



USER MANUAL

POWER TOWER 3.98kWh BATTERY

MANUFACTURED BY:

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3289 Lenworth Dr Unit D-1
Mississauga, ON
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Canada



CAUTION: SHOCK HAZARD

Possible shock or death if used improperly, when damaged or used by untrained personnel.



CAUTION: FLAMMABLE

Lithium ion batteries contain flammable liquid electrolyte that may vent, ignite and produce sparks when subjected to high temperatures (> 150 °C (302 °F)), when damaged or abused (e.g., mechanical damage or electrical overcharge). Burning cells can ignite other batteries in close proximity. Vapors or mists from a ruptured battery may cause respiratory irritation.



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1. OVERVIEW

1.1. Product Description

Thank you for choosing the Power Tower Battery from Hybrid Power Solutions (HPS). We hope you enjoy and use this battery to its full potential.

Please unpack your battery carefully and check the delivery for completeness and obvious damage. In case of damage inform us immediately.

The battery is delivered to you in a ready to use state with 30% energy (+/-10%). However, please make sure you read through this user manual carefully. If you have further questions regarding the Power Tower Battery, please contact HPS.

1.2. Contact Details

Hybrid Power Solutions Inc.
Attn: Customer Service / Technical Support

3289 Lenworth Drive Unit D-1,
Mississauga, ON L4X 2H1
Canada

Phone: +1 (866) 5-HYBRID (549-2743)
E-Mail: info@hybridps.ca
Website: www.hybridps.ca

2. SAFETY INFORMATION

2.1. General Safety Instructions

Before operating the Power Tower Battery, carefully read and fully understand the instructions including all the cautions and safety notices shown on the second page of this manual. Following all instructions for proper operation and troubleshooting will reduce the risk of personal injury, death and/or property damage.

These instructions are not intended as a complete list of all details for operating and troubleshooting, although reading and following them will aim to keep you safe. If you have any questions or concerns about procedures or safety that are not covered by these instructions, do not hesitate to contact HPS.

2.2. Operator Responsibility

Treat the system with general care, by turning the system off when not in use.

If an unfamiliar sound or smell is noted to come from the unit, please turn off the unit and notify HPS immediately. Leave in a well-ventilated area, away from flammable sources.

WARNING: DO NOT PUT FINGERS AND/OR ANY OBJECTS ON THE OUTPUT PLUGS OR TERMINALS.

Always use compatible inverters or loads.

Never open the unit case.

Do not expose the cell to temperatures outside the range of -20°C to 50°C.



To minimize any adverse effects on battery performance it is recommended that the system be kept at room temperature (20°C +/- 10°C). High or low temperatures can result in shortened cell life.

Keep out of reach of children.

2.3. Condition of Use

If the system is in abnormal physical condition, please do not use it.

Critical Errors: If an error message is present, please contact HPS support for reset or repair.

If internal components are heard/ believed to be loose inside/ rattling, please call HPS for technical support.

3. CONFIGURATION

3.1. Overview

The Power Tower Battery system is designed to work with the Power Tower Off-Grid system but may also be used with a variety of other inverters and loads if the appropriate usage parameters are respected. Please see the Integration section for use with other inverters or applications.

3.2. Technical Specifications

Voltage	51.2 V
Max. Amp Output	100A cont. (200A 3 sec)
Min./Max. Voltage	40 V/ 58.4 V
Approximate Weight	31 Kg
Usable Energy	3.98 kWh (@100% DOD)
Recommended Charge Amperage	20A (75A max)
Charge Operating Temp.	0 to 45 °C
Operating/Storage Temp.	-20 to 60 °C
Atmospheric Pressure	86 to 106 kPa
Relative Humidity	25 to 85% RH
Internal Fuse	200A
Parallel Connection	15 maximum
Series Connection	NEVER CONNECT IN SERIES

<p>Cycles</p>	<p>2250 cycles (charging CC/CV @0.3C & discharging CC @0.5C, 100% DOD, 25°C +/-2°C 100% of rated capacity)</p> <p>3800 cycles (charging CC/CV @0.3C & discharging CC @0.5C, 80% DOD, 25°C +/-2°C 100% of rated capacity)</p> <p>10,000 cycles (charging CC/CV @0.3C & discharging CC @0.3C, 70% DOD, 25°C +/-2°C 70% of rated capacity)</p>
<p>Dimensions</p>	<p>L18.1in x W14.2in x H10.63in (L460mm x W360mm x H270mm)</p>
<p>Certifications</p>	<p>UN38.3, ESA inspected to CSA Standards (SPE-1000)</p>

4. COMMISSIONING / SEASONAL STORAGE PROCESS

The initial integration of the battery system with your inverter, charger or load is crucial to proper operation. DO NOT mix the Power Tower Battery with any other type of battery including other lithium, LiFePO4, SLA, GEL or flooded batteries. **NEVER plug the Power Tower Batteries in series.**

4.1. Initial Commissioning

4.1.1. Single Battery Commissioning

If only a single Power Tower Battery is used, then no balancing or voltage check is required.

- 1 - Turn ON the battery master switch to ensure no errors are present
- 2 - Turn OFF master switch
- 3 - Connect Positive wire first
- 4 - Connect Negative wire
- 5 - Turn Master Switch ON
- 6 - Turn ON load

If the battery does not output any voltage after turning on the load (inverter or other), this may be a result of a rapid capacitor charging inside the load that may be tripping the battery's internal safety mechanism. This can be overcome by connecting a second battery in parallel to share the spike or use a pre-charge resistor.

4.1.1.1. **Pre-Charge Resistors (when using 3rd party inverter)**

Certain inverters and capacitive loads may have an inrush of over 1000A on startup which may trip the internal safety cut off of the battery. To charge these capacitors and still maintain the safety profile of the battery, a pre-charge resistor can be used during commissioning. Please review the information in the following resource to match the capacitance of your load (contact inverter manufacturer): <http://liionbms.com/php/precharge.php>. A 100-250W resistor with a 20-50 ohm rating is recommended. Contact HPS or your local solar installer or electrician for assistance.

4.1.2. Multiple Battery Commissioning

4.1.2.1. **Connecting to Power Tower**

The Power Tower inverter system is designed for an easy plug and play commissioning. All parallel connections are made internally when plugging in to the positive and negative terminals.

NO external connections between batteries are required.

Before connecting batteries, turn ON all batteries and ensure that each voltage is within 0.1V of each other or as close as possible. Unbalanced batteries will eventually rebalance but performance may be limited until all batteries are balanced.

Example of batteries that are ready to plug:

Batt #1: 53.2V

Batt #2: 53.2V

Batt #3: 53.1V

Example of batteries that **require** balancing:

Batt #1: 53.2V

Batt #2: 52.8V

Batt #3: 53.2V

4.1.2.1.1. If balancing is not required:

- 1 - Turn OFF all batteries and Power Tower
- 2 - Connect all Positive terminals to Power Tower
- 3 - Connect all Negative terminals to Power Tower
- 4 - Turn ON Batt #1 followed by Batt #2
- 5 - Wait until both batteries equalize. A battery that has a higher state of charge (SOC) will charge the other until stable and will show up on the battery screen as CHRG on one battery and DSCH on the other. Wait until the amperage transfer between batteries is less than 1A before proceeding.
- 6 - Turn ON Batt #3 and repeat step and 6 until all batteries are connected.
- 7 - Turn ON Power Tower

4.1.2.1.2. If balancing is required:

- 1 - Turn OFF all batteries and Power Tower
- 2 - Connect Positive terminal of Battery #1
- 3 - Connect Negative terminal of Battery #1
- 4 - Turn ON Battery #1
- 5 - Turn ON Power Tower
- 6 - Turn OFF any load to the Power Tower (AC Circuit Breaker)

7 - Charge until Battery #1 is full

8 - Turn OFF Power Tower followed by Battery #1

9 - Set aside Battery #1 for a minimum of 1 hour in OFF position to settle voltage

10 - Repeat steps 1-9 for all batteries

11 - Check all voltages to ensure they are balanced, then proceed to section 4.1.2.1.1

It is preferred that the charging process for this step be accomplished using grid power or generators for a more consistent charging process but may be accomplished using solar.

4.1.2.2. Connecting to 3rd party inverters or loads

Recommended Wire Gauge: dependent on total amperage draw. See local authority amperage chart.

Lug Hole Diameter: 7/16" to 1/2"

Before connecting batteries, turn ON all batteries and ensure that each voltage is within 0.1V (100mv) of each other.

If balancing is required, see section 4.1.2.1.2

Multiple batteries should only be used in parallel and never plugged in series. Parallel connections can be made either at the terminal or using a bus.

Terminal Connection: Connect all positive terminals then all negative terminals with one positive and negative lead



connected to load. This is typically accomplished using bus bars or short wire leads

Bus Connection: Connect the positive and negative terminals to their own respective busses. **In this configuration, all wire lengths from battery terminal to bus must be identical in length.**

- 1 - Ensure all batteries are OFF and disconnected from load
- 2 - Connect all batteries in parallel
- 3 - Turn on Battery #1 and #2 and let batteries equalize by waiting until amperage transfer between batteries is less than 1A.
- 4 - Turn ON Battery #3 and repeat steps 3-4 for all batteries
- 5 - Connect to load
- 6 - Turn load ON

4.2. Grounding

Ensure that the battery's metal enclosure is ground to earth in a grounded system or the battery negative terminal when operating a floating system. A grounding point is provided and indicated as shown in the following image.



4.3. Seasonal or Long Term Storage

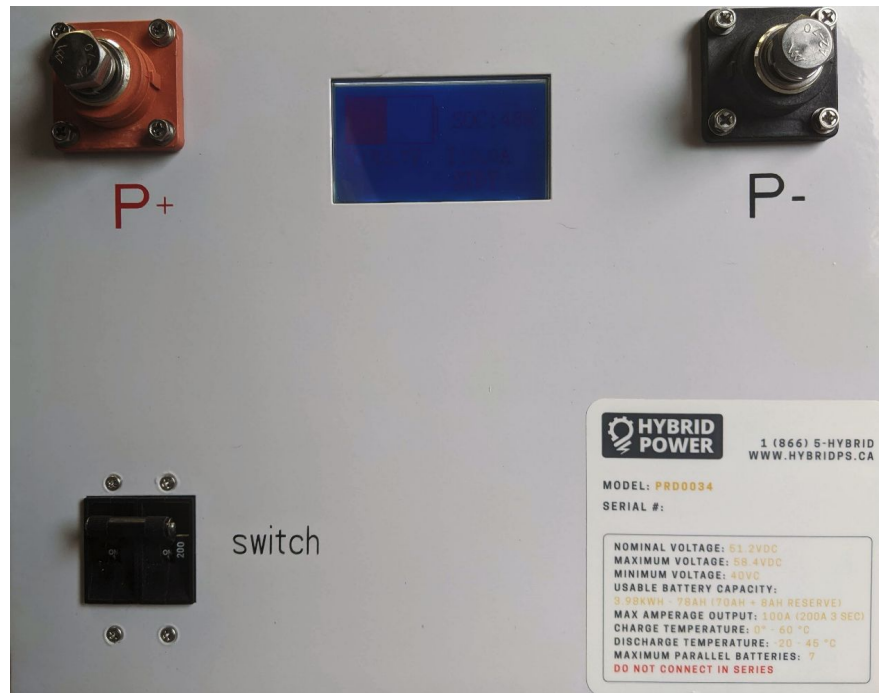
If seasonal shut down is required, please follow the below steps:

- 1 - Fully charge battery
- 2 - Turn OFF load and charger
- 3 - Turn OFF batteries
- 4 - Store batteries in location that does not fall outside specifications including in areas where temperatures could fall below -20°C

Periodically check battery voltage by turning batteries ON with no load connected. Ensure voltage is above 50V. If below, batteries should be recharged.

5. OPERATION

5.1. Component Identification and General Operation

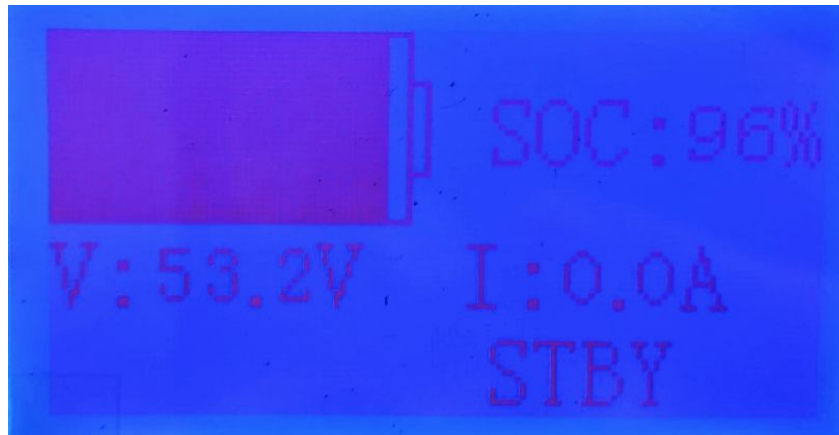


P+: Positive Terminal

P-: Negative Terminal

Switch: Master ON/OFF switch. Should only be operated with limited or no load or in emergency situations.

5.1.1. LCD Display



V: Battery Voltage

I: Instantaneous Battery Current

- + Charging
- Discharging

SOC: State of Charge (battery percentage)

STBY: Battery Status

- Discharging
- Charging
- Standby
- Error

The system should always be left in the OFF position when not in use. In the ON position, very little power is consumed but it will affect future run times and may deplete the system over time. HPS recommends always turning the battery off when not in use.

When using the system in cold temperatures (below 0 degrees Celsius), discharge power may be limited and run time can be affected by up to 40%. The product will naturally warm itself with usage and improve capabilities. For maximum capacity and performance, ensure the battery is stored at room temperature (20 degrees Celsius).

5.2. Recharging Guide and Storage

Charge a minimum of once every 3 month to ensure the energy level does not fall to damaging levels. If this is not possible, periodically check that the voltage is above 50V (25V for 24V version).

Never charge above 75A. To achieve advertised life cycle, each battery pack should only be charged at 20A.

Ensure to follow integration programming guidelines if using this battery with anything other than a Power Tower.

6. TRANSPORTATION & SHIPPING

If shipping is required, please ensure to list the Power Tower Battery with carrier as a hazardous goods and follow all required precautions and regulations. The Power Tower Battery is a UN38.3 certified, class UN3480 (lithium ion battery). It is the shipper's responsibility to ensure all paperwork and required packaging is in order. **Contact HPS or your shipper for support on this matter.**

7. MAINTENANCE & CLEANING

WARNING: DO NOT SPRAY WITH WATER OR LEAVE OUTDOORS.

Always make sure to turn the unit **OFF** when not in use and to keep the unit in charged state if possible.

No user maintenance is required.

To clean the battery, simply turn the system off, disconnect all leads and clean with wet cloth avoiding the battery terminals.

8. EXTREME TEMPERATURES

WARNING: USING THE PRODUCT IN EXTREME TEMPERATURES, ABOVE 45°C AND BELOW -20°C MAY REDUCE THE TOTAL LIFE CYCLE OF THE PRODUCT AND CAUSE PERMANENT DAMAGE.

Always charge the Power Tower Battery in temperatures above 0°C. Charging below this will result in the system shutting down and protecting itself.

Note that performance may be affected in temperatures under 0°C. Run time can be reduced as well as available power.

9. TROUBLESHOOTING

9.1. Common Problems & Solutions

PROBLEM	SOLUTION
ALRM: Low Cell Voltage	Cell is approaching low voltage error. Charge immediately.
ALRM: High Cell Voltage	Cell is approaching high voltage error. If during normal operation, battery is almost full and charger should stop charging shortly. If manually charging, stop the charging process.
PROT: Low Cell Voltage	Cell has hit critically low level and battery has shut off as to protect battery. Connect to charger immediately or turn off and connect to charger as soon as possible.

PROT: High Cell Voltage	Cell has hit maximum voltage and has turned off output in order to protect the battery. Engage load or leave the system on to allow voltage to lower.
PROT: Low Temperature	Temperature is below operating temperature for charging or discharging. Return to temperature within specified parameters.
PROT: High Temperature	Temperature is above specified operating temperature. Allow the battery to cool.
Critical Error	Internal issue. Turn the system off and let sit for 15min. If problem persists, contact HPS immediately

10. WARRANTY

10.1. Manufacturer’s Warranty Coverage

All Power Tower Batteries supplied by Hybrid Power Solutions are tested for reliability and performance before delivery for correct function and condition.

We grant no warranty or liability for defects and losses that occur during the use by the customer or the shipment of the unit.

Please refer to this user manual to ensure proper user operation and operating conditions, which will ultimately prolong the life of the Power Tower Battery unit. The warranty does not cover negligence to this manual's directions.

Hybrid Power Solutions (HPS) warrants its products against defects in material and workmanship. Under normal use and service, every hardware portion of the product will be free from physical defects in material and workmanship during the warranty period, or the product will be repaired or replaced as determined solely by HPS. HPS provides a limited warranty for its products only to the person or entity that originally purchased the product from HPS or its authorized distributor or retailer.

WARRANTY PERIOD: 3 YEARS. HPS warrants that its product be free against defects as stated above for a period of 3 years. This warranty does not scale back or lower its value over the 3 period time. If it's our fault, we will repair or replace it. Simple as that.

10.2. Owner's Warranty Responsibility

If the product does not operate as warranted above during the applicable warranty period, HPS shall, at its option and expense (except for shipping cost), repair the defective product or part, deliver to the customer an equivalent product or part to replace the defective item. All products that are replaced will become the property of HPS. Replacement products may be new or reconditioned as determined by state of the original unit.

For this warranty to remain valid, all wiring instruction must be strictly adhered to and installation must be made according to all directions and guidelines made in this manual or provided with the battery. All inverter and charger settings must be modified to accommodate this battery or else the warranty is void.

THIS LIMITED WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS. YOU MAY HAVE FURTHER LEGAL RIGHTS AND REMEDIES UNDER LOCAL LAWS IN YOUR COUNTRY. THE TERMS OF THIS LIMITED WARRANTY WILL APPLY TO THE EXTENT PERMITTED BY APPLICABLE LAW. SOME COUNTRIES DO NOT ALLOW DISCLAIMERS OF IMPLIED WARRANTIES OR LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, MEANING THE DISCLAIMERS AND LIMITATIONS SET FORTH IN THIS LIMITED WARRANTY MAY NOT APPLY TO YOU. SOME COUNTRIES REQUIRE SPECIFIC DISCLOSURES TO BE INSERTED IN AN IMPLIED WARRANTY. PLEASE SEE THE SPECIFIC DISCLOSURES SET FORTH IN THE APPENDIX TO THIS WARRANTY; SPECIFIC DISCLOSURES MAY RELATE TO YOUR COUNTRY. FOR A FULL DESCRIPTION OF YOUR LEGAL RIGHTS YOU SHOULD REFER TO THE LAWS APPLICABLE IN YOUR COUNTRY.

THIS LIMITED WARRANTY AND ANY DISPUTE OR CLAIM ARISING OUT OF OR IN CONNECTION WITH IT (INCLUDING NON-CONTRACTUAL DISPUTES OR CLAIMS)

IS GOVERNED BY AND CONSTRUED IN ACCORDANCE WITH THE LAWS OF THE COUNTRY OR (IF APPLICABLE) STATE OR PROVINCE WHERE THE WARRANTED PRODUCT IS FIRST INSTALLED. IF ANY PROVISION OF THIS LIMITED WARRANTY IS HELD BY A COURT OF COMPETENT JURISDICTION TO BE UNENFORCEABLE BECAUSE IT IS INVALID OR IN CONFLICT WITH ANY LAW OF ANY RELEVANT JURISDICTION, THE VALIDITY OF THE REMAINING PROVISIONS SHALL NOT BE AFFECTED, AND THE RIGHTS AND OBLIGATIONS OF THE PARTIES SHALL BE CONSTRUED AND ENFORCED AS IF THE UNENFORCEABLE PROVISIONS WERE REPLACED BY VALID, LEGAL AND ENFORCEABLE PROVISIONS THAT COME CLOSEST TO THE INTENT UNDERLYING THE INVALID OR UNENFORCEABLE PROVISION. THE UNITED NATIONS CONVENTIONS ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS (1980) SHALL NOT APPLY TO THIS LIMITED WARRANTY OR ANY ASPECT OF ANY DISPUTE RELATING TO THIS LIMITED WARRANTY.

10.3. Exclusions

Warranty does not apply, if:

- The warranty period is expired,
- The warranty label is broken or removed,
- The serial number label is missing or unrecognizable,
- The product has been modified, opened or repaired by any unauthorized service center or personnel,
- The defect was subject to abuse, improper use not conforming to product manual instructions, or environment conditions more severe than those specified in the manual operating condition and user operation.
- Used with an improper charger, inverter or load

11. BATTERY INTEGRATION

11.1. General settings for non-specific chargers and inverters

Almost any battery charger and inverter can be used if the proper settings are programmed but a LiFePO4 charger is recommended for optimum life and performance.

11.1.1. Lead Acid Chargers

If using a lead acid charger, ensure that the charger specifications do not surpass the parameters listed in the following section. Some **flooded lead acid chargers MAY NOT be used** as they surpass these parameters. Any charger with an **equalize mode or desulfating** setting must have both features turned off or else **NOT BE USED**.

11.1.2. Charging Parameters:

Parameter	24VDC Version	48VDC Version
Battery Chemistry	LiFePO4	LiFePO4
Equalizer Support	Disabled	Disabled
Battery Capacity*	156Ah	78Ah
Charge Cycle (if avail.)	2 stage no float	2 stage no float
Bulk Voltage	26.5V	57V
Absorb Voltage	29V	58V
Float Voltage	26.8V	53.6V
Max Float Current*	50A	25A
Battery Temperature Compensation	0	0

*This value should be multiplied by the number of Power Tower Batteries in parallel (up to the maximum provided by the inverter or charger)

11.1.3. Discharge Parameters:

Parameter	24VDC Version	48VDC Version
Max Discharge Amperage*	100A	100A
Max Pulse Discharge*	200A	200A
Max Pulse Time	3 seconds	3 seconds
Minimum Discharge Voltage	25VDC (Maximum Cycles Settings) 23VDC (Maximum Discharge Settings)	50VDC (Maximum Cycles Settings) 46VDC (Maximum Discharge Settings)

*This value should be multiplied by the number of Power Tower Batteries in parallel (up to the maximum provided by the inverter or charger)

11.1.4. Cold Weather Operation:

If constantly discharging in cold weather the overall battery voltage will be much lower and the inverter/load discharge setting may be changed to accommodate this. Reduce the voltage settings from section 11.1.3. by 3VDC. Note that you will likely experience a 20-35% drop in capacity when approaching -20°C.

11.1.5. Schneider Conext XW Series Setup:

1. Go to Device and select device
2. Select Advanced Settings
3. Select Charger Settings
4. Select Batt Type

5. Select Lithium Ion (may be under custom)
6. If lithium Ion is available, change the following setting (if not skip to 8.) Any setting not shown below can be left to default:
 - a. Batt Capacity: 78Ah
 - b. Max Charge Rate&: 18% (or 25A)
 - c. Charge Cycle: 2StgNoFloat
 - d. Recharge Volts: 50.5V
 - e. Absorb Time: 1h
 - f. DisChglmax Timer: 300 sec
7. LithiumIon Setting:
 - a. Bulk Voltage: 57V
 - b. Absorb Voltage: 58V
 - c. MaxAbsCurrent: 25A
 - d. Float Voltage: 53.6V
 - e. MaxFloatCurrent: 25A
 - f. DisChaglmax: 150%
 - g. DisChglmax: 3 sec

11.1.6. Schneider Solar Charger Settings:

1. Go to Device and select device (MPPT)
2. Select Advanced Settings
3. Select Charger Settings
4. Custom:
 - a. Eqlz Support: Disabled
 - b. Bulk Voltage: 57VDC
 - c. Absorb Voltage: 58VDC
 - d. Float Voltage (if available): 53.6VDC
 - e. Batt Temp Comp: 0mV/C
 - f. Batt Capacity: 78Ah
 - g. Max Charge Rate: 25A
 - h. Charge Cycle: 3 Stage
 - i. Recharge Voltage: 50.5V
 - j. Absorb Time: 2h
 - k. Default Batt Temp: Warm



I. Aux Settings: Not Used