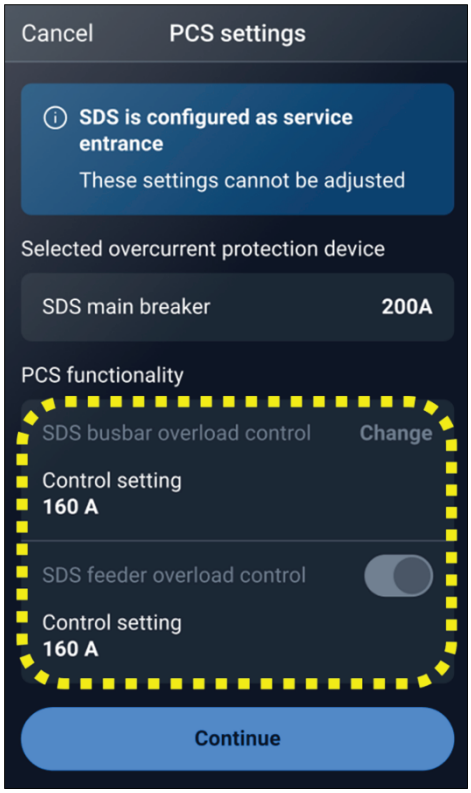

Figure 6-2. PCS Service Entrance

4. See ***Figure 6-3***. If the SDS is not the service entrance equipment and external CTs were installed, the **MSP busbar overload control** is calculated at 80% of the MSP OCPD (minus the value for **Uncontrolled source**) and the **SDS feeder overload control** is calculated at 80% of the SDS feeder OCPD. Tap **Save**.

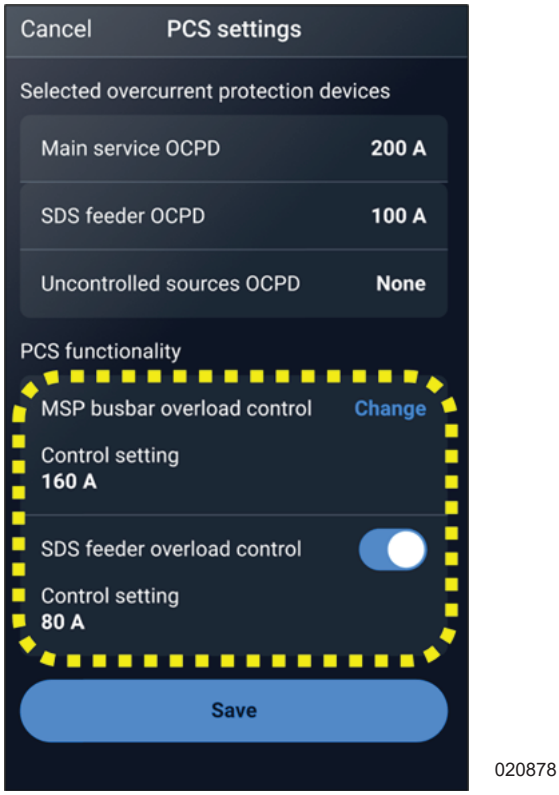

Figure 6-3. PCS Non-service Entrance

NOTE: The MSP busbar overload control can be changed to be more restrictive. Tap **Change** to select **MSP backfeed limit**. If **PCS functionality** is changed to **MSP backfeed limit**, the system will limit export to 32 amps. This will happen by default if no external CTs were installed; or if CTs were installed on the branch circuit conductors; or if more than one pair of CTs was installed.

5. See ***Figure 6-4***. Read the entire **Enable PCS?** message. If qualified, tap **I am qualified: enable PCS**.

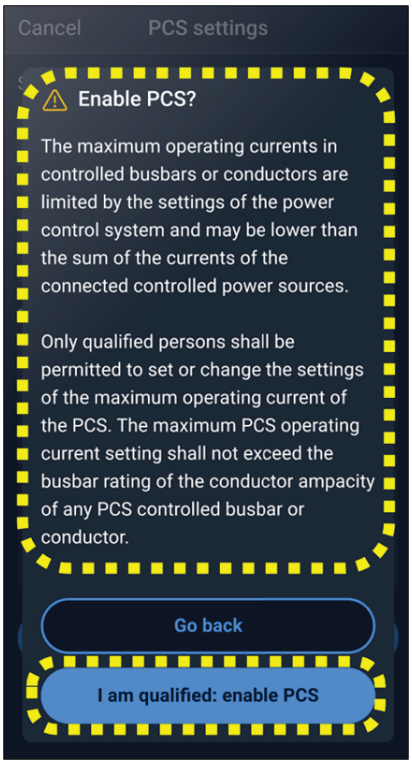

Figure 6-4. Enabling PCS

Configure Storage

6. See ***Figure 6-5***. The **Backup reserve capacity** is set to 20% by default. Use the slider to change this value.

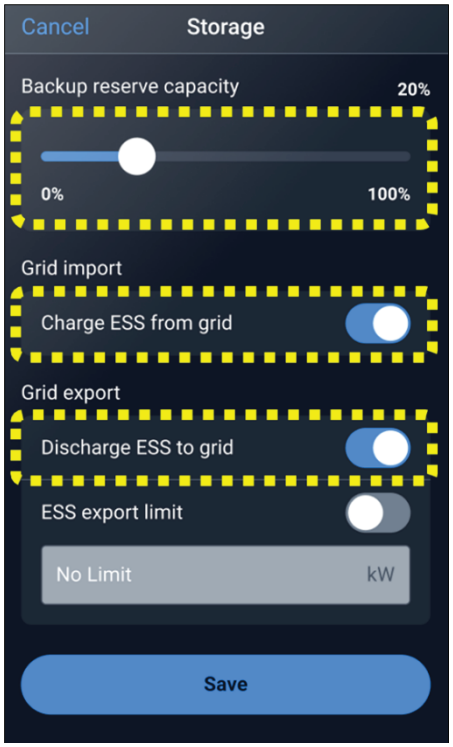

Figure 6-5. Specifying Storage Details

7. See ***Figure 6-5***. The ESS operation mode is based on the storage settings selected in Field Pro. **Charge ESS from grid** and **Discharge ESS to grid** are both on by default. Adjust these based on the interconnection agreement with the utility.

NOTE: If external CTs are not configured, or if **Discharge ESS to grid** is turned off, the **ESS export limit** is not available.

NOTE: Certain utilities may require a limit to be placed on the ESS specifically. If the **ESS export limit** is on, enter a value for the limit, between 1 and 20 kW based on the utility interconnection agreement.

See ***Table 6-1***. The PWRcell 2 ESS operating modes are described in terms of the **Storage** screen settings.

Table 6-1. ESS Operating Modes

Settings in Field Pro		ESS Operating Mode
Charge ESS from grid ON	Discharge ESS to grid ON	Unrestricted
Charge ESS from grid OFF	Discharge ESS to grid ON	Export Only
Charge ESS from grid ON	Discharge ESS to grid OFF	Import Only
Charge ESS from grid OFF	Discharge ESS to grid OFF	No Exchange

NOTE: In Export Only operating mode the system will allow for grid import to prevent damage to a PWRcell 2 Battery; this is referred to as maintenance charging. When maintenance charging, the PWRcell ESS will import up to 10.5 kW from the grid to charge the PWRcell 2 Battery. Maintenance charging only occurs if the state of charge (SOC) for a PWRcell 2 Battery falls below its minimum SOC and charging will cease when the battery is recharged to the minimum state of charge.

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Section 7: System Operation

General Information

The PWRcell 2 SDS is a hub for different sources of power. It uses a PCS to regulate the flow of power the various sources.

See ***Figure 7-1***. The operable mechanical components on SDS are the AC PV circuit breaker (A), the ESS 1 circuit breaker (B), the main circuit breaker (C), the Wi-Fi reset button (E), and the manual override switch for the main utility relay (F).

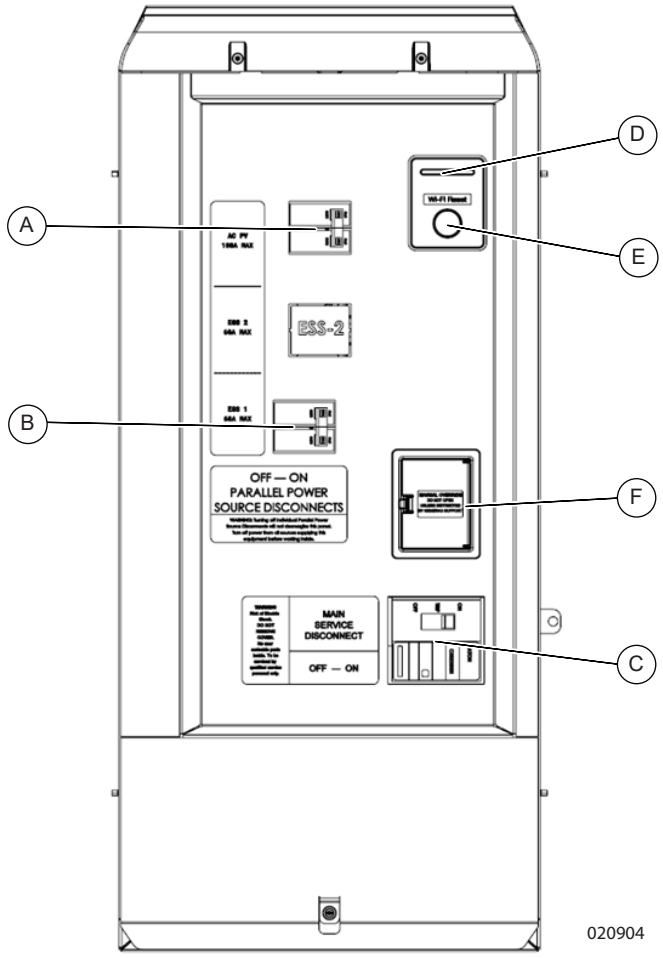

Figure 7-1. SDS Operation

A	AC PV Circuit Breaker
B	ESS 1 Circuit Breaker
C	Main Circuit Breaker
D	Status LED
E	Wi-Fi Reset Button
F	Main Utility Relay

To allow power to move from a given source, the circuit breaker must be in the ON position.

If the Wi-Fi connection needs to be reset after experiencing a lapse in system monitoring due to a lapse in connectivity, press the Wi-Fi reset button.

NOTE: Do not operate the manual override for the main utility relay unless instructed to do so by an IASD or Generac support.

SDS Status LED

LED Color	Interval	SDS Status
Green/Orange/Red	Alternating (1 s)	Initializing or firmware update
Green	Solid	Grid connected, connected to Wi-Fi
Green	Flashing (1 s)	Backup Mode, connected to Wi-Fi
Blue	Flashing (1 s)	Grid connected, no Wi-Fi connection
Blue/Green	Alternating (1 s)	Backup Mode, no Wi-Fi connection
Orange	Solid	ESS in Sleep Mode
Orange	Flashing (1 s)	PV Search Mode activated
Orange/Green	Alternating (1 s)	System performance limited
Red	Solid	System fault
Red	Slow Flashing (2 s)	System shutdown active
Red	Fast Flashing (0.5 s)	ESS overload

Grid Connected

When the PWRcell 2 system is grid connected the SDS main grid relay will be closed. Available power from AC PV will be used to cover house load. As soon as load exceeds PV production the ESS will discharge to cover the load.

Depending on the utility interconnection agreement and the settings set by the installer in Field Pro, the system may allow for the exchange of power with the grid. See the **Smart Disconnect Switch Installation Manual** for more information.

Backup Mode

In the event of a grid service interruption, the PWRcell 2 system will enter Backup Mode. In Backup Mode, the system will support the loads in the backup loads panel connected to SDS. Backup Mode will be indicated by the Inverter and SDS Status LEDs. Upon loss of grid voltage, the PWRcell 2 system will perform the following sequence:

1. SDS Grid Relay will open, disconnecting SDS from utility.
2. During daylight hours, the system will use available PV power to power loads and charge the battery.
3. If the battery is charged and the load is not sufficient, the PV relay in SDS will open and PV power will disconnect.
4. When PV power is insufficient to cover house load, the ESS will discharge.
5. Once the ESS reaches 10% state of charge (SOC), it will go to sleep, requiring the user to activate PV Search Mode from the **PWRview Mobile App** during daylight hours.
6. Alternatively, if equipped with a Generac air-cooled home standby generator, the generator will turn on once the battery discharges to 10%.
7. The system will prioritize using generator power to power the load. Additional generator power will be used to charge the PWRcell 2 Battery.
8. Once the battery reaches 98% SOC, the generator will shut off and the ESS will take over powering the load.

Sleep Mode

The battery requires reserve energy to operate through an extended outage. If the state of charge (SOC) from the battery drops to the reserve threshold of 10% while in Backup Mode, the ESS will enter Sleep Mode to preserve this reserve. The 10% reserve SOC will be used to wake up the system during daylight hours. See ***PV Search Mode*** for more information.

PV Search Mode

PV Search Mode may be enabled to bring the system out of Sleep Mode. In PV Search Mode, the battery will power ON and the ESS will provide power to SDS and the backup loads. This allows the AC PV system to reconnect and start charging the battery.

NOTE: To conserve the battery's limited reserve, reduce house loads as much as possible before turning on PV Search Mode.

Enable PV Search Mode using one of the following methods:

1. Waiting for the morning or for an automatic black start to occur.
2. Perform a reset at the battery cabinet (toggle battery disconnect switch OFF, ON, OFF, ON).
3. Enable PV Search Mode using PWRview.

NOTE: Enabling PV Search Mode while sunlight is not present may cause battery reserve to drain below the Sleep Mode reserve threshold. If battery reserve drops below this point, the system will enter Deep Sleep Mode. Grid or generator power will be required to charge the battery before the system can function.

Once PV Search Mode is enabled, the following sequence occurs:

1. The system wakes up and begins searching for PV power. The system will continually search until PV power is found, or until the Sleep Mode reserve threshold is depleted. If this happens, the battery will enter Deep Sleep Mode, requiring the grid or generator power (if equipped) to recharge.
2. If PV is found, the system will enter backup mode and begin charging the battery (reduce load while charging).

ESS Overload

If the home loads exceed the capability of the PWRcell 2 ESS, the ESS will go into a faulted state and cease moving power. An overload fault will be indicated on **PWRview**, and the system will be disabled. To return functionality, follow instructions on **PWRview** to reduce home loads and restart the system.

Shutting Down

See ***Figure 7-2***. To shut down the system, turn off the battery disconnect switch (A); then turn off the circuit breakers for AC PV and ESS in SDS (B).

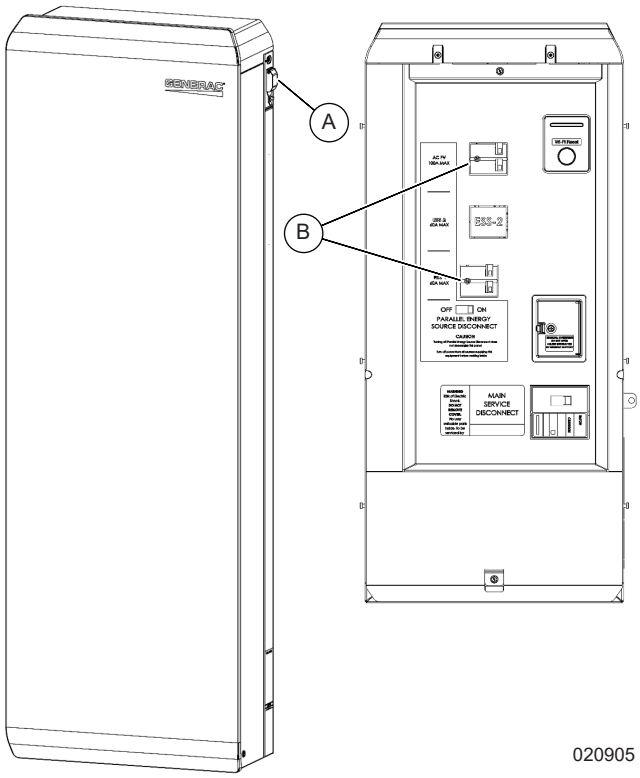

Figure 7-2. Shutting Down the System

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Section 8: Maintenance

Service

DANGER

Electrocution. Verify all system voltages are safe before wiring. Disconnect all AC and DC sources of power before touching conductors or terminals. Failure to do so will result in death or serious injury.

(D000642)

DANGER

Electrocution. Front cover should be removed by a qualified technician only. Removing the front cover could result in death, serious injury, equipment or property damage.

(D000604)

WARNING

Equipment damage. Connecting inverter to electric utility grid must only be done after receiving prior approval from utility company. Failure to do so could result in equipment or property damage.

(W000640)

WARNING

Risk of injury. Do not operate or service this machine if not fully alert. Fatigue can impair the ability to service this equipment and could result in death or serious injury.

(W000215)

IMPORTANT NOTE: Removing the dead front from SDS after removing the front cover will expose hazardous voltage. Only qualified personnel should remove the dead front on SDS.

For any servicing needs, contact the nearest IASD; contact Generac PWRcell Technical Support at 1-855-635-5186; or call Generac Customer Service at 1-888-438-3722 (1-888-GENERAC); or visit ***www. generac. com.***

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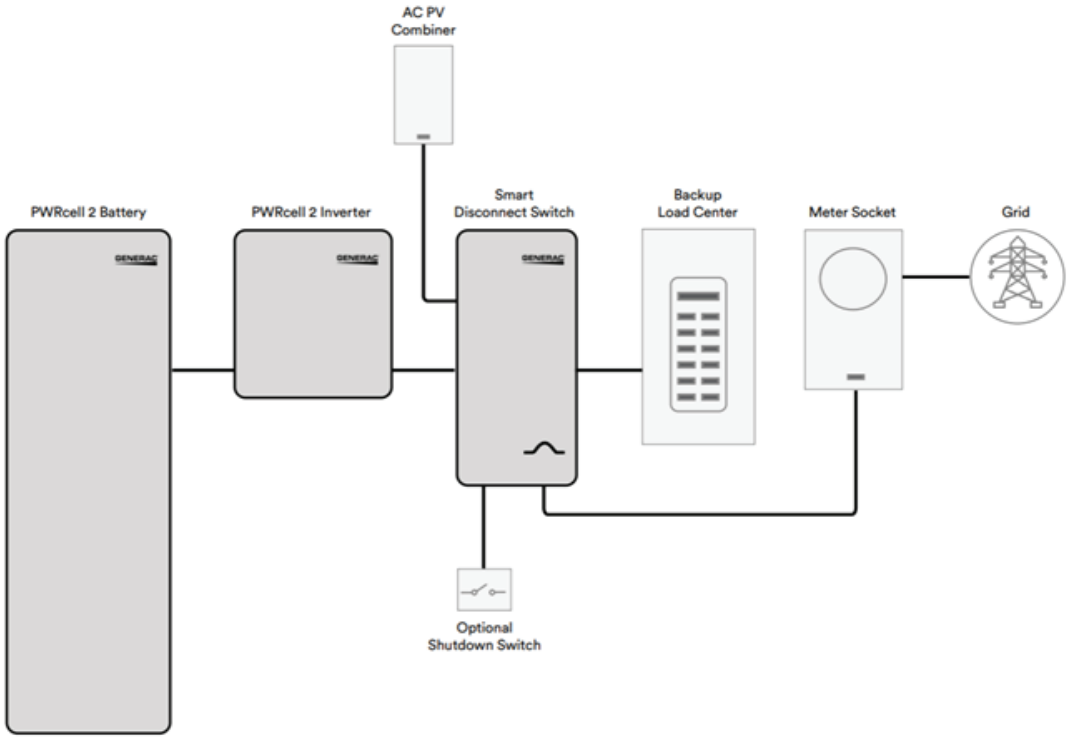
Section 9: Single Line Diagrams

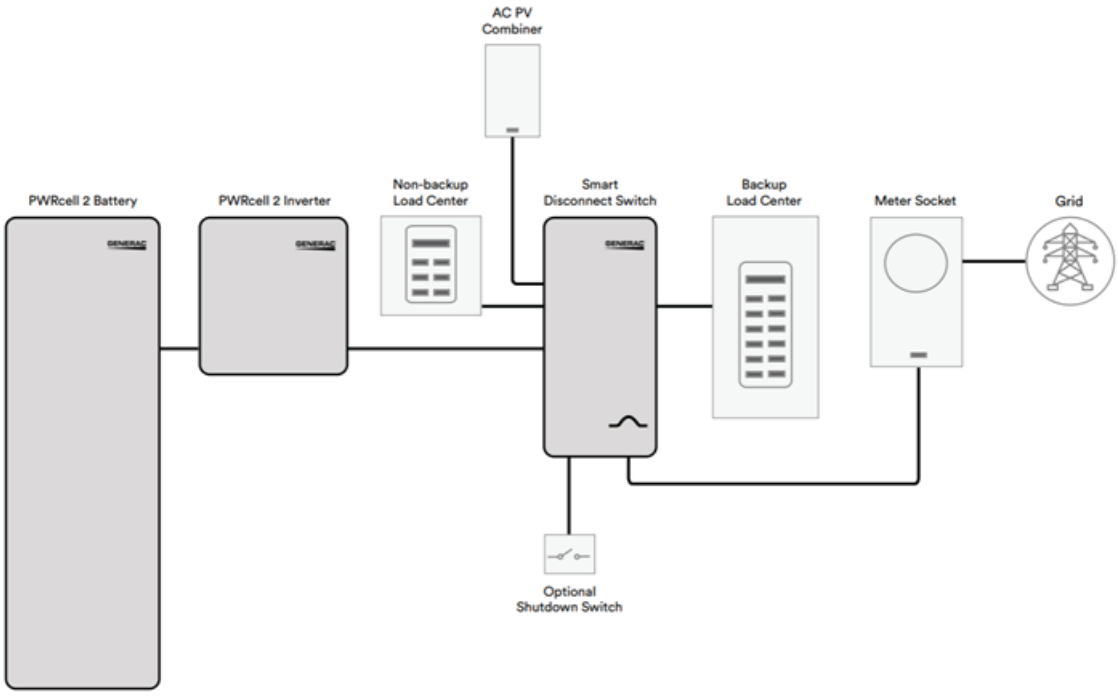
Single line diagrams are for reference only. They are not for construction. Configurations do not account for all possible circumstances.

Whole Home Backup



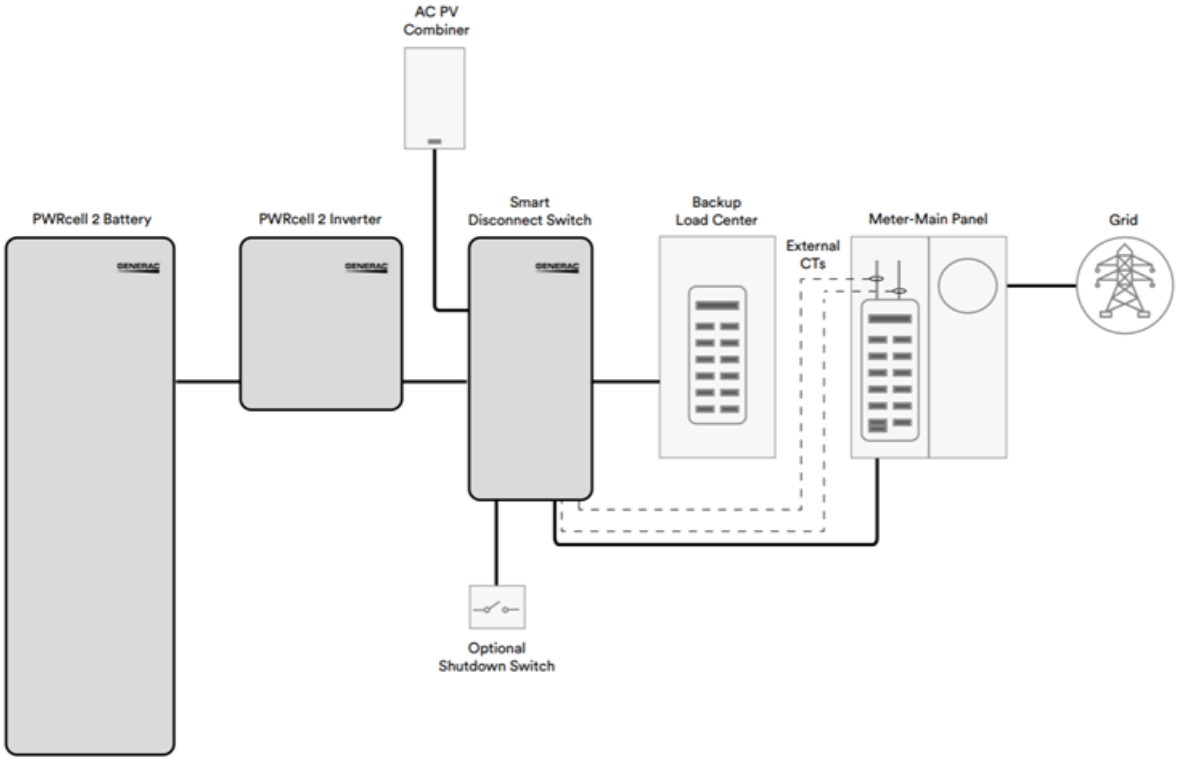
020899

Partial Home Backup w/Non-Backup Load Center

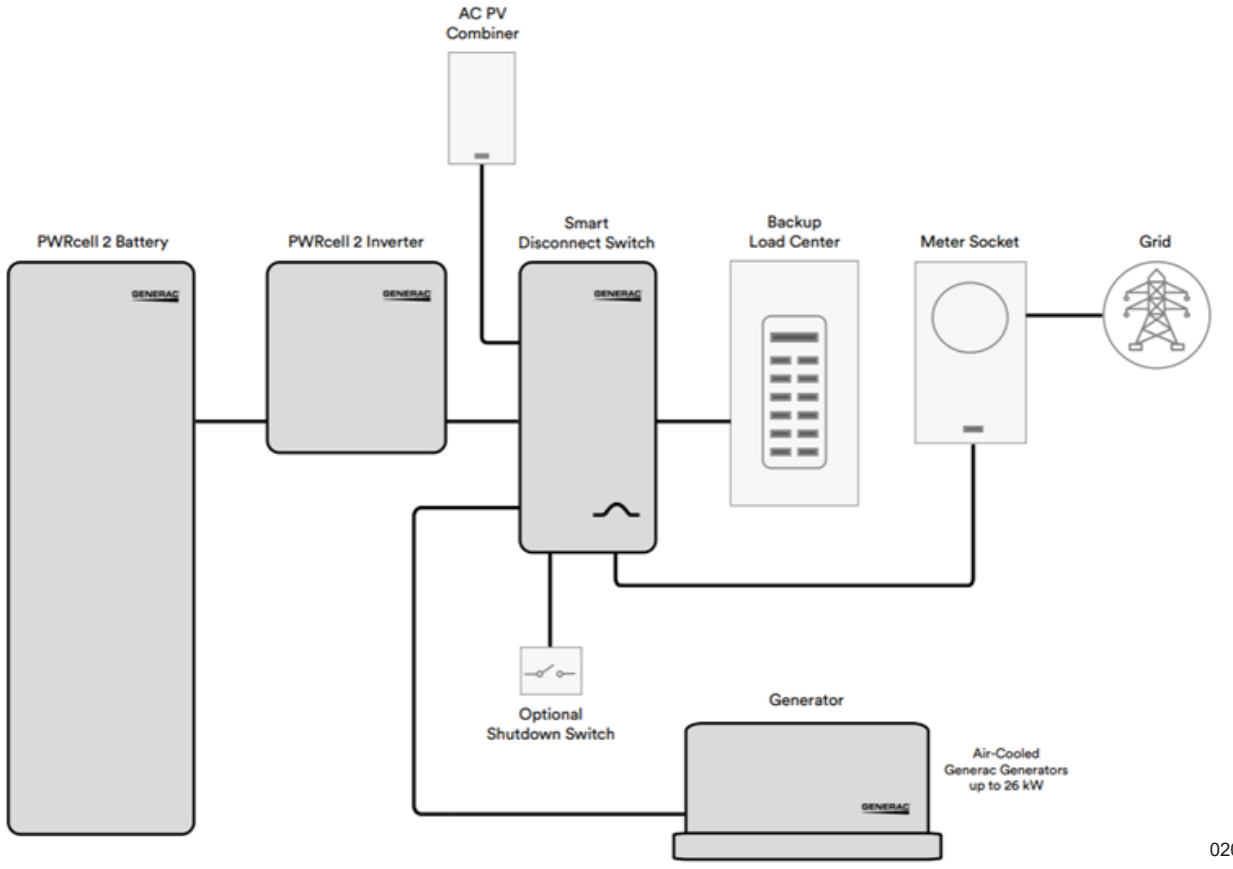


020901

Partial Home Backup w/Meter-Main Combination Equipment



Generator Integration



Section 10: Power Control System (PCS)

The PWRcell 2 system is certified to UL 3141 and listed to UL 1741 PCS CRD for several PCS functions. These PCS functions are used to satisfy the NEC and/or utility requirements which would otherwise not allow the operation of interconnected power sources based on their nameplate ratings.

PCS functions are set during PWRcell 2 system commissioning. Commissioning must be performed by a qualified person and requires the use of a password. If a system requires recommissioning, contact Generac PWRcell technical support to reset the system.

This appendix provides specifications, line diagrams, and descriptions for the following PCS functions: Power Export Limit (PEL), Busbar Overload Control (BBOC), and Feeder Conductor Overload Control (FCOC).

PCS Specifications

PCS Type	Multisource PCS

PCS Function	**Abbreviation**	**Field Pro Setting Name(s)**	**Maximum Setting Value**
Power Export Limit	PEL	Site Export Limit	128 A (30.72 kW)[1]
NEM Integrity Mode	N/A	Site Export Limit[2]	128 A (30.72 kW[1])
Busbar Overload Control	SDS BBOC	SDS Busbar Overload Control	160 A
Busbar Overload Control	MSP BBOC	MSP Busbar Overload Control	160 A
Feeder Conductor Overload Control	FCOC	SDS Feeder Overload Control	200 A
MSP Backfeed Limit	N/A	MSP Backfeed Limit	32 A

[1] At 240 Volts
[2] See ***NEM Integrity Mode*** for implementation details and requirements.

Site Export Limit

Site export limit is used when the local utility requires the total power exported by a PWRcell 2 system to be limited. This function restricts the power exported from SDS controlled power sources (e.g. PWRcell ESS, AC PV) to prevent exceeding the export limit.

Site export limit is enforced using different devices depending on the system configuration.

See ***PCS Line Diagram SDS as Service Entrance Equipment***. When SDS is configured as the service entrance equipment, factory installed CTs in SDS are used to monitor the service conductors.

See ***PCS Line Diagram SDS as Non-Service Entrance Equipment***. When SDS is not configured as service entrance equipment, external CTs must be installed to use this PCS function.

If external CTs cannot be placed on service conductors or related bussing, see ***Section 5 Wiring: External CTs*** and the external CTs instruction sheet for an alternative installation method.

NOTE: Using the alternative installation method for CTs will result in reduced system export.

NOTE: Avoid oversizing the PV array if required to impose a site export limit.

NEM Integrity Mode

NEM Integrity mode is used when a PWRcell 2 system is installed on a site with a legacy NEM system. This function limits the aggregated net export of these systems to not exceed the export limit allowed for the legacy NEM system. This is achieved by controlling the active power export of PWRcell 2 controlled power sources (e.g. PWRcell ESS and AC PV).

A NEM integrity mode export limit is set during commissioning using the site export limit setting. The value of the site export limit must be set to the export limit allowed for the legacy NEM system. When configured to manufacturer's instructions with the site export limit setting, a PWRcell 2 system added to a site with an existing legacy NEM system will comply with UL 3141 NEM integrity mode.

NEM integrity mode is enforced using the devices identified in ***Site Export Limit*** depending on the system configuration. The configuration shown in the ***PCS Line Diagram SDS as Non-Service Entrance Equipment*** in this appendix will most commonly be used and requires use of external CTs.

SDS Busbar Overload Control

SDS Busbar Overload Control is used whenever a PWRcell 2 system is installed. This PCS function limits the current exported by SDS controlled power sources (e.g. PWRcell ESS and AC PV) to prevent overloading the SDS busbar. If necessary, the function will also

disconnect SDS from its feeder conductors to prevent an overload from imported utility grid power.

Factory installed CTs in SDS are used to measure the grid import at the utility connection terminals and to measure the export of SDS connected power sources.

Main Service Panel Busbar Overload Control

Main Service Panel Busbar Overload Control (MSP Busbar Overload Control) is used when SDS is configured as non-service entrance equipment. This function limits backfeed current from SDS controlled power sources (e. g., PWRcell ESS, AC PV) to prevent overloading the service panel busbar.

See **PCS Line Diagram SDS as Non-Service Entrance Equipment** in this appendix. External CTs must be installed to use this PCS function.

If external CTs cannot be placed on service conductors or related bussing, see ***Section 5 Wiring: External CTs*** and the External CTs instruction sheet for an alternative placement method.

NOTE: Using the alternative installation method for CTs will result in reduced system export.

If external CTs cannot be installed, the main service panel backfeed limit must be used. See ***Main Service Panel Backfeed Limit*** for more information.

All power sources interconnected at the main service panel below the main service breaker are defined as uncontrolled power sources. See ***Figure 10-1***. The cumulative rating of OCPDs for uncontrolled power source must be specified during PWRcell 2 system commissioning.

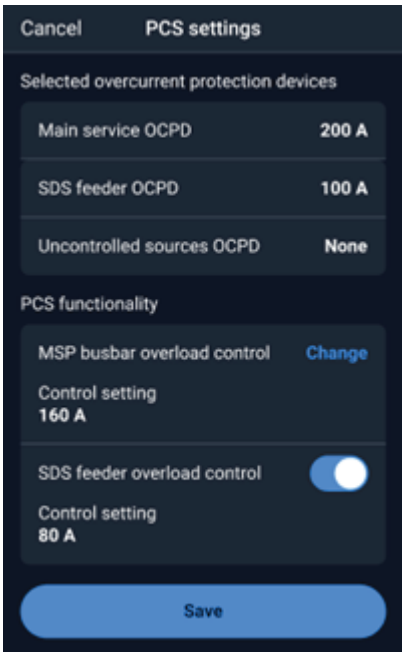


Figure 10-1. Uncontrolled Sources in Field Pro

SDS Feeder Overload Control

SDS Feeder Overload Control is used when SDS is configured as non-service entrance equipment. When active, this PCS function limits the current on the SDS feeder conductors from SDS controlled power sources (e. g. PWRcell ESS, AC PV) to prevent overloading the service panel busbar.

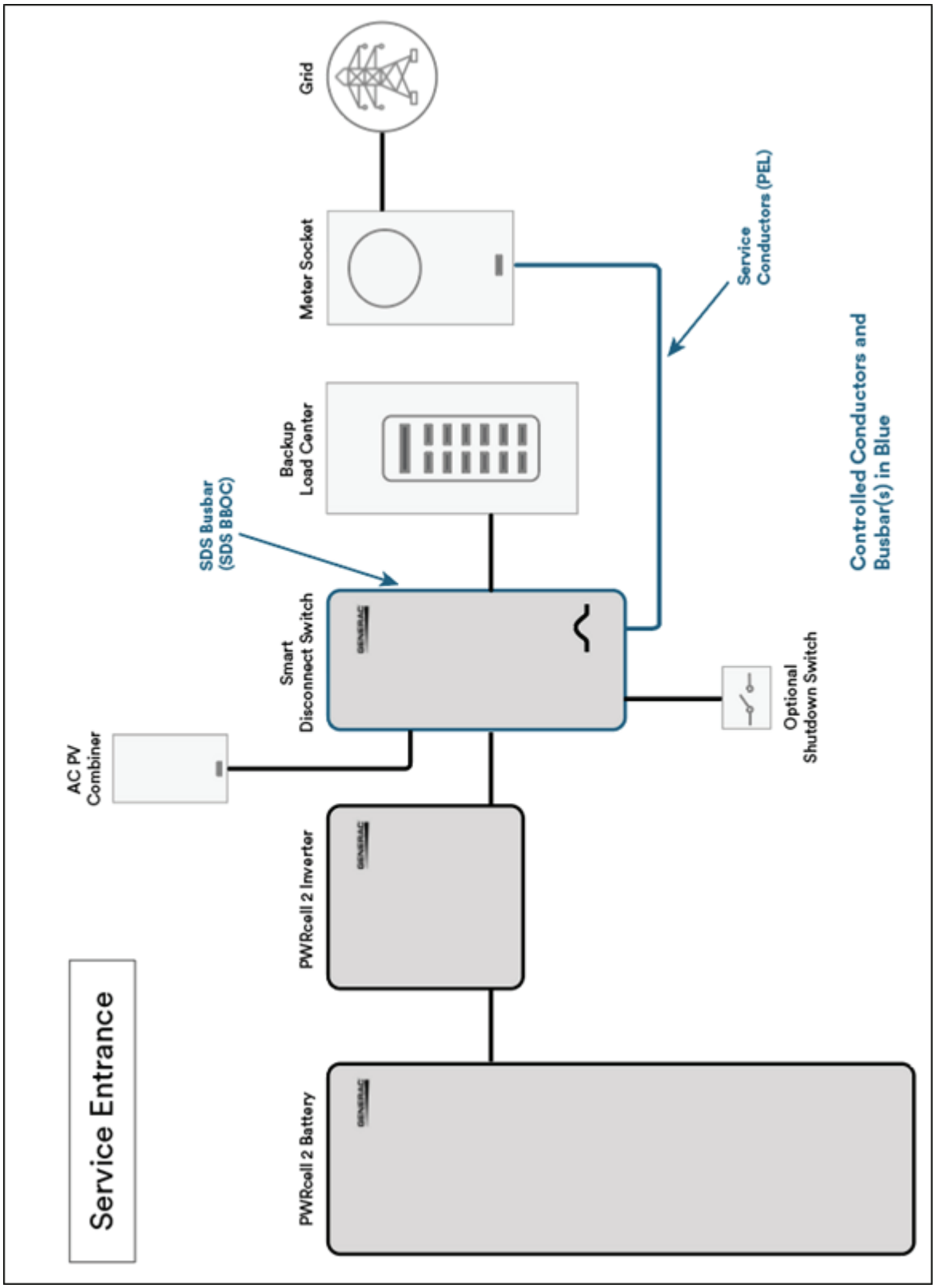
See **PCS Line Diagram SDS as Non-Service Entrance Equipment**. This function uses factory installed CTs in SDS to measure net current flow on the SDS feeder conductors.

Main Service Panel Backfeed Limit

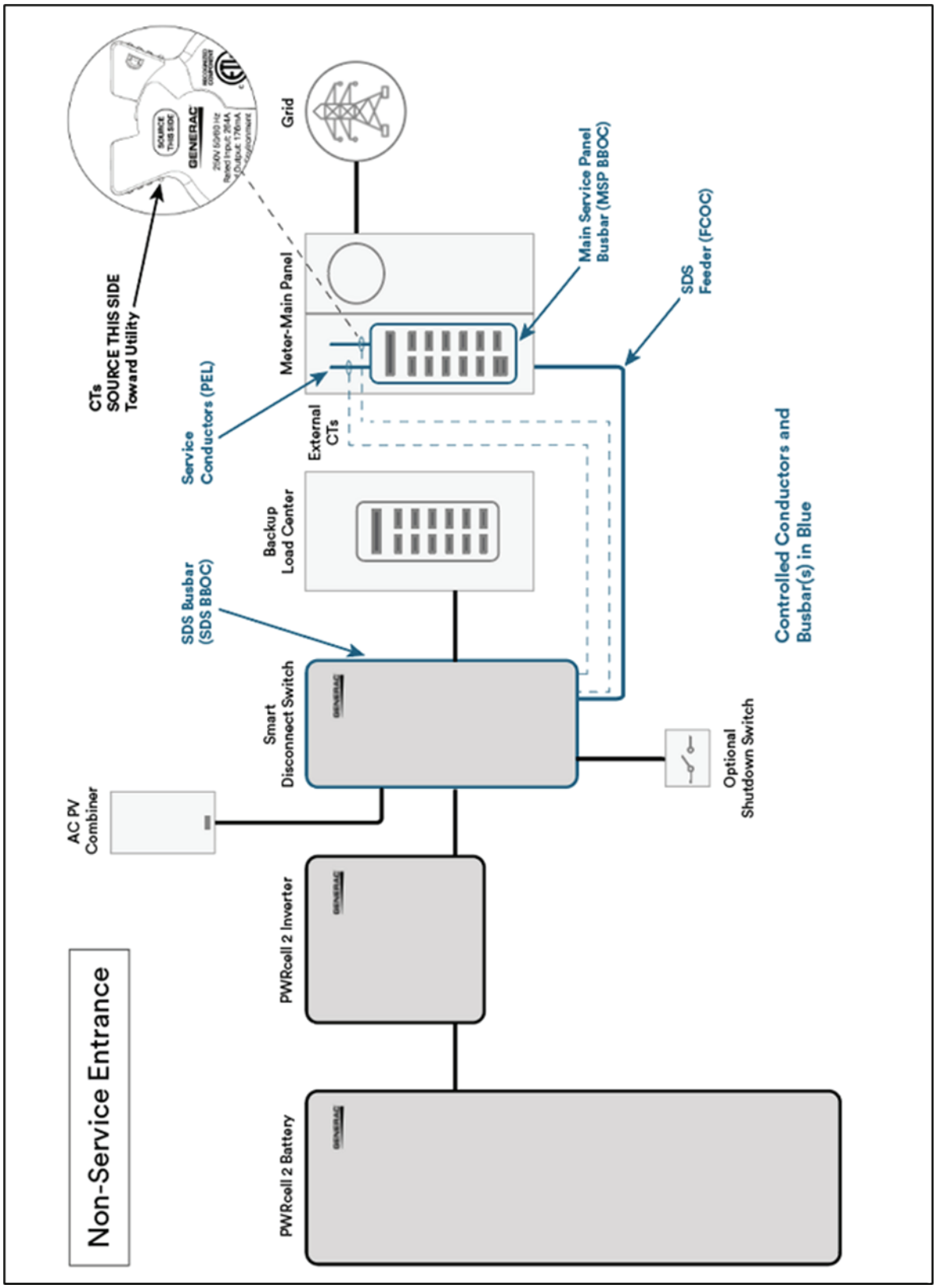
Main Service Panel Backfeed Limit (MSP Backfeed Limit) is used when SDS is not installed in the service entrance configuration and external CTs cannot be installed. MSP backfeed limit controls the exported current from SDS controlled power sources (e.g. PWRcell ESS and AC PV) to a main service panel. Factory installed CTs in SDS are used to measure current exported to the SDS feeder. As a result, MSP backfeed limit reduces the export current allowed by SDS Feeder Overload Control.

PCS Line Diagrams

PCS Line Diagram SDS as Service Entrance Equipment



PCS Line Diagram SDS as Non-Service Entrance Equipment



Section 11: Measurement and Calculation Accuracy

Table 11-1. Measurement and Calculation Accuracy

	Steady-State Measurements			Transient Measurements		
Parameter	**Measurement Accuracy**	**Measurement Window**	**Range**	**Measurement Accuracy**	**Measurement Window**	**Range**
Voltage, RMS	± 1.2 V (1%)	10 cycles	60 V - 144 V	± 2.4 V (2%)	5 cycles	60 V - 144 V
Frequency[b]	10 mHz	60 cycles	50 Hz - 66 Hz	100 mHz	5 cycles	50 Hz - 66 Hz
Active Power	± 575 W (5%)	10 cycles	2,300 W - 11,500 W	Not required	N/A	N/A
Reactive Power	± 575 var	10 cycles	2,300 var - 11,500 var	Not required	N/A	N/A
Time	1%[c]	N/A	5 s to 600 s	2 cycles	N/A	100 ms < 5 s

[a] For voltage THD <2.5% and individual voltage harmonics <1.5%.
[b] For when the fundamental voltage is greater than 30% of the nominal voltage.
[c] Percentage of measured duration.

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Section 12: Voltage and Frequency Trip Thresholds

The PWRcell 2 SDS is certified to UL 1741 when installed with the PWRcell 2 Inverter. This certification includes compliance with SA11.2 (normal ramp rate) and UL 1741 Supplement SB for normal operating performance category B and abnormal operating category III. UL 1741-SB certification demonstrates compliance with IEEE 1547-2018. A full list of the default parameter values is found in ***Voltage and Frequency Trip Thresholds***.

If local electric utility requirements for smart inverters/ DERs specify non-default inverter settings (per the locally adopted grid-standard), follow the steps in the ***Commissioning section*** of this manual to setup with the required grid settings by either selecting a grid profile or entering in custom settings when a profile with the required settings is not available.

NOTE: Use of grid profiles in compliance with local electric utility smart inverter requirements may exceed the tested range(s) and/or have default activation states for grid support functions conflicting with UL 1741-SB.

Voltage Trip

See ***Table 12-1*** for UL 1741-SB default voltage trip settings. Voltage Trip results in the PWRcell 2 SDS grid input relay (microgrid interconnect device) opening its connection from the grid for anti-islanding protection. Voltage trip activates an enter service delay time (300 seconds default) for reconnection to the grid so long as the electrical service remains within the enter service voltage and frequency ranges.

Frequency Trip

See ***Table 12-1*** for UL 1741-SB default frequency trip settings. All over frequency and under frequency trip conditions result in the PWRcell 2 SDS grid input relay (microgrid interconnect device) opening its connection from the grid for anti-islanding protection. Frequency trip activates an enter service delay time (300 seconds default) for reconnection to the grid so long as the electrical service voltage remains within the enter service voltage and frequency ranges.

Table 12-1. Voltage Trip and Frequency Trip Default Settings (UL 1741-SB)

Voltage Trip			Frequency Trip		
Trip Function / Threshold	Voltage (% of nominal)	Clearing Time (s)	Trip Function / Threshold	Frequency (Hz)	Clearing Time (s)
OV2	120	0.16	OF2	62	0.16
OV1	110	13	OF1	61.2	300
UV1	88	21	UF1	58.5	300
UV2	50	2	UF2	56.5	0.16

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Section 13: Grid Support Functions and Range

The table below contains information about the default values and range of adjustment for the parameters of UL 1741 Supplement B Functions and UL 1741 SA11.2 evaluated on the PWRcell 2 Inverter. Advanced Grid Support Functions are listed with Parameter Labels in the order specified in IEEE 1547.1-2020 Annex B per IEEE 1547-2018. The default values below are implemented in the 'IEEE 1547-2018' PWRcell Grid Profile. Grid Support Function default activation states are per IEEE 1547-2018 and not specified.

Table 13-1. Advanced Grid Support Functions: Parameter Values and Range of Adjustability

Grid Support Function / Funct. Abbr.	Parameter Label	Parameter Default /Inverter Setting	Parameter Range	Units	Comments
Enter Service (ES)	ES_Ramp_Rate	0.33	0.1-100	%/s	Enter Service Soft Start Ramp Rate.
DERCtlac[3]	WRMP3	100	1-100	%/s	Normal Ramp Rate; Percent power increase per second.
Volt-VAr / Q(V)					
	QV_REF	1.00	0.95 ─ 1.05	V p.u.	Per Unit voltage based on Nameplate Nominal Voltage.
	QV_VREF_OLRT	300	300.0 ─ 5000.0	s	Use of the Vref Adjustment time constant parameter to be specified by Local Area EPS Operator.
	QV_CURVE_V2	0.98	0.97 ─ 1.00	V p.u.	Per Unit voltage based on Reference Voltage (Vref).
	QV_CURVE_Q2	0[1]	-1.00 ─ 1.00[2]	VAr p.u.	Per-unit reactive power. Negative value indicates absorption.
	QV_CURVE_V3	1.02	1.00 ─ 1.03	V p.u.	Per Unit voltage based on Reference Voltage (Vref).
	QV_CURVE_Q3	0[1]	-1.00 ─ 1.00$_2$	VAr p.u.	Per-unit reactive power. Negative value indicates absorption.
	QV_CURVE_V1	0.92	0.82 ─ 0.98	V p.u.	Per Unit voltage based on Reference Voltage (Vref).
	QV_CURVE_Q1	0.44[1]	0 ─ 1.00[2]	VAr p.u.	Per-unit reactive power. Negative value indicates absorption.
	QV_CURVE_V4	1.08	1.02 ─ 1.18	V p.u.	Per Unit voltage based on Reference Voltage (Vref)

Grid Support Function / Funct. Abbr.	Parameter Label	Parameter Default /Inverter Setting	Parameter Range	Units	Comments
	QV_CURVE_Q4	-0.44[1]	-1.00 — 0[2]	VAr p.u.	Per-unit reactive power. Negative value indicates absorption
	QV_OLRT	5.0	1.0 — 90.0	s	Open Loop Response Time; Time in seconds
Watt-VAr / Q(P)					
	QP_CURVE_P3_GEN	1.0	0.6 — 1.0	W p.u.	Per-unit rated active power output.
	QP_CURVE_P2_GEN	0.5	0.4 — 0.8	W p.u.	Per-unit rated active power output.
	QP_CURVE_P1_GEN	0.2	0 — 0.4	W p.u.	Per-unit rated active power output.
	QP_CURVE_P1_LOAD	–0.2	-0.4 — 0	W p.u.	Per-unit rated active power absorption.
	QP_CURVE_P2_LOAD	–0.5	-0.8 — -0.4	W p.u.	Per-unit rated active power absorption.
	QP_CURVE_P3_LOAD	-1.0	-1.0 — -0.4	W p.u.	Per-unit rated active power absorption.
	QP_CURVE_Q3_GEN	0.44[1]	-1.00 — 1.00[2]	VAr p.u.	Per-unit reactive power. Negative value indicates absorption.
	QP_CURVE_Q2_GEN	0[1]	-1.00 — 1.00[2]	VAr p.u.	Per-unit reactive power. Negative value indicates absorption.
	QP_CURVE_Q1_GEN	0[1]	-1.00 — 1.00[2]	VAr p.u.	Per-unit reactive power. Negative value indicates absorption.
	QP_CURVE_Q1_LOAD	0[1]	-1.00 — 1.00[2]	VAr p.u.	Per-unit reactive power. Negative value indicates absorption.
	QP_CURVE_Q2_LOAD	0[1]	-1.00 — 1.00[2]	VAr p.u.	Per-unit reactive power. Negative value indicates absorption.
	QP_CURVE_Q3_LOAD	0.44[1]	-1.00 — 1.00[2]	VAr p.u.	Per-unit reactive power. Negative value indicates absorption.
	QP_OLRT	N/A	max. 10	s	Open Loop Response Time in seconds.

Grid Support Function / Funct. Abbr.	Parameter Label	Parameter Default /Inverter Setting	Parameter Range	Units	Comments
Volt-Watt / P(V)					
	PV_CURVE_V1	1.06	1.05 — 1.09	V p.u.	Per-unit nominal voltage.
	PV_CURVE_P1	1.00	N/A	W p.u.	Per-unit rated active power output.
	PV_CURVE_V2	1.10	1.06 — 1.10	V p.u.	Per-unit nominal voltage.
	PV_CURVE_P2_GEN	N/A	N/A	W p.u.	Applicable only if inverter can only generate active power and not absorb power.
	PV_CURVE_P2_LOAD	0	0 — 1.0	W p.u.	Per-unit rated active power absorption.
	PV_OLRT	10.0	0.5 — 60.0	s	Open Loop Response Time in seconds.
Overvoltage Trip / OV					
	OV2_TRIP_V	1.20	1.2	V p.u.	Per Unit voltage based on Nameplate Nominal Voltage.
	OV2_TRIP_T	0.16	0.16	s	Clearing time in seconds.
	OV1_TRIP_V	1.10	1.10 — 1.20	V p.u.	Per Unit voltage based on Nameplate Nominal Voltage.
	OV1_TRIP_T	13.0	1.0 — 13.0	s	Clearing time in seconds.
Undervoltage Trip / UV					
	UV1_TRIP_V	0.88	0 — 0.88	V p.u.	Per Unit voltage based on Nameplate Nominal Voltage.
	UV1_TRIP_T	21.0	21.0 — 50.0	s	Clearing time in seconds.
	UV2_TRIP_V	0.5	0 — 0.50	V p.u.	Per Unit voltage based on Nameplate Nominal Voltage.
	UV2_TRIP_T	2.0	2.0 — 21.0	s	Clearing time in seconds.
Overfrequency / OF					
	OF2_TRIP_F	62.0	61.8 — 66.0	Hz	
	OF2_TRIP_T	0.16	0.16 — 1000.0	s	Clearing time in seconds.

Grid Support Function / Funct. Abbr.	Parameter Label	Parameter Default /Inverter Setting	Parameter Range	Units	Comments
	OF1_TRIP_F	61.2	61.0 ─ 66.0	Hz	
	OF1_TRIP_T	300.0	180.0 ─ 1000.0	s	Clearing time in seconds.
Underfrequency / UF					
	UF1_TRIP_F	58.5	50.0 ─ 59.0	Hz	
	UF1_TRIP_T	300	180.0 ─ 1000.0	s	Clearing time in seconds.
	UF2_TRIP_F	56.5	50.0 ─ 57.0	Hz	
	UF2_TRIP_T	0.16	0.16 ─ 1000.0	s	Clearing time in seconds.
Frequency-Droop / P (f)					
	PF_DBOF	0.036	0.017 ─ 1.0	Hz	Single-sided deadband value
	PF_DBUF	0.036	0.017 ─ 1.0	Hz	Single-sided deadband value
	PF_KOF	0.05	0.02 ─ 0.07	N/A	Per-unit frequency change corresponding to 1 per-unit power output change
	PF_KUF	0.05	0.02 ─ 0.07	N/A	Per-unit frequency change corresponding to 1 per-unit power output change
	PF_OLRT	5	0.2 ─ 10.0	s	Open Loop Response Time in seconds

[1] Setting based on apparent power rating of 11500 VA.
[2] Setting based on 100% reactive power capability of 11500 VAr.
[3] Function/Parameter not specified in IEEE 1547.1-2020.

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