CASCADE MISSION CRITICAL, LLC
Data Center Consulting

PROJECT DESCRIPTION

November 22, 2023

Re: Centeris Data Center
Puyallup, WA
Voltage Park Project

Project Description

General

This project will consist of developing new mechanical and electrical infrastructure to support new data center tenant loads for this facility. The project will include the addition of a new medium voltage feeder from the existing PSE sub-station to the data center building and the addition of new cooling equipment and electrical equipment.

Existing Site Information

Project Address: 1023 39th Avenue SE

Legal Description:

Section 03 Township 19 Range 04 Quarter 42 LOT 2 OF BLR 2022-03-22-5003 A POR OF BLR 2019-05-22-5002 LY IN CY OF PUYALLUP MORE PARTICULARLY DESC AS FOLL COM AT STONE MON MARKING S 1/4 COR OF SEC 3 SD STONE MON LIES N 86 DEG 31 MIN 42 SEC E 2621.06 FT

Lot Area: 15.77 Acres

Owner: BCC PUYALLUP LLC, Address:9675 SE 36TH ST STE 115

Zoning: MP – Business Park

New Medium Voltage Feeder

A new medium voltage electrical feeder will be installed from the existing PSE sub-station located on the south side of the property to the north side of the existing data center on the northern edge of the property. This part of the project will include the construction of a new pre-engineered metal switchgear building adjacent to the existing sub-station and will encompass approximately 1,500 sf of building area.

The new medium voltage feeder will be routed in an underground trench from the switchgear building to the north utility yard of the data center, where it will terminate in dedicated equipment to serve the data center.

CASCADE MISSION CRITICAL, LLC
6210 36th Avenue N.E.
Seattle, WA 98115
P: 206-294-1288

New Electrical Infrastructure – Exterior

Ten (10) new diesel standby generators will be installed as part of this project, located in the existing utility yard area on the north side of the data center. Each generator will be installed within a self contained acoustical weather proof enclosure and will be equipped with UL 142 base fuel storage tanks. All fuel storage will be in above ground tanks.

Also within the utility yard will be new electrical transformers and switchgear to distribute the normal utility power and standby power to within the data center.

New Electrical Infrastructure – Interior

Within the existing building, new UPS (Uninterruptable Power Supply) systems with batteries will be installed to provide back up power for server loads. The battery systems anticipated for use in these UPS systems will be of the nickel-zinc type of batteries. Please refer to the attached battery systems information.

There will also be new electrical distribution equipment installed in the data center electrical rooms and on the data center floor to distribute critical power to the tenant server pods.

New Mechanical Infrastructure – Exterior

New exterior air cooled chiller units will be installed to support the cooling loads for the new equipment spaces and future tenant installations. Two new chillers will be installed in the north utility yard to provide cooling for the new interior UPS rooms, and four new chillers will be installed at a future date to support cooling load for a planned future data center tenant space.

The chillers will be provided with exterior pumping systems and will be installed on concrete equipment pads.

New Mechanical Infrastructure – Interior

New exhaust fan systems will be installed on the lower level of the data center to provide enhanced airflow as required for the new data center cooling loads.

IFC 2021 Hazard Mitigation Analysis

ESS specific information for Nickel-Zinc electrochemical storage systems

Executive Overview

This document will provide information regarding the compliance of Nickel-Zinc battery Energy Storage System (ESS) as required by the IFC 2021 (International Fire Code). As described in Section 1207.1.3 Construction Documents, this document will provide detailed information on the quantity and type of ESS (specifically, the ZincFive nickel-zinc battery ESS), the specifications, ratings and listings of the ESS, and the energy storage management system and its operation.

In addition, test report data provided by UL as required in Section 1207.1.5 and Section 1207.1.5.2, and the Operations and Maintenance (O&M) manual is attached as required in Section 1207.2.2 (1).

Qualification based on Capacity and Electrochemistry

In IFC 2021 Table 1207.1.1 Threshold Quantities, nickel-zinc ESS. The nickel-zinc electrochemistry is not specifically named in the table or the notations as a listed electrochemistry. Nickel-zinc is, however, very similar to nickel-cadmium or nickel-metal hydride technologies and exhibit the same safety and reliability as either of the other nickel chemistries. Although nickel-zinc isn't specifically listed (and therefore falls under "other battery technologies") in this table, there is adequate documentation to assure the AHJ that the chemistry is both safe and reliable. In the NFPA 855 document, nickel-zinc is specifically noted as being the equivalent of nickel-cadmium and nickel-metal hydride batteries. This may also be referred to as additional substantiation for the use of this chemistry.

In Section 1207.5 Maximum Stored Energy and in Table 1207.5 Maximum Allowed Quantities, other nickel nickel-based batteries have an unlimited Maximum Stored Energy capacity in each fire area. In the NFPA 855 document, nickel-zinc is specifically noted as being the equivalent of nickel-cadmium and nickel-metal hydride batteries. This information, coupled with the UL 9540A report should provide adequate justification for requesting a variation from the maximum allowed capacity in a single fire control area.

Hazard Mitigation Analysis Information

In the event a ZincFive ESS is installed in a situation covered by Section 104.8.2, the UL9540A test report (as require in 1207.1.5) is included to provide the data regarding thermal runaway conditions in the nickel-zinc battery and the listing information for the Energy Storage Management System is provided showing that the entire system meets UL 1973, and as such is a qualified ESS component for a UL 9540 system.

Although IFC 2021 states in Section 1207.3.1 Energy Storage System Listings, that "ESS shall be listed in accordance with UL 9540", in Section 1.1 of UL 9540, it states that "Individual parts (e.g. power conversion system, battery system, etc.) are not considered to be an energy storage system on their own". A reference block diagram of an energy storage system is depicted in Figure 6.1 of UL 9540.

Specific requirements for nickel-zinc batteries in IFC 2021

In the NFPA 855 document, nickel-zinc is specifically noted as being the equivalent of nickel-cadmium and nickel-metal hydride batteries.

1207.4 General installation requirements

1207.4.7: Toxic and highly toxic gas: ZincFive nickel-zinc batteries release ~98.1% Hydrogen and ~1.99% Carbon Dioxide, with trace elements of several other gasses as related in Table 15 of the attached UL 9540A test report. As indicated in the UL9540A test report, the Post Test Thermal Runaway and Re-Ignitions section indicates that no posttest thermal runaway behavior or re-ignitions were observed.

1207.3.4: The battery management system installed in the ZincFive battery cabinet complies with and is listed to UL 1973. There are no critical failure modes with nickel-zinc batteries, but the system was previously certified prior to ZincFive selecting the system.

1207.5.1: ZincFive battery cabinets have an absolute maximum rating of 48 kWh each.

1207.5.1(2) ZincFive battery cabinets may be placed closer than 3' to other cabinets and walls based on the UL 9540A test report conclusions.

1207.5.5(2): Sprinkler systems using minimum stated densities are adequate to provide fire control.

IN NFPA 855, there is a Technical Interim Amendment TIA 20-1 (1) revises 4.11.2.1 to read as follows: "Sprinkler systems for ESS units (groups) with a maximum stored energy of 50 kWh, as described in 4.6.2, shall be designed using a minimum density of 0.3 gpm/ft^2 (12.2 mm/min) based over the area of the room or 2500 ft^2 (230 m^2) design area, whichever is smaller, unless a lower density is approved based upon large-scale fire testing in accordance with 4.1.5." The same TIA revises 4.11.2.1.1 to read as follows: "Sprinkler systems for ESS units (groups) exceeding 50 kWh shall be permitted to use an alternate density based on large-scale fire testing in accordance with 4.1.5." Also revised is the explanation given in Annex A.4.11.2.2 to read as follows: "UL 9540A Installation Level Test, Method 1, provides the data needed to determine if automatic sprinkler design densities can be changed. A sprinkler density in excess of 0.3 gpm/ft^2 (12.2 mm/min) can be necessary to provide an adequate level of protection, especially for some lithium-ion battery ESS designs. However, test results for some ESS designs and technologies indicate sprinkler densities less than 0.3 gpm/ft^2 (12.2 mm/min) could be acceptable. Equivalent test standards, as permitted in 4.1.5, might provide comparable data."

Table 1207.6: Electrochemical ESS Technology-Specific Requirements

Table 1207.6, Notes(b) and (e) are addressed in the UL 9540A report and the UL 1973 listing for the battery management system installed in the ZincFive battery cabinet assemblies.

This table is focused on well-known chemistries that are widely available in the marketplace and have a long history of deployments. Nickel-zinc may not be as well-known as other battery types. The ZincFive nickel-zinc battery is listed under UL 1989 as a non-spillable valve regulated battery and is installed in a UL 1778 listed battery cabinet system for stationary UPS applications. The battery management system contained in every battery cabinet is listed to UL 1973 as an Energy Storage Management system.

Table 1207.6.1: Due to the low volume of emitted gases and the non-explosive nature of the nickel-zinc chemistry (as reflected in the UL 9540A report), the minimum exhaust ventilation as required by this section is adequate for nickel-zinc installations.

1207.6.3(2): As reflected in the UL 9540A Test Report, there is no additional requirement for deflagration venting when using ZincFive nickel-zinc batteries.

1207.6.2: ZincFive batteries are listed to UL 1989 as a non-spillable valve regulated battery and require no spill control.

UL 9540A Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems, Third Edition

Cell Level Test Report

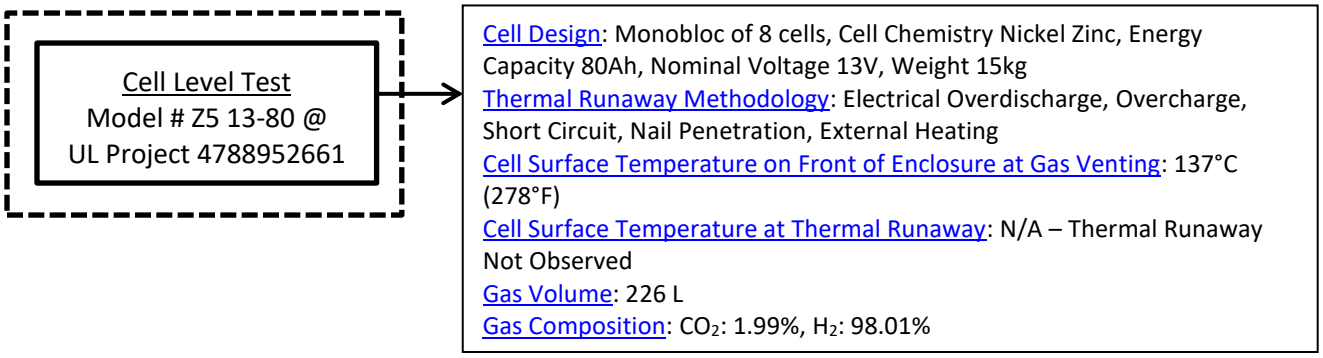
Model Z5 13-80 @ (@ - models may be followed by; H, S, M, and/or F. Designating; Rate, Terminal type and case Flame rating)

Prepared by UL LLC for ZincFive

Issued: November 22, 2019

Project Number 4788952661

Summary of UL 9540A Test Results



(@ - models may be followed by; H, S, M, and/or F. Designating; discharge rate, terminal type and case material flame rating)

For each of the 5 test methods implemented to induce thermal runaway, no thermal runaway was observed with the ZincFive NiZn battery under test.

Summary of Cell Test Results

Battery Vent and Thermal Runaway Results

A summary of battery venting times and temperatures, and thermal runaway time and temperatures are presented in Table 16.

Table 16 – Summary of measurements collected in Cell Level Tests 1 - 6

Test	Test Method	Venting Time (mm:ss)	Venting Temperature (°C)	Thermal Runway Time (mm:ss)	Thermal Runway Temperature (°C)
1	Overdischarge	Not Observed	N/A	Not Observed	N/A
2	Overcharge	91:30	103.7	Not Observed	N/A
3A	Heating Trial 1	22:30	216	Not Observed	N/A
3B	Heating Trial 2	46:30	180.5	Not Observed	N/A
4	Nail Penetration	00:15	84.5	Not Observed	N/A
5	Short Circuit	00:18	99.6	Not Observed	N/A
6[3]	Gas Composition (Overcharge)	66:40	97.5	Not Observed	N/A

The average vent temperature based upon tests 1, 2, 3, 4, and 5 is 137°C, as measured on the front face of the monobloc. Thermal runaway was not observed in any of the 5 tests, therefore repeat tests were not required.

Battery Venting Gas Analysis

The total amount of gas collected from the battery after venting was 226 L at Normal Tempreature and Pressure (NTP), over a period of approximately 1 hour and 6 minutes. Flammability properties were determined empirically:

- LFL: 4.0%
- Pmax: 116 psig
- S_u: N/A – Burning velocity cannot be accurately measured due to the high percentage of hydrogen.

[3] Cell test 6 is not included in the average venting temperature or thermal runaway temperature, as the test environment inside the gas composition chamber is not the same as free air.

Data Sheet

BC Series UPS Battery Cabinet

BC 2

Introduction

The ZincFive UPS Battery Cabinet is the world's first NiZn (Nickel-Zinc) BESS (Battery Energy Storage Solution) product with backward and forward compatibility with megawatt class UPS inverters. Unique NiZn benefits include:

- Industry-leading safety with no thermal runaway[1]
- Depleted NiZn cells remain conductive, enabling reliable string operation
- High power density in a light-weight package
- Module and String level monitoring
- Over Current and Over Voltage Protection
- Easy maintenance pullout battery trays
- Seismic IBC 2018 rated, highly durable cabinet design
- Highly effective charge control across multiple inverter platforms
- UL 1778 and CAN/CSA C22.2 No. 107.3
- IEC 62040-1, IEC 62040-2
- CE and RoHs Compliance in progress

[1] ZincFive batteries were tested at the cell level to UL9540A, a Test Method for Evaluating Thermal Runaway, and ZincFive's nickel-zinc batteries did not exhibit thermal runaway in any of the five tests.

Benefits of NiZn Technology

Superior Power Density – Approximately 50% the weight of lead acid batteries. Twice the power density.

Low Total Cost of Ownership – Low battery maintenance and small footprint.

Superior Battery Cycle Life – Exceeds twice the typical industry required cycle life

Safety – No thermal runaway nor travel restrictions for NiZn batteries.

ZincFive BC Series UPS Battery Cabinet

Specifications

Model	ZincFive BC Series UPS Battery Cabinet ZF-37A6SU022KB1-LF000	ZincFive BC Series UPS Battery Cabinet ZF-38A6SU022KB1-LF000	ZincFive BC Series UPS Battery Cabinet 507V ZF-39A6SU022KB1-LF000
Electrical			
Nominal Voltage	481 Vdc	494 Vdc	507 Vdc
Charge Voltage Range	552 Vdc to 570 Vdc	567 Vdc to 585 Vdc	582 Vdc to 600 Vdc
Minimum and Maximum Charge Current	20 A minimum; 160 A maximum		
Standard Charging Current	80 A		
Charge Time	Ranges from 2 hours to 5 hours for 0-100% SOC, dependent on charge current		
Low Voltage Cutoff	370 Vdc	380 Vdc	390 Vdc
Nominal Capacity C/2 at 25°C	>80 Ah		
Nominal Energy Storage at C/2	37 kWh	38 kWh	39 kWh
Battery Chemistry	NiZn with starved, KOH aqueous electrolyte (Alkaline, no acid)		
Maximum Discharge Current	800 A		
Single String Battery Configuration	37 Battery modules in a single string per cabinet (37S1P)	38 Battery modules in a single string per cabinet (38S1P)	39 Battery modules in a single string per cabinet (39S1P)
System BMS Functions			
Monitoring	BMS manages charge/discharge functions and monitors full suite of parameters including battery voltage, temperature and current.		
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 and isolates battery string in two parts		
Operating Temperature Range [1]	20°C to 35°C		
Storage Temperature Range	-20°C to 50°C		
Storage Period	6 months at 25°C before batteries need charge		
Humidity Range	0-90%, Non-Condensing		
Cooling	Forced Ventilation Standard		
Transport	No Transportation Restrictions		
Certifications			
Cabinet	UL1778, CE, RoHS, CSA		
Battery	UL 1989; CAN/CSA-C22.2 No. 60896-21:17 EU Batteries Directive (2006/66/EC)		
Seismic	IBC 2022		
Mechanical			
Height	82.5 inches for Cabinet / 83.5 inches with High Voltage Box		
Width	21" (533mm)		
Depth	Depth: 36" (914mm)		
Total Weight	2,065 lbs. (936.67 kg)	2100 lbs. (952.54 kg)	2135 lbs. (968.42 kg)

[1]consult with ZincFive for use outside this temperature range

* All Specifications Valid at Operating Temperature Range *All Specifications Subject to Change

SAFETY DATA SHEET

Section 1: Identification

Product Name: Nickel Zinc Battery (Cell) Sizes: Sub-C and Prismatic

Chemical Name/Synonyms: None

Identified uses: Power storage

Company: ZincFive (dba PowerGenix in China)

Address: 20170 SW 112th Avenue Tualatin, OR 97062

Telephone: 001 503-399-3517

Emergency Phone number: 001 503-399-3517 (Within USA call 911)

For information about this SDS, use this department contact phone#: 503.399.3517

Section 2: Hazard(s) Identification

2.1 Hazard Classification:

Corrosive to metals (Category 1), H290
Acute toxicity, Oral (Category 4), H302
Skin corrosion (Category 1A), H314
Skin sensitisation (Category 1), H317
Acute toxicity, Inhalation (Category 4), H332
Respiratory sensitisation (Category 1), H334
Germ cell mutagenicity (Category 2), H341
Carcinogenicity, Inhalation (Category 1A), H350i
Reproductive toxicity (Category 1B), H360
Specific target organ toxicity - repeated exposure (Category 1), H372
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

2.2 Label elements

Pictograms:

Signal Word(s): Danger

Hazard Statements:

H290 May be corrosive to metals.
H302 Harmful if swallowed.
H314 Causes severe skin burns and eye damage.
H317 May cause an allergic skin reaction.
H332 Harmful if inhaled
H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H341 Suspected of causing genetic defects.
H350i May cause cancer by inhalation.
H360 May damage fertility or the unborn child.
H372 Causes damage to organs through prolonged or repeated exposure.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary Statements:

P201 Obtain special instructions before use.
P261 Avoid breathing dust.
P273 Avoid release to the environment.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330 IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell. Rinse mouth.
P303 + P361 + P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 + P310 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/doctor.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Other hazards: Do not dispose of battery in fire- may explode

Section 3: Composition/ Information on Ingredients

MIXTURE: This is a manufactured product that does not fall under a chemical designation.

Component	CAS#	Classification	Conc.
Nickel Hydroxide	12054-48-7	Acute Tox. 4; Skin Irrit. 2; Resp. Sens. 1; Skin Sens. 1; Muta. 2; Carc. 1A; Repr. 1B; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H302, H332, H315, H334, H317, H341, H350i, H360, H372, H400, H410 M-Factor - Aquatic Acute: 10	<20%
Potassium Hydroxide	1310-58-3	Met. Corr. 1; Acute Tox. 4; Skin Corr. 1A; H290, H302, H314	<10%
Lithium Hydroxide	1310-66-3	Acute Tox. 4; Skin Corr. 1B;H302, H314	<1%
Zinc Oxide	1314-13-2	Aquatic Acute 1; Aquatic Chronic 1; H400, H410 M-Factor - Aquatic Acute: 1	<19%
Nickel (Powder)	7440-02-0	Carc. 2; Skin Sens. 1; STOT RE 1; Aquatic Chronic 3; H351, H317, H372, H412 M-Factor - Aquatic Acute: 1	<2%
Cobalt	7740-48-4	Resp. Sens. 1; Skin Sens. 1; Aquatic Chronic 4; H334,H317, H413	<1%
Steel	N/A	N/A	<15%

Section 4: First-Aid Measures

4.1 Description of necessary measures

If inhalation: If liquid vapors are inhaled, provide fresh air and seek medical attention if respiratory irritation develops.

If eye contact: If liquid comes into contact with eyes, wash with copious amounts of water for 15 minutes, and contact a physician.

If skin contact: If liquid leakage occurs and makes contact with skin, flush area with water

immediately.

If Ingestion:. Never give anything by mouth to an unconscious person. Consult a physician

4.2 Most important symptoms/effects, acute and delayed.

See section 2 & section 11

4.3 Indication of immediate medical attention and special treatment needed

No data available

Section 5: Fire-Fighting Measures

5.1 Suitable extinguishing media: Carbon Dioxide, Dry Chemical, or Foam extinguishers

5.2 Specific hazards arising from the chemical: Nickel/nickel oxides, Cobalt/cobalt oxides, Zinc/zinc oxides, Lithium oxides, Potassium oxides

5.3 Special protective equipment and precautions for fire-fighters: Wear Protective cloths and a positive pressure Self-Contained Breathing Apparatus (SCBA). if necessary.

Section 6: Accidental Release Measures

6.1 Personal precautions, protective equipment, and emergency procedures: Steps to be taken in case material is released or spilled Batteries that are leaking should be handled with rubber gloves. Avoid Direct contact with liquid. Wear Protective cloths and a positive pressure Self-Contained Breathing Apparatus (SCBA).

6.2 Methods and materials for containment and cleaning up: Discharge into the environment must be avoided

Section 7: Handling and Storage

7.1 Precautions for safe handling: Batteries should be handled and stored carefully to avoid short circuits. NEVER disassemble a battery. Do not breath cell vapors or touch internal material with bare hands.

7.2 Conditions for safe storage, including any incompatibilities: The ingredients are contained in a hermetically sealed case, designed to withstand temperatures and pressures encountered during normal use. As a result, during normal use, hazardous materials are fully contained inside the battery. The battery should not be opened or exposed to heat because exposure to the following ingredients contained within could be harmful under some circumstances. Do not store in disorderly fashion or allow metal objects to be mixed with stored batteries. Keep batteries between -30° and 35°C for prolonged storage.

Section 8: Exposure Controls/Personal Protection

8.1 Control parameters

Chemical Name	OSHA PEL	OSHA PEL (ceiling)	ACGIH OEL (TWA)	ACGIH OEL (STEL)
No data available				

8.2 Appropriate engineering controls: Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and after work

8.3 Individual protection measures:

Breathing equipment: Wear a positive pressure Self-Contained Breathing Apparatus (SCBA).

Protection of hands/skin: Handle with gloves, wear protective cloths and use proper glove to avoid skin contact with this product.

Eye protection: Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards

Section 9: Physical and Chemical Properties

Appearance: Cylindrical or Prismatic Shape

Odor: Odorless

Odor threshold: No data available

pH: No data available

Melting point/freezing point: No data available

Initial boiling point and boiling range: No data available

Flash point: No data available

Evaporation rate: No data available

Flammability: No data available

Upper/lower flammability or explosive limits: No data available

Vapor pressure: No data available

Vapor density: No data available

Relative density: No data available

Solubility: No data available

Partition coefficient: No data available

Auto-ignition temperature: No data available

Decomposition temperature: No data available

Viscosity: No data available

Section 10: Stability and Reactivity

10.1 Reactivity: No data available

10.2 Chemical stability: see section 7

10.3 Possibility of hazardous reactions: No data available

10.4 Conditions to avoid: Do not dispose of battery in fire- may explode

10.5 Incompatible materials: No data available

10.6 Hazardous decomposition products: No data available

Section 11: Toxicological Information

Acute toxicity: No data available

Potential routes of exposure/potential health effects

Skin: In case of liquid leakage, contact with skin can cause severe irritation and chemical burns.

Eye: Exposure to the liquid contained inside the battery may result in severe irritation and chemical burns

Inhalation: Inhalation of liquid vapors may cause irritation of the upper respiratory tract and lungs.

Ingestion: . If the battery case is breached in the digestive tract, the electrolyte may cause localized burns.

Skin corrosion/irritations: No data available

Serious eye damage/eye irritation: No data available

Respiratory or skin sensitisation: No data available

Germ cell mutagenicity: No data available

Carcinogenicity: Carcinogenicity: Nickel has been identified by the National Toxicology Program (NTP) as reasonably anticipated to be a carcinogen. Cobalt has been identified by IARC as a 2B carcinogen.

Reproductive toxicity: No data available

Specific target organ toxicity - single exposure: No data available

Specific target organ toxicity - repeated exposure: Chronic overexposure to nickel may result in cancer; dermal contact may result in dermatitis in sensitive individuals.

Aspiration hazard: No data available

Section 12: Ecological Information (non-mandatory)

12.1 Ecotoxicity: Under normal use this battery is not hazardous to the ecology. If the battery case is broken, the chemicals inside the battery are harmful to the environment and must be disposed of properly.

12.2 Persistence and degradability No data available

12.3 Bioaccumulative potential: No data available

12.4 Mobility in soil: No data available

12.5 Other adverse effects (such as hazardous to the ozone layer: No data available

Section 13: Disposal Considerations (non-mandatory)

13.1 Waste treatment methods

ZincFive cares about our environment and has made arrangements for users to easily recycle batteries at end of life. Call ER2, our recycling partner, at 1-844-372-0002 or visit ER2.com to schedule a pick-up and learn more. Nickel-zinc batteries must be handled in accordance with all applicable state and federal laws and regulations.

Section 14: Transport Information (non-mandatory)

14.1 UN number: No data available

14.2 UN proper shipping name: No data available

14.3 Transport hazard class(es): No data available

14.4 Packaging group: No data available

14.5 Environmental hazards: No data available

14.6 Special precautions for user

ZincFive batteries are considered to be "Dry Cell" batteries and are unregulated for the purpose of transportation by the U.S. Department of Transportation (DOT), International Civil Aviation Administration (ICAO), International Air Transport Association (IATA), and International Maritime Dangerous Goods Regulations (IMDG). The DOT requirement for shipping Nickel Zinc batteries is Special Provision 130 which states: "Batteries, dry are not subject to the requirements of this subchapter only when they are offered for transportation in a manner that prevents the dangerous evolution of heat." (For example, by the effective insulation of exposed terminals) Special Provision A123 in the IATA Dangerous Goods. Regulations and ICAO Technical Instructions and Special Provision 130 in 49 CFR 172.102 of the U.S. hazardous materials regulations requires batteries being transported by air must be protected from short-circuiting and protected from movement that could lead to short-circuiting in addition, the words "Not Restricted" and "Special Provision A123" are required on the air waybill, when an air waybill is issued.

Section 15: Regulatory Information (non-mandatory)

US Federal Regulations

SARA Section 355 (extremely hazardous substances): No data available

SARA Section 313 (specific toxic chemical listings): No data available

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs): No data available

TSCA (Toxic Substances Control Act): No data available

Section 16: Other Information

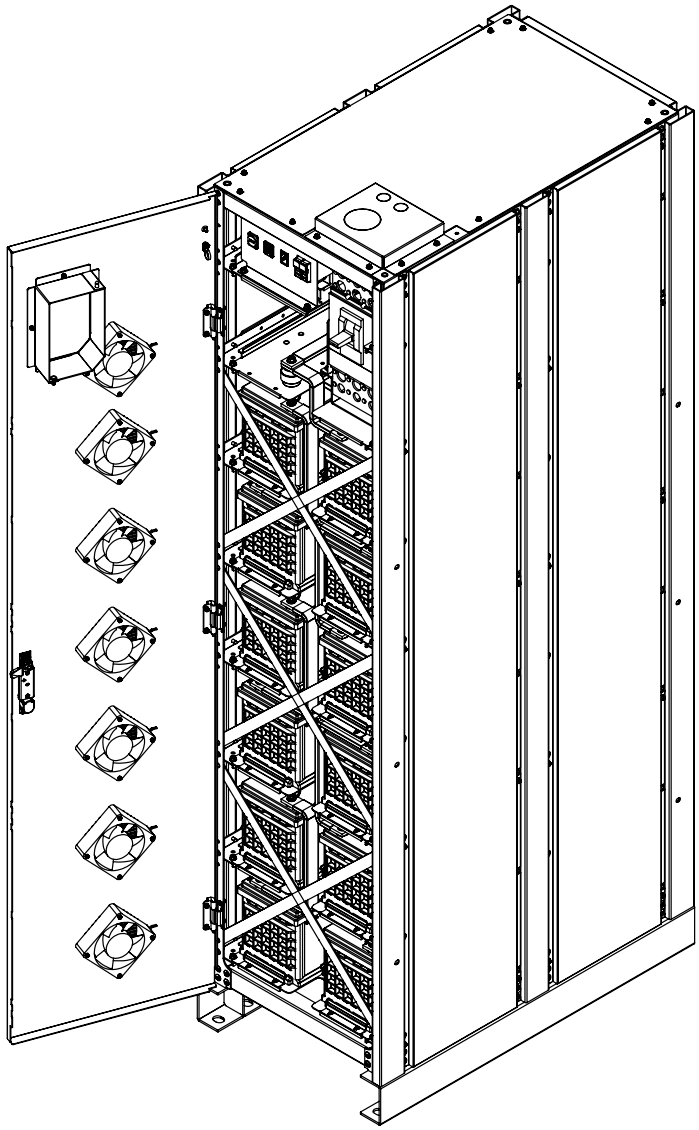
The information of SDS is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information of the document is based on the present of our knowledge and is applicable to the product with regard to appropriate safety precautions.

SDS date of preparation/update: 5/24/2019

INSTALLATION INSTRUCTIONS

BC Series
UPS Battery Cabinets

BC 2



BC 2 UPS
Battery Cabinet

Table of Contents

Introduction

Proprietary Information

This document contains information that is confidential and proprietary to ZincFive, Inc. It may not be reproduced, distributed, or translated in any other language, in whole or in part, without written approval from ZincFive and/or its associated partners.

Support

Support Contacts

For technical support, please contact a ZincFive support representative:

Support Phone: 888.517.7776
Support Email: support@zincfive.com
Support 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

Returns Email: support@zincfive.com
Support Phone: 888.517.7776

Customer is responsible to properly package product for return.. ZincFive does not warranty product damage from return shipping unless it is shipped in approved packaging.

About this Manual

This manual contains information to help owners and operators understand how to safely and properly prepare, install and operate the ZincFive batteries.

Instructions in this manual must be followed to ensure proper installation, operation and maintenance of the batteries in accordance with the Limited Warranty.

Save this Manual

This manual provides guidelines for safe and reliable battery operation. Save this manual, it contains important installation and operating instructions. If you have any questions about the safe installation, operation, or maintenance of the batteries, contact a ZincFive support representative.
(visit zincfive.com/support or call 888-517-7776).

Disclaimer

While efforts have been made to ensure the accuracy and validity of information contained in the document, ZincFive assumes no responsibility and disclaims all liability for any errors and/or omissions that may be contained herein.

Due to possible changes and/or updates to component design and software applications, this document, completely or in part may become obsolete or out-of-date until a subsequent revision is released by ZincFive.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

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

Safety

Safety Symbols

ZincFive BC Series UPS Battery Cabinet 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 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 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 électriqueexiste dans ce domiane. Faites preuve d'une extréme 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

Used to designate a connection point to ground.

Symbole de terre de protection/ symbole de terre

Désigne un point de connexion à la terre.

Battery Safety

English

⚠ This 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. The batteries may explode.

⚠ Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes. 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:

a. Remove watches, rings, or other metal objects.
b. Use tools with insulated handles.
c. Wear rubber gloves and boots.
d. Do not lay tools or metal parts on top of batteries.
e. Disconnect charging source and load prior to installing or maintaining the battery.
f. Remove battery grounds during installation and maintenance to reduce likelihood of shock.
g. Remove the connection from ground if any part of the battery is determined to be grounded.

Note: Reference the Z5 13-80 H S F Safety Data Sheet for additional battery safety instructions.
https://www.zincfive.com/subc-prismatic-material-safety-data-sheet

French

⚠ 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 raccordements 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 :

a. Retirer toutes montres, bagues ou autres objets métalliques.
b. Utiliser des outils avec des poignées isolées.
c. Porter des gants et des bottes en caoutchouc.
d. Ne pas poser d'outils ou de pièces métalliques sur les batteries.
e. Déconnecter la source de charge et la charge avant d'installer ou d'entretenir la batterie.
f. Retirez les mises à la terre de la batterie pendant l'installation et l'entretien afin de réduire les risques de choc.
g. Retirer le raccordement à la terre si une partie de la batterie est déterminée comme étant mise à la terre.

Remarque : Référez-vous à la fiche de données de sécurité du Z5 13-80 H S F pour des instructions supplémentaires sur la sécurité des batteries.
zincfive.com/subc-prismaticmaterial-safety-data-sheet

Battery Warnings and Cautions

English

⚠ SHIELD EYES AT ALL TIMES WITH PROTECTIVE GEAR.

NO SPARKS. FLAMES. 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.

French

⚠ 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.

Specifications

Refer to the ZincFive BC Series UPS Battery Cabinet data sheet for specifications.
zincfive.com/technical-documents

Safety Precautions

⚠ **DANGER: HAZARD OF ELECTRIC SHOCK, EXPOSION 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 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.

Notice: To limit drift in SOC with extended storage, the batteries must not be stored more than six months without recharging.

If attached to a UPS that remains de-energized for a long period ZincFive recommends you energize the UPS system every six months for a 12 hour period in order to recharge the batteries.

HIGH VOLTAGE: The Battery Cabinet Voltage varies by model between **370Vdc - 596Vdc**
MAXIMUM FAULT RATING (BREAKER): 20kA (instantaneous trip <10mS for any current >=7800A)
ARC FLASH DETAILS: Incident Energy at: 18in, Min. Arc Rating: 20 cal/cm2, Arc Flash Boundary: 72.5in
MAXIMUM SHORT CIRCUIT RATING (BATTERY): 5400A

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: For installation of AC wires to terminal block and to tighten cord grips.
- Insulated 8mm or 5/16" Hex driver bit: For DC Breaker termination.
- Long and short #2 Philips head screwdriver.
- Insulated Torque Wrench with crow's foot adapter and 10MM Socket: For Battery bolts.
- For cover, side panels, and GND screw a 8mm socket
- For the Faceplate a 10MM socket

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.

Avis : Pour limiter la dérive de l'état de charge lors d'un entreposage de longue durée, il ne faut pas entreposer les batteries plus de six mois sans les recharger.

Si relié à une ASI qui reste inerte pendant une période prolongée, ZincFive vous recommande d'alimenter l'ASI tous les six mois pendant une période de 12 heures afin de recharger les batteries.

HAUTE TENSION : La tension d'armoire de batteries varie selon le modèle entre 370 V c.c et 596 V c.c.
VALEUR ASSIGNÉE DE RUPTURE MAXIMALE (DISJONCTEUR) : 20 kA (déclenchement instantané < 10 mS pour tout courant >=7 800 A)
DÉTAILS DE L'ÉCLAT D'ARC ÉLECTRIQUE : Énergie incidente à : 18 po, Valeur assignée d'arc minimale : 20 cal/cm2, Limite d'arc électrique : 72,5 po
TENUE MAXIMALE AU COURT-CIRCUIT (BATTERIE) : 5 400 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.

Shipping and Unpacking

The Battery Cabinet comes fully assembled and is shipped in an Air Ride Truck to limit vibrational damage. The cabinet will be shipped upright on a pallet.

CAUTION: The Cabinet has a high center of gravity (39.2″) – use caution when moving.

Upon arrival follow these steps:

1. Inspect the outside of the cabinet for damage prior to signing for release.
   Visible Damage
   - It is the responsibility of the person receiving the shipment to inventory and fully inspect all materials against the bill of lading or weigh bill IMMEDIATELY while the carrier representative is still present. Ensure that all items are accounted for, including 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.
   - Examine the TILT and SHOCK sensor 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 time of acceptance.

Figure 1. Palletized Battery Cabinet Packaging

2. Remove foam wrap, protectors, and clear plastic over the battery cabinet.

3. There are NO strap downs on the batteries. Everything will remain secure in place.

4. 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. Note: Drawers are locked in place with two bolts and will not pull out without those being removed.
   b. Check torque seal markers on batteries
   c. Concealed Damage
      - 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.
      - Note observations of any liquid or crystallized elecotrolyte on the sides of the batteries.
   d. Return of Damaged Goods
      - For product returns, please contact a ZincFive support representative to obtain a return material authorization (RMA).

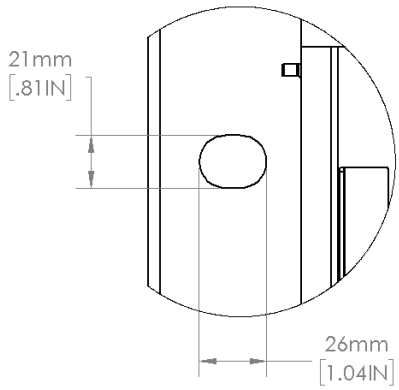
ZincFive, Inc.
20170 SW 112th Ave.
Tualatin, Oregon 97062

5. Save the packaging material in the event a return is needed. ZincFive does not warranty product damage from return shipping unless it is shipped in approved packaging. Carefully move the cabinet to the install location using necessary fork lift / pallet jack
   a. Remove bolts holding cabinet to pallet
   b. Spread forks as wide as possible when lifting.
   c. Keep as low as possible to keep center of gravity as low as possible.
   d. The cabinet has been designed to be movable while fully loaded with batteries.

NOTES:
- 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

1. The Battery Cabinet has several bolt locations for securing to the floor.
    - Refer to figure below for Bolt Hole location.
2. The cabinet should be placed where it will be mounted, holes marked and 0.75 size bolts placed for anchoring the cabinet.
    - It may be necessary to remove the bottom tray with batteries from the frame to bolt down the cabinet.
3. Set cabinet in place with anchor bolts installed. Anchoring is the responsibility of customer and is site and seismic rating dependent, bolts are not provided.
4. Anchor the frame using appropriate size Nut and Bolts for the install location.
    - Anchor bolt hole dimension: 0.75"



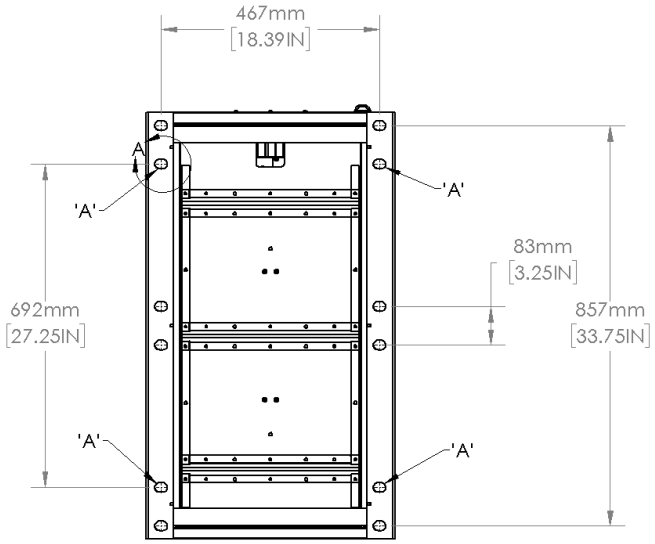


Figure 2. Cabinet Anchoring Locations

Additional Inspection

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

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

Field Connections

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

1. GROUND: Connect the GROUND wire to the GROUND NUT at the top of the cabinet.

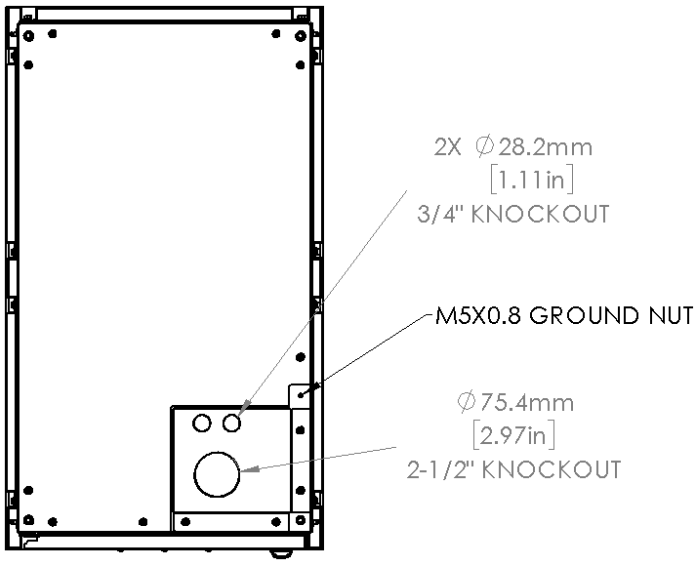


Figure 3. Knockout and Ground Details

2. DC: Connect the Positive and Negative conductors to the circuit breaker.

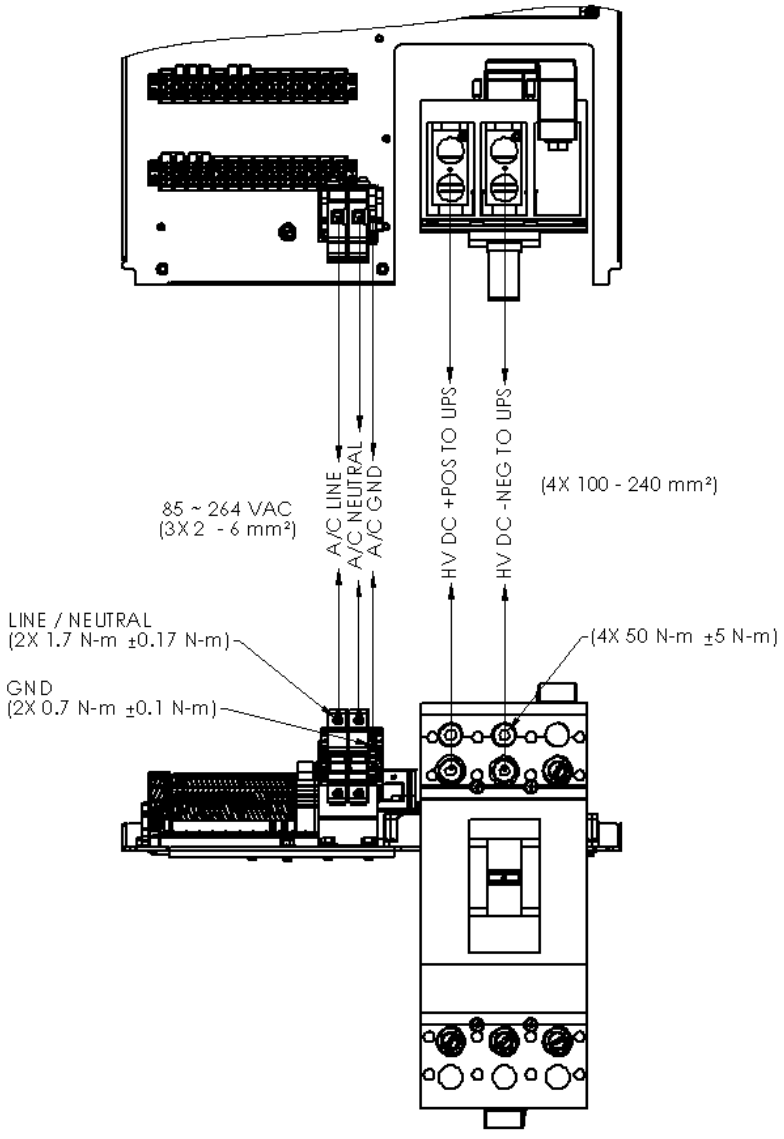
    a. Make sure all power is off before making connection.
    b. Positive conductor(s) will be attached to Terminal 1 (top of breaker)
    c. Negative conductor(s) will be attached to Terminal 3 (top of breaker)
    d. The circuit breaker torque and wire details:
        - Torque to: 442 in-lb/50N-m
        - Wire Details: Use 90C rated or higher, between #2/0 AWG - 500 kcmil Copper or Aluminum.
        - 2x 4/0 copper and use of cord grips is recommended for power rating. Should be installed by a licensed electrician and follow all local electrical codes.

Figure 4. Breaker connection detail

e. Refer to Appendix C for the circuit breaker connection details.

3. AC: Connect the Ground, Neutral and Line to the terminal block for incoming AC. Refer to figures 5 and 6.

   a. String AC and Neutral connect to fuse holders, strip wiring to 12MM. Torque screws to 1.7Nm (14.75 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 temrinal block and requires 9MM stripped length.
      Torque screws to 0.7Nm (6.19in-lb).
      Faceplate will require removal (10mm) 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.
   c. Note: The AC power MUST be supplied by a 100Watt UPS backed circuit. This powers the BMS and must remain powered when in backup during a power outage for the system to function.



CUSTOMER A/C DC INTERFACE

Figure 6. AC Input wiring (on right side at front of cabinet) and ON/OFF Switch

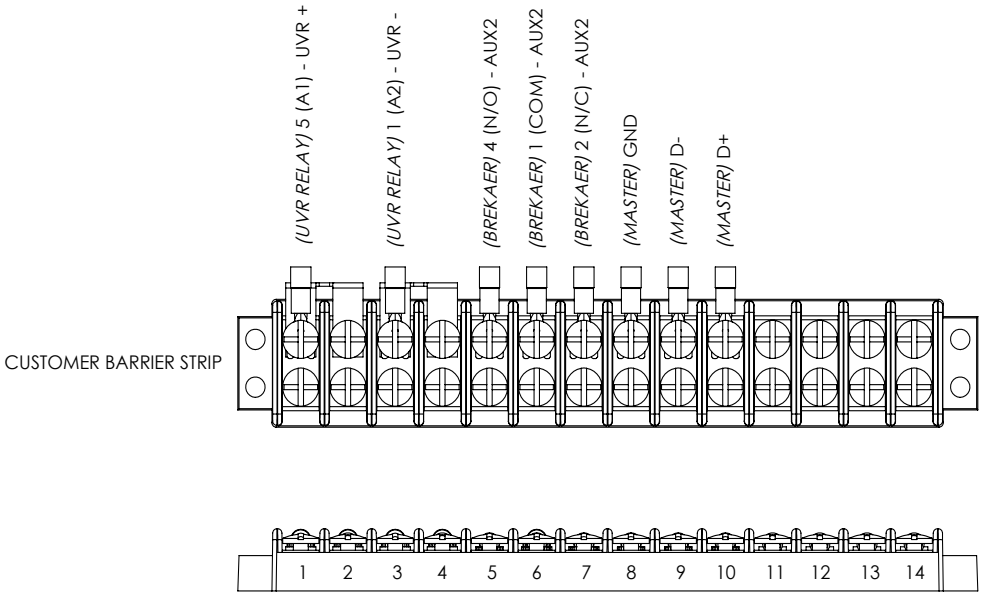


Figure 7. Pins 1,3 - UVR/Shunt Relay Access, Pins 5,6,7 (NO, COM, NC)

4. **UVR/SHUNT and AUX Access:** For UPS Systems that require an interface to the Circuit Breaker a customer accessible Terminal Block has been provided. Utilize 14-16 AWG UL approved wire and #6 spade connectors

   a. UVR/SHUNT Relay – A relay coil is provided to facilitate external UPS connection to the battery circuit breaker, refer to the Figure. 7 for details. When the battery cabinet is configured with an UVR access, the circuit breaker cannot be turned on until UPS outputs its rated UVR voltage.
      - UVR/SHUNT Pin 1 = POSITIVE (+) Polarity
      - UVR/SHUNT Pin 3 = NEGATIVE (-) Polarity

      When the battery cabinet is configured with a shunt access, the circuit breaker will trip when the UPS outputs its rated shunt trip voltage.
   b. AUX Circuit Breaker Access - Access to the Circuit Breaker status is provided via NO, NC and COM on the terminal block provided, see Figure. 7 for details.

5. Confirm all the harnesses to the BMS (top Box) are connected and secure.

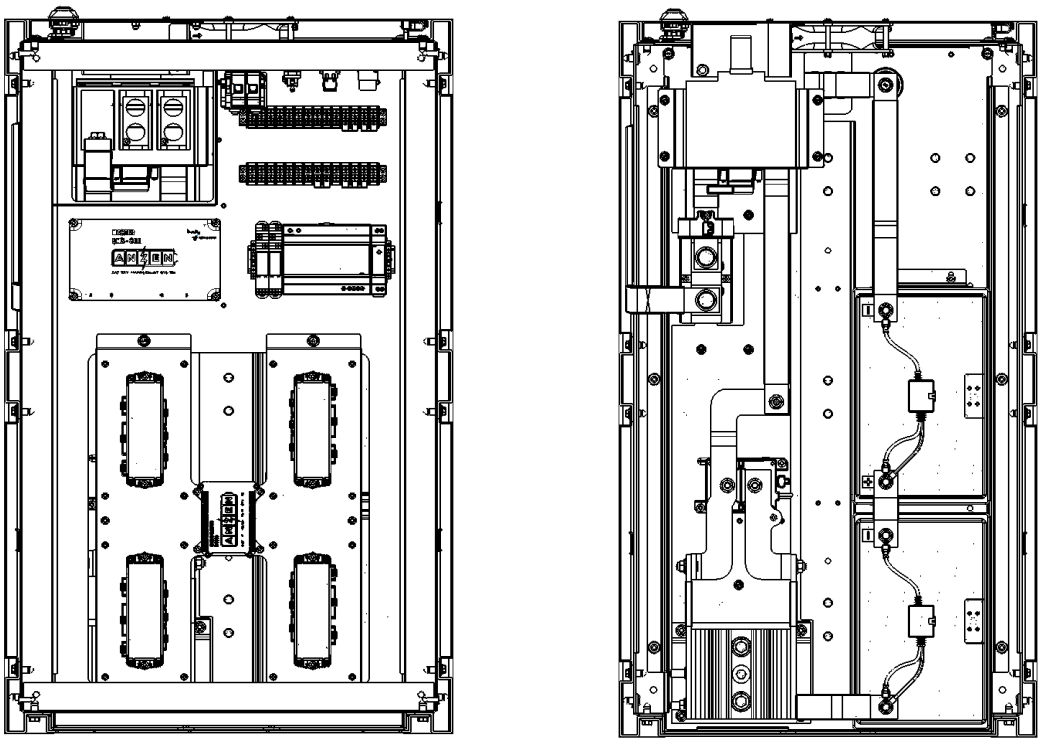


Figure 8. BMS and Power Tray Component Layout

6. Connect Ethernet cable to the Faceplate (top left panel inside door) if any remote monitoring of the Battery Cabinet is desired.
   a. Configuration details are provided in the Operations Manual.

7. Apply AC Power to the system
   a. It will take approximate 1-3 minutes for the BMS/R3000 to initialize and communicate with the server.
      - The network requirements needed for the R3000 to communicate with the Cloud or Local server:
        1. Local DHCP assigned IPv4 address
           Inbound and Outbound permit TCP/443 and TCP/9101 to:
           139.177.197.251
           173.255.231.159
           172.105.103.167
           45.33.95.14
        2. Outbound permit tcp/3030, tcp/9101 to 172.105.23.38

   b. If using the Cloud server, go to website to verify system is online: https://manage.anzenbms.com/
   c. The system will begin in "Pre-standby state" until DC Power is applied
   d. Confirm all batteries are within +/-0.3V of one another. Since all batteries ship between 30-50% State of Charge it is likely the batteries will be around 13.5 +/- 0.3V.

8. Enable the DC Power (UPS/Charger)
   a. Ensure UPS or battery charger is set properly to manufacturers recommended settings for operation with the battery system.
   b. Close the Breaker with the system in the "Pre-standby State." The system will immediately go into "Standby state" which means it is ready to function.
   c. The system will transition immediately into a "Charge State" if the SOC is below 90% and battery temperatures are all > 15C and < 40C.

   Note: If system was recently power cycled it may try to go into CHARGE state regardless of the SOC.

9. Perform a full or partial discharge (if possible) to confirm the system is working properly.
   a. Confirm system shuts down properly with no system errors.

Appendix A

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	H01	HVM RELEASE	1/31/2023	

CAUTION:

HIGH CENTER OF MASS - USE CAUTION WHEN MOVING CABINET

ONLY PERSONNEL TRAINED TO MOVE HEAVY EQUIPMENT SHOULD HANDLE THESE BATTERY SYSTEMS.

USE A FORKLIFT OR SIMILAR DEVICE WITH APPROPRIATE LIFTING CAPACITY TO LIFT THE CABINET.

NOTE THE CENTER OF MASS LOCATION.

MOVE SLOWLY WHEN HANDLING. AVOID BOUNCING THE CABINET WHILE MOVING. THE CABINET COULD FALL FORWARD/REARWARD OR SIDEWAYS IF HANDLED ROUGHLY.

CABINETS ARE HEAVY. APPROPRIATELY RATED FORKLIFTS OR SIMILAR DEVICES SHOULD BE USED TO MOVE THE CABINET.

ENSURE FLOORS ARE LEVEL AND RATED TO CARRY THE WEIGHT OF THE CABINET.

PROCEDURE FOR BATTERY CABINET INSTALLATION:

1. REMOVE SIDE PANELS AND TIGHTEN ALL ELECTRICAL POWER CONNECTIONS ON BATTERY TERMINALS UPON DELIVERY OF CABINET. SEE SHEETS 3 AND 6 FOR ADDITIONAL INFORMATION.
2. INSTALL FLOOR ANCHORS OR DRILL FLOOR HOLES TO ALIGN WITH CABINET AS SHOWN ON SHEET 2.
3. MOVE CABINET INTO POSITION OVER OR ONTO FLOOR ANCHORS AND INSTALL ANCHORS.
4. INSTALL ANY ADDITIONAL ADJACENT CABINETS AND FASTENER THEM TOGETHER THRU THE CORNER POSTS. REFER TO SHEET 4 FOR ADDITIONAL INFORMATION.
5. INSTALL THE BUSBARS AS SHOWN ON SHEETS 7 AND 8.
6. ROUTE AND INSTALL THE DATA CABLES AS SHOWN ON SHEETS 7-13.
7. SEE SCHEMATIC AND BARRIER STRIP DETAILS ON SHEETS 14 AND 15 FOR ADDITIONAL INFORMATION.
8. INSTALL THE DOORS AND LOCK WHEN NOT OPEN FOR MAINTENANCE.

THE CABINET IS RATED FOR SEISMIC INSTALLATIONS ACCORDING TO IBC 2018. CONTACT ZINCFIVE FOR SEISMIC INSTALLATION OPTIONS. INSTALL THE SEISMIC KIT ON THE FRONT OF THE CABINET AS NECESSARY. REFER TO SHEET 4 FOR ADDITIONAL INFORMATION.

CAUTION: HIGH VOLTAGE, RISK OF ELECTRICAL SHOCK

FOLLOW ALL SAFETY PRECAUTIONS WHEN WORKING ON THIS SYSTEM

ALWAYS WEAR PROPER PPE, INCLUDING EYE PROTECTION

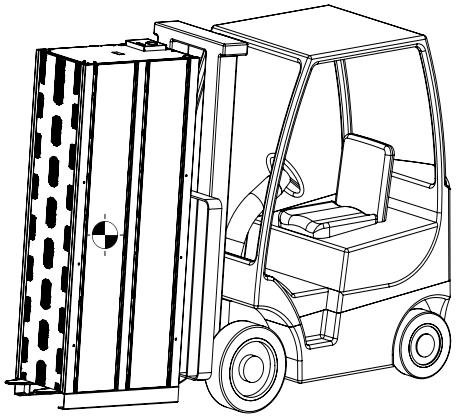
GENERAL NOTES:

ONLY QUALIFIED TECHNICIANS SHOULD PERFORM INSTALLATION OR MAINTENANCE OF THIS BATTERY SYSTEM.

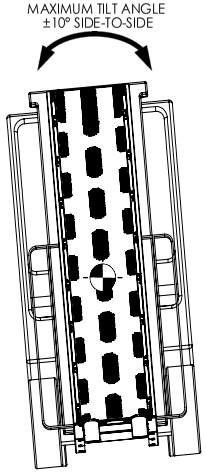
ALL TOOLS SHOULD BE INSULATED TO PREVENT ELECTRICAL SHOCK.

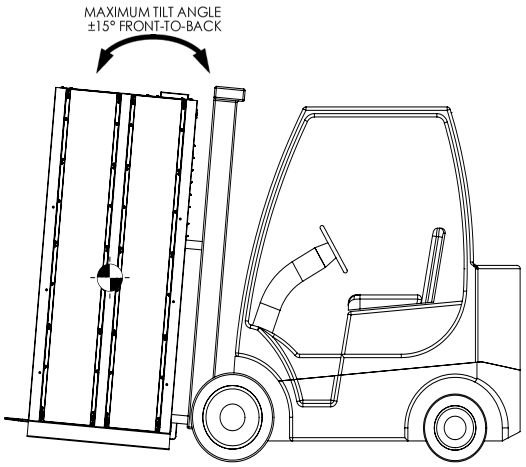
OPEN DISCONNECTS BEFORE INSTALLATION OR MAINTENANCE.

CHECK DC VOLTAGE AT BATTERY OUTPUT AND UPS OUTPUT TO ENSURE PROPER POLARITY BEFORE MAKING FINAL CONNECTIONS.



SPREAD FORKS TO FULL WIDTH OF CABINET.
ENSURE FORKS AND INSERTED FULLY AND LONG ENOUCH TO SUPPORT ENTIRE DEPTH OF CABINET, OR CABINET MAY TIP DURING TRANSPORT.





>IMPORTANT<

REVIEW THE DRAWINGS AND READ ALL INFORMATION BEFORE PROCEEDING WITH MOVING AND INSTALLING THE BATTERY CABINET.

	NAME	DATE
DRAWN	D. DUKARIC	1/31/2023
CHECKED		

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN mm. 3D CAD FILE IS MASTER. ALL FEATURES ARE AT BASIC AND IN NOMINAL CONDITION. INTERROGATE MODEL FOR MISSING INFORMATION. ALL FEATURES ☐ | 0.1 | A | B | C |. INTERPRET GEOMETRIC TOLERANCING PER: ASME Y14.5-2009. MATERIAL. FINISH. DO NOT SCALE DRAWING.

PROPRIETARY AND CONFIDENTIAL. THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF ZINCFIVE. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF ZINCFIVE IS PROHIBITED.

THIRD ANGLE PROJECTION

ZincFive

TITLE: ASY, ZF38A6SU GEN 1.5 BASE CABINET

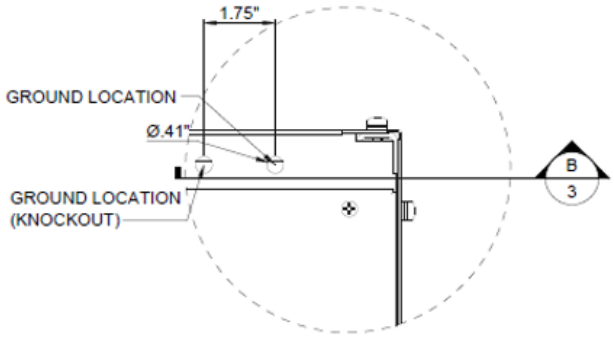
SIZE	DWG. NO.	REV
C	00100-00400-00002	H01

SCALE: 1:20 WEIGHT: 950 kg SHEET 1 OF 18

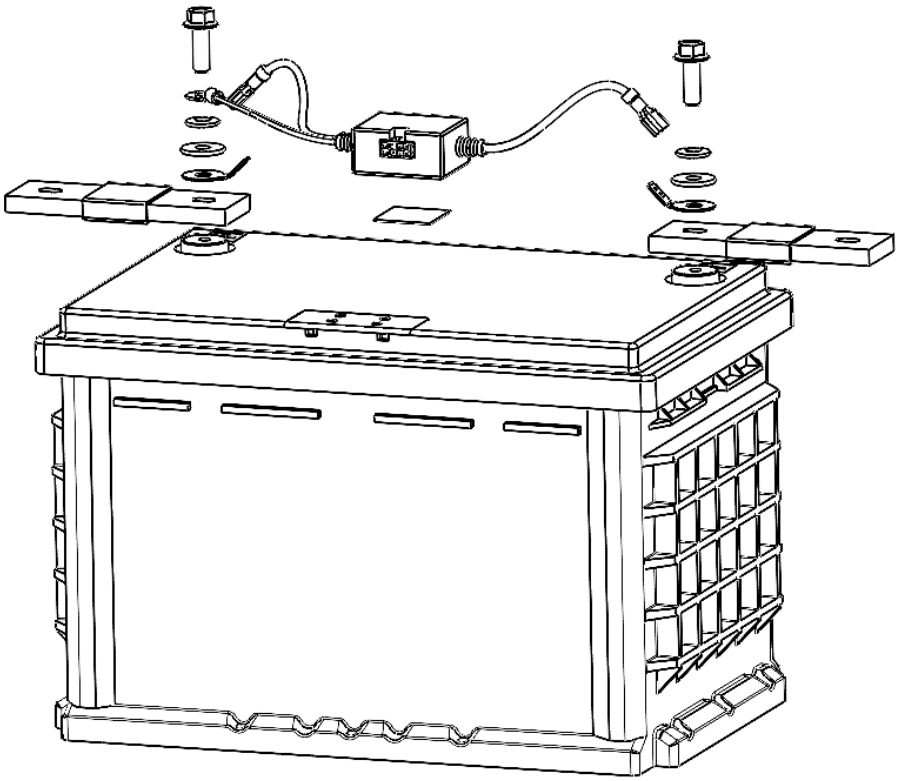
Appendix B

CAUTION: HIGH VOLTAGE, RISK OF ELECTRICAL SHOCK

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



GROUNDING INSTALLATION (TOP OF CABINET)



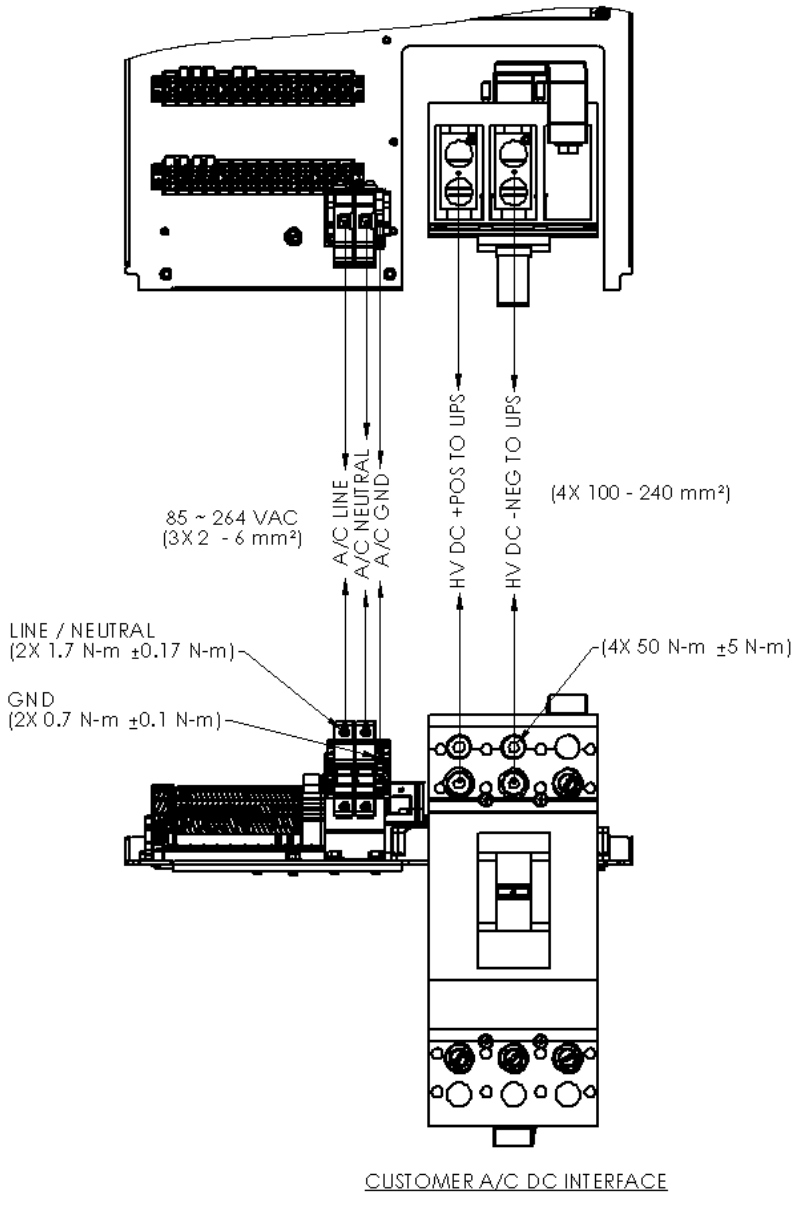
Appendix C

BREAKER INFORMATION			
BREAKER PART NUMBER	AMPS	24 VDC UVR PART NUMBER	2A2B AUX. CONTACTS PART NUMBER
LLL3760D33ABUO	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



CUSTOMER A/C DC INTERFACE

LUG INFORMATION					
LUG PART NUMBER	CONDUCTOR SIZE	STRIP LENGTH	TORQUE	NECESSARY TOOLS	MANUFACTURER DOCUMENT LINK
AL600LS2K3	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_enDocType=Instruction+sheet&p_File_Name=S1A14748.pdf&p_Doc_Ref=S1A14748

Notes

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

zincfive.com/support
01100-00400-00104, rev H02

Operations Manual

ZincFive BC Series UPS Battery Cabinets

ZincFive BC Series UPS Battery Cabinet

Table of Contents

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

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

Safety

Safety Symbols

ZincFive BC Series UPS Battery Cabinet 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 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 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 électriqueexiste dans ce domiane. Faites preuve d'une extréme 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

Used to designate a connection point to ground.

Symbole de terre de protection/ symbole de terre

Désigne un point de connexion à la terre.

Battery Safety

English

⚠ This 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. The batteries may explode.

⚠ Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes. 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:

a. Remove watches, rings, or other metal objects.
b. Use tools with insulated handles.
c. Wear rubber gloves and boots.
d. Do not lay tools or metal parts on top of batteries.
e. Disconnect charging source and load prior to installing or maintaining the battery.
f. Remove battery grounds during installation and maintenance to reduce likelihood of shock.
g. Remove the connection from ground if any part of the battery is determined to be grounded.

Note: Reference the Z5 13-80 H S F Safety Data Sheet for additional battery safety instructions.
https://www.zincfive.com/subc-prismatic-material-safety-data-sheet

French

⚠ Cette batterie doit être installée dans les applications d'utilisation fin par un personnel qualifié dans l'utilisation sécuritaire des alimentations à haute énergie et de leurs batteries. La connaissance du code électrique local et de leur application sécuritaire est également suppose.

⚠ Pour éviter les shorts, chocs ou électrocutions accidentels, ne laissez jamais l'eau ou toute autre forme de toucher liquide, entourer ou entrer dans les batteries.

⚠ Ne pas faire fonctionner les batteries avec des câbles et des fils endommagés. Les câbles et les fils défectueux doivent être remplacés avant l'installation du système. Avant l'installation du système, vérifiez que tous les câbles et fils sont correctement fixés et connectés. Les connexions défectueuses peuvent interrompre le fonctionnement et causer des dommages irréparables à ce produit.

⚠ Le démantèlement ou l'ouverture de l'enceinte de la batterie annulera la garantie du produit et créera un risque de choc électrique.

Battery Warnings and Cautions

English

⚠ SHIELD EYES AT ALL TIMES WITH PROTECTIVE GEAR.

NO SPARKS. FLAMES. 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.

French

⚠ 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.

Specifications

Refer to the ZincFive BC Series UPS Battery Cabinet data sheet for specifications.
zincfive.com/zincfive-ups-bc-series

Safety Precautions

⚠ **DANGER: HAZARD OF ELECTRIC SHOCK, EXPOSION 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 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.

Notice: To limit drift in SOC with extended storage, the batteries must not be stored more than six months without recharging.

If attached to a UPS that remains de-energized for a long period ZincFive recommends you energize the UPS system every six months for a 12 hour period in order to recharge the batteries.

HIGH VOLTAGE: The Battery Cabinet Voltage varies by model between **370Vdc - 596Vdc**
MAXIMUM FAULT RATING (BREAKER): 50kA (instantaneous trip <10mS for any current >=7800A)
ARC FLASH DETAILS: Incident Energy at: 18in, Min. Arc Rating: 20 cal/cm2, Arc Flash Boundary: 72.5in
MAXIMUM SHORT CIRCUIT RATING (BATTERY): 5400A

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: For installation of AC wires to terminal block.
- Insulated 8mm or 5/16" Hex driver bit: For DC Breaker termination.
- Long and short #2 Philips head screwdriver.
- Insulated Torque Wrench with 10MM Socket: For Battery bolts.

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.

Avis : Pour limiter la dérive de l'état de charge lors d'un entreposage de longue durée, il ne faut pas entreposer les batteries plus de six mois sans les recharger.

Si relié à une ASI qui reste inerte pendant une période prolongée, ZincFive vous recommande d'alimenter l'ASI tous les six mois pendant une période de 12 heures afin de recharger les batteries.

HAUTE TENSION : La tension d'armoire de batteries varie selon le modèle entre 370 V c.c et 596 V c.c.
VALEUR ASSIGNÉE DE RUPTURE MAXIMALE (DISJONCTEUR) : 50 kA (déclenchement instantané < 10 mS pour tout courant >=7 800 A)
DÉTAILS DE L'ÉCLAT D'ARC ÉLECTRIQUE : Énergie incidente à : 18 po, Valeur assignée d'arc minimale : 20 cal/cm2, Limite d'arc électrique : 72,5 po
TENUE MAXIMALE AU COURT-CIRCUIT (BATTERIE) : 5 400 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.

Introduction

ZincFive BC Series UPS Battery Cabinet Introduction

The ZincFive BC Series UPS Battery Cabinet is comprised of ZincFive's Nickel-Zinc Batteries integrated into a battery cabinet with built in Battery Monitoring System. The ZincFive BC Series UPS Battery Cabinet can house up to 39 batteries to support various UPS runtimes and voltage requirements. This manual covers the 37 to 39 battery solutions. The integrated battery monitoring solution provides highly detailed information on the operation and performance of the battery system. The information can be accessed through the customer interface portal as detailed later in this document. The battery cabinet is designed as a long-life reliable solution for the Mission Critical Data Center Space.

ZincFive BC Series UPS Overview

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

- Low weight and compact cabinet design for easy installation.
- Breaker is accessible through door for safer operation.
- Battery string is wired in a split string for increased safety during maintenance.
- Draw-out trays simplify battery maintenance.
- Integrated Battery Monitoring System provides real time data and alarms.
- High current discharge capability of up to 800A continuous.
- Reduced recharge times due to 160A maximum recharge current.
- Wide operating temperature range.
- Certified to UL 1778 and CAN/CSA C22.2 No. 107.3, IEC 62040-1, IEC 62040-2.
- CE and RoHs Compliance.
- Cabinet is seismic rated to IBC 2018.
- Employs ZincFive's UL 1989 and CAN/CSA-C22.2 No. 60896-21:17

ZincFive BC Series UPS Battery Cabinet

Physical Characteristics

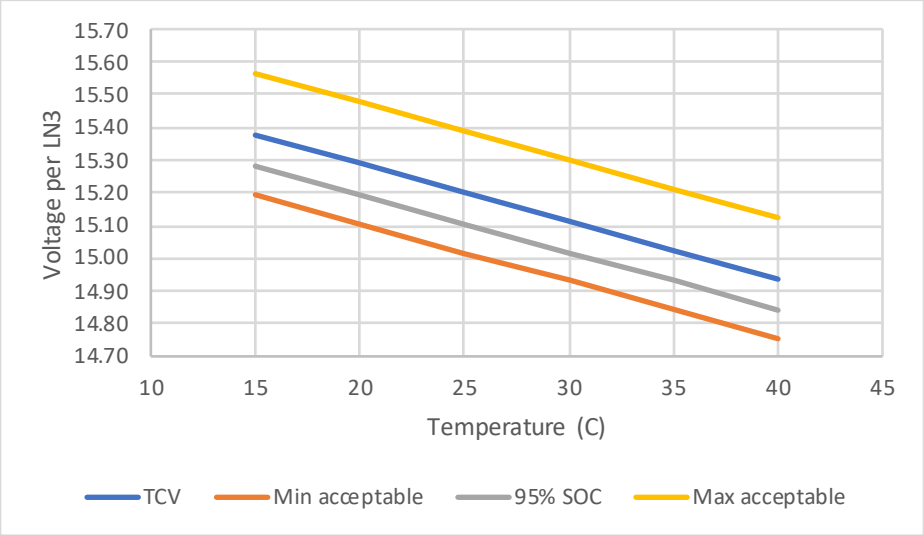
ZF37A6SXXXXIAXXX.....26.6"W x 31"D x 82"H Weight: 1,925 lbs (873 kg)
ZF38A6SXXXXIAXXX.....26.6"W x 31"D x 82"H Weight: 1,960 lbs (889 kg)
ZF39A6SXXXXIAXXX.....26.6"W x 31"D x 82"H Weight: 1,995 lbs (905 kg)

Setup

a. All cables should be attached to the cabinet: DC Power and AC Power. Also UVR/Shunt and Aux contacts to the UPS if needed.
    - The 120Vac feed to the cabinet must be always available (from UPS, backed up—100W backup recommended). Loss of 120VAC will shut the system down and turn off the Battery Management System (BMS).
b. To be installed in ambient environment between 20°C-35°C.
c. For optimum performance we recommend the UPS charger voltage to be set as follows
    - 37 Battery Cabinet (37 BC): 559Vdc
        - If Temperature Compensated Voltage (TCV) is available then Voltage Range is: 566Vdc @20°C to 556Vdc @35°C.

    - 38 Battery Cabinet (38 BC): 574Vdc
        - If TCCV is available then Voltage Range is: 580Vdc @20°C to 571Vdc @35°C

    - 39 Battery Cabinet (39 BC): 589Vdc
        - If TCCV is available then Voltage Range is: 596Vdc @20°C to 586Vdc @35°C



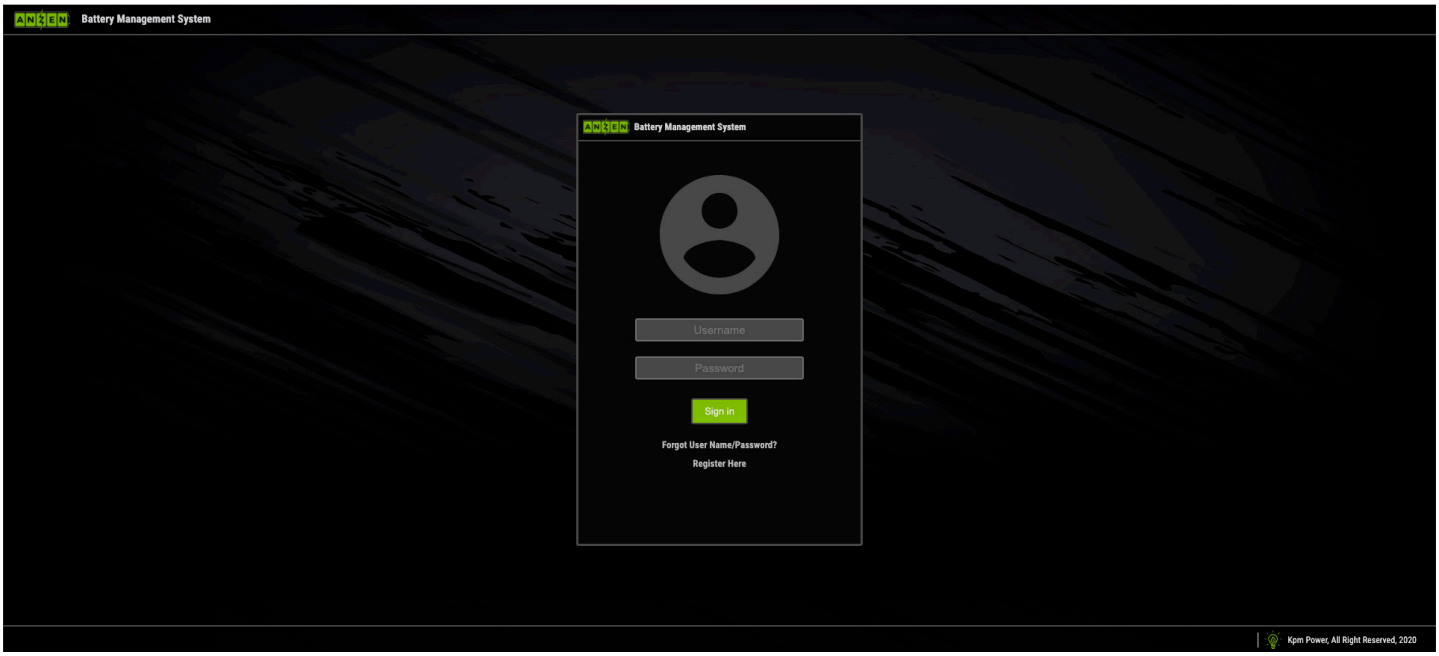
Individual LN3 Minimum and Maximum acceptable charging voltages over temperature range

Power Sequencing

a. Power up the system by turning ON the 120Vac to the UPS Battery Cabinet. Make sure the BMS ON/OFF switch on inside of cabinet door is turned ON.
    - Allow 1 minute for the BMS to initialize.

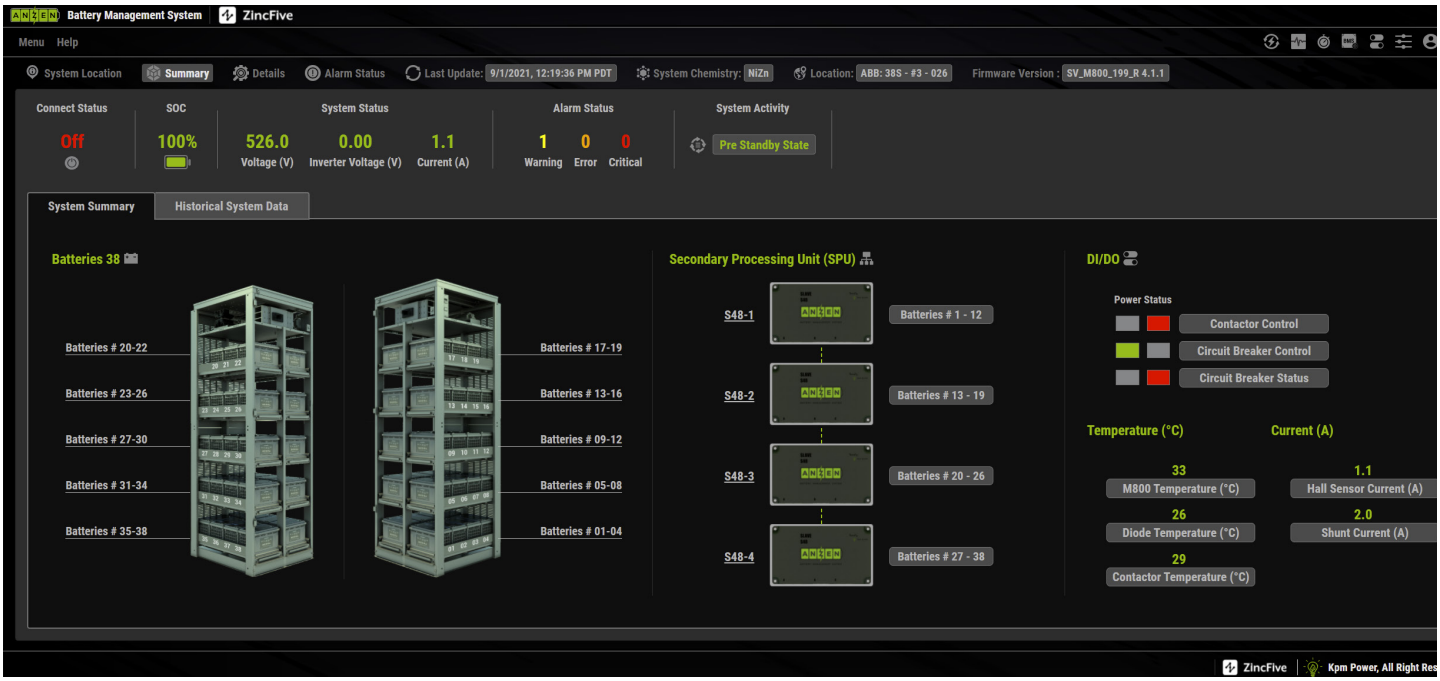
b. Log into the Web interface and verify that the BMS is Online.
    - For Cloud Server option refer to item 1.
    - For local server refer to the BX50 Manual for how to connect.
    - For MODBUS TCP/IP refer to the MODBUS Dictionary.

    1. Browse to : https://manage.anzenbms.com/



2. Login using your assigned login. (Example: user1@userdomain.com)
3. Select the Assigned Systems tab and then select the cabinet which is being monitored.

4. Verify that the "Connected Status" is On



c. The system will start operations from the **Service State**.
d. Once the circuit breaker is closed the system will enter a **Standby, Charge, or Discharge State**.

Operation

Charging

To ready the cabinet to attempt charging the batteries, the follow steps should be followed:

a. Close the Circuit Breaker
   The "System Activity" indicator should change to **Standby State**
b. The Battery Cabinet will remain in the **Standby State** and will only begin charging when:
   - SOC < 90% and all batteries are between 15°C-40°C
   - Set the UPS to charge the Battery Cabinet with any current between 20-160Amps.
c. The "System Activity" should change to **Charge State**
d. Charging is complete if any of the following occur on a 38 Battery Cabinet:
   - Current < 4A AND String Voltage > 566Vdc
   - Any Monoblock Voltage > 15.5V
   - String Voltage > 581V
e. "System Activity" will change to **Standby State**
   - If in **Standby State**, charging voltage is greater than 581Vdc, the system won't change into **Charge State.**

Discharging

a. The discharge can start if the system is in a Standby State or Charge State.
b. If current draw is between -2Amp to -800Amp the system will enter a Discharge State.
c. Discharge will end upon any of these conditions:
   - String Voltage < 380V (38 BC)
   - Any 3 Monoblock < 10V
   - Any 3 Monoblock reaches 75°C
   - Current <= -800A
d. The BMS will open the breaker if any of the above conditions are met.
e. Alternatively, the UPS can open the circuit breaker via the UVR / Shunt relay.
f. Specification: (Notes: Data Sheet & Table below)
g. After a discharge, all batteries must fall below 40°C before recharge begins.
h. Maximum current is 800Amps. Any current over 800Amps for 2s will result in the BMS remotely tripping the circuit breaker.
i. The breaker is set to trip at 2500A for a dead short circuit.

Controls Parameters

Item	Parameter	Number of Batteries	Operation Min/Max	Warning	Error / Fault	Critical Alarm	Email[7] (X)	Comments
1a	BPOV - Battery pack total voltage overvoltage (V)	36	551	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 – 14 V.
1b	BPOV - Battery pack total overvoltage (V)	37	566	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 – 14 V.
1c	BPOV - Battery pack total voltage overvoltage (V)	38	581	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 – 14 V.
1d	BPOV - Battery pack total voltage overvoltage (V)	39	596	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 – 14 V.
2a	BPUV - Battery pack total voltage undervoltage (V)	36	360	369	346	336	X	
2b	BPUV - Battery pack total voltage undervoltage (V)	37	370	380	355	346	X	
2c	BPUV - Battery pack total voltage undervoltage (V)	38	380	390	365	355	X	
2d	BPUV - Battery pack total voltage undervoltage (V)	39	390	400	374	364	X	
3	SBOV - Single battery (cell) overvoltage (V)		15.5		15.6	3.925[2]	X	Added 0.1 V for buffer (3.925 * 4 = 15.7)(critical alarm is ¼ the battery voltage, ¼ * 15.7 =3.9).
4	SBUV - Single battery (cell) under voltage (V)			10	8.6	0[2]	X	
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.
6	Over temperature when charging or discharging (°C)		None[1]	75		85	X	System keeps running up to 85C reached at battery.
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[1]	< 20	none			No safety issue. Warning < 20C.
9	Over current when fast charge (A)				160	180	X	Added 10% buffer.
10	Over current when discharge (A)				-800[6]	-1000	X	Spec
11	Diode Temperature (°C)				100		X	Used table with 1000A estimate used.
12	Contactor Temperature (°C)				150		X	Measured at Terminal. Terminal temperature.
13	ADAh[4] (Ah)			< 0[5]	<-40		X	
14	Contactor Stuck Closed in Standby				X		X	If in Standby and Current >2A AND (String Voltage = Inverter Voltage) (+/- 5V) then Generate Error/Fault Alarm
15	Power Supply Voltage Low					<=21V		
16	Power Supply Voltage High					>=32.5V		

All parameters are shown as expected. It is understood there are tolerances associated with the hardware regarding resolution of each parameter.

BMS Error / Fault Parameter reference notes:

1. System operating temperature should be 20-35°C. Start of charge temperature window is 15°C to 40°C. Once charge started there are no limits just Fault at 85°C.
2. Critical values are for voltage divider readings therefore they are ¼ the full module voltage.
3. N/A
4. Defined in later section.
5. If the UPS voltage is too low on charge the system will undercharge the batteries and not indicate a normal end of charge. To mitigate this, if there has been enough charge to indicate: ADAh is < 0, And Current is < 4A And the EOC Voltage threshold is not met, then the system should exit charge, indicate EOC and issue a Warning.
6. Minimum current limits are exceeded, shall have persistence of 2s for Current < -800A AND > -1000A. Current <-1000A is Critical Alarm and requires an instantaneous trigger.
7. Emails are to be transmitted for errors and critical alarms.

Battery Management System

The BMS consists of a main processing Unit (M800) and several Secondary Processing Units (S48).

- The M800 is the master control module for performing real-time monitoring of the ZincFive Nickel-Zinc batteries.
- The S48 is a secondary module which has direct connections to the batteries monitoring voltage, temperature State of Charge (SOC) and State of Health (SOH)
- The R3000 module provides for remote monitoring of the BMS and battery status.
- See: 5 Web Interface

Checking data via USB

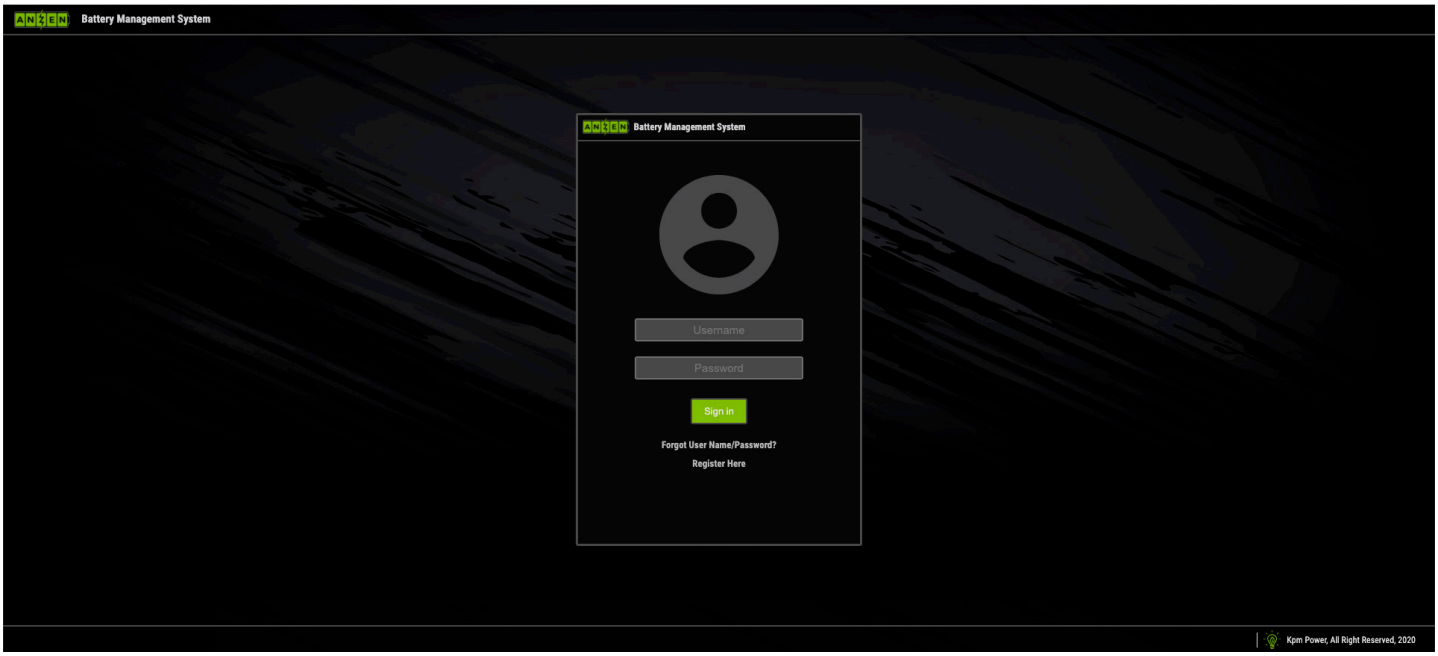
- This can provide 1-2 month's worth of logging data from batteries.
- The activity indicator/LED on the USB Stick will stop flashing when the data is downloaded.
- The download can only be completed by using a USB flash drive. (1GByte Flash drive minimim.)

Web Interface

The Web Interface allows for the remote monitoring of a battery cabinet.

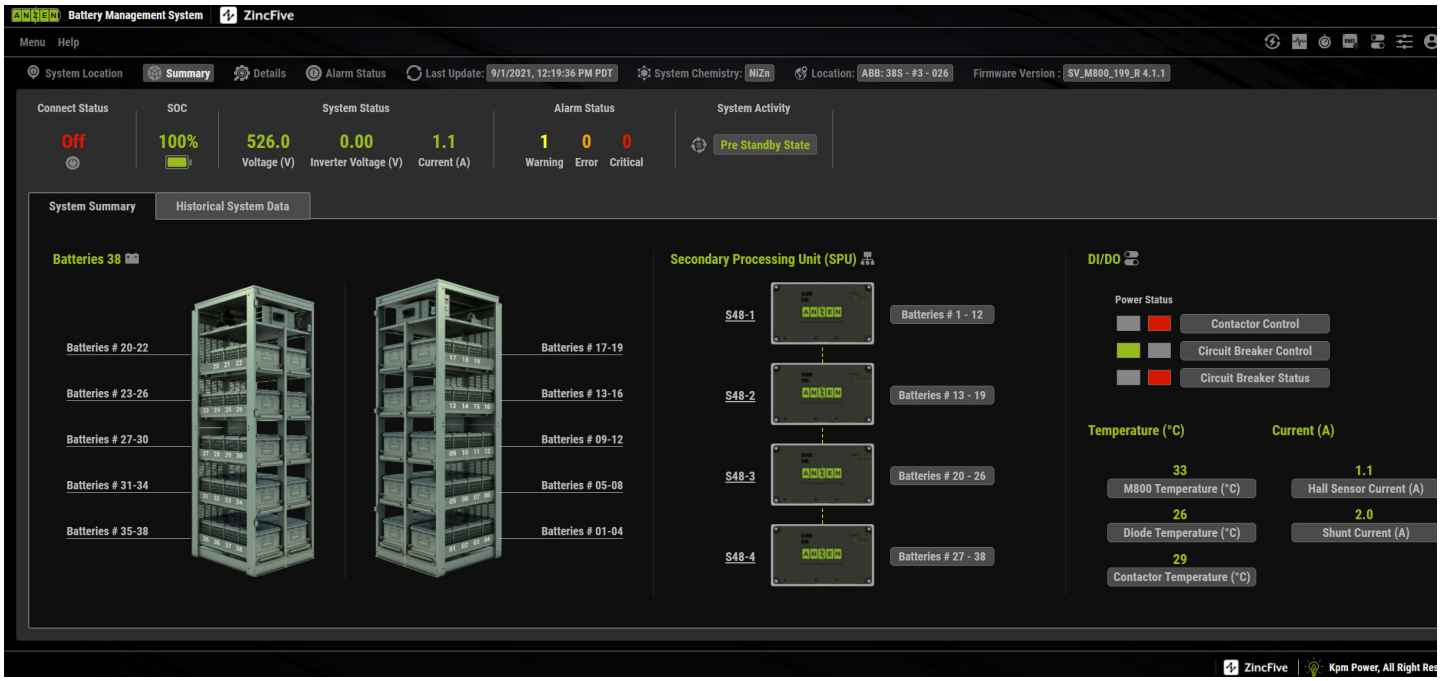
Login & System Selection

Browse to https://manage.anzenbms.com/ to see the login prompt:



Then select the “Assigned Systems” tab and select the system to be monitored:

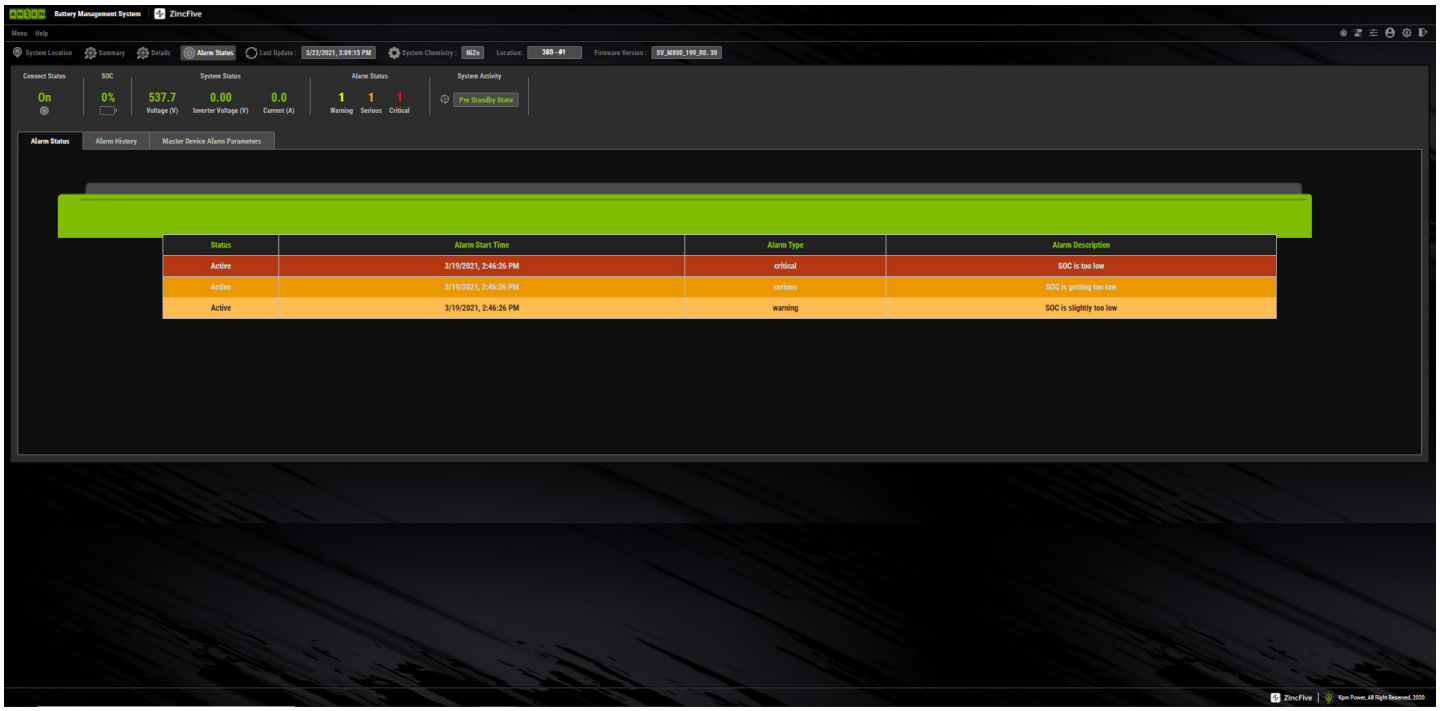
System Status



The System Summary page shows the attributes of the system:

- Connect Status: On/Off
- SOC: <Percentage>
- System Status: Voltage
- System Status: Inverter Voltage
- System Status: Current
- Alarm Status: <#Warning, #Serious, #Critical>
- System Activity (State)
    - **Service State** – Breaker is open, no error
    - **Pre-Standby State** – The system will only reach this state if a UPS (Inverter/Charger) is connected and voltage is being read. The user can close the breaker.
    - **Standby State** – Breaker is closed, standby
    - **Charge State** – Breaker is closed, charging or waiting to charge
    - **Discharge State** – Breaker and contractor closed, negative current, discharging
    - **Error State** – Breaker is open, error occurred

Note: In Error State the system will display the alarm and trip the breaker:



Alarm List

URS Parameter	Message Type	Condition	Descriptions		Result
			Interface Display	CSV	
BPOV	Warning	String Voltage > 36S - 547V, 37S - 562V, 38S - 578V, 39S - 593V	System Voltage Close to High Limit	N/A	Just Warning
	Critical	String Voltage > 36S - 555V, 37S - 570V, 38S - 585V, 39S - 600V	System Voltage Exceeded High Limit	ANZEN_SAFETY_ALARM_STRING_OVER_VOLTAGE	Breaker Opens. Error State
BPUV	Warning	String Voltage < 36S - 369V, 37S - 380V, 38S - 390V, 39S - 400V	System Voltage Close to Low Limit	N/A	Just Warning
	Error	String Voltage < 36S - 346V, 37S - 355V, 38S - 365V, 39S - 374V	System Voltage Low	STRING_VOLTAGE_LOW_ERROR	Breaker Opens. Error State
	Critical	String Voltage < 36S - 336V, 37S - 346V, 38S - 355V, 39S - 364V	System Voltage Exceeded Low Limit	ANZEN_SAFETY_ALARM_STRING_UNDER_VOLTAGE	Breaker Opens. Error State
SBOV	Error	Monoblock Voltage > 15.6V	Single Battery Voltage Higher than Maximum Operating Voltage. Service System.	MONOBLOCK_LOW_VOLTAGE_ERROR	Breaker Opens. Error State
	Critical	Single Battery (Cell) Voltage > 4.5V	Single Battery Voltage Exceeded High Limit	ANZEN_SAFETY_ALARM_SINGLE_OVER_VOLTAGE	Breaker Opens. Error State
SBUV	Error	Monoblock Voltage < 8.6V	Single Battery Voltage Lower than Minimum Operating Voltage. Replace Battery.	MONOBLOCK_HIGH_VOLTAGE_ERROR	Breaker Opens. Error State
	Critical	Single Battery (Cell) Voltage < 0V	Single Battery Voltage Exceeded Low Limit	ANZEN_SAFETY_ALARM_SINGLE_UNDER_VOLTAGE	Breaker Opens. Error State
Battlow	Warning	Number Low Voltage Monoblocks = 1	Number Low Voltage Monoblocks = 1. Check Battery #x.	MONOBLOCK_LOW_VOLTAGE_SINGLE_WARNING	Just Warning
	Warning	Number Low Voltage Monoblocks = 2	Number Low Voltage Monoblocks = 2. Check Battery #x, #y.	MONOBLOCK_LOW_VOLTAGE_DUAL_WARNING	Just Warning
	Warning	Number Low Voltage Monoblocks >= 3	EOD. Number of Low Voltage Monoblocks Exceeded Limit. Check Battery #x, #y, #z	MONOBLOCK_LOW_VOLTAGE_THREE_OR_MORE_WARNING	Breaker Opens. EOD
Over Temperature	Warning	Battery Temperature > 75C	Battery Temperature Close to High Limit during Charge	N/A	Just Warning
	Critical	Battery Temperature > 85C	Battery Temperature Exceeded High Limit during Charge	ANZEN_SAFETY_ALARM_CHARGE_SINGLE_OVERTEMP	Breaker Opens. Error State
	Warning	Battery Temperature > 75C	Battery Temperature Close to High Limit during Discharge	N/A	Just Warning
	Critical	Battery Temperature > 85C	Battery Temperature Exceeded High Limit during Discharge	ANZEN_SAFETY_ALARM_DISCHARGE_SINGLE_OVERTEMP	Breaker Opens. Error State
Num Batt T High	Warning	Number High Temperature Monoblocks = 1	Number High Temperature Monoblocks = 1. Check Battery #x.	MONOBLOCK_TEMPERATURE_SINGLE_WARNING	Just Warning
	Warning	Number High Temperature Monoblocks = 2	Number High Temperature Monoblocks = 2. Check Battery #x, #y.	MONOBLOCK_TEMPERATURE_DUAL_WARNING	Just Warning
	Warning	Number High Temperature Monoblocks >= 3	EOD. Number of High Temperature Monoblocks Exceeded Limit. Check Battery #x, #y, #z	MONOBLOCK_TEMPERATURE_THREE_OR_MORE_WARNING	Breaker Opens. EOD
Low temperature when charging	Warning	Battery Temperature < 20C	Single Battery Temperature Close to Low Limit for Charging	N/A	Just Warning
Over current when fast change	Error	Current > 160A	Maximum Charge Current Exceeded	MAX_CHARGE_CURRENT_ERROR	Breaker Opens. Error State
	Critical	Current > 180A	Charge Current Exceeded Critical Limit	ANZEN_SAFETY_ALARM_FASTCHARGE_OVERCURRENT	Breaker Opens. Error State
Over current when dischange	Error	Current < -800A	Maximum Discharge Current Exceeded	DISCHARGE_CURRENT_HIGH_ERROR	Breaker Opens. Error State
	Critical	Current < -1000A	Discharge Current Exceeded Critical Limit	ANZEN_SAFETY_ALARM_DISCHARGE_OVERCURRENT	Breaker Opens. Error State
Diode temperature	Error	Diode temp > 100	System temperature #1 too high – The charge blocking diode temperature exceeded 100C	DIODE_TEMPERATURE_HIGH_ERROR	Breaker Opens. Error State
Contactor temperature	Error	Contactor temp > 150	System temperature #2 too high – The contactor temperature exceeded 150C	CONTACTOR_TEMPERATURE_HIGH_ERROR	Breaker Opens. Error State
ADAh	Warning	ADAh<0 and Current <4 A and String voltage< (BPOV-14V)	Charge Completed Below Lower Voltage Threshold. System Undercharged.	CHARGE_FINISHED_STRING_VOLTAGE_LOW_WARNING	Just Warning
	Error	ADAh < -40Ah	System 50% Overcharge	ACTUAL_DISCHARGE_ERROR	Breaker Opens. Error State
Contactor stuck closed in StandBy	Error	StandBy and Current > 2A AND (String Voltage = Inverter Voltage)	Contactor Stuck Closed	CONTACTOR_STUCK_CLOSED	Breaker Opens. Error State
R3000 over temperature	Critical	R3000 temp > 75 C	R3000 Temperature Exceeded High Limit	N/A	Breaker Opens. Error State
M800 over temperature	Critical	M800 temp > 100 C	BMS Temperature Exceeded High Limit	ANZEN_SAFETY_ALARM_BMS_TEMPERATURE_HIGH	Breaker Opens. Error State
Battery Low voltage Position Warning	Warning	Battlow > 5 for 1 battery	Low Performance Battery. Replace Battery #x.	N/A	Just Warning
Battery High Temperature Position Warning	Warning	Num Batt T High > 5 for 1 battery	High Temperature Battery. Replace Battery #x.	N/A	Just Warning
Supply voltage low	Critical	Supply voltage < 21V	BMS Power Supply Exceeded Low Limit	ANZEN_SAFETY_ALARM_SUPPLY_VOLTAGE_LOW	Breaker Opens. Error State
Supply voltage high	Critical	Supply voltage > 32.5V	BMS Power Supply Exceeded High Limit	ANZEN_SAFETY_ALARM_SUPPLY_VOLTAGE_HIGH	Breaker Opens. Error State
Anzen Critical Error	Critical	When any critical alarm is triggered	Critical Error Notification - A critical BMS Alarm was encounted, See alarm history.	ANZEN_SAFETY_ALARM_ERROR	Breaker Opens. Error State

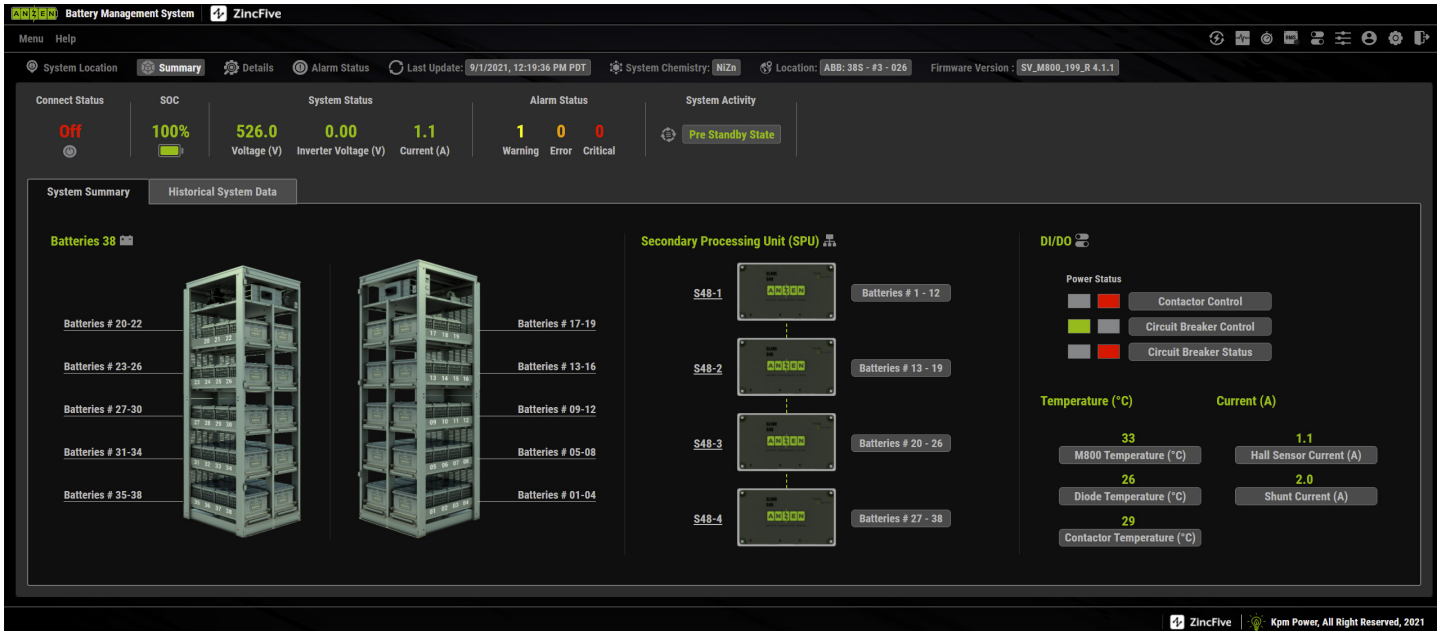
System Summary

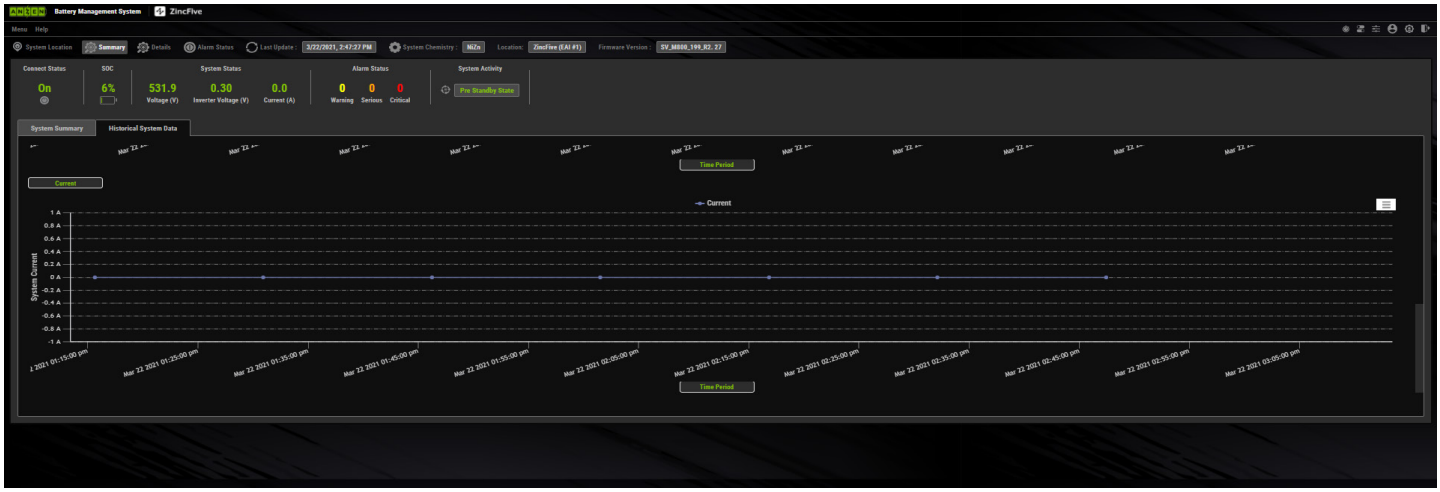
The System Summary section shows a graphic of the battery cabinet, a list of all the secondary processing units and status of the digital inputs/outputs.

Clicking on any one of the Secondary Processing Unit icons will show the detailed voltages and temperature readings for the batteries attached to that SPU. (This is the same display as when the "Details" icon is selected.) See: 5.2.3 Details

Historical System Data

System voltage, temperature and current over time can be displayed by clicking on the Historical Data tab.





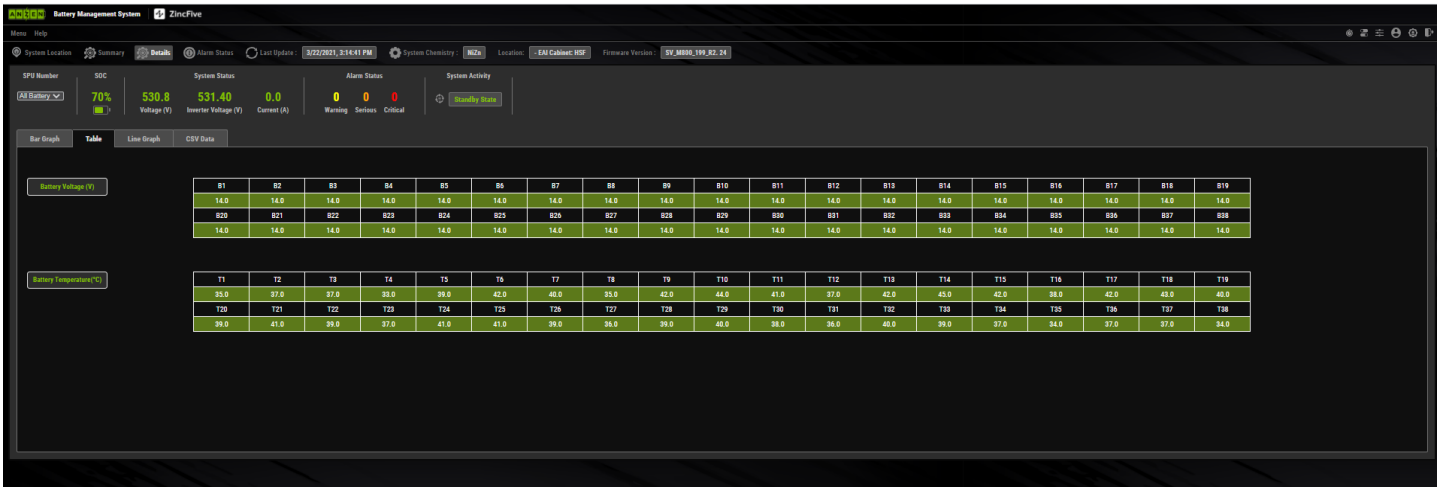
Details

The Details page allows you to see information about individual battery strings and the ability to download the historical data in a comma separated values (CSV) format formatted file.

The SPU Number dropdown allows you to view all the batteries or concentrate on an individual string connected to a single SPU.

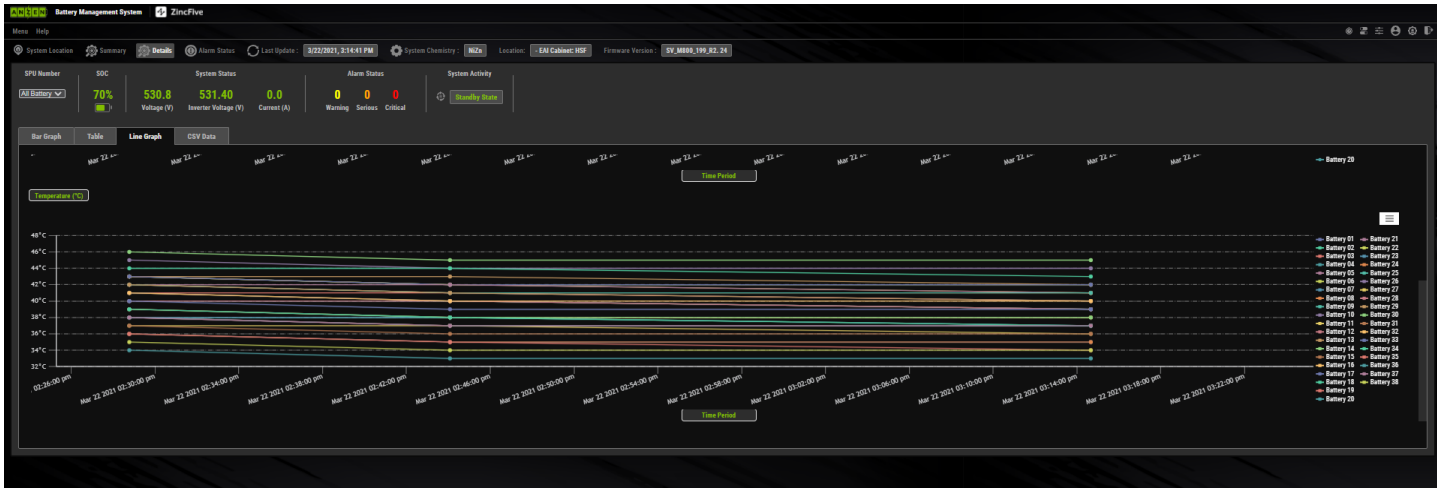
Table View

Clicking on the Table tab will show the battery voltages and temperatures in table format.



Line Graph

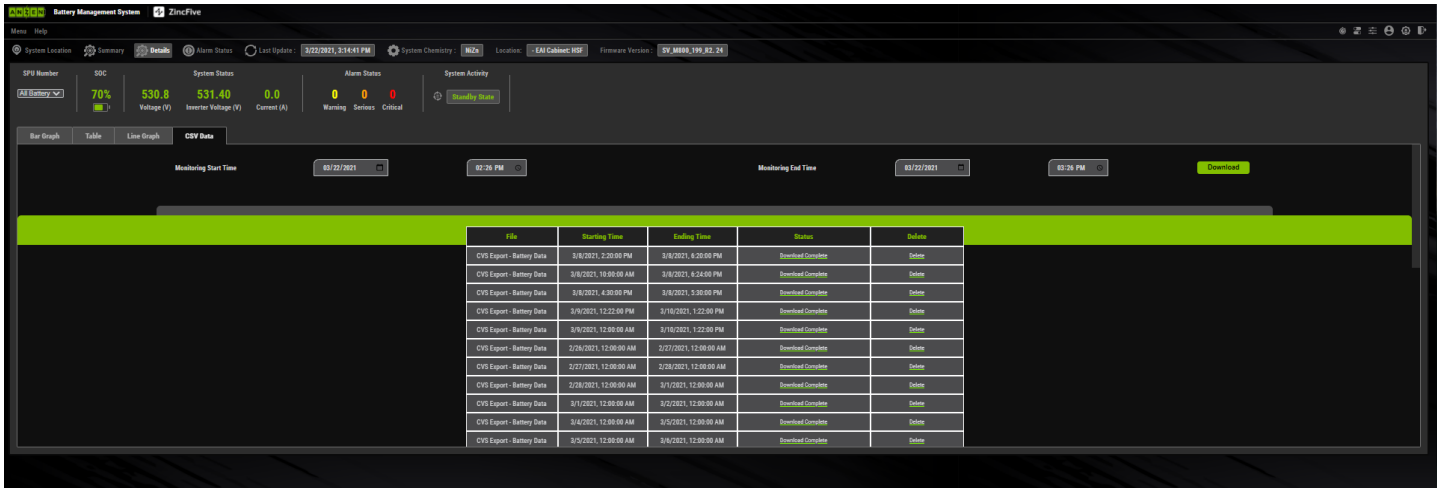
Clicking on the Line Graph will allow you to specify the start and end time for the monitoring data to be shown. Then press the Get Data button to update the display.



CSV Data

The CSV Data tab allows you to capture a specific date range of data and download it as a Comma Separated Value (CSV) file which can be read into MS Excel. Follow the following steps to download the data:

- Specify Monitoring Start Time
- Specify Monitoring End Time
- Press the Download to server button



- After pressing Download to server, wait several minutes for the Status to indicate Download Complete
- Click on the Download Complete link in the Status column to to download the data to your local system. By default the file will be named downloadBmsData.csv. The Web Interface and servers will make several data downloads available from the same page. Previous downloads can be deleted by clicking on the Delete link in the Delete column.

The following information is included in the CSV file for the timespan specified:

Field Name	Notes
Timestamp	Time stamp of the record.
Battery Voltage 1-38	One column per battery.
Battery Temperature 1-38	One column per battery.
System Temperature	
Diode Temperature	
Contactor Temperature	
State	One of the following: Service States: • Service • Pre-Standby • Standby • Charge • Discharge • Error
Previous Timestamp State	
Previous State	
Error Msg	Error Message when in Error State.
Battery System Voltage	
Inverter Voltage	
Supply Voltage	24 Supply Voltage
System Current	
Hall Current	Hall Effect Sensor Current
Shunt Current	
SOC	State of Charge
SOH	State of Health
cdah	Cumulative Discharge Amp Hours
adah	Actual Discharge Amp Hours
Firmware Version	
Months Sense Commissioning	
Elapse Discharge Time	
Circuit Breaker Status	ON or OFF
Contactor Control	On or OFF
Circuit Breaker Control	On or OFF
Cumulative Discharge Energy (kWh)	
Instant Power (W)	

Troubleshooting

Critical Alarms:

- Battery Pack Overvoltage - BMS failure to stop during normal charging sequence. Call Service Technician for BMS evaluation.
- Battery Pack Undervoltage – On discharge the breaker will open when reaching the operational limits. Critical Alarm level will only be reached if multiple battery failures occur. Call Service technician for evaluation and replacement of bad batteries.
- Single Battery Overvoltage / Undervoltage – This will only be reached if the BMS fails to stop a charge or discharge. Portions of the BMS Main or Secondary Processor Units may need to be replaced.
- Over temperature when charging or discharging – Battery should be inspected to see if there is a problem on any charge or discharge where it reaches the Critical Alarm temperature. It will likely need to be replaced.
- Over-Current on Charge – Max current should not exceed 160Amps from the battery charger. The BMS will open contactor and not allow charging when greater than this.
- Over-Current on Discharge – The Battery Cabinet will open the breaker if current exceeds 800Amps for more than 2 seconds. A critical Alarm will occur if the cabinet every sees greater than 880Amps. Reduce the load to resolve exceeding the discharge current limits.
- Monoblock Voltage Differential – No battery in the system should differ from the remainder of the batteries by 1.2V. If they do then that battery has lost a cell and will need to be replaced for the system to function properly.

Discharge ended earlier than expected with a Over Temperature Critical Alarm: Battery Unit temperature too high – A battery exceeded 75°C

- This means 3 batteries reached 75°C (or higher) on the Positive Terminal Post during the discharge. The system historical data will need to be evaluated during the failed discharge to determine which batteries reached >75°C. Any battery that exceeded >85°C should be replaced for optimum system performance.

System is not going into Charge state (SOC < 90% and all batteries between 15°C – 40°C) – Contactor Control Power Status is Red.

- Open and close the breaker and the state should be reset.

Battery voltage or temperature is not reading correctly:

- Check for lose or poor connections on the spade/quick connect terminals on the battery terminals.
- Check for connection issues like shown in the picture where the Quick Connect is not attached correctly (did not go over the QC correctly). Also the Torque Seal is broken here, so this bolt should be re-torqued.

Multiple Power Outages Occurrence

- If the battery cabinet has a FULL discharge and opens the breaker it WILL NOT be available for any subsequent discharges until the breaker is manually closed.

During a charge or discharge the battery voltages are not aligned.

- Generally all the batteries will be within +/-0.3V of one another. If that is not the case there maybe a short to chassis ground or problem with the harness.
- Check to see which Secondary Processing Unit batteries have the issue and inspect connections and measure voltages around those batteries. Try to plug and re-plug the SPU connections near batteries and in the BMS box.

Maintenance Instructions

ONLY AUTHORIZED PERSONNEL CAN PERFORM MAINTENANCE.

a. Ensure that the battery string circuit breaker is open before performing any maintenance action that creates the potential for making contact with any battery or exposed conductive components.
b. Perform visual inspection of battery trays, batteries and visible cabling to ensure that all components are clean and don't exhibit any indications of heat, breakage, or chaffing of any wire or cable.
c. Annually, withdraw one battery shelf at a time and measure individual battery voltages and intercell connector resistance.
    - If intercell connection resistance is more than 15% higher than the string average, disconnect, clean and reconnect the cable, retorquing to the proper torque value.
d. There is no need for discharge on an annual basis. The discharge requirement will be on a site by site basis as directed by the customer.

Note: Before energizing the system, verify that the cabling has been connected and torqued correctly.

Battery Replacement

Refer to our Battery Replacement Method of Procedures document for full details.

APPENDIX

Current Sensor Calibration

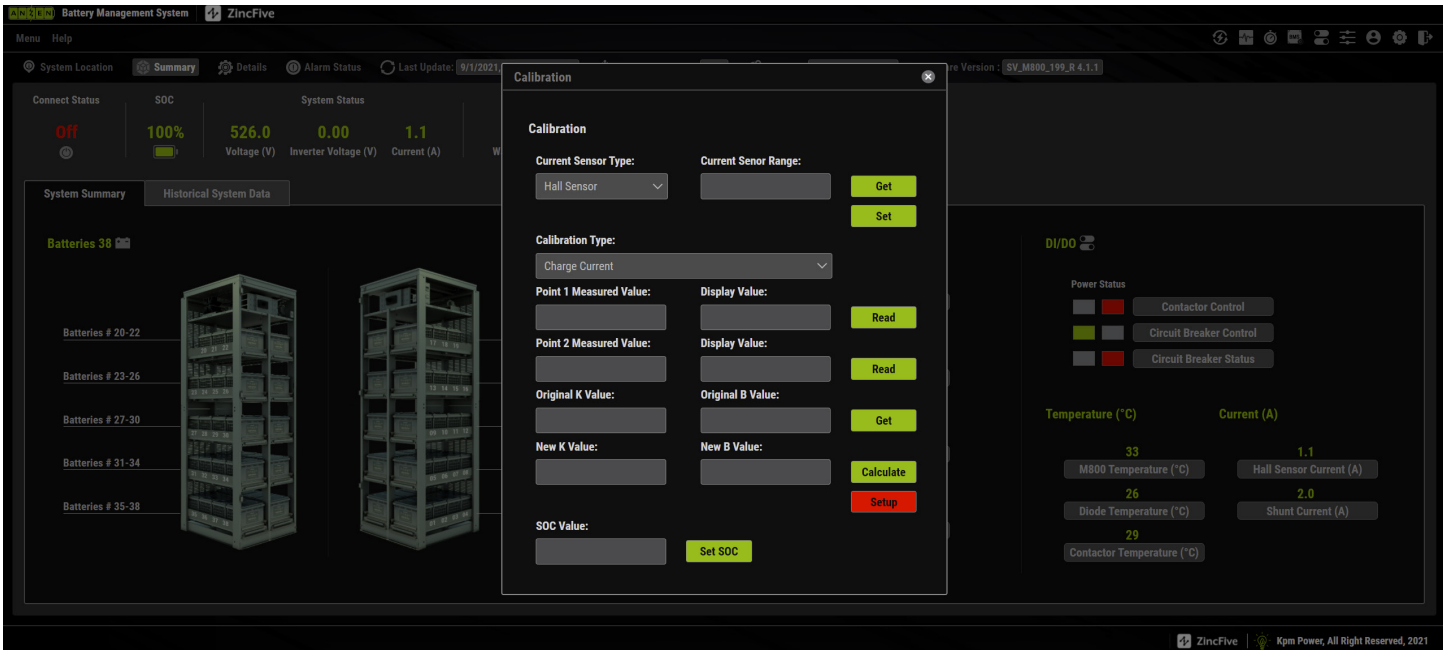
ONLY AUTHORIZED PERSONNEL CAN PERFORM MAINTENANCE.

The current Sensor calibration is done in the factory prior to shipment of the battery cabinet. This step should NOT need to be done unless BMS components are replace, settings are lost, or when tested the system calibration is off by more than 10%.

To calibrate the hall effect and current shunt sensors on the system the following steps need to be taken:

1. Install a multimeter (Left side of C/B on negative cables.) to get current measurements.
2. Make sure the System Activity displays "Standby State".
3. Open current calibration window on the Web interface by pressing the Calibration icon on the upper right:

4. Start calibration with hall effect sensor. Select "Hall Sensor 1(1)" under the Current Sensor Type. Select Current Sensor Range to be 500. Click set.



6. Input 1 for New K Value and 0 for New B Value. Press Setup.
7. Check that the new values are set by clicking read next to original K/B values.
8. Acquire the Point 1. For Measured Value input the value from multimeter and press read to input the display value.

9. To start charging the batteries set SOC to 50% so that the positive current would start to flow.
10. Acquire the Point 2. For Measured Value input the value from multimeter and press read to input the display value.
11. Calculate and setup new K/B values by clicking Calc and Setup.
12. Check that the new values are set by clicking read next to original K/B values. The values should be the same as the calculated values from step 11.
13. Repeat steps 8-12 until the measured and displayed current values are as accurate as possible.
14. This is the end of calibration for "Charge current".
15. Select Calibration Type to be "Discharge Current".
16. Repeat steps 6 to 8.
17. Start discharging the batteries, so that the negative current would start to flow.
18. Repeat steps 10 to 13. This is the end of calibration for "Discharge Current"
19. Continue calibration with current shunt. Select "Shunt (2)" under the Current Sensor Type. Select Current Sensor Range to be 1200. Click set.
20. Repeat steps 5 to 18.
21. Finish calibration by selecting "Hall Sensor 1, Shunt (3)" under the Current Sensor Type. Select Current Sensor Range to be 1200. Click set.