



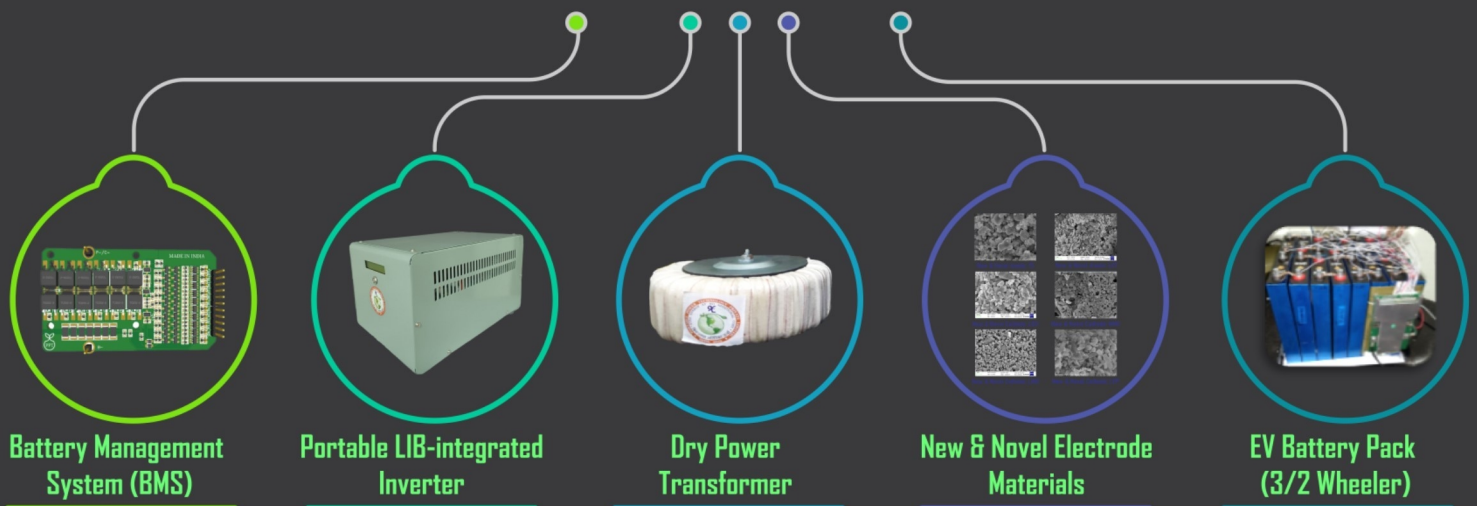
Portable Power Technology Private Limited (A DPIIT Recognized Start-Up Firm)



1st Indian Manufacturer of Battery Management System (BMS)

Proudly introduces

Product Vertical



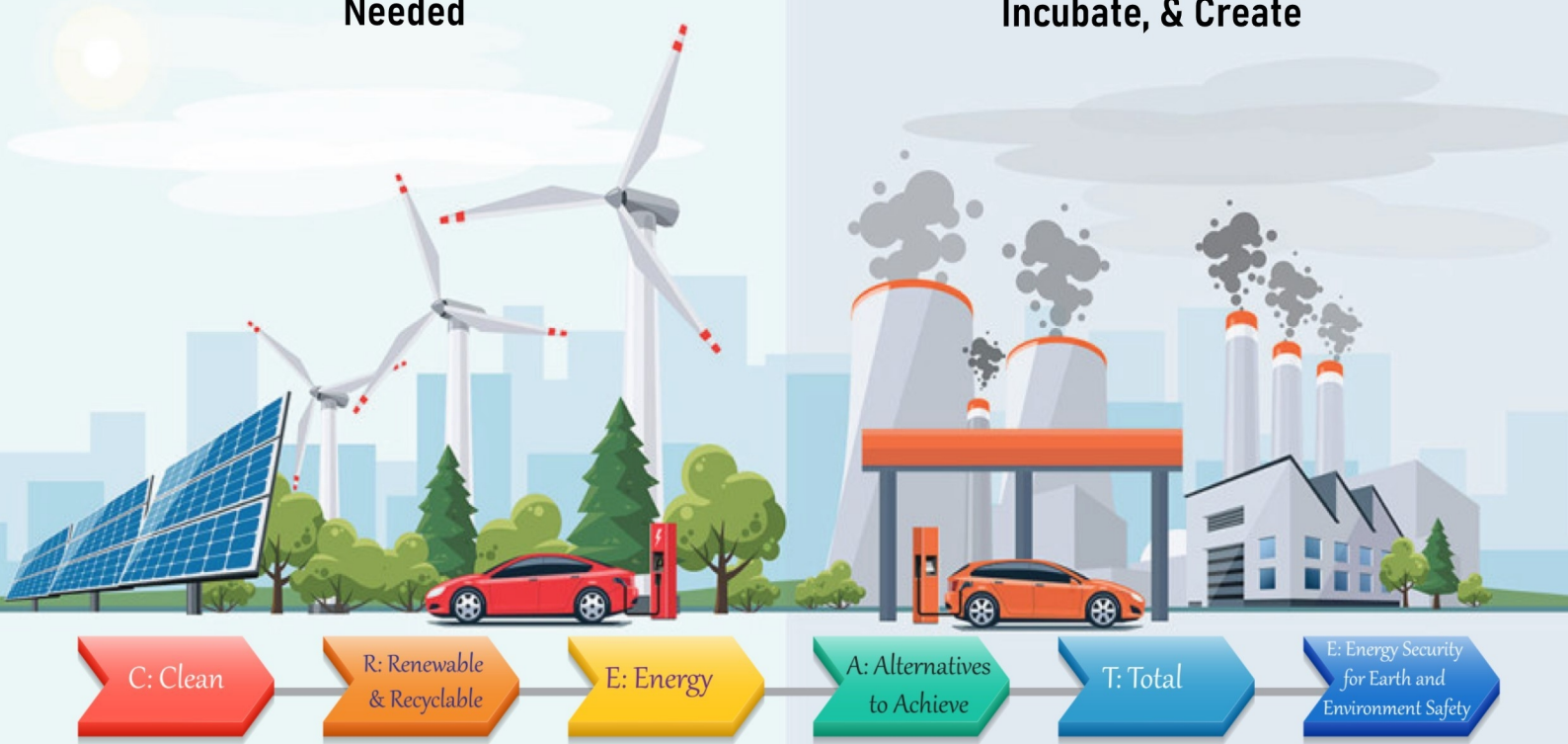
“Design Customization, Reliable Product Creation, & Cost Performance Optimization is our Strength & Specialty.”



#startupidia

Vision: "CREATE" - Innovative, Novel, & Needed

Mission: "IC" - Ideate, Conceive, Innovate, Incubate, & Create



Incubation Center, Indian Institute of Technology Patna, Main Road Bihta, Patna, Bihar, 801103

portablepowertechnology.com

portablepowertechnology

@PowerPortable

Vision Theme

The central focus of our vision lies in novelty based on contemporary need for creating "cutting edge technology" to serve society and humanity at affordable cost with energy and environment at prime importance.

Mission Theme

With stated "Mission Theme" we are working diligently with adequate skill & competence to achieve the national goal of **Startup India, Make in India** aimed at realizing the ultimate target of **Standup India**.

About Us:

We are a Start-Up incubated at IIT Patna, since 3 years. We feel delighted in announcing our milestones, with national pride, that we are the **1st Indian manufacturer of BMS** from concept, design, to product meeting IEC standards at par with the international benchmark.

Needless to say that BMS are essential for operational safety and thermal runaway protection for cell and battery packs. It is the most needed sub-system for LIB packs in EV, street-lighting based on solar power battery banks, and lithium battery (LIB) powered consumer electronics.

Our other products include:

- Light-weight, Compact LIB-integrated Portable Inverter
- 2 wheeler/3 wheeler Battery Pack
- Dry Power Transformer

Our Marketing Unit:

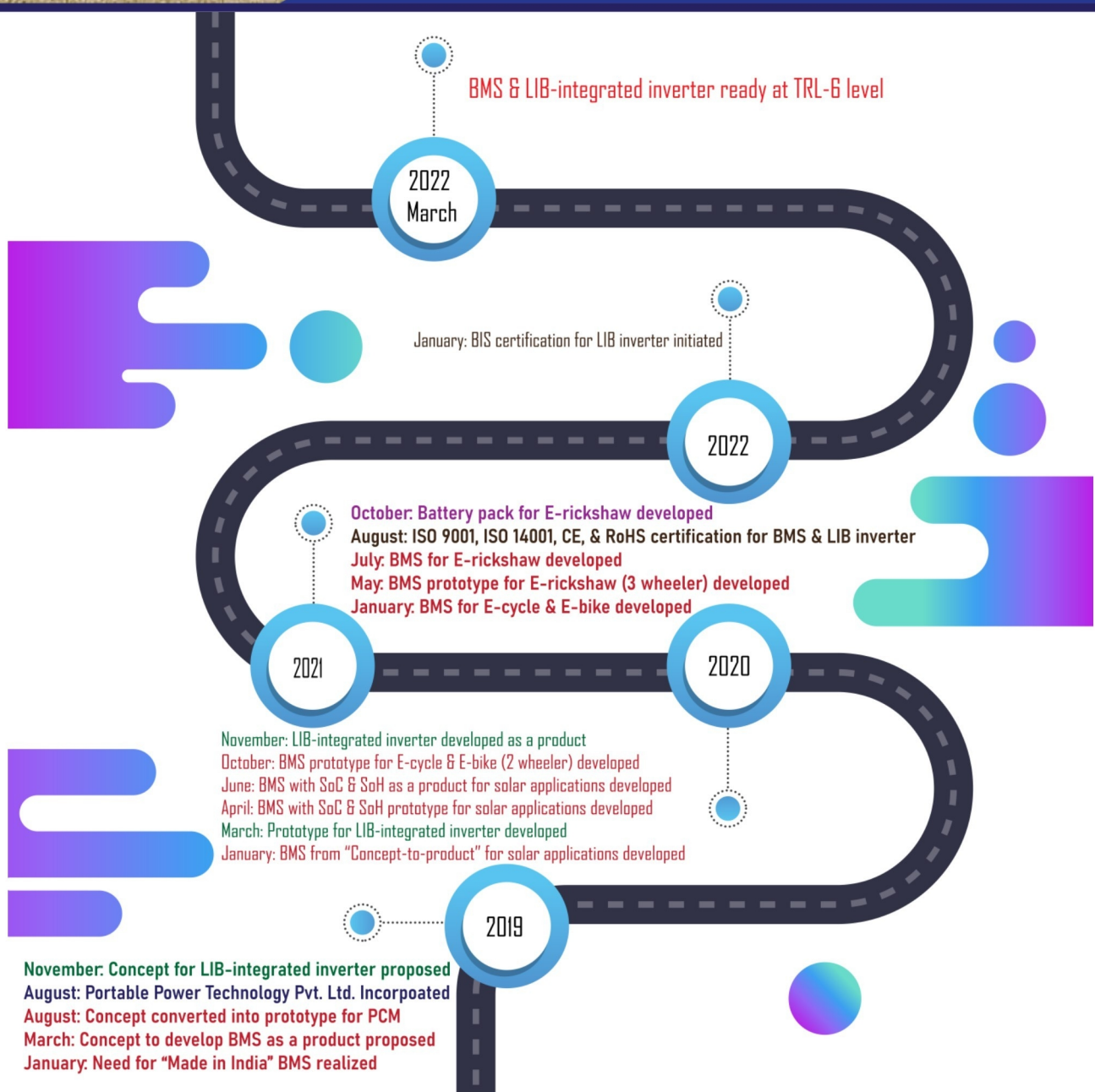
LiPo Energy



Our Certifications:



Product Development Journey.....





Infrastructure Support

Financial Support

Mentor

Prof. A. K. Thakur
Professor
Department of Physics,
Indian Institute of Technology Patna

Director

Abhijeet Kumar

Mentor's Statement

21st century, being the era of knowledge driven economy, is all set to mark the beginning of an age of ideation, innovation, incubation, novelty and creation of new and needful items relevant to society. Any development aimed at wealth creation is good. However, a technological goal aimed at resolving societal problems, say solid waste or garbage disposal converting it into energy or waste water treatment for irrigation etc., would turn the tide resolving societal problem, creating employment and wealth. Such a drive from technically skilled and academically bright younger generation may create an ecosystem of knowledge transfer into wealth with the vehicle of Entrepreneurship as the means to benefit economy of the country in a variety of ways.

I do feel delighted to announce my experience of mentoring the Startup, namely Portable Power Technology Pvt. Ltd., at IIT Patna Incubation center. A group of students, working with me in the government (DRDO, DST) funded projects, came up with the idea of doing some novel developments that can substitute heavy Indian import. The idea was exactly matching with the national goal of "Make in India" for "Atmnirbhar Bharat". I supported the idea. It delivered 1st Made in India Battery Management System (BMS). This is a product developed from concept to product certification meeting all benchmark standards and truly "Made in India". In addition, the team has developed light weight compact and easy to carry portable LIB Inverter variants with added features of longer life, better endurance and cutting edge cost enabling its market sustainability vis-à-vis competing identical products.

I am sure, Portable Power Technology Pvt. Ltd., would emerge as a leading force in due course of time since the team as a whole has fire in the belly to achieve.

Director's Statement

Ever since I completed my M.Tech. specializing in product development, I started dreaming for developing new product(s) that can benefit society and country in addition to creating both jobs and wealth. Creating jobs through Entrepreneurship has been my dream. It slowly moved forward towards a meaningful end after I spent two years of rigorous training in a DRDO project at IIT Patna. While working to develop specific project deliverable, a novel development occurred. The outcome is creation of 1st Made in India Battery Management System and a number of other products in the pipeline. Despite inherent challenges of Entrepreneurship, it's a wonderful path that doesn't allow to sleep till goal realization occurs. Secondly, Entrepreneurship is the greatest enabler of a number of attributes like social and ethical values, team spirit, compliance in time and meaning of deadlines etc. I enjoy my work and do feel job satisfaction.

Battery Management System (BMS):

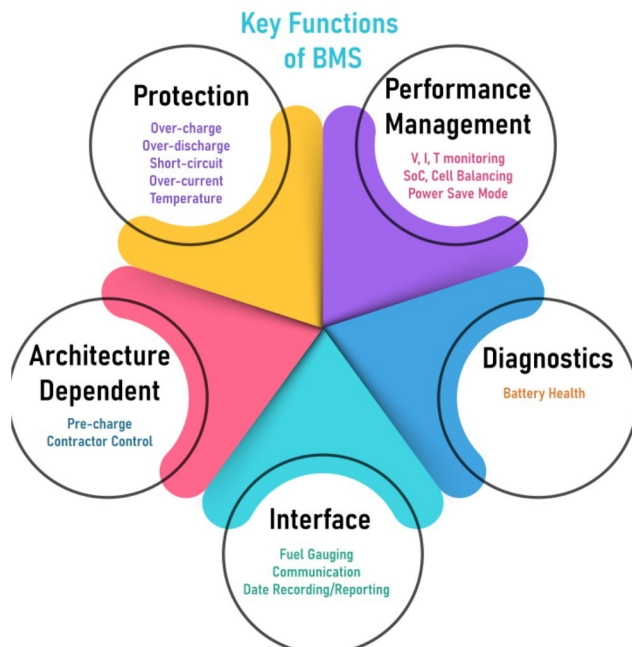
FROM CONCEPT TO PRODUCT

Why BMS?

Lithium Batteries (LIBs) have become essential commodity in everyone's life now with widespread applications ranging from consumer electronics to surface transport in e-cycles, e-bike, e-rickshaw and electric cars. Even beyond these applications, critical strategic applications such as; torpedo, telemetry, drones etc., also require LIB for power backup. Operational safety in these applications is a mandatory need that, in turn, demands utmost need for battery protection from use and abuse under extreme conditions of operation. The much-needed operational safety and longer battery life can be guaranteed only if a battery pack is integrated with battery management system (BMS) comprising varied actions, i.e.; protection (overcharge, under-discharge, short-circuit, depth of discharge), cell balancing action along with protection feature for each cell of the battery pack, state of charge (SoC) detection and display with protection, balancing and thermal runaway safety along with all these actions in a single module.

To meet the need of benchmark safety standards, a complete BMS comprising all the features in a single customized unit with option of modular design to achieve any or all of the needed action. Keeping in mind the customized need of the end user, we have innovated & developed BMS products at different levels from concept through design to product with highly competitive customization, reliable performance, proper endurance under extreme conditions of use & abuse within product's recommended testing limits.

Motivation for BMS Challenge to IITP Team



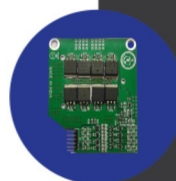
Intelligent component of a LIB or LIB pack responsible for monitoring & controlling battery and battery pack parameters



Protection: Overcharge, over-discharge, temperature overrun, short-circuit, & depth-of-discharge
Cell Balancing: During charge/discharge
State of Charge (SoC)
State of Health (SoH)



For integration, compatibility, and ease of interface with another sub-system for operational safety in EVs, solar lighting, and electronics



Battery Chemistry: LFP (LiFePO₄), LCO (LiCoO₂), NMC (LiNiMnCoO₂)
Modular BMS: 1S-20S
Current Rating: 1A-100A

Battery Management System (BMS):

FROM CONCEPT TO PRODUCT

BMS: Technology Development



Protection Circuit Module (PCM)



Essential for all applications with safety for over-voltage, over-current, short-circuit, and depth of discharge (DoD) features.



Cell Balancing Module (CBM)

Protection and uniform energy transfer in cells of battery pack during charge-discharge action. Essential for EV safety.

BMS Technology Development



Thermal Runaway Protection (TRP)

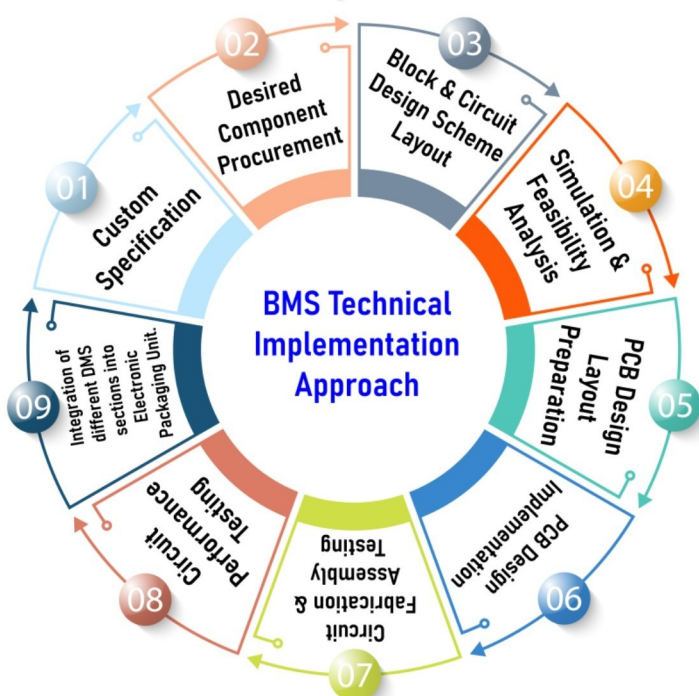
Temperature overrun

State of Charge (SoC) Module

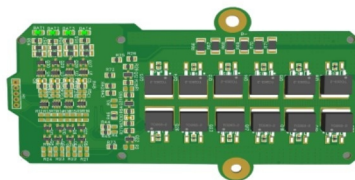


Protection, balancing, thermal, state of charge (SoC) status at cell level in a battery pack with display and diagnosis for cell failure.

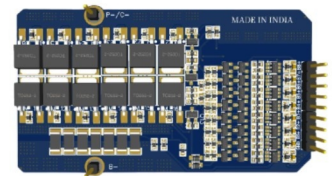
BMS: Technical Implementation



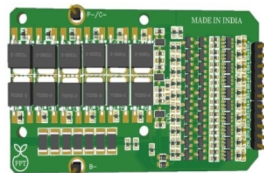
BMS: Products Ready for Commercialization



BMS Model: 4S
Application: Solar Lighting



BMS Model: 8S
Application: E-bicycle



BMS Model: 10S
Application: E-bike (2 wheeler)



BMS Model: 16S
Application: E-rickshaw (3 wheeler)

Battery Management System (BMS):

FROM CONCEPT TO PRODUCT

1S-16S BMS Technical Specifications

Battery Chemistry: **LiFePO₄ (LFP)**; **LiCoO₂ (LCO)**; **LiNiMnCoO₂ (NMC)**

Parameter	Description	Specification																			
		LiFePO ₄								LiCoO ₂ & LiNiMnCoO ₂											
		1S	2S	3S	4S	8S	10S	12S	16S	1S	2S	3S	4S	8S	10S	12S	16S				
Discharge	Continuous Discharge Current	1-60 A	1-60 A	1-60 A	10-60 A	10-60 A	10-60 A	10-60 A	10-60 A	1-60 A	1-60 A	1-60 A	10-60 A	10-60 A	10-60 A	10-60 A	10-60 A				
	Charging	Charging Voltage	3.65 V	7.30 V	10.95 V	14.6 V	29.2 V	36.5 V	43.8 V	58.4 V	4.25 V	8.5 V	12.75 V	17.00 V	34.00 V	42.50 V	51.00 V	68.00 V			
	Recharging Current	1-60 A	1-60 A	1-60 A	10-60 A	10-60 A	10-60 A	10-60 A	10-60 A	1-60 A	1-60 A	1-60 A	10-60 A	10-60 A	10-60 A	10-60 A	10-60 A				
Over-Charge Protection	Over-charge Detection Voltage	3.65 ± 0.025 V								4.25 ± 0.025 V											
	Over-charge Protection Delay	1200 milliseconds (ms)								1200 milliseconds (ms)											
	Over-charge Release Voltage	3.45 ± 0.05 V								4.10 ± 0.05 V											
Balancing	Battery Balance Detection Voltage	3.6 V								4.15 V											
	Battery Balance Release Voltage	3.6 V								4.1 V											
	Battery Balance Current	74 milliampere (mA)								74 milliampere (mA)											
Over-discharge Protection	Over-discharge Detection Voltage	2.5 ± 0.05 V								2.5 ± 0.05 V											
	Over-discharge Protection Delay	140 ms								140 ms											
	Over-discharge Release Voltage	3.0 ± 0.05 V								3.0 ± 0.05 V											
Over-current Protection	Over-current Detection Voltage	200 millivolt (mV)								200 millivolt (mV)											
	Over-current Protection Release Condition	Disconnect Load								Disconnect Load											
Short-circuit Protection	Short-circuit Protection Condition	Short-circuit of External Load								Short-circuit of External Load											
	Short-circuit Detection Delay	250 microseconds (μs)								250 microseconds (μs)											
	Short-circuit Protection Release Condition	Disconnect Load								Disconnect Load											
Temperature Protection	During charge	Over Temperature	50 °C				Under Temperature	0 °C				Over Temperature	50 °C				Under Temperature	0 °C			
	Over temperature during discharge	70 °C								70 °C											
Self-consumption	Working Current	≤ 20 microampere (μA)								≤ 20 microampere (μA)											
	Sleeping Current	≤ 10 microampere (μA)								≤ 10 microampere (μA)											
Operating Temperature	Temperature Range	-30 to 85 °C								-30 to 85 °C											



LIB-integrated Inverter: Specifications

Parameter(s)	250 VA	500 VA	850 VA	1 kVA
Physical dimension (L x W x H), mm	190 x 301 x 162	301 x 201 x 201	361 x 362 x 362	380 x 361 x 297
Weight, kg	6	9	16	18
Output power	200 W	400 V	680 W	800 W
Battery class	Lithium battery			
Battery pack	12.8 V, 15 Ah	12.8 V, 30 Ah	12.8 V, 80 Ah	12.8 V, 100 Ah
Battery backup	Integrated with UPS			
Battery life	7-8 years			
Battery operating temperature	-10 to 60 °C			
Operational safety	Electrical & thermal protection			
Transformer type	Dry power			
Input voltage (AC)	230 V			
Input voltage type	Single phase			
Input frequency	50-60 Hz			
Nominal output voltage	230±5 V			
Output frequency	55-60 Hz			
Output waveform	Sinewave			
Output voltage distortion	±1%			
Overload sustainability	60-90 seconds			
Output voltage tolerance	±2% static; ±5% underload			
Efficiency (full load)	≥90%			
Display	Operating voltage, current, temperature, overload			

Lithium Battery (LIB)-integrated Inverter



Converts DC voltage of the battery to AC pure sinewave output via PWM switching through MOSFET or IGBT impedance matching to the switching device



Light-weight, Compact, Portable
Protection: Overload, deep discharge, short-circuit, MCB, temperature overrun, input over voltage, input low voltage
LCD Display: Shows operation status
Efficiency: >90%
Standby Charging Mode
Intelligent Cooling Fan Control



Home Appliances/Office Equipment: PC, laptop, LED/LCD TV, CFLs, tube light, fan, refrigerator, washing machine, and numerous wide-ranging applications

Dry Power Transformer: Rectangular/Toroidal



- High Efficiency
- Longer Functional Life
- Low Power loss
- Fire Resistant
- High Dynamic Short-circuit Length
- Good Overload Capacity
- Low Hysteresis & Magnetizing Current
- Low Signal Distortion
- Zero Flux Leakage
- Minimal Magnetic Core Loss



High UPS & Online/off-line UPS System

Automatic Rescue Devices (ARDs) used in Elevators

Solar Inverters



Rectangular:

250 VA, 500 VA, 850 VA, 1 kVA

Toroidal:

250 VA, 500 VA, 850 VA

Transformer Development

Scheme

1 Design of Transformer's Parameters & Calculation

2 Material Procurement: Laminated Core, Bobbin, Enameled Copper Wire

3 Windings for HV, LV, and Sensing

4 Fabrication and Assembly

5 Test: Winding Resistance, Transformer Ratio, Polarity, Copper Loss, Core, Loss, Temperature Rise, Noise

6 Commercialization



Technical Specifications: Toroidal Transformer

Parameter(s)	250 VA	500 VA	850 VA
Physical dimension (L x W x H), mm	125 x 70 x 50	150 x 81 x 55	180 x 90 x 56
Weight, kg	2.8	5.4	8.1
High side voltage	250 V		
Low side voltage	7.5 V		
Sensing voltage	45 V		
High side current	1.0 A	2.0 A	3.4 A
Low side current	33.33 A	66.66 A	113.33 A
Resistance (HSV)	4.0 Ω	3.4 Ω	2.2 Ω
Resistance (LSV)	0.011 Ω	0.004 Ω	0.002 Ω
Operating frequency	50 Hz		
Phase	Single phase		
Cooling type	Air cooled		
Conductor type	Cooper		
Core loss	1.8 W	2.5 W	3.6 W
Copper loss	18.3 W	33.7 W	51.4 W
Total loss	20.1 W	36.2 W	55.0 W
Noise reading	4.6 dBA	6.0 dBA	12.7 dBA
Efficiency	92.00%	93.00%	94.00%
Maximum temperature rise	55 °C	60 °C	65 °C
Battery current at no load	1.00 A		



Technical Specifications: Rectangular Transformer

Parameter(s)	250 VA	500 VA	850 VA	1000 VA
Physical dimension (L x W x H), mm	115 x 77 x 92	115 x 98 x 92	115 x 116 x 92	140 x 115 x 92
Weight, kg	3.2	4.7	6.2	6.6
High side voltage	250 V			
Low side voltage	7.5 V			
Sensing voltage	45 V			
High side current	1.0 A	2.0 A	3.4 A	4.0 A
Low side current	33.33 A	66.66 A	113.33 A	133.33 A
Resistance (HSV)	6.6 Ω	4.2 Ω	2.3 Ω	2.3 Ω
Resistance (LSV)	0.083 Ω	0.016 Ω	0.054 Ω	0.050 Ω
Operating frequency	50 Hz			
Phase	Single phase			
Cooling type	Air cooled			
Conductor type	Cooper			
Core loss	5.0 W	7.0 W	15.0 W	11.0 W
Copper loss	24.0 W	59.0 W	93.0 W	138.0 W
Total loss	29.0 W	66.0 W	108.0 W	149.0 W
Noise reading	6.0 dBA	6.3 dBA	6.8 dBA	8.0 dBA
Efficiency	85.50%	83.50%	84.00%	82.00%
Maximum temperature rise	65 °C	70 °C	80 °C	85 °C
Battery current at no load	1.00 A			



"The nation that leads in renewable energy
will be the nation that leads the world"

-James Cameron -

Working towards "Make in India" - A mission towards Atmnirbhar Bharat

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Our Marketing Unit:

LiPo Energy