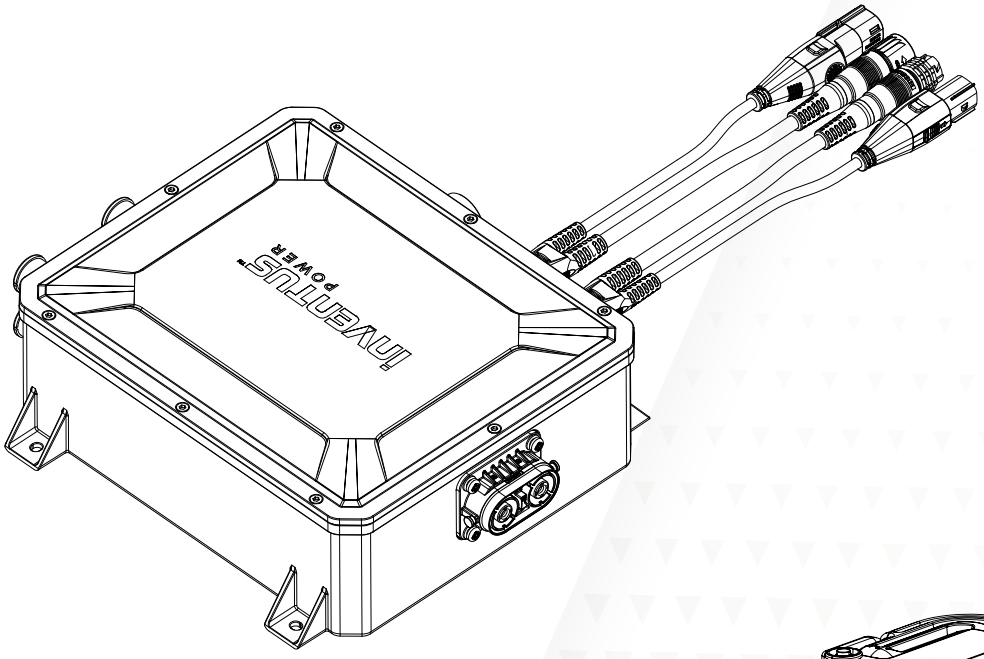
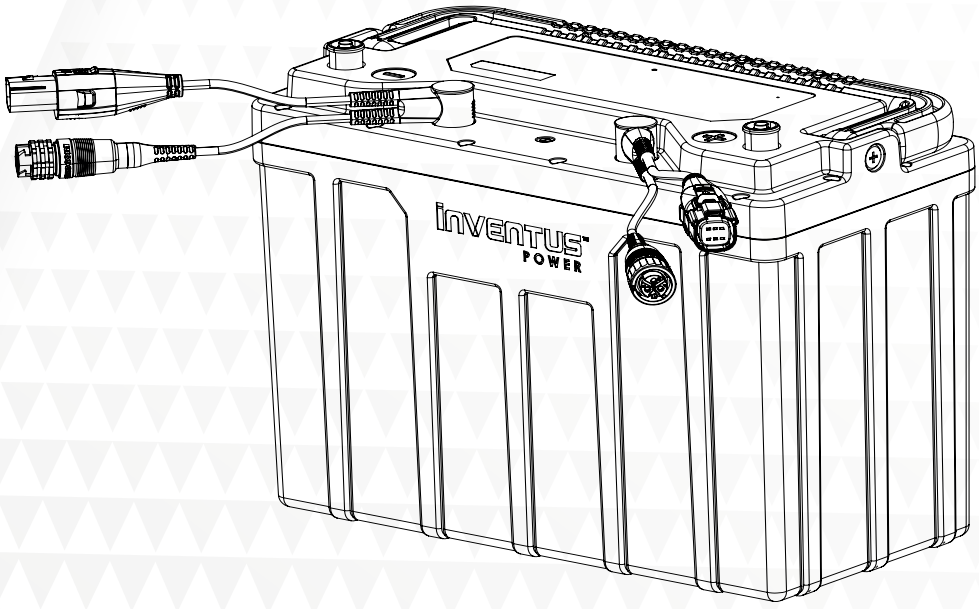
PROTRXion™
HV Battery User Manual



HV-PDM-450



HV-24V105

Designed & Manufactured by

Inventus Power, Inc.
1200 Internationale Parkway
Woodridge, IL 60517

inventuspower.com
info@inventuspower.com
+1 877.423.4242

Applicable Models

Model	Part No.
HV-450-PDM	903-09557-001
HV-24V105	03-58976-101 (with heater) 03-58976-102 (no heater)

Document Information

Release Date	Revision	Scope of Change
02-27-2026	V1.0	None

Introduction

The HV Battery System is a high voltage (HV) modular battery system comprised of a power distribution module (PDM) with integrated battery management system (BMS) and battery modules. The modular architecture provides flexibility to support a 72V system in either 8kWh or 16kWh options.

Environmental Regulations

The HV Battery System is compliant with the following environmental regulations:

- EU Directive 2011/65/EC for Restriction of Hazardous Substances (RoHS 2)
- Regulation (EU) 2023/1542 on batteries and accumulators and waste batteries and accumulators
- EU Directive 1907/2006 on the Registration Evaluation Authorization and Restriction of Chemicals (REACH)
- Management Methods for Controlling Pollution Caused by Electronic Information Products Regulation (China RoHS)

Please read all contents of this User Manual prior to the installation of Inventus Power PROTRXion™ HV Battery System.

DOCUMENT NOTICE: The information contained in this manual is the property of Inventus Power and is subject to change without notice. Inventus Power reserves the right to make changes in the design of its products or components as progress in engineering and manufacturing may warrant. It is the customer's responsibility to satisfy itself as to whether the information contained herein is adequate and sufficient for a user's particular use. It is the further responsibility of each user to ensure that all applications of Inventus Power products are appropriate and safe based on conditions anticipated or encountered during use. This document does not create any additional obligation for Inventus Power and does not constitute additional warranties and representations.

Technical Support: **For any issues, please email tech_support@inventuspower.com**

Abbreviations

CANOpen	Controller Area Network Bus Communication	**SOC**	State of Charge
PPE	Personal Protective Equipment	**OCV**	Open Circuit Voltage
BMS	Battery Management System Constant	**RT**	Room Temperature
OSHA	Occupational and Safety Health Administration	**A**	Ampere
PDM	Power Distribution Module (HV-PDM-450)	**Ah**	Ampere Hour
DC	Direct Current	**V**	Voltage
Aux	Auxiliary	**VCM**	Vehicle Control Module
bps	Bytes per second	**SoH**	State of Health
kW	Kilowatts	**GND**	Ground
kWh	Kilowatt hours		

Contents

Safety

Symbol	Definition
	Important safety information will follow.
	DO NOT dispose of battery in fire
	RECYCLE! Battery may require recycling in accordance with local laws. Regardless, recycling is encouraged. Contact local regulatory authorities for more information. DO NOT include battery with lead acid battery recycling.
	DO NOT dispose of battery in the trash.
	Shock Hazard - Labels may be located on or inside the equipment to alert people that dangerous voltage may be present.
	Burn Hazard - Labels may be located on or inside the equipment to alert people that surface temperature may be dangerous.
	High voltage lithium batteries can cause injury or death

DO	DO NOT
• Always wear proper personal protective equipment • All installations should be performed by a qualified service technician • Use only insulated tools required for assembly • Dispose of the battery properly in accordance with local, state, and federal regulations • Extinguish any flames with carbon dioxide, dry-power fire extinguisher, and cover with copious amounts of water	• Do not use with other types of batteries connected with PROTRXion™ products • Do not short circuit the battery or PDM terminals • Do not operate the PDM, battery, or battery system beyond the specified operating limits • Do not crush, puncture, or drop the PDM or battery • Do not immerse the battery system or its components in water • Do not burn or expose the battery system or its components to fire • Do not charge battery system near flammable materials, liquids, and surfaces • Do not operate or store battery system near any magnetic sources • Do not tamper, alter, disassemble, modify, or open the PDM or battery module • Do not wear jewelry (i.e. rings, watches, bracelets, necklaces) when handling or working near the battery • Do not lift PDM or battery by the terminals, output connectors, signal connectors, or wire harness • Do not mix battery models or models with different firmware

Personal Protective Equipment/ Installation Tools

Before installation or maintenance of your high voltage batteries, we recommend following your company's safety guidelines and processes for high voltage. The following equipment would be recommended as a minimum.

- High voltage PPE compliant with OSHA Personal Protective Equipment as required by the DC electrical system.

Unboxing the HV-PDM-450 and HV-24V105

Before You Start

Please read all the safety and warranty information provided in this document prior to installing and/or operating your HV battery system (HV-PDM-450 and HV-24V105). It is recommended that the installation and operation of all high voltage batteries and components should only be performed by a trained or qualified technician.

IMPORTANT: Remove all jewelry or other metallic objects from your hands and body during the installation and removal of the battery packs and peripherals. The terminals are isolated and touch safe, but caution should always be used to avoid shock as they are live.

What's on the pallet?

- Inventus Power HV-24V105 battery module / Inventus Power HV-PDM-450
- 49 CFR approved trays for ground or ocean freight
- Protective battery terminal covers

What's in the box?

- Inventus Power HV-24V105 battery module / Inventus Power HV-PDM-450
- UNDOT 38.3 / IATA approved packaging
- Protective battery terminal covers

Note: All power cables must be purchased separately.

Unpacking

- If possible, do not discard the packaging.
- The box packaging is designed for the safe transportation of lithium-ion batteries compliant with global shipping regulations and can be reused.
- The plastic trays can be returned and reused.

Visual Inspection

- Please inspect each battery and PDM carefully. Report any damage from shipping to Inventus Power immediately.

Label Format

F **Factory Location** (T: Tijuana, Mexico; Q: QingXi, China)

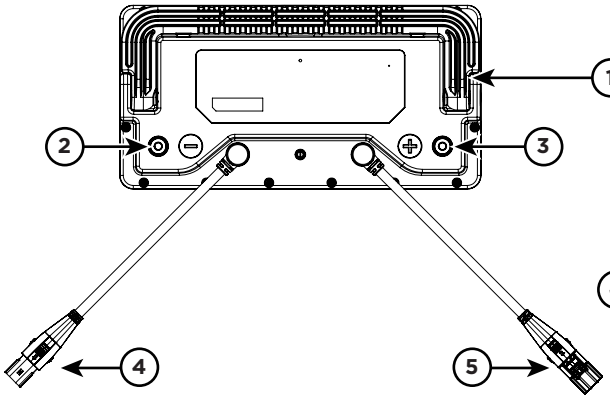
XXXXXXX **SKU Part Number** (Last 7 digits)

SSSSS **Battery Serial Number** (00001-65535)

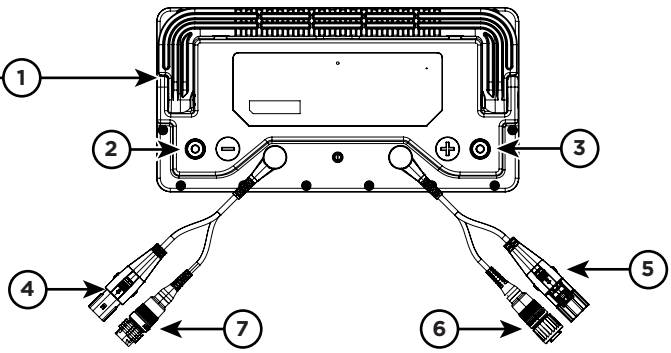
YYDDD **MFG Date** (Year, Day of the year)

HV-24V105 Features

HV-24V105 (without heater)

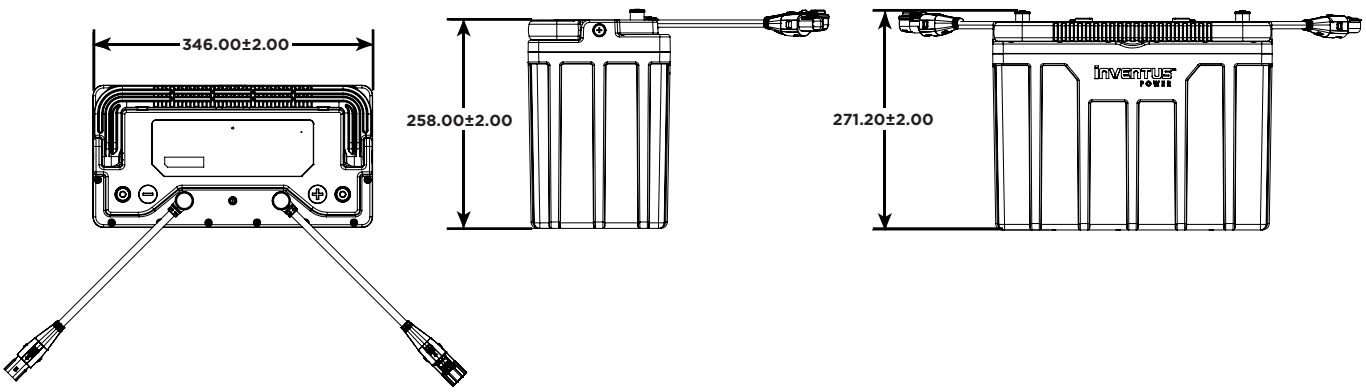


HV-24V105 (with heater)

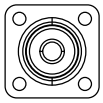
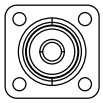
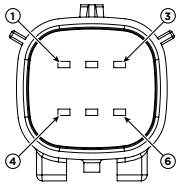
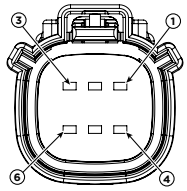
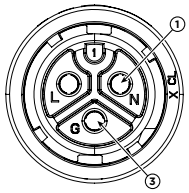
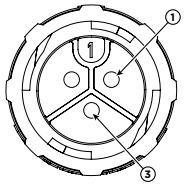


#	Description	Purpose
1	Handle	Easy lift
2	Negative Terminal (Black)	8.0mm Amphenol Surlock Plus for power
3	Positive Terminal (Red)	8.0mm Amphenol Surlock Plus for power
4	Molex (Female)	Signal Connector for internal battery system communication
5	Molex (Male)	Signal Connector for internal battery system communication
6	Chogori (Female)	Power for integrated battery heater (Battery module with heater)
7	Chogori (Male)	Power for integrated battery heater (Battery module with heater)

Product Dimensions



Battery Module (CMU) Connector Guide

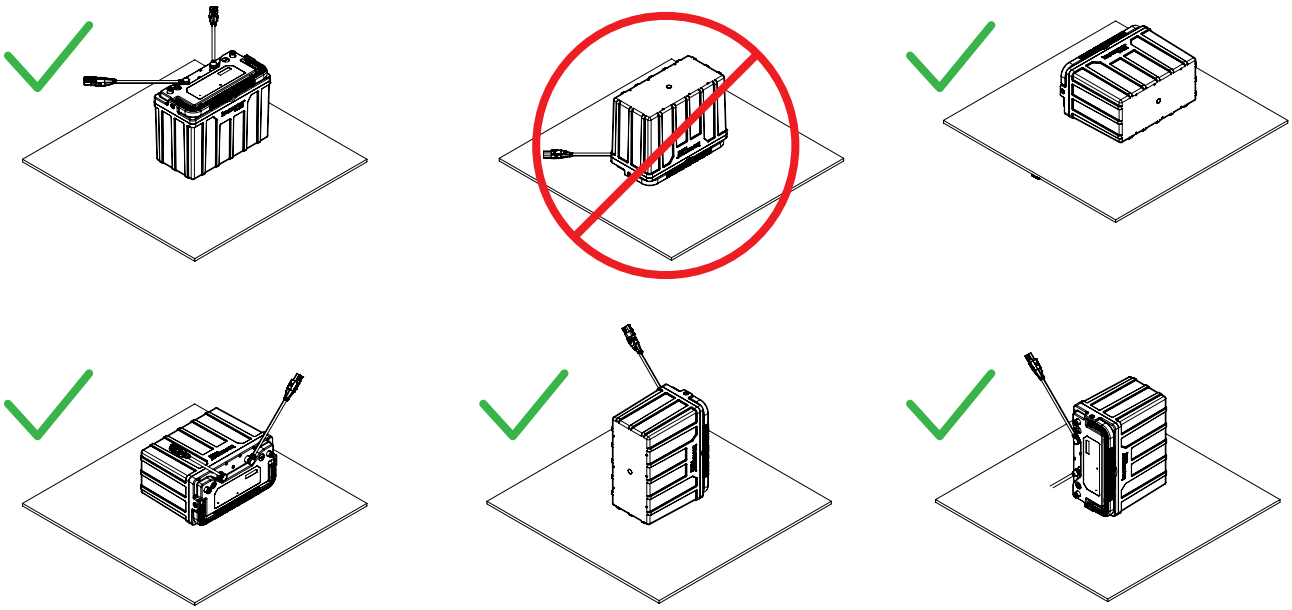
#	Connector	Part Number	Pin Configuration	Image
2	8.0mm Amphenol Black	C10779490-111	Negative Terminal	
3	8.0mm Amphenol Red	C10779490-211	Positive Terminal	
4	Molex (Female)	334823601	Pin 1: GND1 Pin 2: IMA Pin 3: IPA Pin 4 Not Used Pin 5 Not Used Pin 6 Not Used	
5	Molex (Male)	334720606	Pin 1: GND2 Pin 2: 1MB Pin 3: IPB Pin 4 Not Used Pin 5 Not Used Pin 6 Not Used	
6	Chogori (Female)	23003233-01-001-512	Pin 1/L: Heater+ Pin 2/N: Heater+ Pin 3/G: Heater+	
7	Chogori (Male)	23003B2K01	Pin 1/L: Heater - Pin 2/N: Heater - Pin 3/G: Heater -	

Battery Module Mounting Diagram

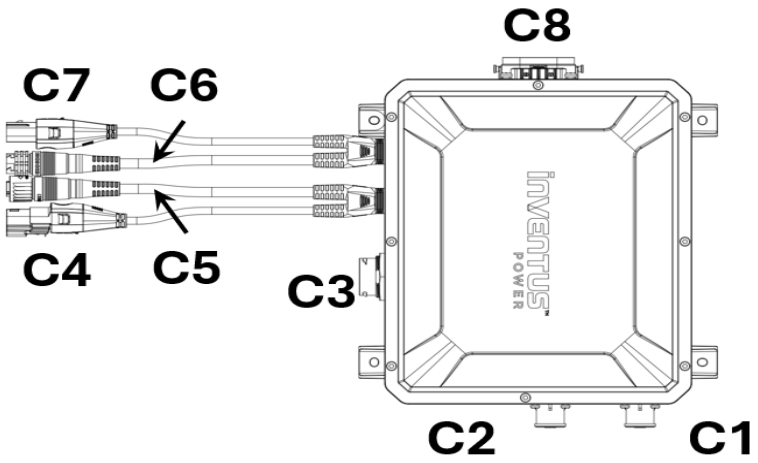
CAUTION: Do not mount battery with terminals facing the mounting surface. When using a battery bracket or mounting bar, it is recommended to align the mounting fixture such that it does not cover the terminals, communication ports, LEDs, vents, barcodes, serial numbers, or push button on the battery.

Below are acceptable mounting orientations. Ensure the battery module is held with sufficient strength to meet the end application environment and loading conditions. Mounting design shall not apply more than 40MPa of stress to the battery surface.

1. Bottom surface of battery module contacting mounting surface.
2. Front surface of battery module contacting mounting surface.
3. Left surface of battery module contacting mounting surface.
4. Back surface of battery module contacting mounting surface.
5. Right surface of battery module contacting mounting surface

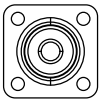
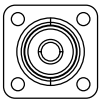
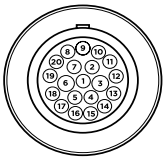
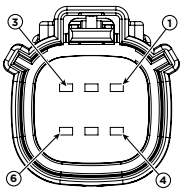
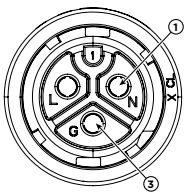
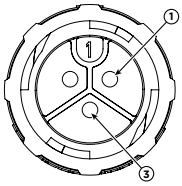
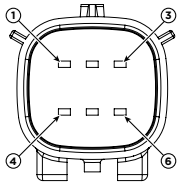
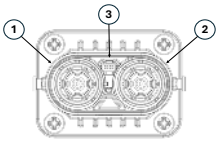


HV-PDM-450 Features

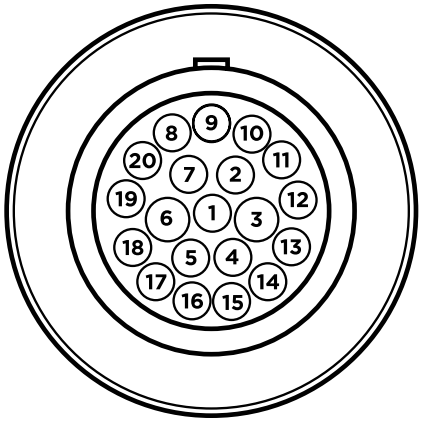


#	Description	Purpose
C1	Positive Terminals (Red)	8.0mm Surlock Plus for power
C2	Negative Terminals (Black)	8.0mm Surlock Plus for power
C3	Amphenol 20-pin Signal Connector	PDM to System Communication
C4	Molex (Male)	Signal connector for internal battery system communication
C5	Chogori (Female)	Power for integrated battery heater (Battery module with heater)
C6	Chogori (Male)	Power for integrated battery heater (Battery module with heater)
C7	Molex (Female)	Signal connector for internal battery system communication
C8	PDM to System Power	12mm Amphenol UPC Power Connector with HVIL

HV-PDM-450 Connector Guide

#	Connector	Part Number	Pin Configuration	Image
C1	8.0mm Amphenol Red	C10779490-211	Negative Terminal	
C2	8.0mm Amphenol Black	C10779490-111	Positive Terminal	
C3	Amphenol 20a-pin Signal	AHDP04-18-20PN-SRA	See Fig. 1 below	
C4	Molex (Male)	334720606	Pin 1: GND2 Pin 2: 1MB Pin 3: IPB Pin 4: +12 Ctr Pin 5: CAN H Pin 6: CAN L	
C5	Chogori (Female)	23003233-01-001-512	Pin 1/L: Heater+ Pin 2/N: Heater+ Pin 3/G: Heater+	
C6	Chogori (Male)	23003B2K01	Pin 1/L: Heater - Pin 2/N: Heater - Pin 3/G: Heater -	
C7	Molex (Female)	334823601	Pin 1: GND1 Pin 2: IMA Pin 3: IPA Pin 4: +12 Ctr Pin 5: CAN H Pin 6: CAN L	
C8	Amphenol PDM to System Powerl	C10-780301-00X	Pin 1: Neg Pole Pin 2: Pos Pole Pin 3: HVIL	

HV-PDM-450 Signal Connector Pin Definition



VIEWED FROM WIRE-ENTRY SIDE

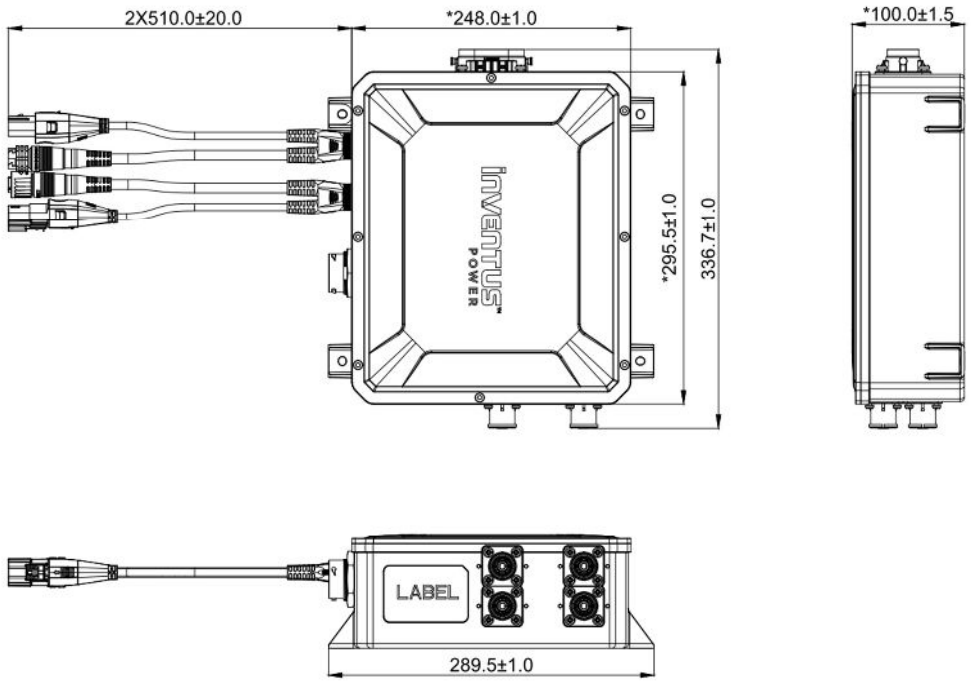
Pin	Circuit Description
1	Wake Discharge Input (Active Low)
2	Not Used
3	12V Main Aux Output (GND reference to pin 6)
4	Internal CAN High (for PDM to PDM Communication)
5	Internal CAN Low (for PDM to PDM Communication)
6	Signal Ground
7	Charge Enable Input (Active High)
8	12V Aux Output #1 (GND reference to pin 6)
9	Not Used
10	12V Aux Output #2 (GND reference to pin 6)

Pin	Circuit Description
11	12V Contactor Coil Interlock
12	Wake Charge Input (Active Low)
13	12V Contactor Coil Interlock
14	Not Used
15	External CAN High (Battery system to VCM communication)
16	External CAN Low (Battery system to VCM communication)
17	Not Used
18	Not Used
19	12V Aux Output #3 (GND reference to pin 6)
20	Not Used

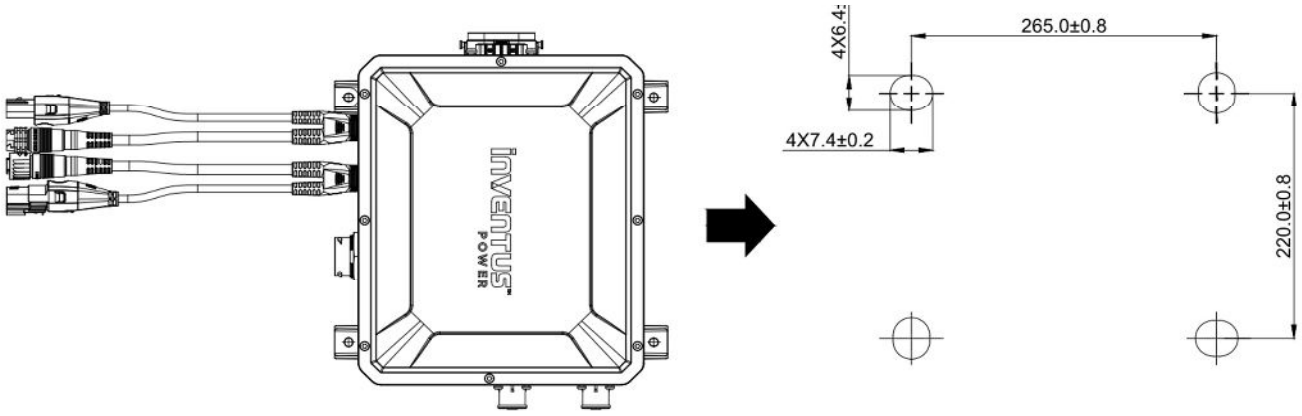
Cable Accessories

Reference Appendix A for complete list of cable accessories available to connect the batteries and PDM.

HV-PDM-450 Dimensions (max dimensions)



Simplified Mounting Pattern



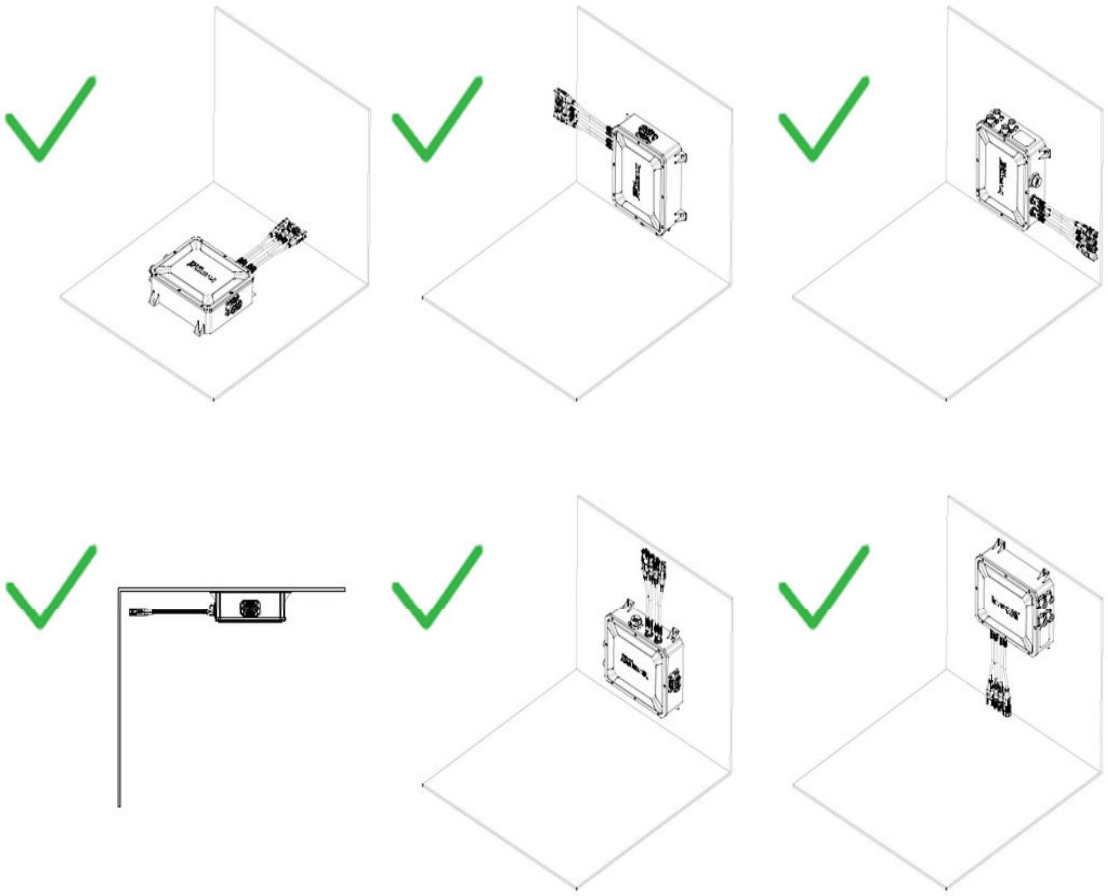
Notes:

- Vertical orientation as shown in PDM image to the left drawing not to scale
- All slot dimensions are the same but rotated 90°
- Recommended bolt size: M3

HV-PDM-450 Mounting Diagram

CAUTION: Do not mount PDM near magnetic surfaces or near areas with magnetic fields. Do not to apply more than 100MPa of stress per mounting foot when securing the HV-PDM-450 to the mounting surface.

Below are acceptable mounting orientations. Ensure the PDM is held with sufficient strength to meet the end application environment and loading conditions. The mounting brackets on the PDM are secured and contacting the mounting surface.



Battery Specifications (per module)

Specification	State Definition
Cell Chemistry	Lithium Iron Phosphate
Voltage *(Nominal/Max Charge)*	25.6/ 28.0V
Energy *(Rated Capacity*)*	2.7kWh/105Ah
Continuous Discharge Current *(per module)*	118A
Peak Pulse Discharge *(@ 40°C and <60 secs)*	299A
Continuous Charge Current *(per module)*	52.5A
Max Continuous Charge Current	>90A
Peak Charge Current *(60 secs)*	210A
Cycle Life *(@ 25°C)*	2,500 cycles
Charge Operating Temperature	1°C to +55°C
Charge Operating Temperature *(w/ heater)*	-35°C to +55°C
Discharge Operating Temperature	-20°C to +55°C
Discharge Operating Temperature *(w/ heater)*	-35°C to +55°C
Operating Humidity	5% to 95%
Scalability	72V up to 210Ah
Weight (ea)	<22kg (48.5lbs)
Communication	Differential Communication Bus

* Rated capacity is the total chemical potential energy in the battery. Usable capacity will depend on charge voltage, the depth of discharge, age, and other environmental conditions.

Note: Charge and discharge current limits will be dependent on temperature and SOC.

Power Distribution Module Specification

Battery System Specification		
Voltage		Up to 450V
Continuous Current		Up to 350A
Peak Current 60 sec		600A
Continuous Power		158kW
Peak Power 60 sec		270kW
12V AUX (6A max)	**Main**	6A
	#1	3A
	#2	3A
	#3	3A
Baud Rate (Auto)		500bps
Charging		Supports J1772 through approved chargers
Cooling		Passive
Storage Temperature		-40˚C to 80˚C
Operating Temperature		-35˚C to 60˚C
Environmental Considerations		IP67 rated; powder coated aluminum enclosure to provide protection against, fluids, dust, salt, and chemicals associated with commercial and off-highway conditions
Weight		PDM: 9.0 kg (19.8 lbs)
Mounting		Reference mounting guidelines as described above
Communication		CANopen or J1939

Selecting Power Cables

Choose the appropriate power cable size based on the system load requirements. Cables are rated at ambient temperature of 30°C (86°F) per the table below. When connected in parallel configuration, it is preferable for all cables to be the same length & gauge.

Copper Wire Gauge (AWG)	Metric Wire Cross-section (mm^2)	Ampacity (A)
1	35	115
1/0	50	150
2/0	70	200
3/0	95	350

Note: Optional cable accessories can be purchased through Inventus Power. See Appendix A for list of cable accessories.

Module Configuration

Series Connections

Up to sixteen (16) batteries can be connected in series to increase the system voltage up to 450V. To configure a series connection, first arrange the required number of batteries to achieve the desired system voltage. Next, connect the signal cables between each battery module in a daisy-chain configuration.

After all signal cables are connected, wire the power terminals by connecting the negative (black) terminal of the first battery module to the positive (red) terminal of the next module. Continue this sequence until all battery modules are connected and the required system voltage is achieved (for example, three batteries connected in series provide 72V).

Once the battery string is fully assembled, connect the signal cables from the first and last batteries in the series string to the PDM. Finally, connect the negative (black) terminal of the first battery and the positive (red) terminal of the last battery to the corresponding negative (C1) and positive (C2) input terminals on the PDM.

Parallel Connections

Up to ten (10) batteries may be connected in parallel to form a battery bank that supports the required system capacity (Ah). The overall configuration is limited by the maximum number of nodes supported by the BMS, which is 32 nodes. For example, a 3S10P configuration results in 30 nodes, while a 16S2P configuration reaches the 32-node limit.

To connect batteries in parallel, first arrange the required number of batteries to achieve the desired capacity. Next, connect the signal cables between each battery module in a daisy-chain configuration. After all signal connections are completed, connect the negative (black) terminal of the first battery to the negative (black) terminal of the next battery. Repeat this process until all batteries in the bank are connected. Then, connect the positive (red) terminal of the first battery to the positive (red) terminal of the next battery, repeating until all batteries are fully connected in parallel. If connecting battery strings in series, follow the same process by connecting batteries at the front and end of the string to the next string.

Once the desired number of batteries are connected in parallel to achieve the required capacity, follow the previously described series-connection steps to increase the system voltage. This is accomplished by connecting the positive and negative terminals between battery banks and then connecting the completed battery configuration to the PDM as outlined above.

Note that the PDM includes two (2) input terminal sets. As a best practice, the total battery configuration should be evenly divided so that equal battery strings are connected to each PDM input

Refer to the next page for battery connection diagrams and consult the Connection Guidelines section on the following pages for additional examples

Connecting the HV Battery System

CAUTION: To avoid serious injury or death, please remove all jewelry, wear the proper PPE and follow the safety guidelines as explained on page 5.

1. Remove power to the vehicle/device prior to installation of the HV battery system.
2. Remove all other batteries from the system prior to replacing them with HV battery system.
3. Remove the protective battery terminal covers from the terminals. Retain these covers in the event that you need to remove or move the battery at some future time.
4. Connect series and parallel connections per above page.
5. Once the batteries are properly connected to the PDM, connect the large 12mm UPC power connector to the host system followed by connecting the large 21-pin communication connector from the PDM to the host.
6. Follow CAN standards to properly terminate on vehicle system.
7. It is recommended to fully charge upon initial connection to properly calibrate and balance the modules within the battery system. Follow calibration cycle guidelines on page 24.

Warning: Do not connect the heater connectors (C5 and C6) on the PDM. The heater cables should ONLY be connected to the battery module if available. Connecting the heater cables on the PDM will damage the PDM.

See Connection Guidelines for more details and examples

Disconnecting the HV Battery System

1. Power off the machine/device prior to the removal of the HV battery system.
2. To disconnect the PDM, first disconnect the 12mm UPC connector from the host system followed by disconnecting the round 21-pin communication connector from the host..
3. Disconnect the 8.0mm Surlock positive cable(s) from the positive terminal(s) on the PDM.
4. Disconnect the 8.0mm Surlock negative cable(s) from the negative terminal(s) on the PDM.
5. Disconnect the power connections (positive to negative) between the battery modules.
6. Disconnect all the 6-pin M-150 signal connectors from the PDM and between the battery modules.

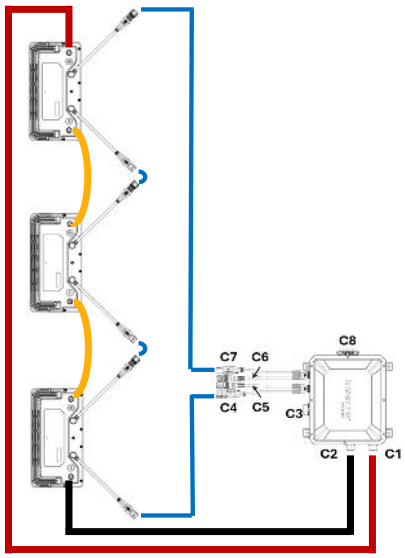
See Connection Guidelines for more details and examples and follow in reverse order

Connection Guidelines

It is recommended to use the same cable lengths and gauge sizes across all connections to maintain balancing between the battery modules. The cable lengths shown in the diagrams are not to scale. Please use wiring diagram to the right of the examples for reference.

Daisy Chain Connections (Power)
Example 3S1P Configuration

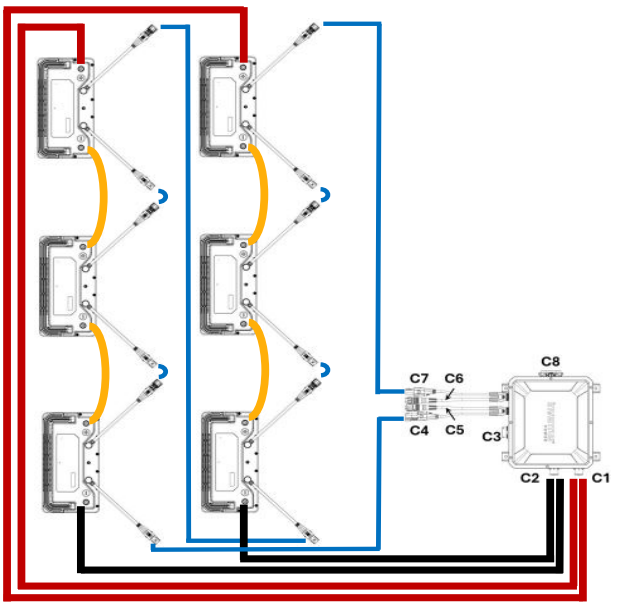
- **Step 1:** Connect the daisy chain **signal harnesses** between battery modules and the PDM
- **Step 2:** Connect positive to negative using the **power cables** between the battery modules
- **Step 3:** Connect the **negative power cable** between the battery module and PDM (C2)
- **Step 4:** Connect the **positive power cable** between the battery module and PDM (C1)
- **Step 5:** Connect the system output power connectors (C8) to the system
- **Step 6:** Connect the system signal connector, C3, to the system
- **Step 7:** Leave C5 and C6 on PDM disconnected



.

Daisy Chain Connections (Power)
Example 3S2P Configuration

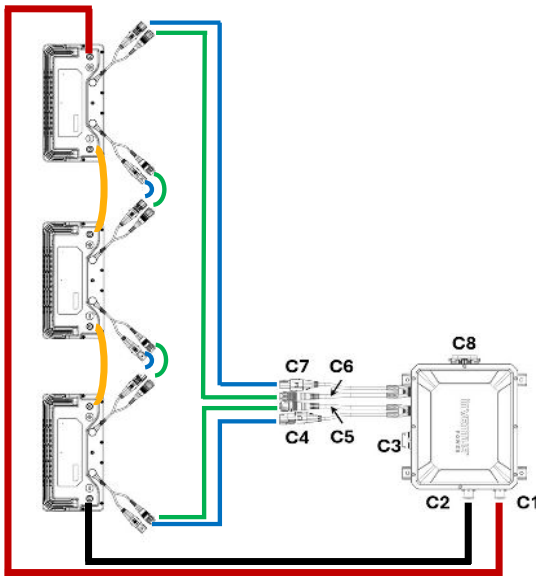
- **Step 1:** Connect the daisy chain **signal harnesses** between battery modules and the PDM
- **Step 2:** Connect positive to negative using the **power cables** between battery modules
- **Step 3:** Connect the **negative power cable** between the battery modules and PDM (C2)
- **Step 4:** Connect the **positive power cable** between the battery modules and PDM (C1)
- **Step 5:** Connect the system output power connectors (C8) to the system
- **Step 6:** Connect the system signal connector, C3 to the system
- **Step 7:** Leave C5 and C6 on PDM disconnected



Connection Guidelines

Daisy Chain Connections (Power)
Example 3S1P Configuration

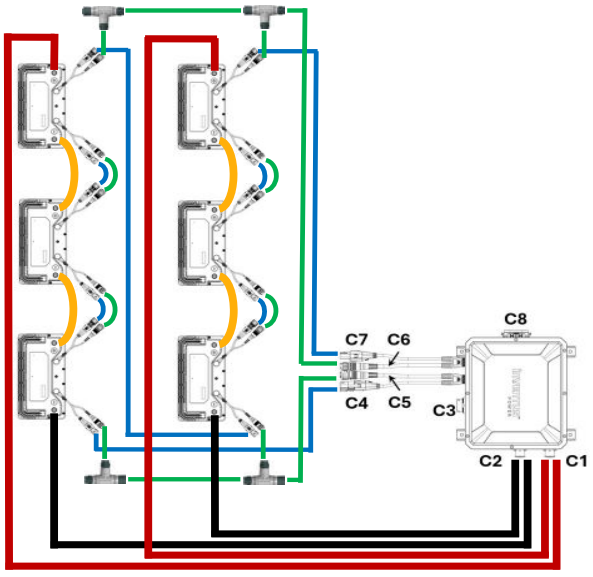
- **Step 1:** Connect the daisy chain **signal harnesses** between battery modules and the PDM
- **Step 2:** Connect positive to negative using the **power cables** between the battery modules
- **Step 3:** Connect the **negative power cable** between the battery module and PDM (C2)
- **Step 4:** Connect the **positive power cable** between the battery module and PDM (C1)
- **Step 5:** Connect the **3-pin heater cable** between each battery module and the PDM
- **Step 6:** Connect the system output power connectors (C8) to the system
- **Step 7:** Connect the system signal connector, C3, to the system



.

Daisy Chain Connections (Power)
Example 3S2P Configuration

- **Step 1:** Connect the daisy chain **signal harnesses** between battery modules and the PDM
- **Step 2:** Connect positive to negative using the **power cables** between battery modules
- **Step 3:** Connect the **negative power cable** between the battery modules and PDM (C2)
- **Step 4:** Connect the **positive power cable** between the battery modules and PDM (C1)
- **Step 5:** Connect the **3-pin heater cable** between each battery module in each set of battery banks. Next, connect the **3-pin heater cable** from each battery bank via heater T-harness, so the heater cables are connected in series. Connect the the **heater T-harness** from the 1st battery bank to C5 & C6 on the PDM
- **Step 6:** Connect the system output power connectors (C8) to the system
- **Step 7:** Connect the system signal connector, C3 to the system



Initializing Battery System for the First Time

When connecting the battery system, the 12V Contactor Coil Interlock (Pin 11) should be shorted to the other 12V Contactor Interlock (Pin 13) to enable the contactors to operate. This is a fail-safe for enabling / disabling of the contactors.

The battery system will exit any low power state (Sleep or Deep Sleep mode) and initialize with one of the following options:

1. Short Wake Discharge Input (Pin 1) to Signal Ground (Pin 6) [Active Low]
2. Short Wake Charge Input (Pin 12) to Signal Ground (Pin 6) [Active Low]
3. Short Charge Enable - Input (Pin 7) to Battery Positive [Active High]
4. VCM sends any CAN messages to the battery to wake

Selecting Charger

It is important to select the correct charger for your system so the voltage and power requirements are aligned with the battery system configuration. Before using any charger, please ensure the charger is compatible with the Inventus Power HV system and complies with Inventus Power's charger requirements. If you have any questions or concerns, please consult with a member of our Technical Support Team.

Modes of Operation

Mode	Mode Name	Details	Data Logging	CAN Messages	AUX Circuit MOSFET	Contactor State
1	Ship	Power disconnected from the PDM	No	Off	Open (Disabled)	Open (Disabled)
2	Deep Sleep	Lowest power mode	Yes	Read Only	Open (Disabled)	Open (Disabled)
3	Sleep	Low power mode	Yes	Read Only	Open (Disabled) Aux Main Closed (Enabled)	Open (Disabled)
4	Initialization	Transition mode to perform safety checks prior to entering and active power state.	Yes	Read and Fault Messages Only	Open (Disabled) Aux Main Closed (Enabled only if previously enabled)	Open (Disabled)
5	Idle	Communication mode with main power path disabled but auxiliary power allowed.	Yes	On	Closed (Enabled)	Open (Disabled)
6	Charge	Mode for charging the battery pack system.	Yes	On	Closed (Enabled)	Closed (Enabled)
7	Discharge	Mode for discharging the battery pack system.	Yes	On	Closed (Enabled)	Closed (Enabled)
8	Pre-Sleep	Transition mode to perform housekeeping prior to entering low power state.	Yes	On	Open (Disabled) Aux Main Closed (Enabled)	Open (Disabled)

Maintenance and Storage

Calibration Cycle

It is recommended to charge the battery to 100% SOC after installation. A full charge and discharge cycle is recommended at least every 6 to 12 months to maintain proper SOC calibration and cell balancing. In general, charging to 100% every 10 cycles or more frequently during normal use is considered best practice, but is not required.

Maintenance Charging

PROTRXion™ batteries can be stored in an environment with temperatures between -20°C (-4°F) and +60°C (140°F) and between 5% and 95% relative humidity, non-condensing. For long storage periods it is recommended to check the battery SOC every 12 months. If batteries are stored at 25°C (77°F), charge the battery every two years. For storage temperatures above 25°C (77°F), charge the battery annually. It is recommended to charge the batteries when SOC falls below 10%

Battery Case Visual Inspection

Please perform regular visual inspections of the battery case. If the battery case is found to have dents, discoloration, cracks, or appears to be damaged in any way, DISCONTINUE USE IMMEDIATELY. Please contact Inventus Power for assistance with evaluating the product for continued usability.

Battery Storage

- Battery should be stored between 30-50% SOC.
- Store in an open, well ventilated, and dry area <30°C for maximum life.
- Do not expose the battery to extreme temperature or sunlight over 60°C (131°F).
- Do not expose the battery to direct sunlight or moisture and/or precipitation.
- Handle each battery carefully to avoid sharp impacts or extreme pressure on the case.
- Do not store a fully discharged battery. Recharge battery after every use.

Minimum Temperature	Maximum Temperature	Duration
-20°C (-4°F)	45°C (113°F)	1 month
-20°C (-4°F)	35°C (95°F)	3 months
-20°C (-4°F)	25°C (77°F)	12 months

Transporting Lithium-ion Batteries

This section discusses the regulations governing the transportation of lithium-ion cells and batteries both within the United States and internationally. You should read and understand all relevant regulations discussed in this section before shipping Inventus Power PROTRXion™ batteries.

Lithium batteries are classified as Class 9 when transporting by air or ground. When shipping by air, all lithium batteries are required to have a 30% (SOC) state of charge or less. Lithium batteries greater than 300Wh and not exceeding 30kg (66lbs) are fully regulated Class 9 hazardous materials, which require proper packaging, labeling, and handling. For more information on shipping Lithium Batteries, please see your freight carrier's requirements.

NOTE: The regulations discussed in this manual apply to lithium-ion cells and batteries. Once the Inventus Power PROTRXion™ battery is integrated into a host system, the host may be subject to additional transportation regulations that require additional certification testing. Since Inventus Power cannot anticipate every possible configuration and application, you must verify that your system integrated with our PROTRXion™ battery system is compliant with all local ordinances and regulations.

Transporting Batteries for Installation

- Place the battery terminal protective caps on the battery terminals prior to removing the battery from its current location, to prevent accidental shorts or arcing from occurring if a terminal touches a metal object.
- Battery handle must be in the close position prior to assembly.
- Avoid heavy vibration during transportation.
- Avoid throwing, dropping, rolling and excessive stacking during loading and transportation.
- Make sure that all cables and external connectors are disconnected and properly removed from the battery prior to transporting it.
- Do not hang or hook battery handle with sharp device or at one corner only.

Transporting Batteries to a Different Location

If the battery needs to be shipped to a different location or sent back to Inventus Power for any reason:

1. Disconnect all cables, both power and communications from the batteries. (reference section “Disconnecting the Battery” for proper disconnection procedure)
2. Place the protective caps on the battery terminals prior to removing the battery from its current location, to prevent accidental shorts or arcing from occurring if a terminal touches a metal object.
3. All large lithium-ion batteries are considered “Dangerous Goods” by the US Department of Transportation, and as a result, transporting them by common carrier (whether by ground or by air) requires compliance with UN DOT regulations UN3480, Class 9 - “Dangerous Goods”.
4. Pack the batteries in “Dangerous Goods” certified boxes and packaging materials as specified by the Department of Transportation (DOT). The packaging must protect the contents from reasonable handling damage and prevent short circuits from taking place. Ideally, one would use the original box if it’s still in good condition.
5. The package should be prepared for shipment and shipping documents should be signed by an individual who is certified to handle and prepare the paperwork and products that have been designated as “Dangerous Goods” for shipment.

IMPORTANT: Each PROTRXion™ battery is shipped in a specially designed box to provide maximum protection for the contents. We strongly recommend that you save this box and use it whenever you need to transport or ship the battery. Please follow all local laws/regulations regarding the shipment of lithium-Ion batteries.

Following UN and DOT Regulations

Failure to comply with UN and DOT regulations while transporting Class 9 Hazardous Materials (Dangerous Goods) may result in substantial civil and criminal penalties.

Emergency and First Aid Procedures

Emergency Procedures for a Smoking Battery

- If a battery begins to smoke or melt, remove charging source immediately.
- If possible, move the battery to a well-ventilated area, preferably outside.
- Submerse in water or douse with copious amounts of water.

First Aid Procedures for Human Contact/Exposure to Battery Content

In the event of exposure to battery contents, the following could occur:

- Vapor or mist could irritate eyes, mucous membranes and/or respiratory tract
- Irritation to eyes and skin
- Exposure can cause nausea, dizziness or headache.

In case of contact with the battery's electrolyte:

- Immediately flush eyes with copious amounts of water for at least 15 minutes
- Assure adequate flushing of the eyes by separating the eyelids with fingers
- Flush skin with water
- Remove and wash contaminated clothing promptly
- If inhaled, remove oneself to fresh air
- If swallowed, wash out mouth with water
- If not breathing or having difficulty breathing, seek first aid

Troubleshooting

For general troubleshooting, we recommend going through the following steps below to ensure the battery system was properly wired and connected.

1. Checking wiring and ensure the correct configuration was installed.
2. Ensure there are no loose connections.
3. Check CAN termination and ensure the CAN bus is properly terminated per CAN standards.
4. Check power and ensure the battery system is on.

If the above steps did not resolve the issues, a trained technician will need to diagnose and resolve the issues.

Warranty Violations

CAUTION: Performing any of the following actions will immediately void your warranty on the product and could lead to a potentially dangerous situation

1. Tampering with the PDM and/or battery modules.
2. Incorrect battery wiring and/or installation to the PDM. Verify polarity at all connections and proper connection to the vehicle.
3. Operating or storing the battery system beyond the specified limits.
4. Modifying or tampering with any connector interface and internal data logging functions.
5. Connecting more than 6 battery modules to the PDM.
6. Pairing the PDM and battery module with incompatible equipment. Use of accessories not recommended or sold by the manufacturer may result in a risk of fire, electric shock, or injury to persons and will void the warranty.
7. Exceeding the maximum specification and negligence will void the warranty.

Inventus Power does NOT cover product damage caused by mishandling or improper use per the Installation Manual, Integration Guides and Warranty, exposure to liquids, impacts from falling objects or being dropped, or attempts to repair the battery by any party other than Inventus Power.

The complete list of Warranty Exclusions is included in the Inventus Power Battery Warranty document.

If you believe that in the course of using the PROTRXion™ battery, you will conflict with any of the above listed conditions or any other safety precautions listed in this manual, please DO NOT proceed any further.

Contact Inventus Power immediately for guidance and information.

Recycling

Inventus Power batteries are recyclable and should be disposed properly. For information about recycling, please visit our website at: **www.inventuspower.com/recycling**

Technical Support

If you have any technical questions regarding the PROTRXion™ HV battery system, please contact our technical support team at:

Phone: +1.877.423.4242

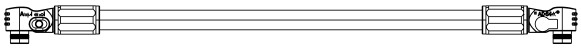
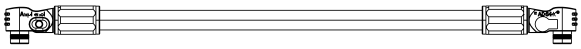
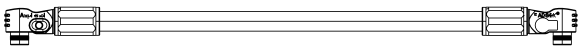
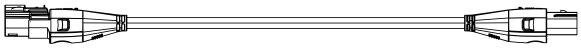
E-mail: tech_support@inventuspower.com

Serial Number Record

Please record both the serial number and date of purchase and store this in a safe place for future reference.

Serial Number		**Date of Purchase**	
Serial Number		**Date of Purchase**	
Serial Number		**Date of Purchase**	
Serial Number		**Date of Purchase**	
Serial Number		**Date of Purchase**	
Serial Number		**Date of Purchase**	
Serial Number		**Date of Purchase**	
Serial Number		**Date of Purchase**	
Serial Number		**Date of Purchase**	
Serial Number		**Date of Purchase**	
Serial Number		**Date of Purchase**	
Serial Number		**Date of Purchase**	
Serial Number		**Date of Purchase**	
Serial Number		**Date of Purchase**	
Serial Number		**Date of Purchase**	
Serial Number		**Date of Purchase**	
Serial Number		**Date of Purchase**	

Appendix A - Cable Accessory List

P/N	Description	Image
67400-671	600mm HV Surlock Power Cable with Pos (Red)	
67400-672	600mm HV Surlock Power Cable with Neg (Black)	
67400-673	280mm HV Surlock Power Cable with Pos & Neg (Red/Black)	
202-0000624	Heater power extension cable	
202-0000623	600mm Molex signal extension cable	

Appendix B - Electrochemical Performance and Durability

Model	Description
Rated Capacity	105Ah
Capacity Fade (%)	2500 cycles to 70%
Power	2.83kW (continuous)
Power Fade (%)	0
Internal Resistance (ohms)	0.005Ω
Resistance Increase (%)	20%
Energy Round Trip Efficiency (Based on Wh loss)	93%
Energy Round Trip Efficiency Fade (%)	4%
Cycle Life	2,500 cycles