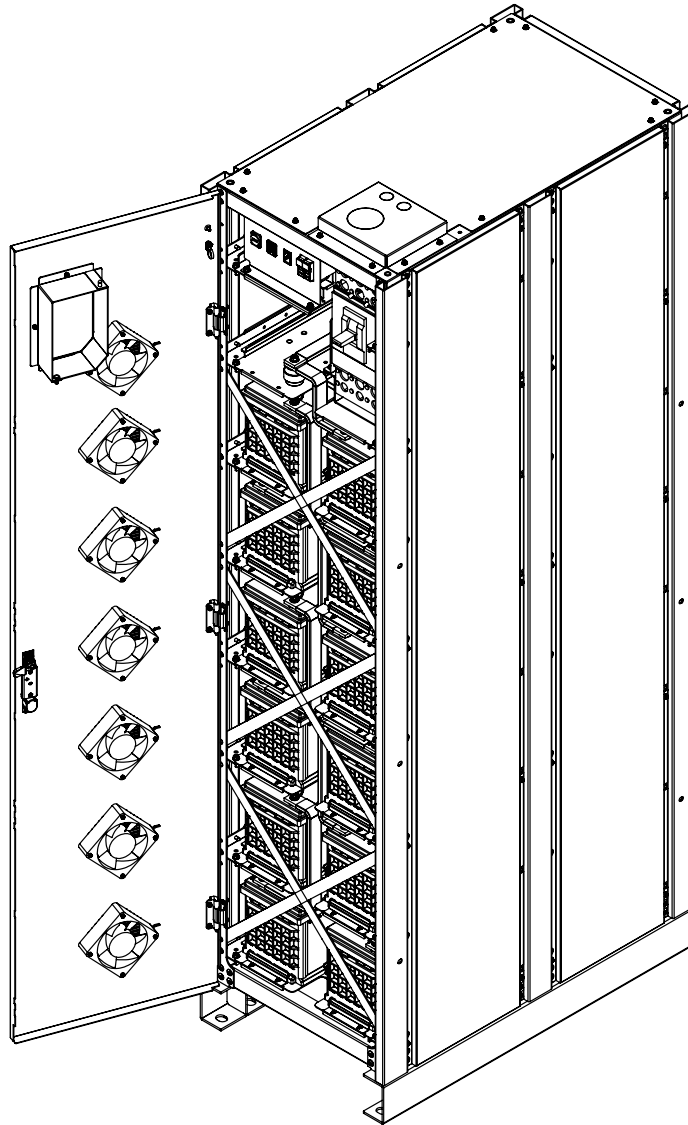


BC 2 Series UPS Battery Cabinets

BC 2, BC 2 - 300X, and BC 2 - 500



*BC 2, BC 2 - 300X, BC 2 - 500
UPS Battery Cabinet*

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Introduction

This manual contains information intended to help owners and operators understand how to safely and properly prepare, install, and operate ZincFive batteries. To ensure successful installation, operation, and maintenance of the batteries. The instructions in this manual must be followed in accordance with the Limited Warranty. Refer to ZincFive's *BC Series UPS Battery Cabinet Service Manual* for information related to servicing and maintenance of the battery cabinet. Contact a ZincFive support representative, using the information listed below, if you have any questions.

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Support

For technical support, or questions about the safe installation, operation, or maintenance of ZincFive batteries, please contact a ZincFive support representative:

Phone: 888.517.7776
Email: support@zincfive.com
Website: zincfive.com/support

Returns

For product returns, please contact a ZincFive support representative to obtain a return material authorization (RMA).

ZincFive, Inc.
20170 SW 112th Ave.
Tualatin, Oregon 97062

Email: support@zincfive.com
Phone: 888.517.7776

Customer is responsible for properly packaging the product(s) for return. ZincFive does not warranty product damage from return shipping unless it is shipped in approved packaging and according to the approved packaging and shipping guidelines.

 **IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS** 

THIS MANUAL CONTAINS IMPORTANT INSTRUCTIONS AND WARNINGS FOR ZINC FIVE'S BC SERIES UPS BATTERY CABINET THAT SHOULD BE FOLLOWED DURING INSTALLATION, OPERATION, STORAGE AND MAINTENANCE OF THE BATTERY SYSTEM. FAILURE TO HEED THESE INSTRUCTIONS AND WARNINGS WILL VOID YOUR WARRANTY.

Safety

Safety Symbols

ZincFive BC Series UPS Battery Cabinets are carefully designed and manufactured to ensure that they are safe and reliable products when used properly. To ensure the safe and proper use of the ZincFive BC Series UPS Battery Cabinet, the following symbols are used throughout this manual or on the equipment. Operators, buyers, and technicians must observe each occurrence of these symbols as they appear throughout the document. Only qualified personnel should carry out the instructions accompanied by these symbols.



DANGER Symbol

DANGER:

An electrical danger exists in this area. Use extreme caution at all times.

Symbole de danger

DANGER:

Un danger électrique existe dans ce domaine. Faites preuve d'une extrême prudence en tout temps.



CAUTION Symbol

CAUTION:

Important information or operating instructions. Follow them exactly.

Symbole d'attention

ATTENTION:

Informations importantes ou instructions d'exploitation. Suivez-les exactement.



Protective Earth/Ground Symbol

GROUND SYMBOL:

Used to designate a connection point to ground.

*Symbole de terre de protection/
symbole de terre*

Désigne un point de connexion à la terre.



Read the Instructions Symbol

READ THE INSTRUCTIONS:

Read and understand the manual and all safety instructions carefully before using this equipment.










WEEE Disposal Symbol

**ELECTRONIC DEVICE:
DO NOT THROW AWAY**

Proper disposal of batteries is required. Refer to your local codes for disposal requirements.


Battery Safety

-  The battery must be installed by qualified personnel in accordance with the latest edition of the National Electrical Code ANSI/NFPA 70 and/or Canadian Electrical Code, Part I, CSA C22.1.
-  To prevent accidental shorts, shocks or electrocutions, never let water or any form of liquid touch, surround or enter the batteries.
-  Do not operate the batteries with damaged cables and wires. Defective cables and wires must be replaced before system installation. Prior to system installation, verify that all cables and wires are properly secured and connected. Faulty connections can interrupt operation and cause irreparable damage to this product.
-  Opening or attempting to dismantle the battery case will void the warranty and create a risk of electrical short circuit, burns, or other physical harm.
-  Do not dispose of batteries in a fire as the batteries may explode.
-  Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes and it may be toxic.
-  A battery can present a risk of electrical shock and high short-circuit current. Contact with any part of a grounded battery can result in electrical shock. The following precautions should be observed when working on batteries:
 1. Remove watches, rings, or other metal objects.
 2. Use tools with insulated handles.
 3. Wear rubber gloves and boots.
 4. Do not lay tools or metal parts on top of batteries.
 5. Disconnect the charging source and load prior to installing or maintaining the battery.
 6. Remove battery grounds during installation and maintenance to reduce the likelihood of shock.
 7. Remove the connection from ground if any part of the battery is determined to be grounded.

Notes:

1. The batteries used in the BC Series UPS Battery Cabinets, Z5 13-80 H S F and Z5 13-90 U S F, were tested by UL Solutions at the cell level, in accordance with UL 9540A on 11/21/2019 and 02/14/24, and did not exhibit thermal runaway. See UL File E518051 for further reference.
2. If an emergency situation exists, please contact 911 or the local fire department for assistance. ONLY if is safe to do so, isolate the battery cabinet from the system by opening the battery breaker OR wait until emergency personnel have arrived and determined the area to be safe. Contact ZincFive for any other questions or concerns.

Battery Warnings and Cautions

-  SHIELD EYES WITH PROTECTIVE GEAR AT ALL TIMES.
NO SPARKS, FLAMES, OR SMOKING.
ALKALINE ELECTROLYTES.
FLUSH EYES IMMEDIATELY WITH WATER.
WET NON-SPILLABLE.
DO NOT INCINERATE, PUNCTURE, OR IMPACT.
DO NOT SHORT CIRCUIT.
KEEP OUT OF REACH OF CHILDREN. DO NOT TIP. KEEP LEVEL.
WARNING: RISK OF FIRE, EXPLOSION, OR BURNS. DO NOT DISASSEMBLE, HEAT ABOVE 75°C, OR INCINERATE.

Safety Precautions



DANGER: HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

This product must be installed by qualified personnel according to the requirements defined below. This battery cabinet must be installed according to local and national regulations. Install the battery cabinet according to the following standards (depending on your local area):

- **National Electrical Code NFPA 70**
- **Canadian Electrical Code CSA C22.1**

The battery cabinet must be installed indoors only in a temperature-controlled area free of conductive contaminants. Install on a level, solid surface (e.g. concrete or floor stand) that can support the weight of the system.

Follow all safety precautions when working on this system and always wear proper safety equipment including eye protection.

HIGH VOLTAGE: The battery cabinet voltage varies by model between 360 Vdc to 600 Vdc.

MAXIMUM FAULT INTERRUPTING RATING (MAIN CIRCUIT BREAKER): 20 kA, 35 kA, and 50 kA options (instantaneous trip ≤ 20 mS for any current ≥ 7800 A)

ARC FLASH DETAILS: Refer to the Arc Flash Details in ZincFive's *BC Series UPS Battery Cabinet Service Manual*.








MAXIMUM AVAILABLE OUTPUT FAULT CURRENT: BC 2: 5400 A or BC 2 - 300X and BC 2 - 500: 6200 A.

Tools

Use insulated tools for all installation and maintenance. The batteries and all bolts come pre-torqued and marked. The tools needed for final installation include:

- An insulated Flat Head Screwdriver and wrench (Installation of AC wires to terminal block, tightening cord grips)
- Insulated 8 mm or 5/16" Hex driver bit (DC Breaker termination)
- Long and short #2 Philips head screwdriver.
- Insulated Torque Wrench with crow's foot adapter and 10 mm Socket (Battery bolts, Faceplate)
- 8 mm socket (Cover, side panels, and GND screw)


Sécurité de la batterie

-  Cette batterie doit être installée par un personnel qualifié conformément à la dernière édition du National Electrical Code ANSI/NFPA 70 et/ou du Code canadien de l'électricité, Partie I, CSA C22.1.
-  Pour éviter des courts-circuits, des chocs ou des électrocutions accidentels, ne jamais laisser de l'eau ou toute forme de liquide toucher, entourer ou pénétrer dans les piles.
-  Ne pas faire fonctionner les batteries avec des câbles et des fils endommagés. Les câbles et fils défectueux doivent être remplacés avant l'installation du système. Avant l'installation du système, vérifier que tous les câbles et fils sont correctement fixés et connectés. Des raccords défectueux peuvent interrompre le fonctionnement et causer des dommages irréparables à ce produit.
-  L'ouverture ou la tentative de démontage du boîtier de la batterie annule la garantie et crée un risque de court-circuit électrique, de brûlures ou d'autres dommages physiques.
-  Ne pas jeter les batteries dans un feu. Elles peuvent exploser.
-  Ne pas ouvrir ou endommager les batteries. L'électrolyte libéré est nocif pour la peau et les yeux. Cela peut être toxique.
-  Une batterie peut présenter un risque de choc électrique et de courant de court-circuit élevé. Tout contact avec une partie quelconque d'une batterie mise à la terre peut entraîner un choc électrique. Les précautions suivantes doivent être observées lorsque vous travaillez sur des batteries :
 1. Retirer toutes montres, bagues ou autres objets métalliques.
 2. Utiliser des outils avec des poignées isolées.
 3. Porter des gants et des bottes en caoutchouc.
 4. Ne pas poser d'outils ou de pièces métalliques sur les batteries.
 5. Déconnecter la source de charge et la charge avant d'installer ou d'entretenir la batterie.
 6. Retirez les mises à la terre de la batterie pendant l'installation et l'entretien afin de réduire les risques de choc.
 7. Retirer le raccordement à la terre si une partie de la batterie est déterminée comme étant mise à la terre.

Notes:

1. **Les batteries utilisées dans les armoires de batteries UPS série BC, Z5 13-80 H S F et Z5 13-90 U S F, ont été testées par UL Solutions au niveau des cellules, conformément à UL 9540A le 21/11/2019 et le 14/02/24. , et n'a pas présenté d'emballement thermique. Voir le fichier UL E518051 pour référence supplémentaire.**
2. En cas d'urgence, veuillez contacter le 911 ou le service d'incendie local pour obtenir de l'aide. Si vous pouvez le faire en toute sécurité, isolez l'armoire de batteries du système en ouvrant le disjoncteur de batterie. Attendez l'arrivée du personnel d'urgence et jugez la zone sûre avant de prendre toute autre mesure. Contactez ZincFive pour toute question ou préoccupation.

Avertissements et mises en garde sur la batterie

-  PROTÉGER LES YEUX EN TOUT TEMPS AVEC UN ÉQUIPEMENT DE PROTECTION.
PAS D'ÉTINCELLES OU DE FLAMMES. INTERDICTION DE FUMER.
ÉLECTROLYTES ALCALINS.
RINCER LES YEUX IMMÉDIATEMENT AVEC DE L'EAU.
HUMIDE ÉTANCHE.
NE PAS INCINÉRER, PERFORER OU COGNER.
NE PAS COURT-CIRCUITER.
TENIR HORS DE PORTÉE DES ENFANTS. NE PAS RENVERSER. MAINTENIR À NIVEAU.
ATTENTION : RISQUE D'INCENDIE, D'EXPLOSION OU DE BRÛLURES. NE PAS DÉMONTER, CHAUFFER AU-DESSUS DE 75°C, OU INCINÉRER.

Précautions de sécurité

DANGER : RISQUE DE CHOC ÉLECTRIQUE, D'EXPLOSION OU D'ÉCLAT D'ARC ÉLECTRIQUE

Ce produit doit être installé par un personnel qualifié conformément aux exigences définies ci-dessous. L'armoire de batterie doit être installée conformément aux règlements locaux et nationaux. Installez l'armoire de batterie selon les normes suivantes (en fonction de votre région) :

- **Code national de l'électricité NFPA 70**
- **Code canadien de l'électricité CSA C22.1**

L'armoire de batterie doit être installée dans une zone à température contrôlée exempte de contaminants conducteurs. Installez sur une surface plane, solide (par exemple, support en béton ou au sol) capable de supporter le poids du système.

Suivez toutes les précautions de sécurité lorsque vous travaillez sur le système et portez toujours l'équipement de sécurité approprié, notamment une protection oculaire.

HAUTE TENSION : La tension d'armoire de batteries varie selon le modèle entre 360 VDC to 600 VDC.

VALEUR ASSIGNÉE DE RUPTURE MAXIMALE (DISJONCTEUR) : 20 kA, 35 kA, and 50 kA (déclenchement instantané < 20 mS pour tout courant $\geq 7\ 800$ A)

DÉTAILS DE L'ÉCLAT D'ARC ÉLECTRIQUE : Reportez-vous aux détails sur les arcs électriques dans le manuel d'entretien de l'armoire à batteries UPS de la série BC de ZincFive.

COURANT DE DÉFAUT DE SORTIE MAXIMUM DISPONIBLE : BC 2 - 5400 A or BC 2-300X and BC 2-500 - 6200 A.

Outils

Utilisez des outils isolés pour toute tâche d'installation et d'entretien. Les batteries et tous les boulons sont préserrés et marqués. Outils nécessaires pour l'installation finale :

- Un tournevis à tête plate isolé : Pour installer les fils c.a. au bornier.
- Embout de tournevis hexagonal isolé 8 mm ou 5/16 po pour le raccordement du disjoncteur c.c.
- Tournevis cruciforme no 2 long et court.
- Clé dynamométrique isolée avec douille de 10 mm : Pour les boulons de batterie.

ZincFive BC Series UPS Battery Cabinet Introduction

Each ZincFive BC Series UPS Battery Cabinet features ZincFive's patented Nickel-Zinc batteries and a built-in battery monitoring system (BMS). The battery cabinet is designed as a long-life, reliable solution for the Mission Critical Data Center space. See BC Series Versions and Model Numbers below for additional details on individual cabinet solutions. For an overview of battery cabinet design, see BC Series UPS Battery Cabinet Features below. Additionally, refer to pg. 23 for details on the integrated battery monitoring solution, which provides highly-detailed information on the operation and performance of the battery system, accessible through the customer interface portal.

Versions and Model Numbers

There are three distinct UPS battery cabinet versions within the ZincFive BC Series: BC 2, BC 2 - 300X, and BC 2 - 500. Each cabinet features a reliable, safe, and sustainable immediate power solution (IPS) with individual versions demonstrating increasing power density and decreasing footprints as the series progresses. All cabinets can house 36, 37, 38, or 39 batteries to support various UPS runtimes and voltage requirements. This manual includes instructions for each battery solution and cabinet version.

Each battery cabinet has a specific model number which differs from the series name, but reflects variables such as version, battery count, power supply, color, and other manufacturing details. A comprehensive breakdown of model nomenclature for the ZincFive BC Series is located in Appendix E on pg. 39.

Battery Cabinet Features

The BC Series UPS Battery Cabinet is an extremely feature rich design. Some of the major design features are highlighted below.

- A low weight and compact cabinet design that is easy to install.
- An accessible breaker door for safer operation.
- Draw-out trays, which simplify battery maintenance.
- An Integrated Battery Monitoring System that provides real time data and alarms.
- High current discharge capability of up to 1200A continuous.
- Reduced recharge times due to 160A maximum recharge current.
- Wide operating temperature range.
- IEC 62040-1, IEC 62040-2.
- UL1973, UL9540, UL1778
- CAN/CSA C22.2 No. 107.3
- CE, RoHs, and FCC Compliant
- Cabinet is seismic rated to IBC 2021.

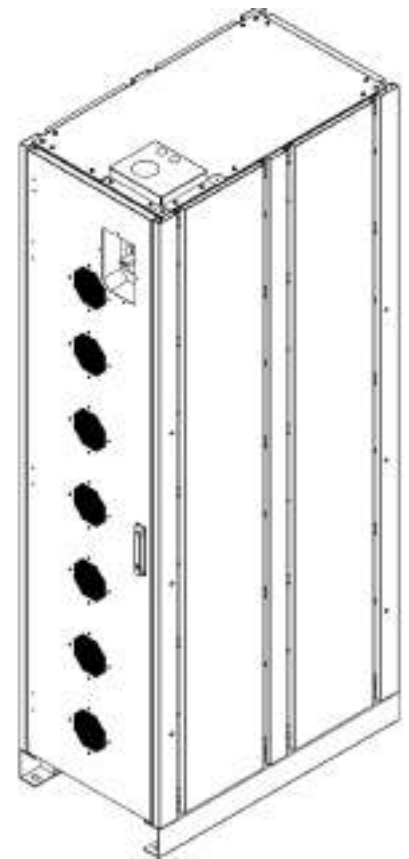


Figure 1- BC 2 UPS Battery Cabinet.

Shipping and Unpacking

CAUTION: THE CABINET HAS A CENTER OF GRAVITY BETWEEN 38.2" AND 39.7" DEPENDING ON BATTERY COUNT. USE CAUTION WHEN MOVING! REFER TO APPENDIX A FOR FURTHER DETAIL.

The battery cabinet comes fully assembled and is shipped upright on a pallet, in an air ride equipped truck. Upon arrival follow these steps:

1. Inspect the outside of the cabinet for visible damage prior to signing for release.
 - a. It is the responsibility of the person receiving the shipment to inventory and fully inspect all materials against the bill of lading, or weigh the bill immediately while the carrier representative is still present. Ensure that all items are accounted for, including the number of skids and quantity of boxes. Also note any visible external damage that may have occurred during transit. Make all applicable notations on the delivery receipt before signing and file a damage report with the carrier.
 - b. Examine the **Tilt** and **Shock** sensors on the cabinet. Both are just notifications to show the unit may have been exposed to excessive forces and that inspection is required to ensure no damage was done. Units received should be accepted from the shipper, but the activation must be noted with the shipper at the time of acceptance.
2. Remove foam wrap, protectors, and clear plastic over the battery cabinet. There are no strap downs on the batteries - everything remains secure and in place.
3. Perform a visual inspection of the cabinet.
 - a. Open the door and examine all the batteries/drawers to make sure everything is still secure and attached.
 - b. Check the seismic brackets to ensure bolts are present and secure.
 - c. Check any torque seal markers on batteries.
 - d. Immediately unpack the system and check for any concealed damage. Check the materials received against the detailed packing list to verify the quantity and the condition as complete and satisfactory.
 - e. Note observations of any liquid or crystallized electrolyte on the sides of the batteries.
4. To return any damaged goods, please contact a ZincFive support representative to obtain a return material authorization (RMA). ZincFive does not warranty product damage from return shipping unless it is shipped in approved packaging - please ensure all packaging material is saved.
 - a. Remove all bolts holding the cabinet to the pallet.
 - b. Carefully move the cabinet to the install location using the necessary fork lift/pallet jack. Spread forks as wide as possible when lifting.
 - c. Keep the cabinet as low as possible to keep the center of gravity as low as possible.
 - d. The cabinet is designed to be movable while fully loaded with batteries.



Figure 2. Palletized Battery Cabinet Packaging.

NOTE: Do not lift from the top of the cabinet as it will not support the frame weight. Refer to Appendix A for additional moving details.

Placement and Bolt Down

The battery cabinet has several bolt locations for securing to the floor. Refer to Appendix D for bolt hole locations and spacing requirements. Either the A or B bolt patterns will meet a seismic rating of 2.29 g.

See the below *IBC 2021 Seismic Product Data Sheet* for specifics.

IBC 2021 Seismic Product Data Sheet

ZincFive BC 2 Battery Cabinet

This data sheet provides a summary of the analysis and verification of the seismic performance for the ZincFive BC 2 battery cabinet. The seismic design capability of the cabinet was analyzed according to IBC 2021 / ASCE 7-16 and varies according to the following installation configurations:

Single battery cabinet without internal seismic brackets: **0.36 g** (Cs)

Single battery cabinet with internal seismic brackets: **0.86 g** (Cs)

Multiple battery cabinets ganged together without internal seismic brackets: **0.47 g** (Cs)

Multiple battery cabinets ganged together with internal seismic brackets: **0.95 g** (Cs)

A single battery cabinet with the internal seismic brackets (configuration 2 above) was used to validate the seismic design capability of the cabinet according to ICC AC156. The test value (Sds) of **2.29 g** was calculated based on the following values from ASCE 7-16: $z/h = 1$, $I_e = 1.5$, and $R = 4.0$. The cabinet passed the test without structural damage, validating the analyzed design configurations.

The Cs value can be used to determine the seismic capability of the battery cabinet at the installation site. For example, assuming the following values from ASCE 7-16: $F_a = 1.2$, $I_e = 1.5$, and $R = 4.0$, the capability of configurations 1 through 4 above cover 94.0%, 96.6%, 99.4 %, and 99.8% of the counties in the USA, respectively.

Code References:

- a) International Building Code (IBC), International Code Council, 2021
- b) Minimum Design Loads for Buildings and Other Structures, ASCE 7-16
- c) Steel Construction Manual, AISC A360-16
- d) Engineering detailed report and qualification test report issued by "Clark Dynamic Test Laboratory Inc" available by request.

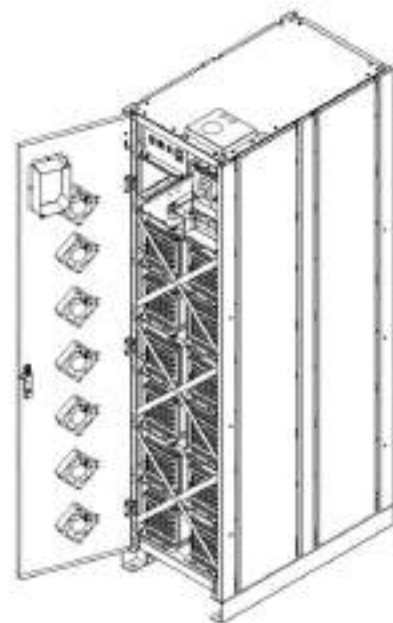


Figure 3- Open BC 2 UPS Battery Cabinet.

Anchoring Instructions

1. The cabinet should be set in place after the holes are marked and drilled, and bolts are set in the correct pattern.
 - a. Set and bolt one cabinet at a time to allow side access as needed.
 - b. Access to the rear A or B bolt locations is possible through the front with a wrench extension.
 - c. Access to rear bolt locations is easiest if greater than 6.0 in. or 152 mm of clearance is available.
 - d. If a wrench extension is unavailable or rear clearance is less than 6.0 in. or 152 mm, then access to the A or B rear bolt locations may require pulling the bottom battery tray out 30% and removing the side panels. For tray removal instructions reference ZincFive's *BC 2 Series UPS Battery Cabinet Service Manual*.
2. Set the cabinet in place with anchor bolts installed. Anchoring is the responsibility of the customer and is site and seismic rating dependent - bolts are not provided. For seismic specifics see the *IBC 2021 Seismic Product Data Sheet* on page 12.
3. Anchor the frame using appropriate size nuts and bolts for the install location.
 - a. Anchor bolt hole dimension: 0.75"
4. Required battery cabinet clearances:
 - a. **Rear** - Greater than .5 in. or 12.7 mm for heat rejection, greater than 6 in. or 152 mm for easiest installation.
 - b. **Front** - 35 in. or 890 mm for full tray removal and battery access.
 - c. **Side** - N/A
 - d. **Top** - 24 in. or 610 mm. Clearance is required to service the battery system via the top panel. Nothing can be mounted or supported from the top removable panel.

Additional Inspection

Once the cabinet is placed at its final install location, perform a final inspection. Follow all safety precautions when working on this system and always wear the proper safety equipment, including eye protection. The cabinet voltage will exceed 500 V between some of the batteries/components.

1. Inspect all of the installed batteries:
 - a. Conduct a visual and torque inspection of battery string and cables. Examine torque markings and torque check all battery connections to ensure there are no loose connections. Torque to: 9.1 +/- 0.9 N-m.
 - b. Thoroughly inspect the inside and outside of the cabinet for damage.
 - c. If batteries require a re-torque, the side panels may be removed to gain access or utilization of shelf tray support.
2. Confirm battery cabinet wiring:
 - a. Ensure there is no loose wiring and all connections are still secure.
 - b. Check the BMS wiring on the BMS and Power shelves to confirm that nothing loosened during placement. Access is possible through the top panel as well as the slide out trays.
3. Confirm battery voltage
 - a. Check that all batteries are within +/-0.3 V of one another. Since all batteries ship at 50% State of Charge (SOC), the batteries will likely be around 13.5 +/- 0.3 V.

Field Connections

Below are the final connections required prior to initiating the power ON sequence.

1. Ground: Connect the ground wire to the ground nut at the top of the cabinet.
2. DC: Connect the positive and negative conductors to the circuit breaker. Refer to Figures 4 and 5 a/b for information.
 - a. Make sure all power is off before attempting to connect.
 - b. Positive conductor(s) are attached to Terminal 1 at the top of the breaker.
 - c. Attach the negative conductor(s) to Terminal 3 at the top of the breaker.
 - d. Circuit breaker torque and wire details:
 - Torque to: 442 in-lb/50 N-m
 - Wire Details: Use 90°C rated or higher, between #2/0 AWG - 500 kcmil Copper or Aluminum.
 - This should be installed by a licensed electrician, following all local electrical codes.
 - e. Refer to Appendix C for the circuit breaker connection connection details.
3. AC: Connect the ground, neutral and line to the terminal block for incoming AC. Refer to Figures 5 a/b, 6, and 7.
 - a. String AC connects to the terminal block and requires a 9 mm stripped length. Torque screws to 0.7 N-m (6.19 in-lbs).
 - Wire details: Use 75/90°C rated or higher between #14 to #10 AWG (2.5 to 5.0 mm²) solid/stranded copper.
 - b. AC GND connects to the terminal block and requires a 9 mm stripped length. Torque screws to 0.7 N-m (6.19 in-lbs). Remove the faceplate (10 mm) to access.
 - Wire Details: Use 75/90°C rated or higher between #18 to #10 AWG (0.82 to 5.0 mm²) solid/stranded copper.

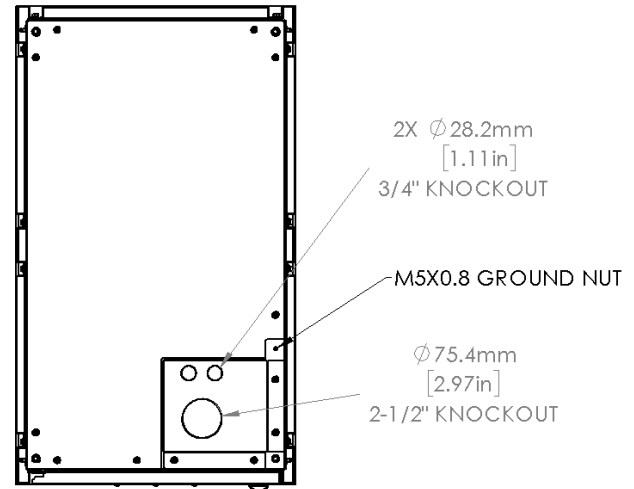


Figure 4 - Knockout and ground details.

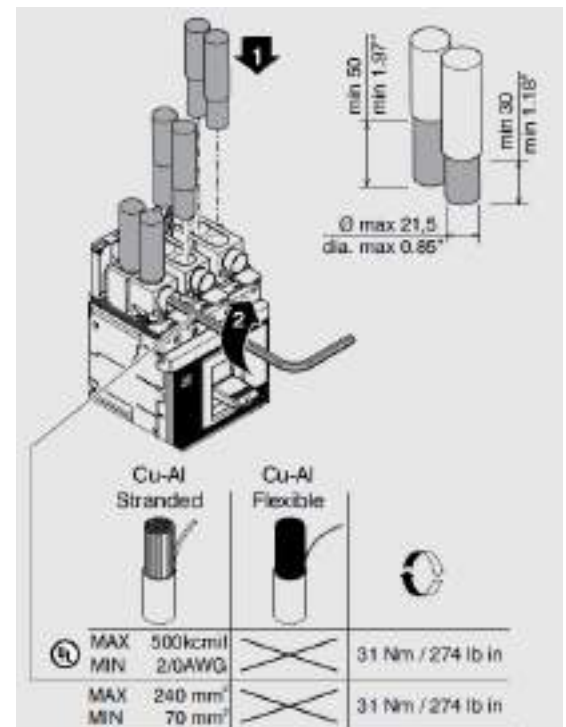


Figure 5a/b- SQD (Top) and ABB (Bottom) Breaker connection specifications.

NOTE: The AC power must be supplied by a 100 Watt UPS backed circuit. This powers the BMS, which must remain powered on when in backup during a power outage, for the system to function.

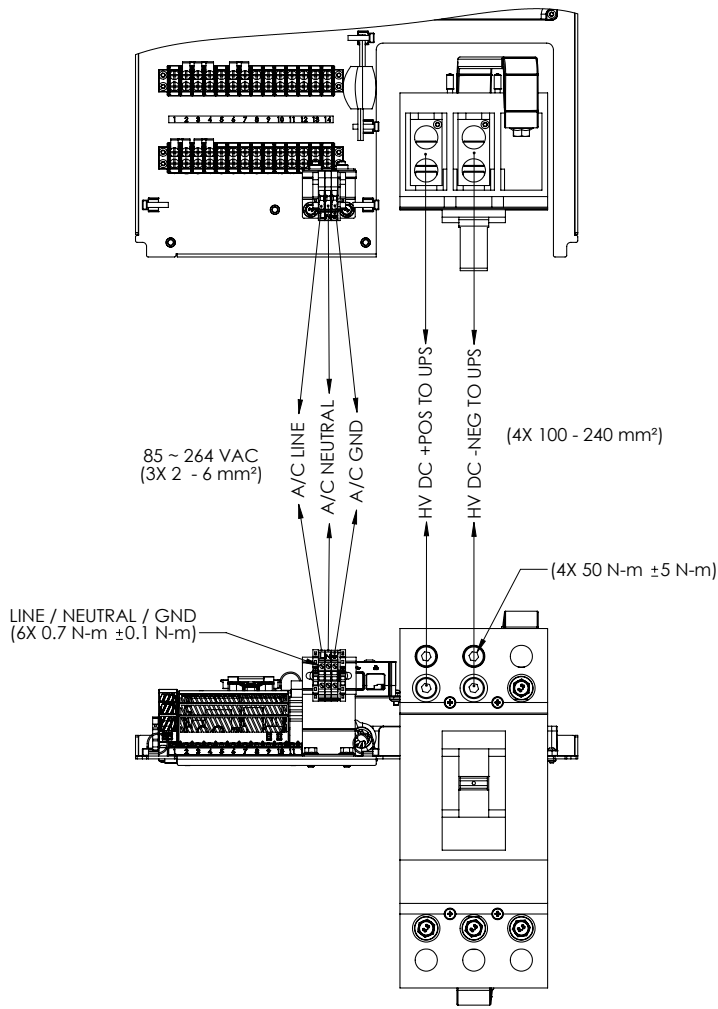


Figure 6 - A/C DC Interface for SQD Breaker.

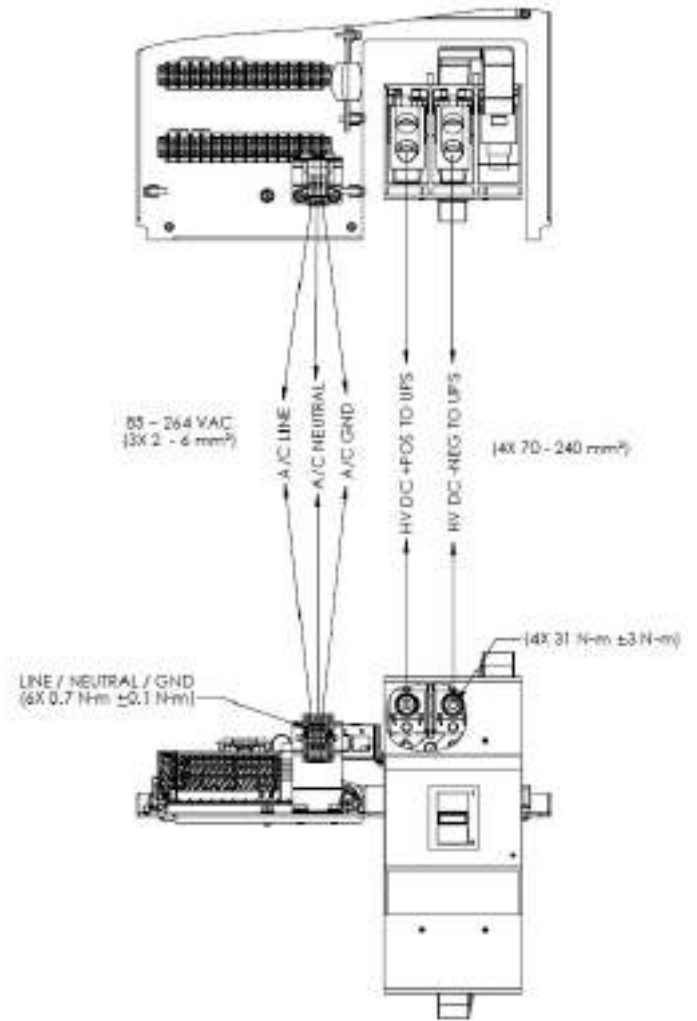


Figure 7 - A/C DC Interface for ABB Breaker.



Figure 8 - AC Input wiring (right side at the front of the cabinet) and ON/OFF Switch.

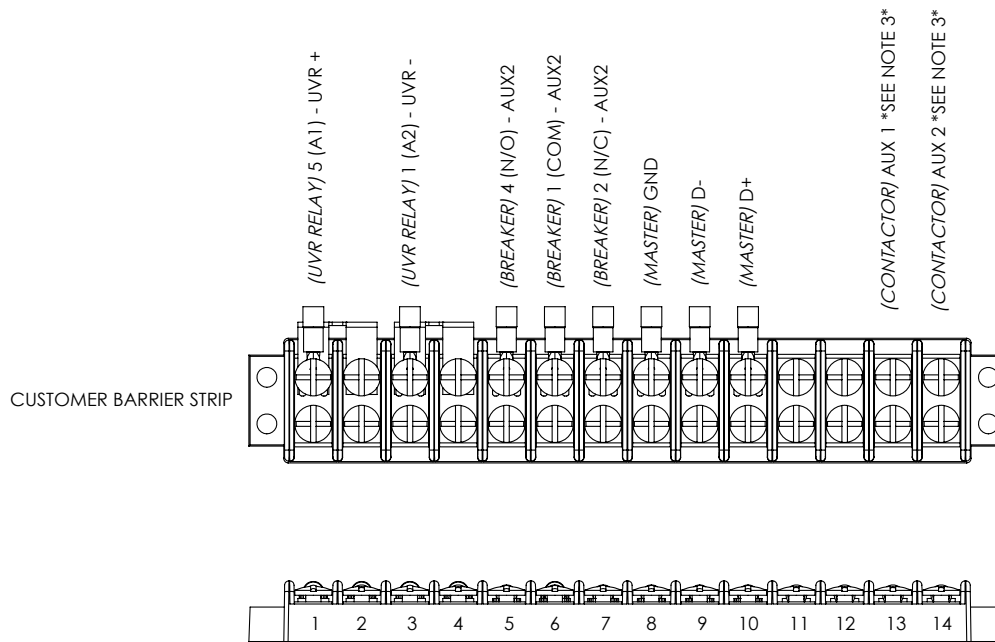


Figure 9 - Customer Terminal Block.

4. UVR/SHUNT and AUX Access: For UPS Systems that require an interface to the circuit breaker, a customer accessible Terminal Block is provided. Utilize 14-16 AWG UL approved wire and #6 spade connectors.
 - a. UVR/Shunt Relay – A relay coil is available to facilitate external UPS connection to the battery circuit breaker - see Figure 9 for details.
 - b. Once the battery cabinet is configured with UVR access, wait until the UPS outputs its rated UVR voltage, prior to turning on the circuit breaker.
 - UVR/Shunt Pin 1 = POSITIVE (+) Polarity
 - UVR/Shunt Pin 3 = POSITIVE (+) Polarity
 - c. Once the battery cabinet is configured with shunt access, the circuit breaker will trip when the UPS outputs its rated shunt trip voltage.
 - d. AUX circuit breaker access is available via NO, NC, and COM on the terminal block provided. See Figure 9 for details.
5. Modbus RTU and Aux Contactor access:
 - a. Modbus RTU – Pins 8, 9, 10 are available for Modbus RTU access. These come directly from the M800.
 - b. Aux Contactor – Pins 13, 14 are available to track the status of the Contactor (Shorted = Closed).
Note: This feature may not be available for all cabinet configurations.
6. Confirm all the harnesses are secured to the BMS (Top box) and the proper BX-50 to cabinet configuration is completed by an authorized service personnel.
7. Connect the ethernet cable to the faceplate (top left panel inside the door) if any remote monitoring of the battery cabinet is desired.
8. Apply AC Power to the system. It will take approximately 1-3 minutes for the BMS/R3000-U to initialize and communicate with the server.
9. See *Generic R3000-U Manual* for setup details. The network requirements needed for the R3000 to communicate with the Cloud or Local server are as follows:

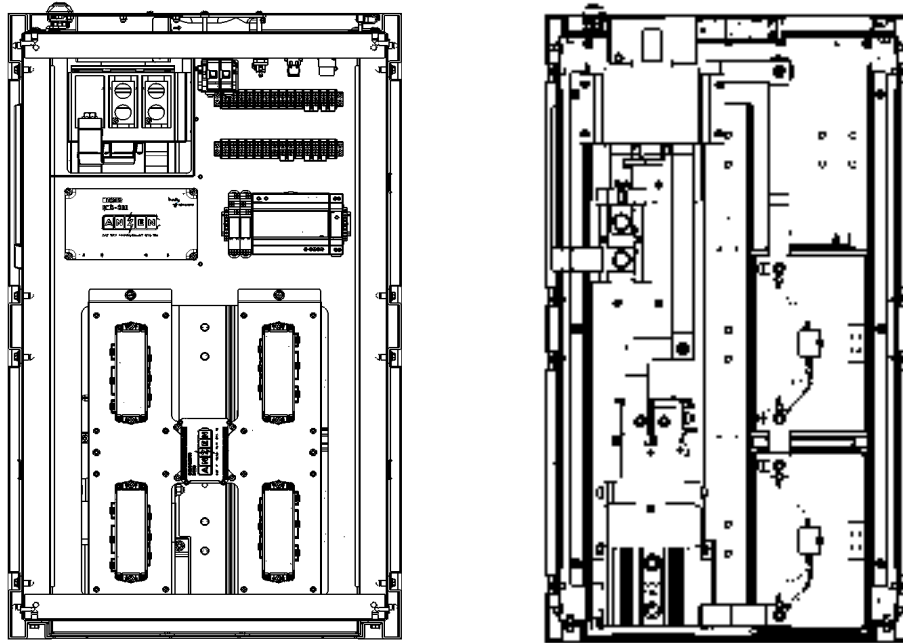


Figure 10 - BMS and Power Tray Component Layout.

- a. Local DHCP assigned IPv4 address. Inbound and Outbound permit TCP/443 and TCP/9101 to:
 - 139.177.197.251 TCP/443 and TCP/9101
 - 173.255.231.159 TCP/443, TCP/9101 and TCP/9102
 - 172.105.103.167 TCP/443 and TCP/9101
 - 45.33.95.14 TCP/443 and TCP/9101
 - b. Outbound permit tcp/3030, tcp/9101 to 172.105.23.38
 - c. If using the Cloud server, verify the system is online by visiting <https://manage.anzenbms.com/>.
 - d. The system remains in **Pre-standby state** until DC Power is applied.
 - e. Confirm all batteries are within +/- 0.3 V of one another. Since all batteries ship between 30-50% SOC, it is likely the batteries will be around 13.5 +/- 0.3 V.
9. Enable the DC Power (UPS/Charger)
- a. Ensure the UPS or battery charger is set to the recommended settings for operation with the battery system.
 - b. Close the Breaker with the system in the Pre-standby State. The system will move immediately into **Standby State**, and is now ready to function.
 - c. If the SOC is below 90% and battery temperatures are all >15°C and <40°C, the system immediately transitions into a **Charge State**.
- NOTE:** Regardless of the SOC, the system may try to transition into a Charge State if it was recently power cycled.
10. Perform a discharge to confirm the system is working properly and without errors. For commissioning and conditioning procedures, please reference ZincFive's *BC Series UPS Battery Cabinet Service Manual*.

Setup

1. DC Power and AC Power: Attach all cables to the cabinet. Additionally attach UVR/Shunt and aux contacts to the UPS if needed.
 - a. The 120 - 240 Vac 50/60 Hz feed to the cabinet must remain continuous - a 100 W UPS backup is recommended). Loss of the 120-240 Vac 50/60 Hz feed opens the breaker, shuts down the system, and turns off the Battery Management System (BMS).
2. The battery cabinet should only be installed in an ambient environment between 20°C -35°C.
3. For optimum performance, refer to the below recommended charge voltage values. See Appendix F for the acceptable charge voltage range, with minimum and maximum values.
 - a. 36 Battery Cabinet (36 BC): 542 Vdc for BC 2 - 300X and BC 2 - 500 or 544 Vdc for BC 2.
 - If Temperature compensated voltage (TCV) is available, then voltage range is 551 Vdc @20°C to 541 Vdc @ 35°C.
 - b. 37 Battery Cabinet (37 BC): 557 Vdc for BC 2 - 300X and BC 2 - 500 or 559 Vdc for BC 2.
 - If TCV is available, then voltage range is 566 Vdc @ 20°C to 556 Vdc @ 35°C.
 - c. 38 Battery Cabinet (38 BC): 572 Vdc for BC 2 - 300X and BC 2 - 500 or 574 Vdc for BC 2.
 - If TCV is available, then voltage range is 580 Vdc @ 20°C to 571 Vdc @ 35°C.
 - d. 39 Battery Cabinet (39 BC): 587 Vdc for BC 2 - 300X and BC 2 - 500 or 589 Vdc for BC 2.
 - If TCV is available, then voltage range is 596 Vdc @ 20°C to 586 Vdc @ 35°C.

Power Sequencing

1. To power up the system, turn ON the AC Power connected to the UPS Battery Cabinet. Ensure that the BMS ON/OFF switch on the inside of the cabinet door is turned ON.
 - a. Allow 1 to 3 minutes for the BMS to initialize.
2. Log into the web interface and verify that the BMS is online.
 - a. Refer to #3 below for instructions on connecting via the cloud server option (external Internet access required).
 - b. Refer to Zinc Five's *BC Series UPS Battery Cabinet Service Manual* for details on connecting via the local server option (BX50 internal server).
 - c. Refer to the Modbus Dictionary for Modbus TCP/IP connection.
3. Navigate to <https://manage.anzenbms.com/>
 - a. Sign in (Figure 11) using your assigned credentials for access. (e.g. user1@userdomain.com)
 - b. Select the Assigned Systems tab (Figure 12) and then select any cabinet to monitor.



Figure 11 - Login Screen.

Figure 12 - Assigned Systems Tab.

4. Refer to the top left of the display shown in Fig. 13, and locate the **Summary** tab. Verify that the **Connected Status** is showing as on.
 - a. Operations will begin from a **Pre Standby State**.
 - b. Once the circuit breaker is closed the system will enter a **Standby, Charge, or Discharge State**.



Figure 13 - Summary Tab.

Operation

Prior to initiating system operation, review the below instructions regarding proper charging and discharging processes for the batteries, as well as fan function and control parameters.

Charging

1. First, close the circuit breaker and confirm that the the **System Activity** indicator shows a **Standby State**.
2. While in Standby State, the battery cabinet only begins charging when SOC < 90% and all batteries are between 15°C - 40°C.
3. Set the UPS to charge the battery cabinet with any current between 20 -160 A. See the conditioning documents for multiple cabinet charge current recommendations. For any current above 160 A, refer to the *Troubleshooting* section on pg. 32.
 - a. The System Activity should change to **Charge State**.
4. Charging is complete if any of the following occur:
 - a. The current <4 A and string voltage >536 Vdc for 36 batteries, >551 Vdc for 37 batteries, >566 Vdc for 38 batteries, and >580 Vdc for 39 batteries.
 - b. Any monobloc voltage >15.5 V.
 - c. The string voltage is >554 Vdc for 36 batteries, >570 Vdc for 37 batteries, >580 Vdc for 38 batteries, and >600 Vdc for 39 batteries.
5. After charging, System Activity will return to Standby State.
 - a. When in Standby State, if the charging voltage is >560 Vdc for 36 batteries, >570 Vdc for 37 batteries, >580 Vdc for 38 batteries, and >600 Vdc for 39 batteries, the system won't change into Charge State.

Discharging

1. The discharge can only start in a Standby State or Charge State.
2. If the current draw is < -15 Amp, the system enters a **Discharge State**.
3. In **Validation Mode**, discharge ends with breaker opening via BMS upon any of these conditions:
 - a. Any (1, 2, or 3) Monoblocs < 10 V
 - b. Any (1, 2, or 3) Monoblocs > 75°C
 - c. EOD Voltage hits user specified threshold (adjustable between 360 V - 460 V).
 - d. Default is 1, 1, 390 with **Validation Mode** enabled.
4. In **Normal Mode** discharge ends once the UPS reaches its Low Voltage Cutoff (typically 383 V - 400 V). Refer to *BC 2 300X/500 Battery Conditioning* (pgs. 35-36) in ZincFive's *BC 2 Series UPS Battery Cabinet Service Manual* for the recommended UPS LVCO and expected power levels in the customer application.
5. After a discharge, all batteries must fall below 40°C before recharge begins.

6. The standard maximum recommended continuous current is 800 A, or up to 1200 A with a high-current power path option and Z5 13-90 U S F battery.
7. The breaker is set to trip at 1500 A for Z5 13-80 H S F batteries and 3000 A for Z5 13-90 U S F batteries with a dead short circuit. **NOTE:** *A negative value signifies the battery is discharging.*

Fan Function

1. Battery Temperatures
 - a. Turn the fan on during discharge, five seconds after the contactor closes.
 - b. Turn the fan off if all battery temperatures $<35^{\circ}\text{C}$ or all batteries $<40^{\circ}\text{C}$ and fans have been on for 5 hours.
2. Diode and Contactor Temperatures
 - a. The fans turn on if the contactor temperature $>60^{\circ}\text{C}$, and turn off if it is $<55^{\circ}\text{C}$.
 - b. The fans turn on if the diode temperature $>80^{\circ}\text{C}$, and turn off if it is $<75^{\circ}\text{C}$.

Controls Parameters

All parameters are shown as expected in Figure 14 on pg. 22. There are tolerances associated with the hardware, regarding the resolution of each parameter. In the event of a BMS error or fault parameter, please refer to the following notes:

1. When selected, emails will be transmitted for warning, serious, and critical alarms.
2. The system operating temperature should be $20 - 35^{\circ}\text{C}$. The system remains in Standby State and does not start charging until the temperature window is $15^{\circ}\text{C} - 40^{\circ}\text{C}$.
3. A serious alarm signals the need for battery replacement when a battery temperature rises above 75°C multiple times or 85°C at any point, or voltage falls below 10 V multiple times or below 8.6 V at any point.
 - a. There are two warnings- one at 10 V and the second at 8.6 V. A battery below 8.6 V must be replaced as soon as possible.
 - b. Voltage falling below 8.6 V indicates that two cells have failed, and triggers a critical alarm message.
4. Actual Discharge Ah (ADAh) is the present cycle Discharge Ah tabulated from the last full charge.
5. If the UPS voltage is too low on charge, the system will undercharge the batteries and not indicate a normal "End Of Charge". If there is enough charge to indicate ADAh is <0 , current is <4 A, and the EOC Voltage threshold is not met, then the system should exit charge, indicating EOC, and issuing a warning.
6. When current limits are exceeded, currents < -1200 A and > -1300 A for BC 2 – 500, and < -800 A and > -1000 A for BC 2 and BC 2 - 300X, will have a persistence of 2 seconds prior to triggering a serious alarm. Currents < -1300 A or < -1000 A respectively issues a critical alarm instantaneously. The breaker has short circuit protection that may open with currents < -1500 A.
7. The charge current is normally ≤ 160 A. The system records a serious alarm if the current is >160 A and < 1000 A for 15 s., and triggers the opening of the contactor. The contactor then closes after another 135 s. to attempt continuing the charge. A current > 1000 A instantaneously triggers an error and opens the contactor, requiring BMS reset/power cycle.



Item	Parameter	Number of Batteries	Operation Min/Max	Warning	Serious Alarm	Critical Alarm	Email ¹ (X)	Comments
1a	BPOV - Battery pack total voltage overvoltage (V)	36	555	547		555	X	The BPOV is a hard upper limit for EOC Voltage. The normal EOC is when current is below 4A and system voltage is above a minimum threshold at BPOV – 18 V.
1b	BPOV - Battery pack total overvoltage (V)	37	570	562		570	X	The BPOV is a hard upper limit for EOC Voltage. The normal EOC is when current is below 4A and system voltage is above a minimum threshold at BPOV – 18 V.
1c	BPOV - Battery pack total voltage overvoltage (V)	38	585	578		585	X	The BPOV is a hard upper limit for EOC Voltage. The normal EOC is when current is below 4A and system voltage is above a minimum threshold at BPOV – 18 V.
1d	BPOV - Battery pack total voltage overvoltage (V)	39	600	593		600	X	The BPOV is a hard upper limit for EOC Voltage. The normal EOC is when current is below 4A and system voltage is above a minimum threshold at BPOV – 18 V.
2a	BPUV - Battery pack total voltage undervoltage (V)	36		Variable	360	346	X	
2b	BPUV - Battery pack total voltage undervoltage (V)	37		Variable	370	356	X	
2c	BPUV - Battery pack total voltage undervoltage (V)	38		Variable	380	365	X	
2d	BPUV - Battery pack total voltage undervoltage (V)	39		Variable	390	374	X	
3	SBOV - Single battery (cell) overvoltage (V)		15.5	15.5		15.6	X	
4	SBUV - Single battery (cell) under voltage (V) ⁴			10.0		7.5	X	Batteries < 7.5 trigger a replace battery critical alarm.
5	Battery Low Flag Counter limit (BattLow)			1, 2	3+		X	Flag incremented for each battery < 10V during a discharge and the number of times a specific battery position exceeds the limit must be captured.
6a	Over temperature when charging (°C)				55	65	X	
6b	Over temperature when discharging (°C)			75		85		
7	Battery (High) Temperature Flag Counter limit (Num Batt T High)			1, 2	3+		X	Flag incremented for each battery >75°C during a discharge and the number of times a specific battery position exceeds the limit must be captured.
8	Low temperature when charging (°C)		None ²	< 20	none			No safety issue. Warning < 20C.
9	Over current when fast charge (A)				160 ⁸	1000	X	
10	Over current when discharge (A)				-1200 ⁷	-1300	X	Spec – BC 2 – 300X/ - 500 CHANGES
11	Diode Temperature (°C)				100		X	Used table with 1000A estimate used.
12	Contactors Temperature (°C)				150		X	Measured at Terminal. Terminal temperature.
13	ADAh ⁵ (Ah)			< 0 ⁶	<-40		X	Not changed for BC 2 – 300X/ - 500
14	Contactors Stuck Closed in Standby					X	X	If in Standby and Vsys – Viny <5 V and I >10 A, with all three conditions satisfied continuously for 10 seconds, then “Stuck Contactors”
15	R3000 over temperature (°C)					>75		
16	M800 over temperature (°C)					>100		
17	Battery Low voltage Position Warning				5 ³			This is a Custom Serious Warning and will be a sticky alarm noting battery to replace whenever > 5 flags are set. Batt. low > 5 for 1 battery (<10V) OR battery voltage < 8.6 V OR [battery #x V < meanV-1V AND in Discharge (for >5s) AND SOC>30%]
18	Battery High Temperature Position Warning				5 ³			This is a Custom Serious Warning and will be a sticky alarm noting battery to replace whenever > 5 flags are set.
19	Power Supply Voltage Low					<=21V		
20	Power Supply Voltage High					>=32.5V		
21	Lost Communication			X				System will still work with lost CAN communication.
22	Voltage Check (OCV) of Batteries					<13.0V		Any battery drops below 13.0V when standing idle after a charge/re-charge. If (OCV<13.2 V OR OCV<OCVmean-0.3 V) for 35 continuous minutes and (Full Charge Flag=True) AND (In Standby for > 10hrs)] Critical Warning – Single Battery low OCV.

Battery Monitoring System

1. The Battery Monitoring System (BMS) consists of a main processing unit (M800), several secondary processing units (S48), and a remote monitoring module (R3000-U).
 - a. The M800 is the master control module for performing real-time monitoring of the batteries.
 - b. The S48 is a secondary module, with direct connections to the batteries for monitoring voltage, temperature, State of Charge (SOC), and State of Health (SOH)
 - c. The R3000-U module allows for remote monitoring of the BMS and battery status.
2. Data accessed via USB provides 1 - 2 months worth of logging data from batteries.
 - a. Insert the USB drive for 3 - 5 minutes to retrieve the downloaded data.
 - b. The download requires a USB flash drive with a 1 GByte storage minimum.

Reset System

To connect an unresponsive R3000 to a BX50 or Cloud UI that the R3000 is not registered to, conduct a system reset. The reset button is used only to allow the R3000 to connect to a new server (cloud or BX50) that the device is not currently registered to. It is not used to deregister the R3000 from the user interface. After resetting, the device can be connected to the new server as a new R3000.

1. Scenarios that involve a System Reset:
 - a. A newly registered R3000 not responding on the interface after being added as a new system.
 - b. Connecting an R3000 to a new interface without deregistration from its previous interface
2. To properly reset the system:
 - a. Connect the R3000 to the new BX50 or Cloud-based system as a new R3000 through the **Add New System** interface. If the system has already been added, continue to step 2b.
 - b. Ensure that the R3000 is powered on and remains on throughout the process.
 - c. Press and hold the red button on the front side of the R3000 for at least 10 seconds. This will detach the R3000 from any previously registered systems.
3. Confirm the successful connection of the R3000, and check that the system appears online under Alarm Status on the Assigned Systems homepage.
 - a. Successfully connected systems will appear online as follows: 
 - b. Unsuccessful installations will appear offline as follows: 
 - c. The R3000 will only appear as online if it is connected to Wi-Fi or a BX50 - U. If it appears offline, the Anzen ID may have been entered incorrectly. The ID can be corrected by selecting **Replace** in the **Edit System** window.
4. The Edit System window allows users to edit details about their system as well as access the **Deregister** and **Replace** functions.
 - a. **System Name** is any name you choose to assign to your R3000 system.
 - b. **Company ID** is an identification number connected to a company's account.
 - c. **Assigned To** allows users to select which company to assign their system to.



Web Interface

Utilize the web interface for the remote monitoring of a battery cabinet.

1. To begin, search, <https://manage.anzenbms.com/>, where you will find the login prompt on the right (Fig.15).
2. Use the assigned login user name. (e.g. user1@yourcompany.com)
3. Select the “Assigned Systems” tab and choose the system to be monitored from the displayed list, as seen in Figure 16 below.



Figure 15 (Top) - BMS login screen, Figure 16 (Bottom) - Assigned Systems Tab.

System Summary

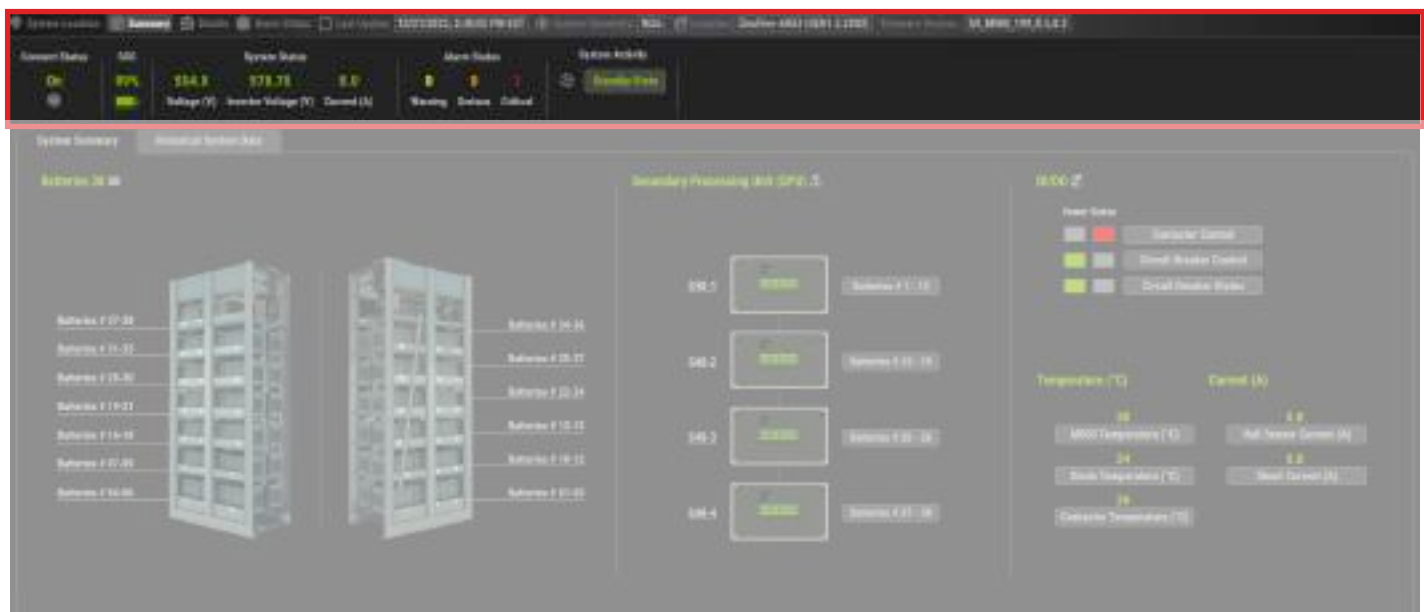


Figure 17 - System Summary Bar.

1. The top of the **System Summary** display (Fig. 17) includes the following system attributes:
 - a. **Connect Status:** On/Off
 - b. **SOC:** <Percentage>
 - c. **System Status:** Voltage, Inverter Voltage, and Current
 - d. **Alarm Status:** <#Warning, #Serious, #Critical, #Error>

2. To the right of the System Summary bar is the **System Activity** section, which displays the following operational states of the cabinet:
 - a. **Pre Standby** – The breaker is open, but the BMS is powered and viewable remotely.
 - b. **Standby** – The BMS is powered, the breaker is closed, and faults are cleared. This state indicates that the system is ready for operation.
 - c. **Charge** – Charging from the UPS (contactor closed).
 - d. **Discharge** – Discharging (powering) UPS.
 - e. **Error** – Unknown error – check alarm status.
 - In Error State, the system displays the alarm (pg. 25, Figure 18) and trips the breaker.

3. To view a list of all previous alarms, select **Alarm History** (pg. 25, Figure 19).

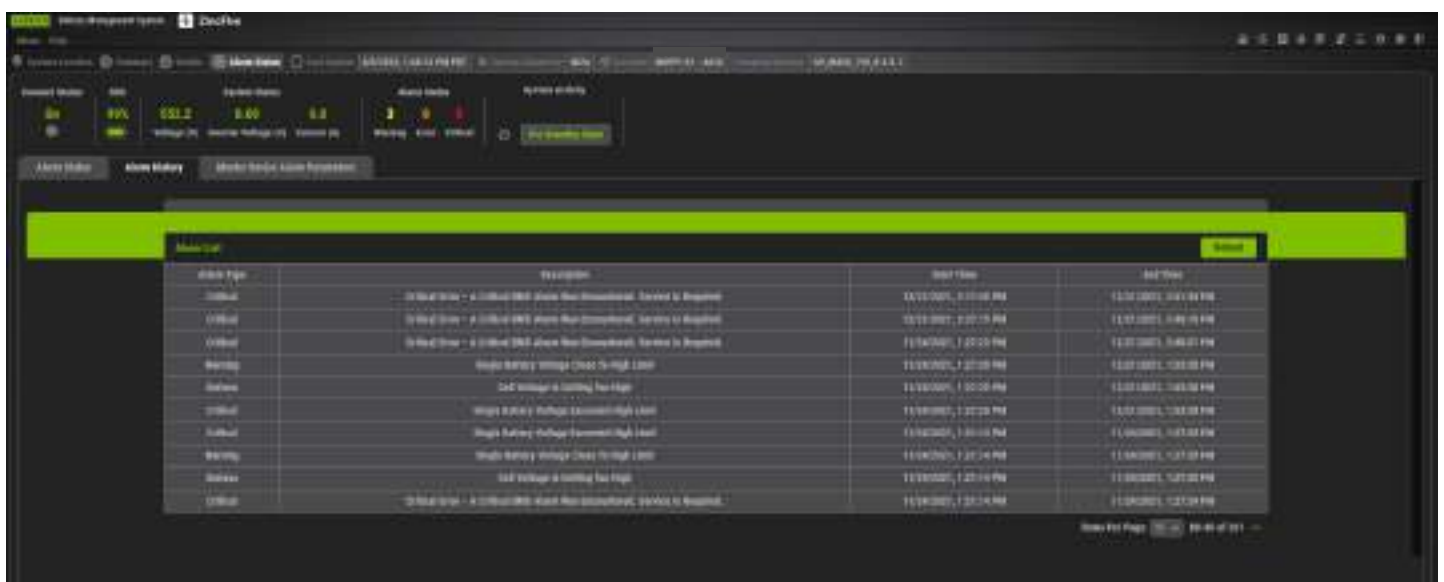


Figure 18 - Alarm Status (Top), Figure 19 - Alarm History (Bottom).

- For a comprehensive list of potential alarms, see Figure 20 on pg. 27.
- The bottom half of the **System Summary** page displays a graphic of the battery cabinet, a list of all the secondary processing units (SPUs), and status of the digital inputs/outputs (Fig. 20).

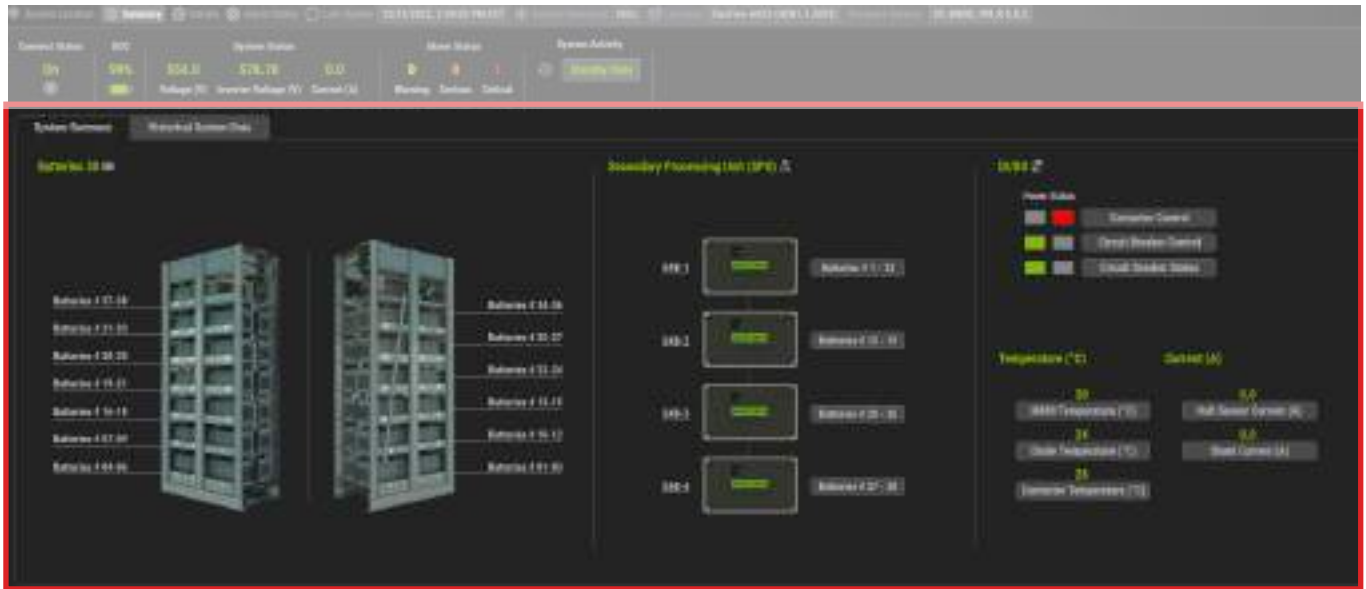


Figure 20 - System Summary Page.

- Clicking on any of SPU icons displays the below detailed voltage and temperature readings for the attached batteries. This display is also accessed by clicking the **Details** icon.

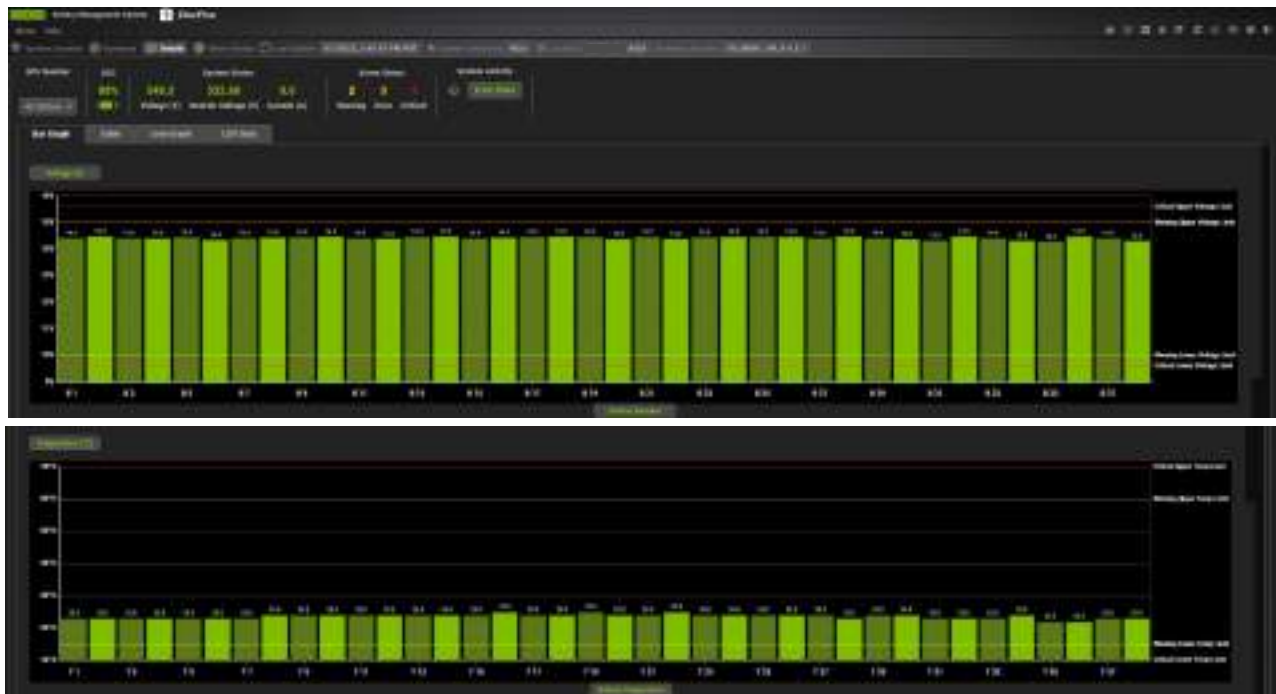


Figure 21 - SPU Readings.

Item	Default Back Difference	US Parameter	Message Type	Condition	Interface Display	Descriptions Modbus	CSV	Action
1	-10	BPOV	Warning Critical	String Voltage > 365 - 347V, 375 - 562V, 385 - 578V, 395 - 593V String Voltage > 385 - 555V, 375 - 570V, 385 - 585V, 395 - 600V Power Level: String Voltage < 365 - 390V, 375 - 509V, 385 - 520V, 395 - 531V 150 - 190Ah: String Voltage < 365 - 380V, 375 - 403V, 385 - 414V, 395 - 425V 200-249Ah: String Voltage < 365 - 384V, 375 - 534V, 385 - 405V, 395 - 416V 250-299Ah: String Voltage < 365 - 374V, 375 - 385V, 385 - 395V, 395 - 405V > 300Ah: String Voltage < 365 - 360V, 375 - 370V, 385 - 380V, 395 - 390V	System Voltage Close to High Limit System Voltage Exceeded High Limit	Upper_Limit_Pack_Voltage_Warning String_Over_Voltage	N/A N/A	Just Warning Just Warning Open Contactor, Reset Error 135 sec.
2	10	BPOV	Warning	String Voltage Close to Low Limit	System Voltage Close to Low Limit	String_Voltage_Close_To_Low_Limit	STRING_VOLTAGE_CLOSE_TO_LOW_LIMIT	Just Warning
3	-0.2	SB0V	Warning Critical	String Voltage At Low Limit String Voltage Exceeded Low Limit Monoblock Voltage < 385 - 340V, 375 - 350V, 385 - 365V, 395 - 370V Monoblock Voltage > 15.5V	System Voltage At Low Limit System Voltage Exceeded Low Limit Single Battery Voltage Higher than Maximum Operating Voltage. Service System	String_Voltage_Low String_Voltage_High Monoblock_Over_Voltage Monoblock_Over_Voltage	STRING_VOLTAGE_LOW STRING_UNDER_VOLTAGE MONOBLOCK_OVER_VOLTAGE MONOBLOCK_OVER_VOLTAGE	Just Warning Just Warning Just Warning Open Contactor, ECC
4	1	SB0V	Critical	Monoblock Voltage < 7.5V	Single Battery Voltage Lower than Minimum Operating Voltage. Confirm BMS Voltage. Replace Battery if confirmed.	Monoblock_Under_Voltage	MONOBLOCK_UNDER_VOLTAGE	Just Warning to Battery Status Report page of Maintenance section of UI
5	N/A	Battlow	Custom Warning	Number low Voltage Monoblocks = 1. Volt < 10V	Number low Voltage Monoblocks = 1. Check Battery Bk.	Monoblock_Low_Voltage_Single_Warning	MONOBLOCK_LOW_VOLTAGE_SINGLE_WARNING	Just Warning Set a flag for "Low Voltage Count" battery in the Battery Status Report of the Maintenance section of UI
6	-10	Over Temperature (Charge)	Custom Warning Custom Serious Serious Critical	Number low Voltage Monoblocks = 2. Volt < 10V AND system state = discharge Number of low Voltage Monoblocks Exceeded limit. Check Battery Bk. #1, #2 Battery Temperature > 55C AND system state = discharge Battery Temperature > 60C AND system state = charge	Number low Voltage Monoblocks = 2. Check Battery Bk, Bk Number of low Voltage Monoblocks Exceeded limit. Check Battery Bk, #1, #2 Batt_Temp_High_Charge Charge_Single_Overtemp	MONOBLOCK_LOW_VOLTAGE_DUAL_WARNING MONOBLOCK_LOW_VOLTAGE_THREE_OR_MORE_WARNING Batt_Temp_High_Charge	Just Warning Just Warning Just Warning Just Warning	
7	N/A	Num Batt High	Custom Warning	Battery Temperature > 75C AND system state = discharge	Battery Temperature Close to High Limit during Discharge.	Batt_Temp_High_Discharge	CHECK TERMINAL CONNECTION. REPLACE BATTERY IF NECESSARY. HIGH TEMP BATTERY CHECK TERMINAL CONNECTION. REPLACE BATTERY IF NECESSARY.	Just Warning
8	2	Low temperature when charging	Warning	Battery Temperature > 80C AND system state = discharge	Battery Temperature Exceeded High Limit during Discharge. Check Terminal Connection. Replace Battery if necessary.	Discharge_Single_Overtemp	HIGH TEMP BATTERY CHECK TERMINAL CONNECTION. REPLACE BATTERY IF NECESSARY.	Just Warning (No flag sent to Battery Status Report page of Maintenance section of UI)
9	N/A	Over current when full charge	Critical	Number High Temperature Monoblocks = 1. Temp > 75C AND system state = discharge Number High Temperature Monoblocks = 2. Temp > 75C AND system state = discharge Number of High Temperature Monoblocks Exceeded Limit. Check Battery Bk, Bk AND system state = discharge	Number High Temperature Monoblocks = 1. Check Battery Bk. Number High Temperature Monoblocks = 2. Check Battery Bk, Bk Number of High Temperature Monoblocks Exceeded Limit. Check Battery Bk, Bk	Monoblock_Temperature_Single_Warning Monoblock_Temperature_Dual_Warning Monoblock_Temperature_Three_Or_More_Warning	Just Warning Just Warning Just Warning	
10	6.5	Over current when discharge	Warning	Battery Temperature > 20C Current > 200A per unit for 15 seconds	Batt Charge Current At High Limit	Charge_Current_High	N/A	Just Warning Open Contactor, Reset Error 135 sec.
11	-20	Bdiac temperature	Warning	80Ah (RSP) Current < 800A 90Ah (LSP) Current < 1200A 100Ah (LSP) Current < 1600A 100Ah (LSP) Current < 1300A	Discharge Current At High Limit	Discharge_Current_High	FASTCHARGE_OVERCURRENT_FIX_ISSUE_RESET_BMS	Open Contactor, Document that this error is latched and can only be reset by BMS reset (power cycle).
12	-20	Contactor temperature	Warning	Diode temp > 100	Diode Current Exceeded High Limit	Diode_Current_High	DISCHARGE_OVERCURRENT	Just Warning
13	N/A	ADAh	Custom Warning	Charge state AND (ADAh=0 AND Current < 4 A and String Voltage < (BPOV-18V) for 10 continuous seconds)	Charge Completed Below lower Voltage Threshold. System Undercharged.	Charge_Finished_String_Voltage_Low_Warning	DIODE_TEMPERATURE_HIGH_ERROR	Just Warning
14	N/A	Contactor stuck closed in Standby	Custom Critical	Charge state AND (ADAh=0 AND Current < 4 A and String Voltage < (BPOV-18V) for 10 continuous seconds)	System 50% Overcharge Error	Excessive_Overcharge_Error	CONTRACTOR_TEMPERATURE_HIGH_ERROR	Just Warning Contactor Open, ECC
15	N/A	R3000 over temperature	Critical	R3000 temp > 75 C	Contactor Stuck Closed. Fix Issue. Reset BMS required.	Contactor_Stuck_Closed_Fix_Issue_Reset_Bms	CONTRACTOR_STUCK_CLOSED_FIX_ISSUE_RESET_BMS	Just Warning Document that this error is latched and can only be reset by BMS reset (power cycle).
16	-2	M800 over temperature	Critical	M800 temp > 100 C	R3000 Temperature Exceeded High Limit BMS Temperature Exceeded High Limit	Bms_Temperature_High	N/A	Just Warning
17	N/A	Battery low voltage Position Warning	Custom Critical	Battlow > 5 for 1 battery (<10V) OR battery voltage < 6.0V OR battery Bk V < meanV (low performance battery. Confirm BMS Voltage. Replace Battery Bk if confirmed)	Low Performance Battery. X (BMS0 Modbus Port 1502)	Low_Performance_Battery_X (BMS0 Modbus Port 1502)	N/A	Just Warning (Set a flag for "Low Voltage Count" battery (8.8V or mean (set)) in the Battery Status Report of the Maintenance section of UI. Status/Alarm) for each battery will trigger under the Alarm Status section of UI)
18	N/A	Battery High Temperature Position Warning	Custom Critical	Battery temperature high > 5 for 1 battery (> 75C)	High Temperature Battery. Check Terminal Connection. Replace Battery Bk if confirmed	High_Temperature_Battery_X (BMS0 Modbus Port 1502)	N/A	Just Warning to Battery Status Report page of Maintenance section of UI
19	0.5	Supply voltage low	Critical	Supply voltage < 24V	Supply Voltage Exceeded Low Limit	Supply_Voltage_Low	SUPPLY_VOLTAGE_LOW	Just Warning
20	-0.5	Supply voltage high	Critical	Supply voltage > 32.5V	Supply Voltage Exceeded High Limit	Supply_Voltage_High	SUPPLY_VOLTAGE_HIGH	Just Warning
21	N/A	SFU Lost Communication	Custom Warning	One or more SFU lost CAN communication. IF (D0C5C33.0V OR D0C5C33.0V) for 35 continuous minutes AND full charge Flag True AND (in Standby for > 10hrs)	SFU Lost Communication. Check CAN connections.	Lost_Communication	LOST_COMMUNICATION	Just Warning
22	N/A	Low DCV	Custom Critical	Single Battery Low DCV. Confirm BMS Voltage. Replace Battery if confirmed.	Single Battery Low DCV. Confirm BMS Voltage. Replace Battery if confirmed.	Single_Battery_Low_DCV	SINGLE_BATTERY_LOW_DCV	Just Warning

Figure 22 - Alarm List

Historical System Data

Click on the **Historical System Data** tab to the right of the **System Summary** tab to view system voltage (Fig. 23), temperature (Figure 24), and current over time (Fig. 25).



Figure 23 (Top), Figure 24 (Middle), Figure 25 (Bottom).

Details

1. Select the **Details** icon, to the right of the **Summary** icon in the navigation menu, to view individual battery string information in the form of a bar graph, table graph, or line graph. The historical data is additionally downloadable in a comma separated values (CSV) formatted file.
2. To view all of the batteries or concentrate on an individual string connected to a single SPU, select an option from the SPU Number dropdown, located just above the **Bar Graph** shown in Figure 26.



Figure 26 - SPU Drop Down Menu

3. Click on the **Table** tab to display the battery voltages and temperatures in table format.

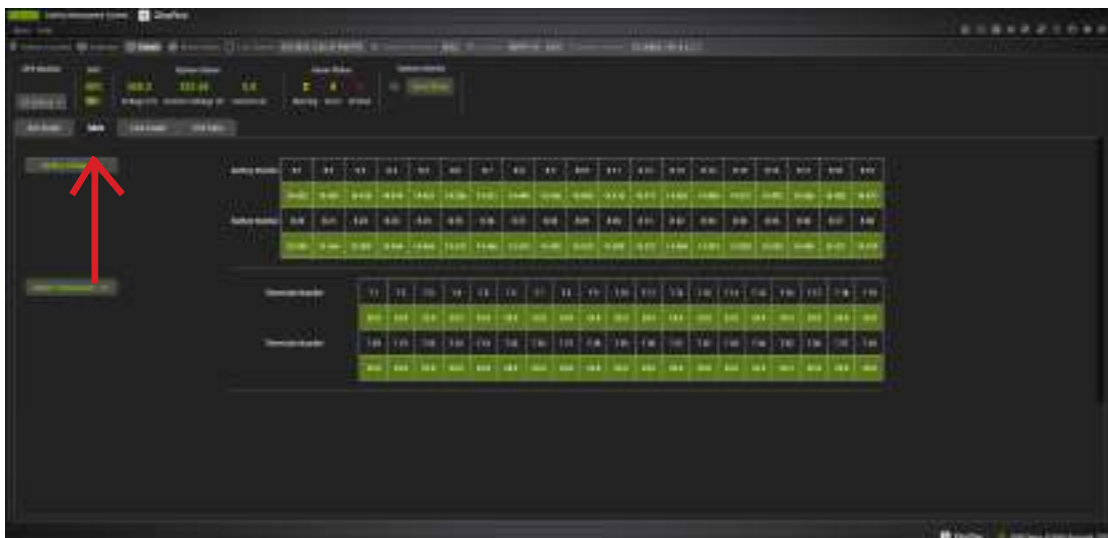



Figure 27 - Table display.

NOTE: Click the stop watch icon  at the top right corner to initiate **Test Mode**, which takes system measurements every two seconds.

4. When selecting **Line Graph**, specify the start and end time for the monitoring data to display. Then press the "Get Data" button to update the display according to those parameters.
 - a. The below line graphs represent Voltage (Figure 28) and Temperature (Figure 29).



Figure 28 (Top) and Figure 29 (Bottom).

5. Access the **CSV Data** tab to capture a specific date range of data and download it as a Comma Separated Value (CSV) file, which is easily opened in MS Excel. To correctly download the data:

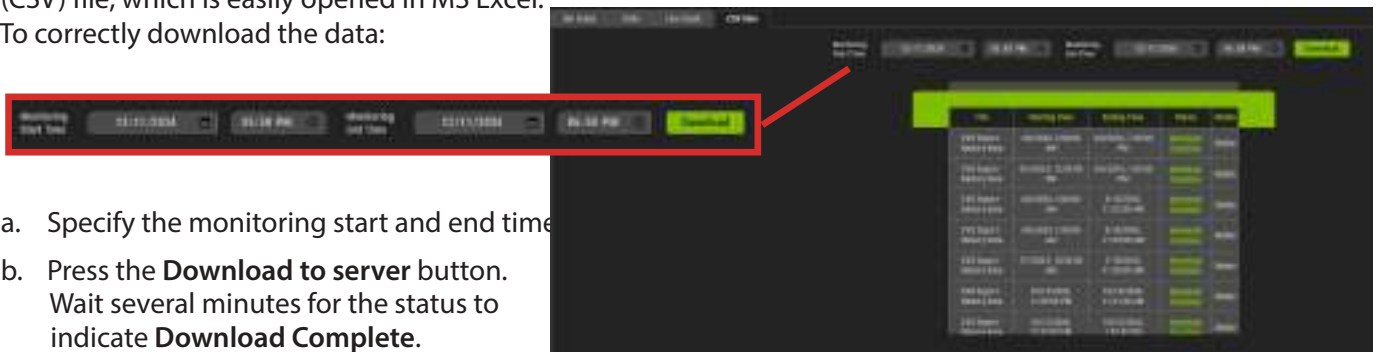


Figure 30 - Preparing CSV data for download.

- a. Specify the monitoring start and end time.
- b. Press the **Download to server** button. Wait several minutes for the status to indicate **Download Complete**.
- c. Click on the Download Complete link in the Status column to download the data to your local system. The default file name is `<R3000ID>_<SystemName>_<Date>_<TimeStamp>.csv`
- d. The web interface and servers make several data downloads available from the same page. Previous downloads are stored in the system for two weeks, unless manually deleted by clicking on the **Delete** link in the corresponding column.
- e. Review Figure 31 on the following page for a breakdown of information included in a CSV file.

Field Name	Notes
R3000 Timestamp	Time stamp of the record in the current time zone.
UTC Timestamp	Time stamp in UTC time zone.
R3000 Time Zone	Current Time Zone location.
Battery Voltage 1-39	One column per battery.
Battery Temperature 1-39	One column per battery.
System Temperature	Same as M800 Temperature.
Diode Temperature	Alarms when >100C
Contactor Temperature	Alarms when >150C
State	One of the following: Service States: <ul style="list-style-type: none"> • Service • Pre-Standby • Standby • Charge • Discharge • Error
Previous Timestamp State	
Previous State of Cabinet	
Error Msg	Any Error messages or Alarms.
Battery System Voltage	Measured at contactor.
Inverter Voltage	Measured at breaker.
Supply Voltage	24VDC Supply Voltage
System Current	I <=50A uses Hall when I > 50A uses Shunt
Hall Current	Hall Effect Sensor Current (For low currents)
Shunt Current	Shunt Current (For high current measurements)
SOC	State of Charge
SOH	State of Health
cdah	Cumulative Discharge Amp Hours
adah	Actual Discharge Amp Hours
Firmware Version	Latest M800 Firmware
Months Elapsed Since Initial Commissioning	
Validation Mode Status	NA, ON, OFF
Fan Status	NA, OFF, ON
Circuit Breaker Status	ON or OFF
Contactor Control	ON or OFF
Circuit Breaker Control	ON or OFF
Elapse Discharge Time	NA, ON, OFF
Cumulative Discharge Energy (kWh)	
Instant Power (W)	

Troubleshooting

Alarm Types

1. **Serious** – Something is wrong with the UPS or battery cabinet, and action or investigation is recommended.
2. **Critical** – A potentially damaging situation occurred with the UPS or battery, and action or investigation is required.
3. **Error** – The battery cabinet encountered an Error condition that requires resetting of the BMS due to an over current condition or contactor stuck condition.
4. **Single Battery Voltage** - If the value is higher/lower than maximum/minimum operating voltage, service the system. This condition is only reached if batteries are out of balance or a cell (or cells) within a battery is compromised, indicating that one or more batteries need to be replaced.
5. **Over temperature when charging or discharging** – Inspect the battery to see if there is a problem on any charge or discharge, where it reaches the Critical Alarm temperature. If so, it likely needs replacement.
6. **Over-Current on Charge** – The max current should not exceed 160 A per string from the battery charger, for more than 15 s. The BMS opens the contactor for 135 s and does not allow charging. The contactor time then resets, and system may try to charge again if SOC < 90%.
7. **Monobloc Voltage Differential** – When a battery's open-circuit voltage differs from the other batteries in the string by > 0.3 V, a cell or cells within the battery are likely compromised and the battery should be replaced. See the Alarm List on page 27 for more details on voltage difference thresholds and battery replacement alarms.

Conditions where the BMS intervenes:

1. When a charging current > 160 A persists for 15 s the contactor opens. The contactor remains open for 135 s before resetting itself and allowing charge again. This prevents the batteries from receiving too much current.
2. When the charging current > 1000 A, the contactor opens and a latching error occurs. This means that the charge current exceeded the high limit setting. The issue that resulted in the over charge current needs to be fixed, and a reset of the BMS is required to unlatch this condition.
3. If the system is undercharged as noted by ADAh <0, Current <4 A, and String Voltage < (BPOV – 18 V), the contactor opens and a warning notifies the user.
4. If batteries are overcharged (System 50% Over-Charge Error) as indicated by the BMS, the contactor will open.
5. If the BMS loses power, the breaker is tripped and the battery cabinet is unable to discharge.
6. If the system encounters one or more batteries <10 V or >75°C, the breaker will open on a discharge, ending the process prematurely. This earlier ending is only possible in **Validation Mode**.
7. The **Contactor Control Power Status** displaying as red, or the SOC <90% and all batteries between 15°C – 40°C, indicate that the system is not going into **Charge State**. Open and close the breaker to reset the stat

Incorrect Battery Voltage or Temperature Reading:

1. Check for loose or poor connections on the spade/quick connect terminals, on the batteries.
2. Check for connection issues where the quick connect is not attached correctly (did not go over the QC correctly). If the torque seal is broken here, this bolt should be re-torqued to 9.1 +/- 0.9 N-m.
 - a. After checking connections, power cycle the BMS via the ON/OFF switch to verify if condition persists.

Misaligned Voltages During Charge or Discharge:

1. If all batteries are not within +/-0.3 V of each other, there may be a short-to-chassis ground or a problem with the harness.
2. Check to see which Secondary Processing Unit (SPU) batteries have the issue, inspecting connections and measuring voltages around those batteries. Try to plug and re-plug the SPU connections near batteries and in the BMS box.

Recycling and Disposal of the Battery Pack

1. Proper disposal of any ZincFive battery is required. Refer to your local codes for disposal requirements.
2. Do not dispose of the battery in a fire as it may explode.
3. Do not open or mutilate the battery.
4. Do not discard the UPS or the UPS batteries in the trash.

Specifications

Battery Count	ZincFive BC 2 36s, 37s, 38s, and 39s Available	ZincFive BC 2 - 300X 36s, 37s, 38s, and 39s Available	ZincFive BC 2 - 500 36s, 37s, 38s, and 39s Available
Electrical			
Nominal Voltage	468 Vdc (36s), 481 Vdc (37s), 494 Vdc (38s), 507 Vdc (39s)		
Charge Voltage Range	537 - 555 Vdc (36s), 552 - 570 Vdc (37s), 567 - 585 Vdc (38s), 582 - 600 Vdc (39s). See the <i>Installation & Operation Manual</i> for more detail.		
Minimum and Maximum Charge Current	20 A minimum; 160 A maximum		
Standard Charging Current	80 A	90 A	
Charge Time	Ranges from 2 hours to 5 hours for 0-100% SOC, dependent on charge current		
Low Voltage Cutoff	360 Vdc - 390 Vdc - 10 Vdc per battery		
Battery Option	Z5 13-80 H S F	Z5 13-90 U S F	Z5 13-90 U S F
Nominal Capacity C/2 at 25°C	>80 Ah	>90 Ah	>90 Ah
Nominal Energy Storage at C/2	36 kWh (36s), 37 kWh (37s), 38 kWh (38s), 39 kWh (39s)	43 kWh (36s), 44 kWh (37s), 46 kWh (38s), 47 kWh (39s)	
Maximum Discharge Current	800 A	800 A	1200 A
Application	High-Rate discharge Less than 5 minute runtime	High-Rate discharge Greater than 5 minute runtime	Ultra-High-Rate discharge Less than 5 minute runtime
Battery Chemistry	Wet, Alkali filled		
Single String Battery Configuration	36, 37, 38, 39 battery modules per battery string		
System BMS Functions			
Monitoring	BMS manages charge functions and monitors full suite of parameters during discharge and standby including battery voltage, temperature and current.		
Power Supply	100 - 240 VAC 50/60 Hz standard. Additional 100 - 240 VAC and 600 VDC redundant supply options available		
Data Communications	Ethernet, Modbus TCP/RTU, USB, Local Server, and Cloud options		
Safety and Environmental			
Safety	Batteries exhibit no thermal runaway as per UL 9540A		
Breaker Protection	Circuit breaker is accessible with door closed and (manual or upon fault) disconnects batteries from inverter. Various kA rated breakers available depending on configuration.		
Operating Temperature Range ¹	20° C - 35° C		
Storage Temperature Range ²	-20° C - 50° C		
Storage Period	6 months at 25° C before batteries need charge		
Humidity Range	0 - 90%, Non-Condensing		
Cooling	Forced Ventilation Standard		
Certifications			
Cabinet	UL 9540, UL 1973, UL 1778, CAN/CSA C22.2 No. 107.3, IEC 62040-1, IEC 62040-2, CE, UKCA, RoHS		
Battery	UL 9540A, UL 1973, UL 1989, CAN/CSA C22.2 No. 60950-1, EU 2023/1542		
Seismic	IBC 2021, ICC AC156 – S _{ss} 2.29		
Mechanical			
Height	82.5" (2096 mm) for Cabinet / 83.5" (2121 mm) with High Voltage Box		
Width	21" (533 mm)		
Depth	36" (914 mm)		
Total Max Weight (39s)	2050 lbs. (929.9 kg)	2131 lbs. (966.4 kg)	2140 lbs. (970.5 kg)

¹ Consult with ZincFive for use outside this temperature range.

² Refer to ZincFive's *BC Series UPS Battery Cabinet Service Manual* for storage details.

All specifications valid at operating temperature range and subject to change.

Appendix A

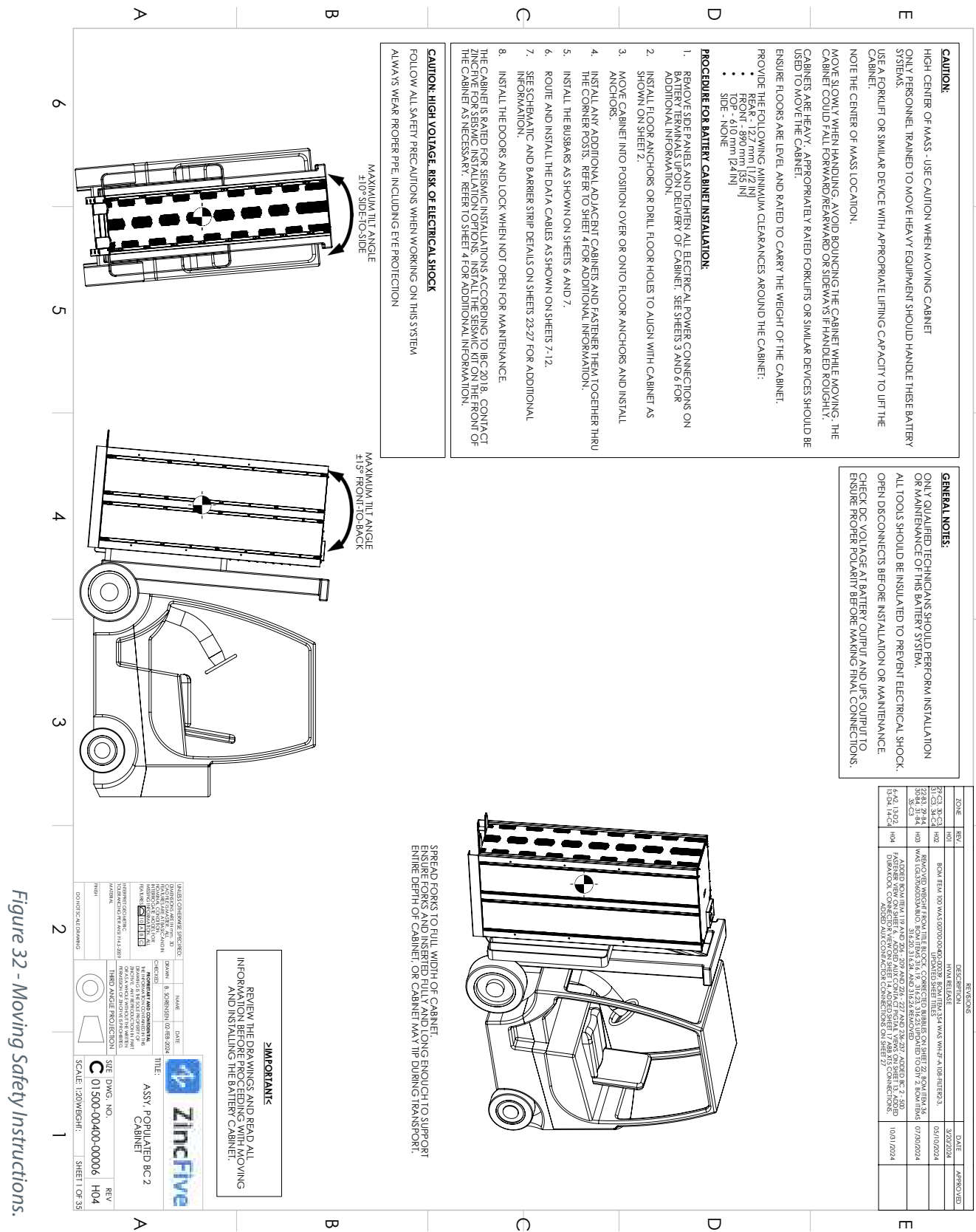


Figure 32 - Moving Safety Instructions.

Appendix B

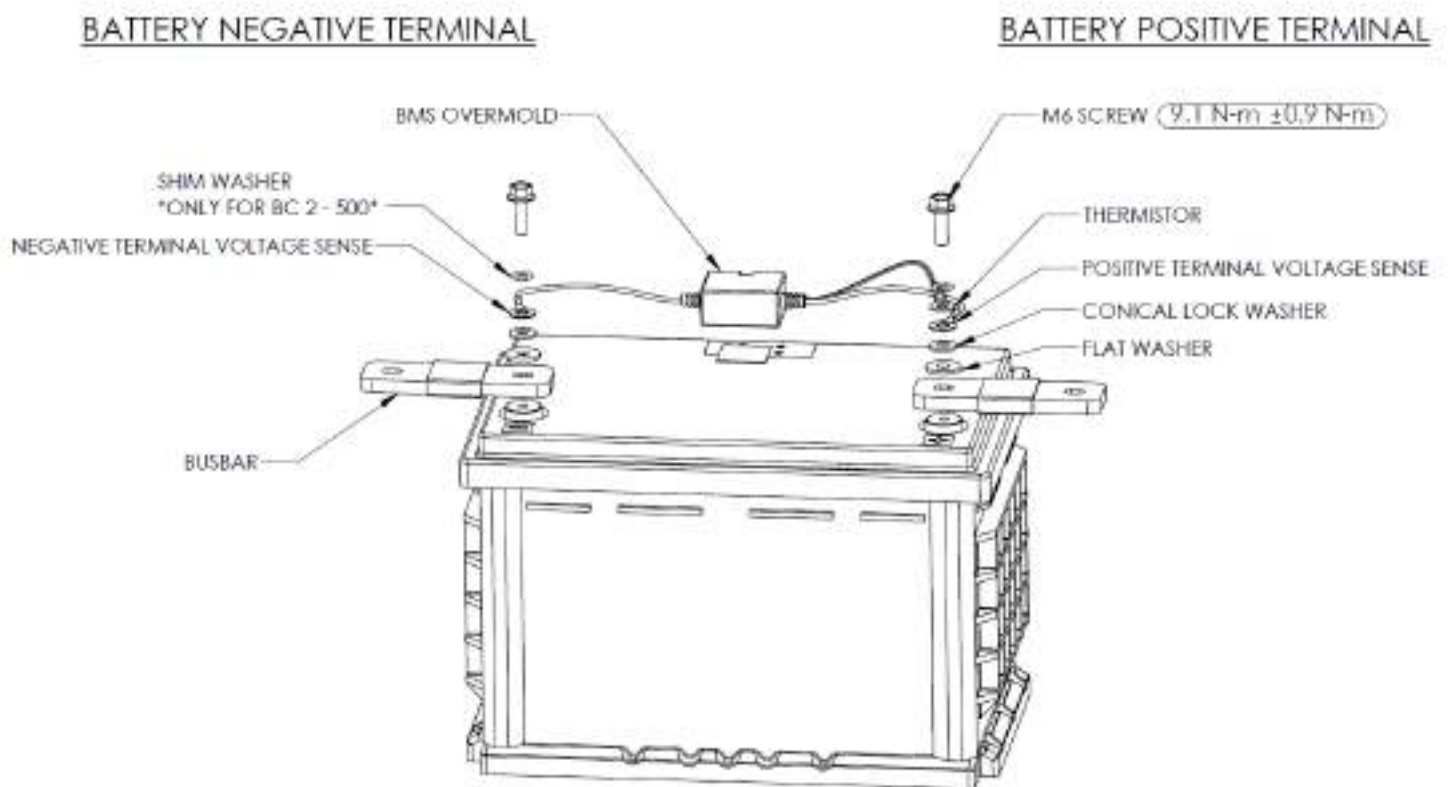


Figure 33 - BC 2 Series Battery Terminal Connections.

Appendix C

BREAKER INFORMATION		
BREAKER PART NUMBER	24 VDC LVR	2A2B AUX. CONTACTS PART NUMBER
LL137060D3A8U0	600	S29410
		S29450

S29450 CHARACTERISTIC		
OPERATIONAL CURRENT	AC	DC
24 V	6 A	6 A
48 V	6 A	2.5 A
110 V	6 A	0.6 A
220/240 V	6 A	-

CAUTION: HIGH VOLTAGE, RISK OF ELECTRICAL SHOCK

- FOLLOW ALL SAFETY PRECAUTIONS WHEN WORKING ON THIS SYSTEM
- ALWAYS WEAR PROPER SAFETY EQUIPMENT INCLUDING EYE PROTECTION

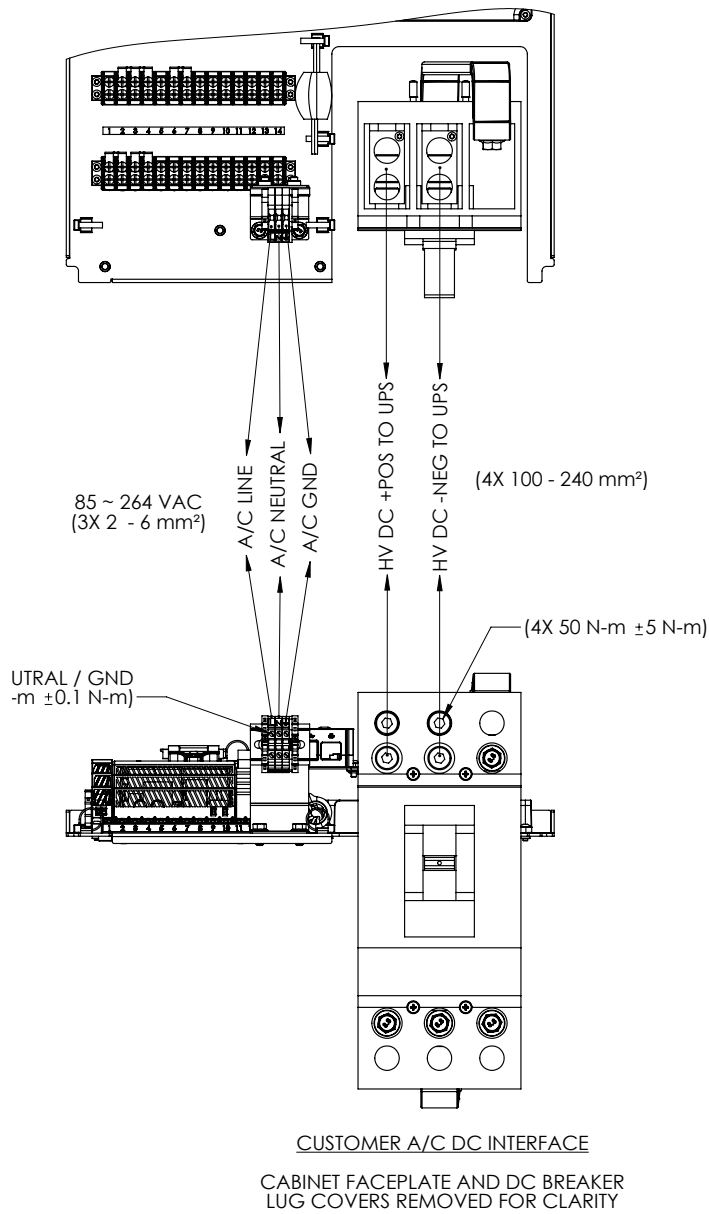


Figure 34 - SCD Breaker Connections.

LUG INFORMATION					
LUG PART NUMBER	CONDUCTOR SIZE	STRIP LENGTH	TORQUE	NECESSARY TOOLS	MANUFACTURER DOCUMENT LINK
AL600L552K3	2/0 AWG - 500 KCMIL	1.2 INCH	442 LB-IN	TORQUE WRENCH, RATED 500 IN-LBS 8 MM HEX WRENCH	https://download.schneider-electric.com/files?p_e=Instruction+sheet&_File_Name=ST1A14748.pdf&p_Doc_Ref=ST1A14748

Appendix D

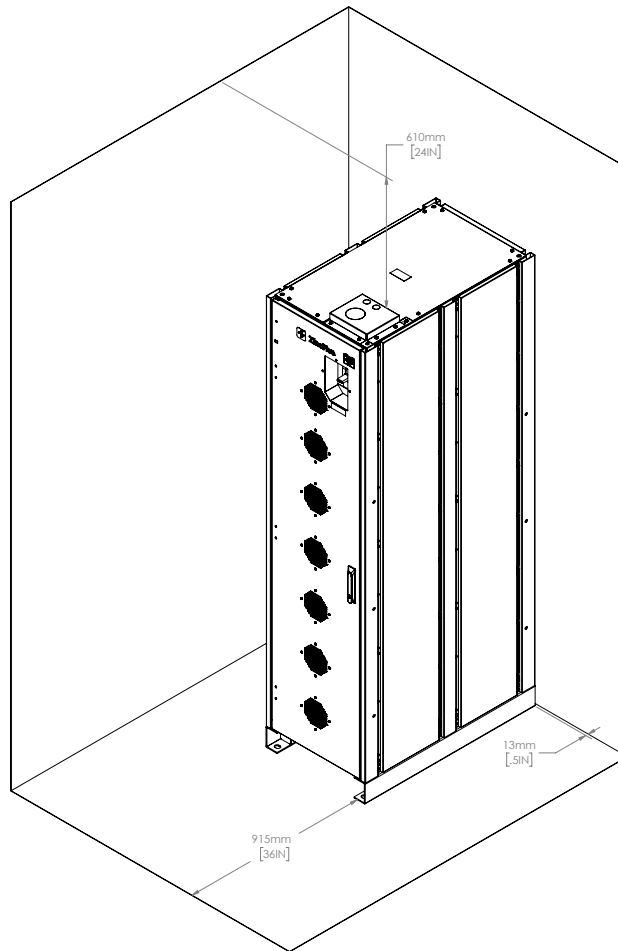
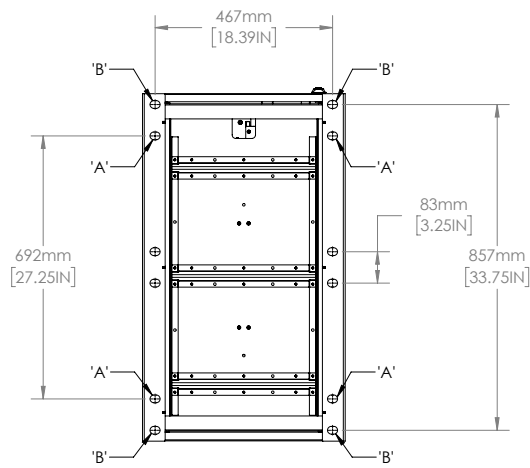


Figure 35 - Required Clearances.



MOUNTING HOLE PATTERNS MARKED 'A' OR 'B' ARE REQUIRED FOR INSTALLATION. OTHER HOLES ARE OPTIONAL.

BOTTOM VIEW OF CABINET

Figure 36 - Bolt hole locations for mounting.

Appendix E

Using model number **ZF-37B6SU011KB1-UF000**, which corresponds with a BC 2 - 500 cabinet, the below provides a detailed breakdown of model nomenclature.

<u>Z</u>	<u>F</u>	-	<u>3</u>	<u>7</u>	<u>B</u>	<u>6</u>	<u>S</u>	<u>U</u>	<u>0</u>	<u>1</u>	<u>1</u>	<u>K</u>	<u>B</u>	<u>1</u>	-	<u>U</u>	<u>F</u>	<u>0</u>	<u>0</u>	<u>0</u>
I			II		III	IV	V	VI	VII	VIII	IX	X	XI		XII	XIII	XIV	XV	XVI	

- I. Company Name Abbreviation: **ZF** = ZincFive, this is the same for every model number.
- II. Number of batteries in the cabinet: Reflects **36**, **37**, **38**, or **39** depending on battery count.
- III. Monobloc Model Number: **A** = Z5 13 - 80 H S F battery (used only in the BC 2) and **B** = Z5 13 - 90 U S F battery (used only in the BC 2 - 300X and the BC 2 - 500).
- IV. Breaker Rating: **6** = 600 A.
- V. Breaker Manufacturer: **A** = ABB XT5LU360 – 50 kA, **B** = ABB XT5HU360 – 35 kA, **C** = ABB XT 5SU360 – 25 kA, **D** = ABB XT5VU360, **S** = Square D (Schneider) LLL37060D33 – 50 kA, and **T** = Square D (Schneider) LGL37060D33 – 20 kA.
- VI. Relay Type: **U** = UVR and **S** = Shunt Trip.
- VII. Relay Voltage: **01** = 12 VDC, **02** = 24 VDC, **03** = 48 VDC, **04** = 120 VAC
- VIII. Power Path: **1** = BC 2 Ultra Power Path (used only in the BC - 2 500) and **2** = BC 2 Power Path (used only in the BC 2 and BC 2 - 300X)
- IX. Enclosure: **K** = Enclosure Manufacturer
- X. Enclosure Width: **B** = 21.1"
- XI. Power Supply Options: **1** = Single 120/240 VAC power supply, **2** = 120/240 VAC and 600 VDC power supply, and **3** = Two 120/240 VAC power supply
- XII. Communication Option: **U** = Universal, **C** = Cloud, L = Local Server, **M** = Modbus
- XIII. Noise Filtering Option: **P** = Pass-thru filter and **F** = LC Filter
- XIV. Cabinet Color: **0** = Black and **1** = White
- XV. Undefined
- XVI. Undefined

Appendix F - Ratings Table

PRODUCT TYPE	BATTERY COUNT	NOMINAL VOLTAGE (VDC)	Max System Voltage (VDC)	Max Energy Capacity (kWh)	NOMINAL CAPACITY (Ah)	POWER RATING (kW)	Recommended Charging Voltage (VDC)
BC 2	36	468	555.00	44.00	80	288	544
	37	481	570.00	45.00		296	559
	38	494	585.00	46.00		304	574
	39	507	600.00	48.00		312	589
BC 2 - 300X	36	468	555.00	50.00	90	288	541
	37	481	570.00	51.00		296	556
	38	494	585.00	52.00		304	572
	39	507	600.00	54.00		312	587
BC 2 - 500	36	468	555.00	50.00		432	541
	37	481	570.00	51.00		444	556
	38	494	585.00	52.00		456	572
	39	507	600.00	54.00		468	587

PRODUCT TYPE	BATTERY COUNT	CHARGING VOLTAGE RANGE (VDC)	CHARGING CURRENT RANGE (ADC)	MAX DISCHARGE CURRENT (ADC)	SHORT CIRCUIT RATING (A)	BATTERY MODEL
BC 2	36	537 - 555	20 - 160	800	5400	Z5 13-80 H S F
	37	552 - 570				
	38	567 - 585				
	39	582 - 600				
BC 2 - 300X	36	537 - 555	20 - 180		6200	Z5 13-90 U S F
	37	552 - 570				
	38	567 - 585				
	39	582 - 600				
BC 2 - 500	36	537 - 555		1200		
	37	552 - 570				
	38	567 - 585				
	39	582 - 600				

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ZincFive, Inc.
20170 SW 112th Ave.
Tualatin, Oregon 97062

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