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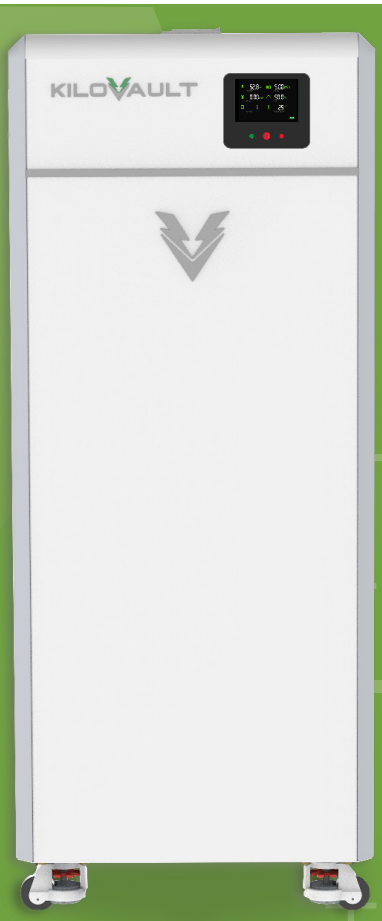


# KiloVault® HAB-XL™ Series

Lithium Iron Phosphate ($LiFePO_4$)
Deep Cycle Solar Batteries

# INSTALLATION & USER GUIDE

Oct 2022 / Rev: 1.1

KILOVAULT®

**WARNING High Voltage Risk of Personal Injury or Death**

As is the case with all batteries, the risk of shock is present. When handling batteries, use protective measures including, but not limited to, safety glasses, insulated gloves, and protective footwear.

When working with or installing batteries, use electrically insulated gloves and tools. Remove personal metal items such as watches, rings, bracelets, etc.

The information included in this manual is accurate at the time of publication. However, this manual is subject to change without prior notice as we continuously improve our products.

Additionally, the illustrations in this manual are for demonstration only and are intended to help explain the KiloVault® HAB-XL™ system concepts and installation instructions. Details may vary slightly depending upon the market region and the product version.

This publication could include technical or other inaccuracies or typographical errors. Changes are periodically added to the information herein; these changes will be incorporated in new editions of the publication. KiloVault® may make improvements and/or changes in the services, facilities or specifications described in this publication at any time.

Please note: If this unit is installed by someone other than the end-user, the installer must explain the contents of this installation and user's manual to the end-user.

No responsibility is assumed by KiloVault® for any consequences arising out of the use of this material.

This manual is for use by qualified personnel only

Read and keep this Installation Guide for future reference.

Oct 2022 / Rev: 1.1

# Contents



**This manual is for use by qualified personnel only**

## Abbreviations and Acronyms

| Name | Abbreviations or Acronyms |
|---|---|
| UNIT | KiloVault® HAB-XL™ |
| CEC | California Energy Commission |
| CSA | Canadian Standards Association |
| GT | Grid Tie |
| LCD | Liquid Crystal Display |
| LED | Light Emitting Diode |
| MPPT | Maximum Power Point Tracking |
| NEC | US National Electrical Code NFPA-70 |
| PV | Photovoltaic |
| PVGFP | PV Ground Fault Protection |
| UL | Underwriters Laboratories |
| ETL | Intertek Testing Laboratories |
| VAC | Volts Alternating Current |
| VDC | Volts Direct Current |

## "DO NOT DISCARD CRATE AND INTERNAL PACKAGING."

Congratulations on your KiloVault® product purchase. Product registration is required for warranty coverage and allows for easier customer and technical support.

https://kilovault.com/register/

## "VERIFY that your HAB-XL firmware is Up To Date"

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

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**This manual is for use by qualified personnel only**

# 1. Safety Information

## 1.1. Symbols Used in this Manual

**It is essential to read, understand, and follow these instructions prior to installing or operating KiloVault® batteries.**

| | |
|---|---|
|  | **Warning:**<br>This is a hazardous situation which, if not avoided, could result in serious injury or death. |
|  | **Warning:**<br>Do not place or install near flammable or explosive materials. |
|  | **Warning:**<br>Install the KiloVault® HAB-XL™ out of the reach of children and animals. |
|  | **Warning:**<br>The KiloVault® HAB-XL™ is heavy, over 600lb. (272kg), and may cause serious back injury. Lift with multiple people and lifting equipment rated to lift and support at least 1000lb. |
|  | **Warning:**<br>Do not dispose of this product with household waste. |
|  | **Caution:**<br>Risk of electric shock. |
|  | **Attention:**<br>Disconnect the KiloVault® HAB-XL™ before carrying out maintenance or repair. |
|  | **Attention:**<br>Read this instruction manual before installing and operating the KiloVault® HAB-XL™ . |
|  | **Note:**<br>Indicates points of particular emphasis that make operation more efficient or convenient. |
|  | **Recyclable:**<br>Please contact your local solid waste recycling agency for recycling instructions. |

This manual is for use by qualified personnel only

## 1.2. General Safety Precautions and Instructions

| | |
|---|---|
|  | **Warning:**<br>Failure to follow the instructions in this manual may result in serious injury or death. |
|  | **Warning:**<br>Never connect KiloVault® HAB-XL™ units in series! |
|  | **Caution:**<br>Risk of electric shock. |
|  | **Warning:**<br>Do not place or install near flammable or explosive materials. |
|  | **Warning:**<br>Install the KiloVault® HAB-XL™ out of the reach of children and animals. |
|  | **Warning:**<br>The KiloVault® HAB-XL™ is heavy, over 600lb (272kg), and may cause serious back injury. Lift with multiple people and lifting equipment rated to lift and support at least 1000lb. |
|  | **Warning:**<br>Do not dispose of this product with household waste. |
|  | **Attention:**<br>Read this instruction manual before installing and operating the KiloVault® HAB-XL™. |

- Do not attempt to use any battery that appears damaged during shipment or otherwise.
- Do not submerge the HAB-XL™. This could cause personal injury and will void your warranty.
- Do not attempt to disassemble the HAB-XL™. Its components are not user serviceable. This could cause personal injury and will void your warranty.
- To avoid the risk of shock or fire, ensure all wire is properly sized and in good condition.
- Do not impact, pull, drag, or step on the HAB-XL™.

This manual is for use by qualified personnel only

- Verify that all equipment that is going to be connected to the KiloVault® HAB-XL™ is turned off before making any connections.
- A small risk of spark does exist while making connections. Ensure the area is free of explosive gasses and liquids and is not installed in confined areas. This includes flammable fuel powered machinery, holding tanks, pipe fittings, and connectors.
- Respiratory irritation may be caused if the HAB-XL™ is punctured or cracked; use appropriate respiratory and hand protection.
- Skin contact with a punctured or otherwise open battery can cause irritation.
- High voltage battery connections (configurations of greater than 36 V DC nominal) can be dangerous in any DC system. The HAB-XL™ is a 48 V nominal battery system and is greater than 36 V DC at the terminals when fully charged! DC voltages over 52 V can stop the human adult heart; please be careful and wear insulated gloves.

## 1.3. Battery Handling Guide

In addition to the General Safety Precautions and Instructions, the following guidelines should be observed when handling the HAB-XL™ .

### 1.3.1. Transportation

- The HAB-XL™ should kept horizontal while being moved, except when it is being lifted into place for mounting.
- Because the HAB-XL™ weighs over 600 lb., it should be moved with the help of multiple people and moving / lifting equipment rated over 1000 lb.
- Do not drop the HAB-XL™ or damage will occur.
- If you are transporting HAB-XL™ batteries while they are still in the packing crate, do not stack them more than two layers high and ensure they are strapped together to prevent tumbling.
- Only transport the HAB-XL™ in an upright position.
- Check the HAB-XL™ immediately after transporting.
- If the HAB-XL™ is damaged in any way, do not use it; contact KiloVault® immediately.

### 1.3.2. Storage

In addition to the General Safety Precautions and Instructions, the following guidelines should be observed when storing the HAB-XL™ .

- Long-term storage (between one and six months) of the HAB-XL™ should be stored indoors in a clean, dry, shaded, and well-ventilated area at a temperature between 59° and 95°F (15° and 35°C).
- Store the HAB-XL™ no longer than 6 months.
- The HAB-XL™ must be charged to at least 70% (the state of charge upon delivery) before storage.

- Repeated 100% discharges will decrease the battery capacity. For example, 3000, 100% discharge cycles will reduce the battery capacity to about 75% of the original amp hour capacity.
- Fully charge the battery within 15 days of a deep discharge of 90% or more.
- Do not drop, stack, or turn the KiloVault® HAB-XL™ upside down.
- Store the KiloVault® HAB-XL™ away from children and animals.

## 1.3.3. Response to Emergency Situations

The HAB-XL™ is comprised of multiple batteries and is designed to prevent hazards resulting from failures; however, no battery system is 100% safe, and KiloVault®, LLC cannot guarantee its absolute safety.

In the unlikely event of a fire first shut off the source of the electricity if possible. We recommend a fire extinguisher in close proximity of your power generating equipment. Class ABC extinguishers are best suited for multipurpose fire types such as wood, flammable liquids, and electrical appliances.

## 1.3.4. Qualified Personnel

This guide, and the tasks and procedures described in this manual, are intended for use by qualified personnel only. Only qualified personnel shall install, operate, overhaul, or maintain the HAB-XL™. During maintenance or overhaul, at least two people (equipped with protective measures, including but not limited to, safety glasses, insulated gloves, and safety shoes) must be present.

Qualified personnel are defined as being a trained and locally certified electrician or installer who has all the following skills and experience:

- Knowledge of the functional principles and operation of on-grid and off-grid (backup) electrical systems.
- Knowledge of the dangers and risks associated with installing and using electrical devices and acceptable mitigation methods.
- Knowledge of the installation of electrical devices.
- Knowledge of and adherence to the information in this guide, to all applicable safety precautions, and to electrical industry best practices.

# 2. Overview

**Warning:**
Never connect HAB-XL™ units in series!

KiloVault® HAB-XL™ Series floor Standing energy storage systems provide a 19.2 Kilowatt-hour rated (20 kilowatt-hour usable) battery in a single package. Up to 20 units can be connected in parallel for additional capacity. The HAB-XL™ Series has been designed for trouble-free mounting and is easy to connect with other system components.

## 2.1. Features

- High safety Lithium Iron Phosphate (LiFePO4) battery
- Integrated HAB-XL to inverter Modbus communications
- Integrated HAB-XL to HAB-XL CAN bus communications
- Integrated Wi-Fi communications (Please contact your KiloVault® salesperson for details)
- Long cycle life (≥6000cycles)
- Advanced High/Low temperature cycle performance
- Intelligent LED & LCD display
- Support for up to 20 HAB-XL™ battery (Leader plus 19 Followers) modules in parallel

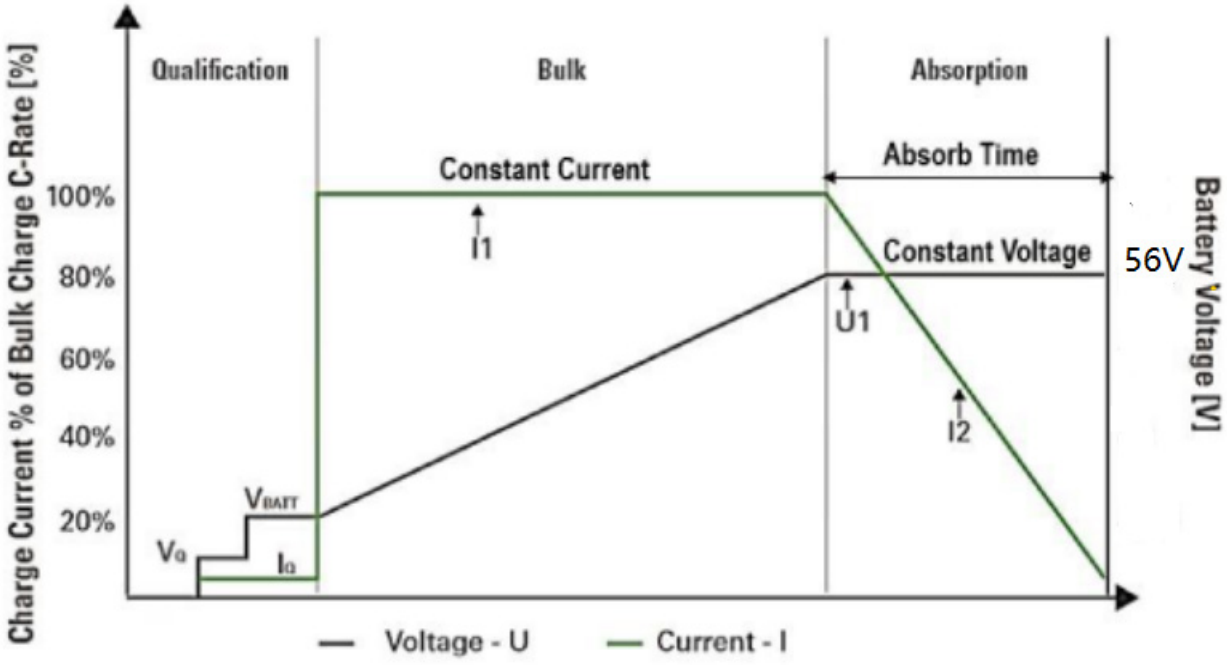
The wiring panel of the HAB-XL™ has been designed for function and convenience.

- The HAB-XL™ wiring panel has access ports on the left and right sides.
- Power and communication cables are now more easily attached

# 3. Specifications

## 3.1. Electrical Specifications

**Note:**
- Specifications are subject to change without prior notice.
- The following are specifications only, NOT set points.




The following specifications describe the HAB-XL™ system.

### Charging Stages

1. Bulk Charge: Charge at Constant Current (CC) to Bulk/Absorb Voltage.
2. Absorption Charge: Maintain Constant Bulk/Absorb Voltage (CV).
3. Terminate when charge current drops below 0.05C.
4. Unlike Lead Acid batteries, Lithium Ferro Phosphate batteries do not require Float Charge.

| Item | Specification |
|---|---|
| Battery Type | LiFePO4 |
| Internal Resistance | ≤15mΩ |

| Item | Specification |
|---|---|
| Battery Efficiency | >98% |
| DC | Direct current |
| Full Charge Voltage | 56 V |
| HAB-XL™ to HAB-XL™ (inter-battery) communication cable | RJ45 120 Ω Resistor Plug, 6-position, 4-conductor, male connectors both ends. Straight through. Maximum length, 10 feet |
| HAB-XL™ to HAB-XL™ (inter-battery) communication protocol | CAN Bus |
| HAB-XL™ to Inverter communication protocol | CAN Bus RS485 |
| High Voltage Cutout | 58.4 ± 0.4 V (not a set point)<br>Recovery 54.0 ± 0.4 V |
| Low Voltage Cutout | 43.2 ± 0.4 V (not a set point)<br>Recovery 50.4 ± 0.4 V |
| Maximum Cell Balancing current | 150 mA |
| Maximum Continuous Charge Current | 180 A (not a set point) |
| Maximum Continuous Discharge Current | 180 A (not a set point) |
| Maximum Continuous Discharge Power | 10 kW |
| Maximum HAB-XL™ to HAB-XL™ Cable Length | 9.84 ft (3 m) |
| Minimum Cell Balancing Volts | 3350 mV |
| Minimum Discharge Voltage | 48.0V±0.5V |
| Nominal Capacity | 400 Ah |
| Rated Energy<br>Usable Energy | 19.8 kWh<br>20 kWh |
| Nominal Voltage | 51.2 VDC |
| Operational Temperature Range | Discharge: -20°C ~60°C (-4°F~140°F)<br>Charge: 0°C ~ 45°C (32°F~113°F) |
| Peak Discharge Current (3s) | 500 A (3S), 750A (1S) |

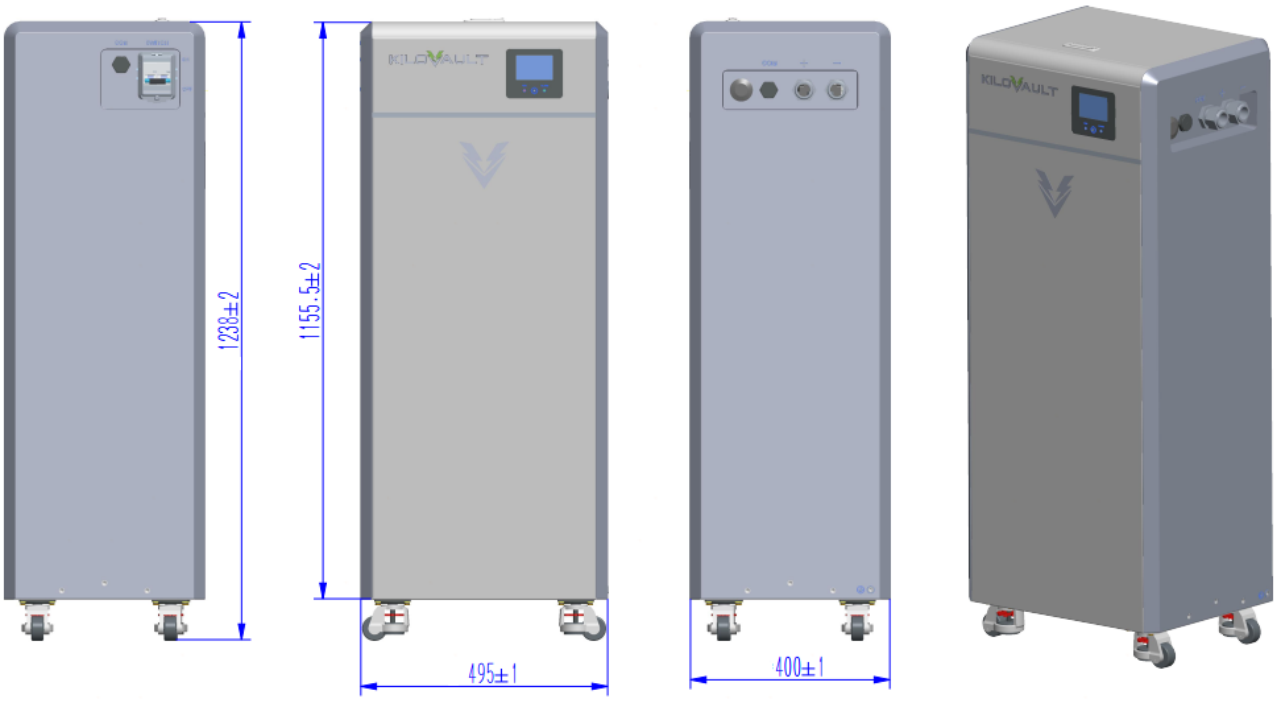
| Item | Specification |
|---|---|
| Peak Discharge Power (3s) | 25KW |
| Recommended Floating Charge Voltage | Floating charge is not recommended for the HAB-XL |
| Self-Discharge Rate | ≤3% per month, ≤15% per year<br>Note: The KiloVault® HAB-XL™ will enter sleep mode:<br>• By pressing down the Power button for 6~8 seconds.<br>• No current for 7 Days and SOC ≤20%<br>• UVP is Triggered, and delay 2 Min |

Refer to Section 6 Troubleshooting for a complete list of protection limits.

## 3.2. Operating Environment Specifications

| Item | Specification |
|---|---|
| Operational Temperature Range | Indoors away from direct exposure to rain or sun |
| Operating Temperature | -10°C~ 40°C (14°F~104°F) |
| Recommended Operating Temperature | 15°C to 35°C (59°F to 95°F ) |
| Short Term (less than one month) Storage Temperature | -20°C~45°C (-4°F~110°F) |
| Absolute Maximum Altitude | 200A@ ≤ 2, 000m<br>180A @ 2,000m~4,000m |

# 3.3. Physical Specifications




| Item | Specification |
|---|---|
| KiloVault® HAB-XL™ Weight | 449.74Lbs 204kg net<br>597.45Lbs 272kg gross |
| KiloVault® HAB-XL™ Height | 32 in (1238 mm) With wheels |
| KiloVault® HAB-XL™ Width | 19.48in (495 mm) |
| KiloVault® HAB-XL™ Depth | 15.74in (495 mm) |
| KiloVault® HAB-XL™ Ingress Rating | IP54 |
| Battery Terminal Torque | 15 Nm, 11.06 ft-lb, 132.76 in-lb |
| Large (power) ports | PG25: Approx. 0.79 in (20mm) |
| Small (communication) ports | PG21: Approx. 1.1 in (28mm) |

## 3.4. Certifications

• Cell Certifications

  o UL1642
  o UL9540
  o UL9540A
  o IEC62619
  o UN38.3

• Complete Unit Certifications

  o cETLus UL 1973
  o UN DOT 38.3 (acceleration three times each side)
  o 50 gn for 11 ms
  o 150 gn for 6 ms
  o IP54
  o OSHAS 18001 / ISO 45001
  o ISO 9001 / 14000

# 4. Installation

| | |
|---|---|
|  | **Warning:**<br>This is a hazardous situation which, if not avoided, could result in serious injury or death. |
|  | **Warning:**<br>Do not place or install near flammable or explosive materials. |
|  | **Warning:**<br>Install the KiloVault® HAB-XL™ out of the reach of children and animals. |
|  | **Warning:**<br>The KiloVault® HAB-XL™ is heavy, over 600 lb. (272 kg), and may cause serious back injury. Lift with multiple people and lifting equipment rated to lift and support at least 1000 lb. |
|  | **Warning:**<br>Do not dispose of this product with household waste. |
|  | **Caution:**<br>Risk of electric shock. |
|  | **Attention:**<br>Disconnect the KiloVault® HAB-XL™ before carrying out maintenance or repair. |
|  | **Attention:**<br>Read this instruction manual before installing and operating the KiloVault® HAB-XL™. |

| | |
|---|---|
|  | **Note:**<br>• Prior to installing your HAB-XL™, please take pictures of the label on the left side, including the serial number, serial number barcode, QR code, and MAC address. Store this information for your records, it is valuable and may be necessary for system configuration or troubleshooting. Depending on your HAB-XL™ unit's position, viewing this information after installation may be difficult. |

This manual is for use by qualified personnel only

## 4.2. Unpacking the KiloVault® HAB-XL™

The HAB-XL™ weighs 600 lb. (272 kg); wear appropriate protective equipment, such as gloves and protective footwear, when handling this unit.

Keep the HAB-XL™ in its box until you are ready to install it. Open the box and inspect all contents to ensure all items in the box are undamaged.

Do not attempt to lift or move the battery without sufficient equipment and human resources. Lifting equipment that is capable of securing the battery from tipping while moving and positioning is highly recommended.

At least 2 to 3 people are necessary to lift and upright the battery from its crate. The use of heavy gloves is highly recommended.

**Retain all packaging material for the duration of your warranty period.**

### 4.2.1. Package Contents

The standard HAB-XL™ packaging includes the battery unit, mounting Plates and floor securing plates, screws, communications cables.

Battery parallel communication cable_RJ45

Inverter communication cable_RJ45

Expanding screw M8*60, fix rack on the floor

This manual is for use by qualified personnel only

## 4.3. Tools, Materials, and Safety Equipment Required for Installation

- Personal protective equipment, including but not limited to, safety glasses, insulated gloves, and protective footwear
- Lift equipment capable of lifting and supporting at least at least 1000 lb (453 kg)
- Drill and drill bit for drilling pilot holes for the mounting plate
- If you will be mounting onto concrete or masonry, you will need a 12 mm drill bit for the included M8*60 expansion screws
- Conduit and conduit fittings (depending upon local electrical requirements)
- Various sized Phillips and flathead screwdrivers
- Torque wrench and sockets
- 2/0 battery to inverter cables
- Battery combiner box (when more than one KiloVault® HAB-XL™ batteries are being used)
- Level

## 4.4. Suitable Installation Locations

The HAB-XL™ must be installed indoors. In addition, make sure that the installation location meets the following conditions:Observe the following:

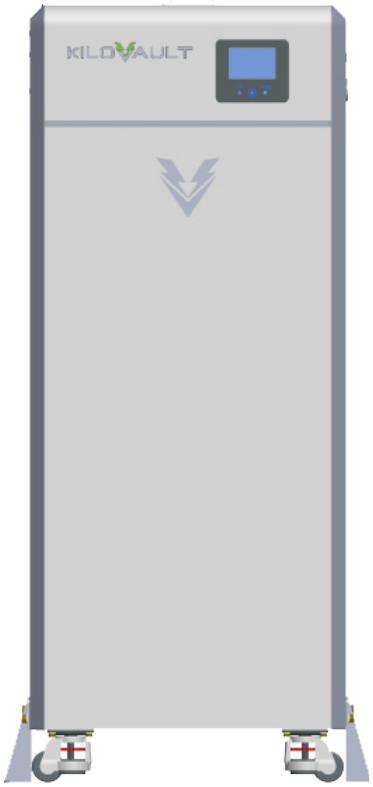
- Install indoors in a cool, dry, ventilated space
- Do not install near a heat source, and keep away from direct sunlight; this prevents from derating the output or shutting down due to overheating
- Keep away from fire, flammable, or explosive items
- Keep out of the reach of children and animals
- The floor is flat and level (Inclination < 15°).
- The optimal ambient temperature is within the range from 59° to 95°.
- The temperature and humidity are maintained at a constant level.
- There is minimal dust and dirt in the area.
- Do not install near a transformer or any other strong electromagnetic field. Strong electro-magnetic fields can disrupt the HAB-XL™ communication system

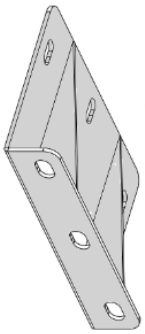
The HAB-XL™ communication and power cable entries are located at the upper right corner of the unit. There must be enough clearance for the conduit and fittings.

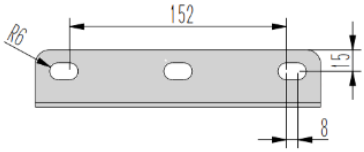
| | |
|---|---|
|  | **Warning:**<br>DO NOT reverse the polarity (positive and negative) of your unit's connections. NEVER short circuit your KiloVault® HAB-XL™. |
|  | **Warning:**<br>The KiloVault® HAB-XL™ is for use with 48 V systems only. DO NOT connect them in series! |

# 4.5. Install the HAB-XL™ Floor Securing Plate

The HAB-XL™ is designed to stand on the floor with the four adjustable support legs on the bottom. The wheels are provided for serviceability only, not intended for stationary installation. We recommend using the floor securing plates in high seismic areas.



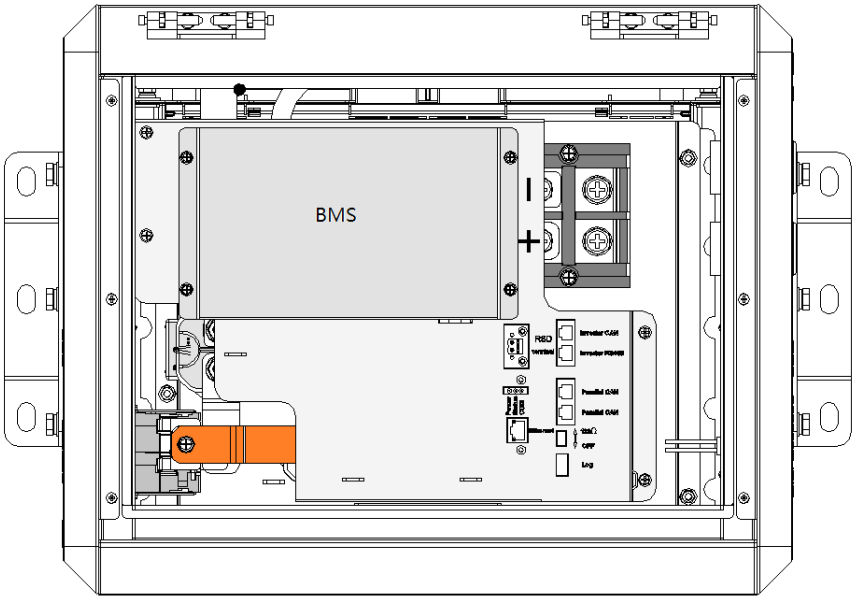


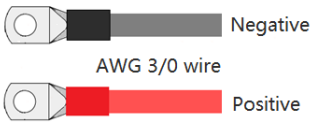
## 4.6. Connecting the HAB-XL™ to Your Inverter / Charge Controller

The battery terminals are positioned under the top cover. To open the cover, slide the raised latch to the right, the handle will then pop up, rotate it counterclockwise 90° and lift the lid to the open position. Note: the lid does not have a mechanism to keep it from shutting so be sure to open it past 90° or use an object to hold it open.

When connecting the cables ensure that the battery DC breaker is OFF and that the battery screen is off. Pay special attention to the polarity of the connections and do not cross the positive and negative terminals between the inverter/charge controller and the battery; also, ensure the terminals are not connected to any metal mounting point, fixture, or body part.

The HAB-XL™ is equipped with two 3/8s (M10) threaded terminals with a lock washer and nut. Recommended terminal torque is 10.0 –19.1 N·m (7.4 – 14.1 ft.lb) The right-hand terminal is for the positive lead while the left- hand terminal is for the negative. Heavy duty battery ring terminals of size 3/8s (10mm) along with proper size wiring cables are required to connect battery to inverter/charger. Do not reverse polarity, doing so will void warranty. Use a voltmeter to check polarity before connecting terminals.



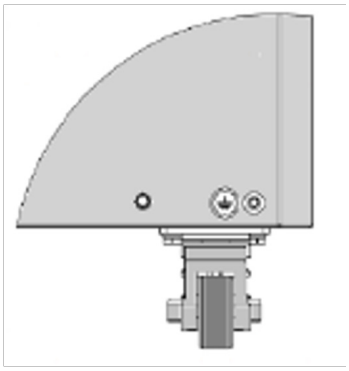

**NOTE**

**Note:** When making the connections, be sure to observe correct hardware stacking and proper polarity, and ensure that nothing obstructs the connection between the terminal surface and the battery cable lug,

## 4.5.5 Grounding

The KiloVault® HAB-XL™ is provided with ground terminals that must be reliably connected to ground (protective earth) by appropriately sized equipment grounding conductors. System grounding for the AC and DC systems must be done according to all applicable NEC and local installation codes. To connect the HAB-XL™ to the DC grounding system, use the ground lug at the bottom of the chassis (see Figure below). The terminal accepts wires from #14 AWG (1.63 mm) to #2AWG (6.54 mm).

**Note:** If a grounded DC system is required, ensure that the system bonding is done in one location only, and that all conductors and connections comply with all applicable NEC and local installation codes.



⏚ **Protective (grounding) conductor terminal**

**WARNING**

**UNGROUNDED EQUIPMENT**

Equipment ground terminals must be reliably connected to ground by appropriately sized grounding conductors. All installations must comply with national and local codes. Consult local and national codes for specific grounding and bonding requirements.

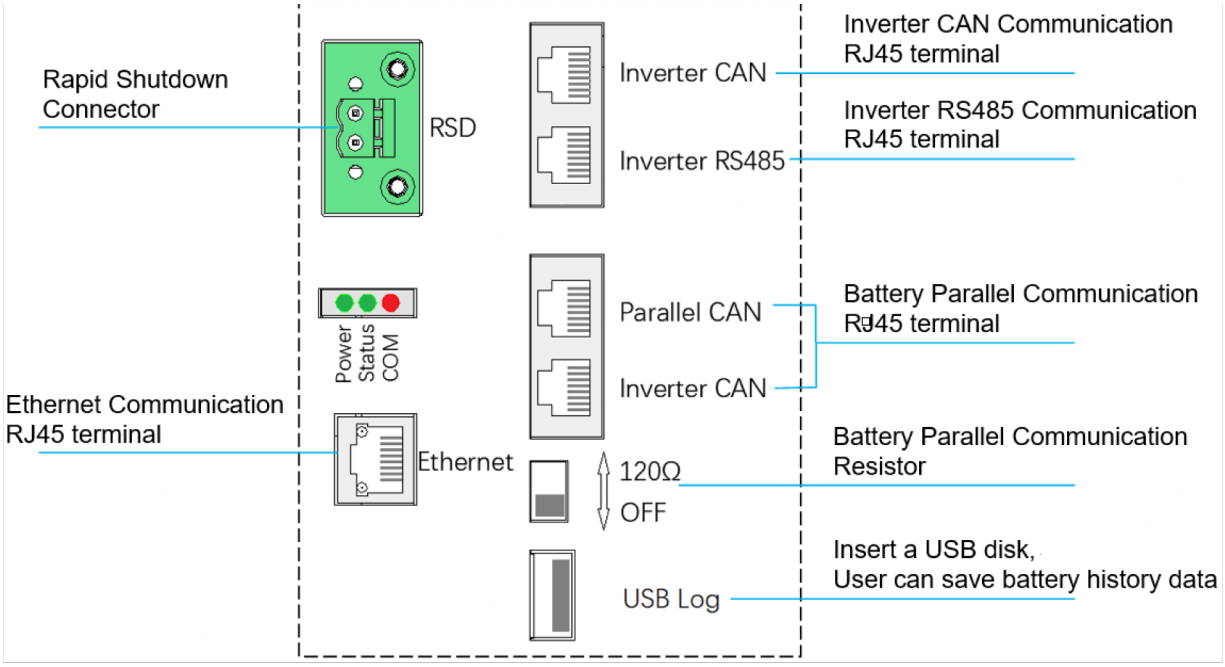
**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

**This manual is for use by qualified personnel only**

## 4.5.4 Battery Communications

The KiloVault® HAB-XL™ has a self-contained Battery Management System (BMS). No communication is required between a battery-based inverter and the KiloVault® HAB-XL™ to operate the system, though closed loop communication is recommended to improve battery and inverter performance.

The Communication Box has five ports next to the battery breaker (refer to communication box picture below). Those ports are designed to support Inverter RS-485 and CAN communication, battery parallel communication and USB Logging.




## 4.5.6 System Commissioning

If you're installing a single HAB-XL™, please follow the below steps to start up the system.

1. When using a single battery be sure to set the "Battery ID" to 0 or the unit will not start.
2. Check the DC cables for correct polarity.
3. Switch the battery's 250A breaker to the "ON" position.
4. Switch inverter breaker to the "ON" position.
5. Push the power button on the front of the unit for approximately 3 seconds until beep indication.

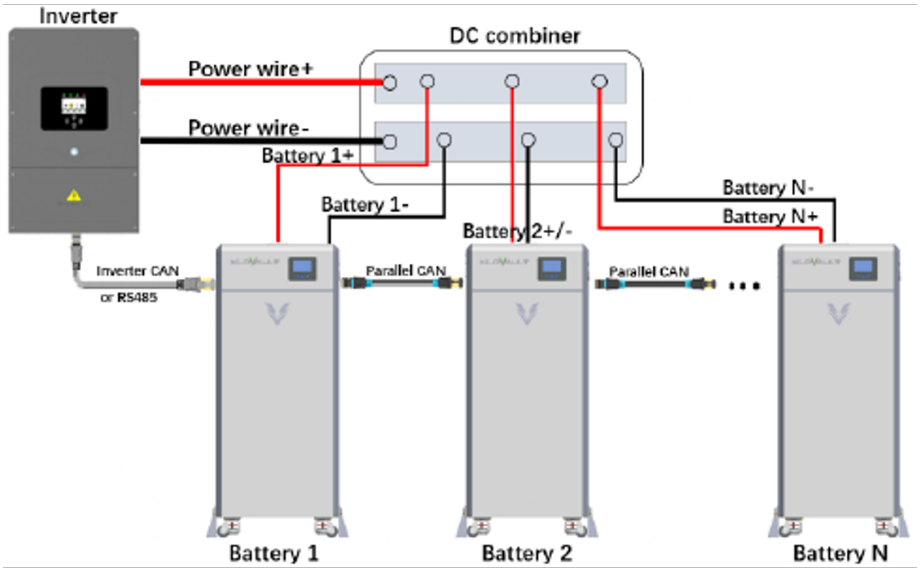
**NOTE**

**Note:** When installing multiple inverters with one or more KiloVault® HAB-XL™, please turn the first inverter on then use the following the steps, then power up the remaining inverters.

## 4.5.7 Parallel HAB-XL™ Units

HAB-XL™ units with the same capacity may be connected in parallel in configurations of up to 14, this is the maximum number allowed for consistent and robust operation. Quantities greater than this will require consultation with KiloVault technical support. A qualified installer should understand the complexities of large-scale storage and must adhere to industry electrical design guidelines, including the NFPA standards and local fire codes when installing systems of this size.

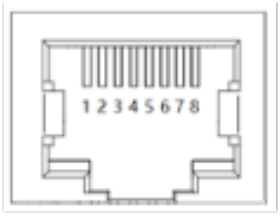
The storage capacity and total available current are increased in a parallel arrangement. The following illustration shows how to connect multiple batteries in parallel. Please note that while the overall system voltage is not changed, the available current from the system has been doubled.



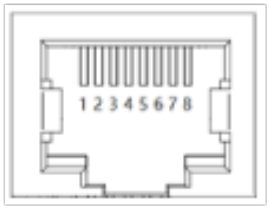

**NOTE**

**Note:** For parallel systems maintain identical wire length and wire type from the HAB-XL™ to the system battery combiner. When installing more than one HAB-XL™, a dedicated battery DC combiner is highly recommended.

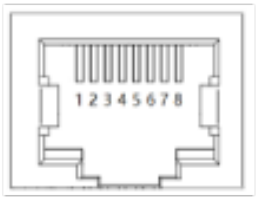
## Communication Interface Details




| BATTERY & INVERTER CAN Port | |
|---|---|
| Pin No. | Definition |
| 1 | INVERTER_CANH |
| 2 | INVERTER_CANL |
| 3 | CANGND |
| 4 | NC |
| 5 | NC |
| 6 | NC |
| 7 | NC |
| 8 | NC |




| BATTERY & INVERTER RS485 Port | |
|---|---|
| Pin No. | Definition |
| 1 | NC |
| 2 | NC |
| 3 | INVERTER_RS485A |
| 4 | NC |
| 5 | INVERTER_RS485B |
| 6 | RS485GND |
| 7 | NC |
| 8 | NC |



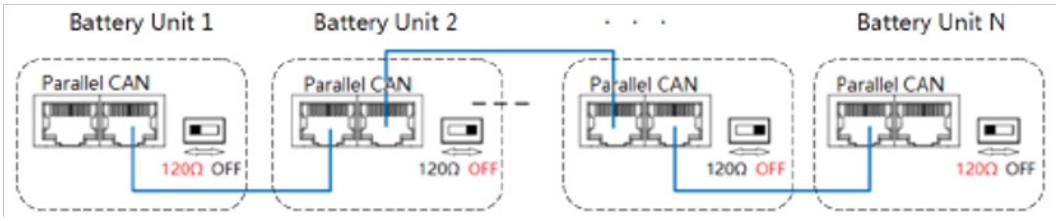

| INTER-BATTERY Parallel CAN port | |
|---|---|
| Pin No. | Definition |
| 1 | BMS debug_CANH |
| 2 | BMS debug_CANL |
| 3 | CANGND |
| 4 | NC |
| 5 | NC |
| 6 | CANGND |
| 7 | Parallel_CANL |
| 8 | Parallel_CANH |

**NOTE**

**Note:** The Inverter CAN and RS485 ports are optional and only one is used at a time for closed loop inverter communications. The battery RS485 port is used when the inverter requires a MODBUS interface such as on the Schneider XW Plus.

## 4.6 COMMUNICATION CONNECTIONS

1. Confirm that each battery DC circuit breaker is in the “OFF” position.
2. Wire each battery to your systems battery combiner. Connect the applicable AC and DC wiring on the inverter side of the system.
3. Connect the first HAB-XL™ COM_Parallel OUT to the input of the next HAB-XL™ IN port. Each unit comes with one RJ45 cable for this purpose. If the cable is missing, please make sure the cable you purchase on the market meets the following standards, CAT5/5e or greater, 24AWG pure copper, this is most typical ethernet cables..
4. Ensure the communication matching resistor of the first and last battery is set as 120Ω, while the others are set to OFF.




5. Press the button on the front of each battery for approximately 3 seconds one by one, until all batteries start up.
6. Touch the battery LCD to set “Battery ID” from 1 to N (Parallel number) as illustrated in the picture below.



7. Touch the LCD to set Inverter “Protocol ID” to the following:

| PROTOCOL ID | SUPPORTED INVERTER PROTOCOL |
|---|---|
| 1 | Reserved |
| 2 | SMA CANbus, 500kbps |
| 3 | Reserved |
| 4 | Victron CAN, 250kbps |
| 5 | Schneider Modbus, 19200bps |
| 6 | Solark CANBus, 500kbps |
| 7 | Growat Modbus, 9600bps |
| 8 | Reserved |
| 9 | Reserved |

8. Use RJ45 cable to connect the inverter CAN or RS485 port of leader battery (which Battery ID set as 1) to inverter communication port.

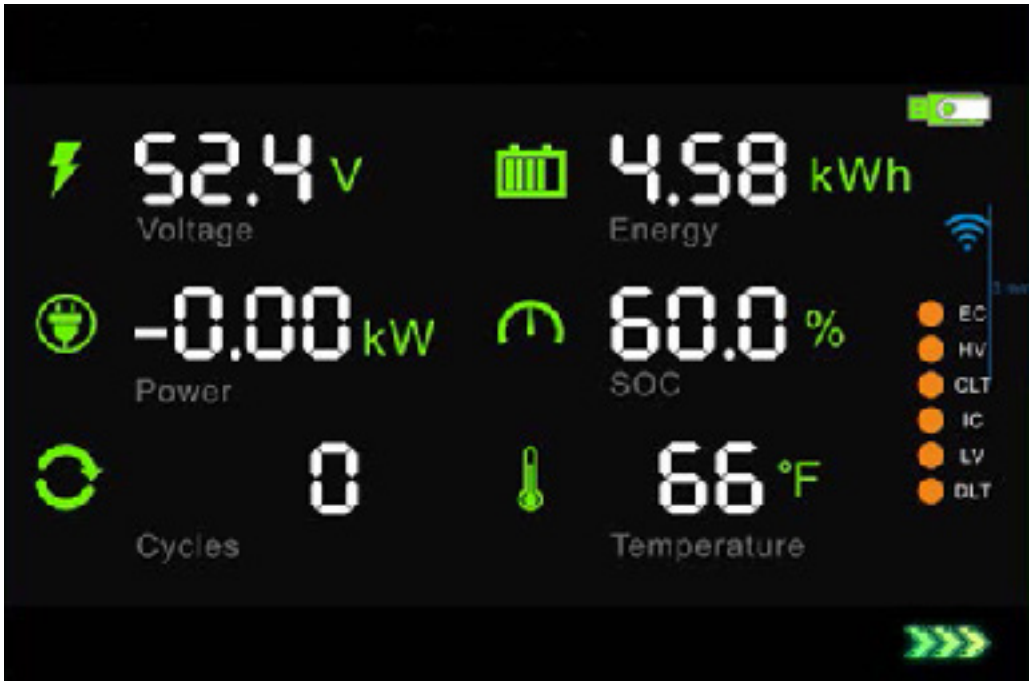
9. Turn ON the inverter breaker, then turn ON all battery DC breakers, and then press the button of leader battery (Battery ID 1) for 8+ seconds to turn off. Finally, press the button on the leader battery for 3+ seconds to start the automatic PARALLEL PROCESS.

10. The leader battery orders the lowest voltage battery of the whole system to pre-charge and turn on relay, and request charge current from inverter. As the battery voltage increases, batteries join the parallel circuit one by one. After all batteries are in parallel, the process ends.

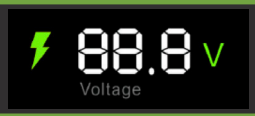
# 5. Operation, Maintenance & Monitoring

## 5.1. HAB-XL™ Control Panel

The KiloVault® HAB-XL™ control panel displays a variety of useful information regarding the operation of your system.



## 5.1.1. HAB-XL™ Control Panel Details

| Display | Description | Notes |
|---|---|---|
|  | Battery Voltage | |
|  | Remaining Energy | |
|  | Charge / Discharge Power | Negative value = Discharging<br>Positive Value = Charging |
|  | State of Charge | Approximate Percentage Full |
|  | Number of Cycles | |
|  | Battery Temperature | |
|  | Wi-Fi Status | • Off = Not connected to router. The HAB-XL™ is configured for a router connection, but the connection has failed.<br>• Rolling = One-Click configuration. The user can check the status through a local connection.<br>• Flashing = The status can be checked only through the unit's Wi-Fi hotspot using the mobile application.<br>• On Steady = Normal Wi-Fi status. Number of semi-circles (1 to 3) indicates the Wi-Fi signal strength. |
|  | Alarm or Warning Indicators | The HAB-XL™ will light these indicators when a warning or alarm condition occurs:<br><br>HV = Battery High Voltage<br>LV = Battery Low Voltage<br>HT = Battery High Temperature<br>LT = Battery Low Temperature<br>OC = Charge or Discharge Over Current<br>SC = Short Circuit<br><br>Refer to Section 6 Troubleshooting for action instructions if the indicators light. |

## 5.2. Calibrating Your HAB-XL™

Calibrate the State of Charge calculator and kWh using the following procedure.

• Fully charge the battery to 56V.

- o If a high voltage alarm occurs, you can ignore it. You will still be below the high voltage protection. Note: If this does occur, the alarm will not clear until the voltage falls below 54V ±0.5V.
- o Even if the SoC (State of Charge) on the front panel gets to 100% before the voltage gets to 56.V, continue to charge until you reach 56V.
- o Once the battery has reached 56v, discontinue charging even if the SoC is not yet showing 100% it should recalibrate to 100% at this time. You may want to record the displayed kWh for your records.

Or Fully discharge your battery(s) to 48V

- o If a low voltage alarm occurs, you can ignore it. You will still be well above the low voltage protection threshold. Note, if this does occur, the alarm will not clear until the voltage rises above 50.4V ± 5 V.

• The HAB-XL™ unit's SoC and capacity should now be calibrated.

## 5.3. Charging Settings

Your battery charger (solar, inverter, or AC), should be set to stop charging at a maximum voltage and your inverter should be set to shut down at a certain voltage. See the inverter and charge controller settings in the following table:

| Device | Setting | Under 40A Charger | 40-60A Charger | 60-150A Charger |
|---|---|---|---|---|
| All | Standard Charge Voltage | 56V | | |
| | Peukert Coefficient | 1.05 | | |
| | Internal Resistance | ≤15mΩ | | |
| | Recommended Charge Current | 100A per HAB-XL™ in Parallel (Solar Charge Controller Amps + Percentage of Inverter/Charger Maximum DC Output). Example: For a single HAB-XL™ system with an inverter/charger maximum DC output of 100 A and a solar charge controller capable of 50 A, limit the inverter/charger output to 50 A (so the total is 100 A). | | |

| Device | Setting | Under 40A Charger | 40-60A Charger | 60-150A Charger |
|---|---|---|---|---|
| Inverter Charger | Absorb Time (some controllers do not allow a selection under 6 minutes, please contact KiloVault for additional information) | Under 6 minutes | Under 4 minutes | Under2 minutes |
| | Battery Capacity | 400 Ah (20kWh) per KiloVault® HAB-XL™ | | |
| | Battery Type | Lithium Ion or Custom - whichever provides access to the required settings | | |
| | Absorption | 56V | | |
| | Bulk (98% to 100% of Absorption) | 56V | | |
| | Bulk Current | 120A | | |
| | Charge Cycle | 2 Stage No Float | | |
| | HBCO (High Battery Cut Out) | 57 V (58V for Schneider Equipment) | | |
| | LBCO (Low Battery Cut Out) | 48.2 V (48V for Schneider Equipment) | | |
| | LBCO Delay | 3 seconds | | |
| | LBCO Hysteresis | 2 V | | |
| | Max Bulk Current | Set to whatever percentage of the inverter current plus the charge controller current is less than or equal to 100 A | | |
| | Absolute Maximum Charge Rate | 120A per HAB-XL™ in Parallel (Solar Charge Controller Amps + Percentage of Inverter/Charger Max DC Output.<br>Example: For a single HAB-XL™ system with an inverter/charger maximum DC output of 100 A and a solar charge controller capable of 80 A, you would limit the inverter/charger output to 40 A (so the total is 120 A). | | |
| | Recharge / Re-Bulk Volts (80% DoD) | 51.4 V (used to set voltage that triggers charge start) | | |

| Device | Setting | Under 40A Charger | 40-60A Charger | 60-150A Charger |
|---|---|---|---|---|
| Charge Controller | Absorb Time | Under 6 min | Under 4 min | Under 2 min |
| | Absorb Voltage | 56 V | | |
| | Battery Capacity | 400 Ah (20 kWh) per HAB-XL™ | | |
| | Battery Temperature Compensation | Do not use an external battery temperature sensor with these batteries. If the sensor is required for a charge controller or inverter charger to work, set the battery temperature compensation to 0mV / °C. | | |
| | Battery Type | Lithium Ion or Custom - whichever provides access to all the required settings | | |
| | Battery Voltage | 48 V | | |
| | Bulk Voltage | 56 V | | |
| | Charge Cycle | 3 Stage | | |
| | Equalization | Disabled | | |
| | Max Float Current | 10 A | | |
| | Float Voltage | 52.8 V | | |
| | Maximum Charge Rate | 1C | | |
| | Recharge / Rebulk Volts | Set to start charging from solar before charging by AC (just above the inverter/charger's recharge/rebulk voltage of 51.4 V). | | |
| Battery Monitor | Midpoint Sensor | If you are using a battery monitor with midpoint sensors, secure the midpoint sensor leads out of the way and electrically isolate the midpoint sensors with electrical tape, shrink wrap, or any other appropriate method.<br>Midpoint sensors are only used on strings of batteries in series. Since the units are NEVER connected in series, midpoint sensors are not used. | | |
| | Battery Temperature Sensor | Do not use an external battery temperature sensor with these batteries. | | |
| | Battery Temperature Compensation | If the sensor is required for the battery monitor to work, set the battery temperature compensation to 0mV / °C | | |

## 5.3.1. Firmware Updates

- Ensure that your HAB-XL™ is connected to the internet and added into HAB™ iT (the HAB-XL™ mobile application).
- Ensure your WiFi router and internet connection are not using power from your inverter. You do not want these devices to lose power during the update.
- If your HAB-XL™ is using the scheduled charging feature, temporarily disable scheduled charging.
- On the HAB™ iT Basic screen flip the slider-like switch highlighted in blue shown in Figure 20: KiloVault® HAB™ iT Basic Screen Slider Switch. The status should change to “No charge or discharge.”

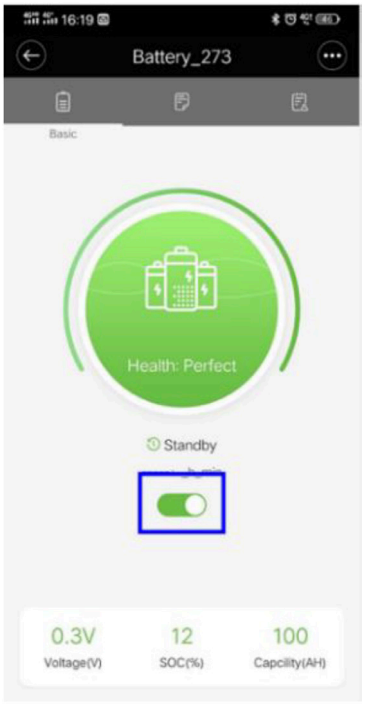



*Figure 20: HA™ iT Basic Screen Slider Switch*

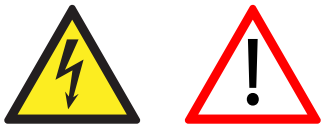
- KiloVault® HAB-XL™ firmware updates take about 10 minutes.
- Firmware updates are usually timed to take place during the evening in North America.
- Depending on what part of the BMS is being updated, either the red “ALARM” LED will flash by itself, or the red “ALARM” LED will flash along with the two bottom red LEDs in the State of Charge bar.
- Firmware updates include BMS improvements to:
    - HAB-XL™ to HAB-XL™ Communications
    - Cycle Counting
    - State of Charge Calculation
    - Other BMS functions as needed.
- The WiFi adapter firmware cannot be updated.

If there are no alarms, the green **RUN** LED will be lit, and the control panel will be populated with information about the running condition of your HAB-XL™. The control panel will remain lit for 1 minutes and then go blank. If you briefly (less than three seconds) press the HAB-XL™ unit's power button, the control panel will again light for 1 minutes.

If there is an alarm condition, the **RED** Alarm LED will light, plus one or more of the alarm or protection state indicators at the right of the control panel will light. Please see the BMS Alarm and Protection table for details.

To turn off the HAB-XL™, press the power button for 6~8 seconds. The run LED will flash five times, then the control panel and the state of charge bar will go dark. The HAB-XL™ is now off.

## 5.5. Monitoring



You can monitor the KiloVault® HAB-XL™ using either the front control panel or the KiloVault® HAB™ iT" mobile application. There are both Android and iOS versions of the app. The iOS app requires iOS 10 or above. The Android app requires Android 5.0 (Lollypop) and above. The apps are available from the iOS App Store or the Google Play Store. Please see the KiloVault® website to download detailed HAB™ iT instructions.

## 5.6. Maintenance

Do not remove the rear panel without authorization. Simply keep the exterior clean, dry, and dust free.

## 5.7. Disposal

Please contact your local solid waste recycling agency for recycling instructions. Do not dispose of this equipment with household waste.

# 6. Troubleshooting

## 6.1. BMS Protection / Alarm Conditions

Alarm events cause the ALARM LED on the front panel to flash. Protection events cause the ALARM LED to flash and will cause the HAB-XL™ to shut down for the indicated time period.

HAB-XL POWER BUTTON REST FUNCTION CHART

| HAB-XL Power button | Amount of Time & Number of Times pressed | Results |
|---|---|---|
| **HAB-XL** | 3 presses in 5 Seconds | Wi-Fi Configuration. The HAB-XL enters Wi-Fi pairing mode. The Wi-Fi symbol in the display flash-es. The Red and Green LED's flash. |
| **HAB-XL** | 1press, 3 to 5 seconds | Power On |
| | 1press, 3 to 5 seconds | Power Off |

| Alarm / Protection Condition | Trigger Values |
|---|---|
| High Voltage Alarm for each Cell | 3.60±0.03 V |
| High Voltage protection for each cell | 3.65±0.03 V, Delay time: 1s |
| High Voltage release for each cell | 3.30±0.03 V |
| High Voltage alarm for total voltage | 57.6 V±0.5 V |
| High Voltage protection for total voltage | 58.4 V±0.5 V, Delay time: 1s |
| High Voltage release for total voltage | 54.0 V±0.5 V |
| High Voltage release method | Under the release voltage (54V ±0.5V) for 1s |
| | |
| Low Voltage alarm for each cell | 2.90±0.03 V |
| Low Voltage protection for each cell | 2.70±0.03 V, Delay time: 1s |
| Low Voltage release for each cell | 3.15±0.03 V |
| Low Voltage alarm for total voltage | 48.0 V±0.5 V |
| Low Voltage protection for total voltage | 43.2V±0.5 V, Delay time: 1s |
| Low Voltage release for total voltage | 50.4 V±0.5 V |
| Low Voltage release method | Charge to recovery |
| Charge over current alarm | 220±10 A |
| Charge over current protection | 260±10 A, Delay time: 5s |
| Charge over current release method | Auto release after 1min |
| Discharge over current alarm | 220±10 A |
| Discharge over current protection | 260±10 A, Delay time: 1s |

| Alarm / Protection Condition | Trigger Values |
|---|---|
| Over current release method | Auto release after 1min |
| Charge High Temperature alarm | 122°F ± 5.4°F (50°C ± 3°C) |
| Charge High Temperature protection | 131°F ±5.4°F (55°C ± 3°C) |
| Charge High Temperature release | 113°F ±5.4°F (45°C ± 3°C) |
| Discharge High Temperature alarm | 140°F ±5.4°F (60°C ± 3°C) |
| Discharge High Temperature protection | 149°F ±5.4°F (65°C ± 3°C) |
| Discharge High Temperature release | 131°F ±5.4°F (55°C ± 3°C) |
| Charge Low Temperature Alarm | 37.4°F ±5.4°F (3°C ± 3°C) |
| Charge Low Temperature Protection | 32°F ±5.4°F (0°C ± 3°C) |
| Charge Low Temperature Release | 41°F ±5.4°F (5°C ± 3°C) |
| Discharge Low temperature alarm | 5°F ± 5.4°F (-15°C ± 3°C) |
| Discharge Low temperature protection | -4°F ± 5.4°F (-20°C ± 3°C) |
| Discharge Low temperature release | 14°F ± 5.4°F (-10°C ± 3°C) |

## 6.2. Warning / Alarm Indicators

| Display | Status | Required Action | Alarm | Run |
|---|---|---|---|---|
| – | Normal | No Action Required | – | ● |
| WFP | Wait For Parallel | No processing required. This battery are waiting for parallel, It will join in parallel within 1 cycle automatically. | – | Flash (1Hz) |
| RDS | Remote Discharge Switch | Battery is remotely switched OFF by WIFI APP, user can resume the discharge ON through APP. | | Flash (1Hz) |
| RSD | Rapid Shut Down | • Check the whether the user has triggered the Rapid Shut Down swtich;<br>• Check the RSD switch must be set NC(Normal) | | Flash (1Hz) |
| ECE | External COM Error | • Check communication cable between battery & inverter.<br>• Check inverter selecting on battery's LCD.<br>• Check the inverter's BMS protocol settings. | – | ● |
| ICE | Internal COM Error | • Check the communication cable between battery<br>• Check the CAN communication resistor following 4.5.6 Parallel Connection, section 4) | – | Flash (1Hz) |
| ASR | Battery Address Repeat | Battery address setting cannot repeat with other battery, please reset address on LCD following 4.5.6 Parallel Connection, section 6); then restart it. | – | Flash (1Hz) |
| AFE / ADS | BMS hardware failure | Need replace the BMS. | – | Flash (2Hz) |
| SLB | Sampling Line Break | Open the top door of the battery rack, then check the battery cable of CON4~CON7. | | |
| HV | High Voltage protection | Stop charge | – | ● |
| COC | Charge Over Current protection | Lower the charge current | – | ● |
| CHT | Charge High Temperature protection | Stop charge | – | ● |
| CLT | Charge Low Temperature protection | Stop charge | – | ● |
| LV | Charge Low Voltage protection | Stop discharge, charge the battery as soon as possible. | – | ● |
| DOC | Discharge Over current protection | Lower the discharge current | – | ● |
| DHT | Discharge High Temperature protection | Stop Discharge | | ● |
| DLT | Discharge Low Temperature protection | Stop Discharge | | ● |

## 6.4. Resetting the HAB-XL™

If necessary, you can reset the HAB-XL™ by first turning it Off and back On using the front power button. This will clear any alarms and protection locks. This will not reset the cycle count.

Kilovault recomends recalibration every 6 months & more frequently if they're not being cycled.

## 6.5. Initial HAB-XL™ Unboxed Voltage

If your HAB-XL™ has a low initial voltage when unboxed, refer to the following information.

### 6.5.1. Low HAB-XL™ voltage when unboxed

If, when you turn on your KiloVault® HAB-XL™ , you measure a very low voltage (under 40 V) at the battery terminals, it is in Low Voltage Hibernation. Press the front power button for 6~8 seconds to turn the KiloVault® HAB-XL™ off. Wait five seconds. Press and hold the front power button to start the KiloVault® HAB-XL™ .

# 7. Technical Support

## 7.1. Downloads and Documentation

Downloads and documentation are available on the KiloVault® website: https://kilovault.com/

## 7.2. Software

The KiloVault® HAB™ iT monitoring software for iOS and Android mobile devices can be downloaded from both the iOS and Android app stores. There is not a desktop version of KiloVault® HAB™ iT.

## 7.3. Contact Us

Email – info@kilovault.com
Phone - +1 (888) 218-5924
KiloVault®, LLC
330 Codman Hill Road
Boxborough, MA 01719

**KiloVault® HAB-XL™ Series**
Lithium Iron Phosphate (LiFePO4)
Deep Cycle Solar Batteries

KiloVault* LLC
330 Codman Hill Road
Boxborough, MA 01719
+1(888)218–5924
info@kilovault.com
www.kilovault.com

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