



# POWER TRAIN

- Electric Propulsion System -

**GEMET**

## ◎ Ocean is future.

Human future is in Ocean.

We GEMET will always be with you where human future is.

We GEMET come true keeping an environment by applying green energy with eco-friendly material and technology to the industry.



## ◎ History

2011

- . MAR. GEMET Co., Ltd. was established
- . APR., 2011 : Distributorship Agreement with James Fisher Defence(UK)
- . JUL., 2011 : Distributorship Agreement with Stirling Dynamics
- . DEC., 2011 : Certificate of "Venture Company"

- . JAN., 2012 : Certificate of ISO 9001/14001
- . FEB., 2012 : Established and certified "R&D Department"
- . FEB., 2012 : Patent Authorization ; "Pure Electric Propulsio Boat mounted Power Manag"

2012

2013

- . MAY., 2013 : Contracted with SBA for development of " POWER TRAIN"
- . DEC., 2013 : Distributorship Agreement with KOKAM Co., Ltd(ROK)

- . APR., 2014 : Developed "POWER TRAIN(36kWh Li-Po Battery & 40Kw CPMHB Motor)" for Electric Boat
- . MAY., 2014 : Contracted with SBA for Development and Modification of electric boa from existing 9.5m Diesel boat
- . SEP., 2014 : Distributorship Agreement with Astronautics Co., Ltd.(Israel)

2014

## ◎ Introduction

A GEMET's Power Train (PT-GM4036E ; image below) consists of PMS (Power Management system), Lithium Polymer Battery including BMS, PMHB (Permanent Magnetic Hybrid BLDC) Motor with Driver, Charger, DC/DC Converter and Distributor were developed, integrated and tested in land without hull/ vehicle under ROK government authority prior to being actually mounted on the boat.

All of major equipment on Power Train are designed to be monitored and controlled by our patented PMS simultaneously.



01

Patented PMS (Power Management System) to monitor Li-Po Battery, PMHB Motor, Charger, Stern Drive, Converter and other controller together at once.

02

Li-Po Battery system with BMS proud of High Efficiency, Safety and weight- & space-optimized Compact configuration.

03

PMHB Motor based on High Efficiency, compact size and silence.

04

Compatibility to general STERN-DRIVE or PROPELLER in COTS.

05

Flexibility to integrate a Power Train with a variety of capacities on electric vehicles for Sea or Land according to designated requirement from customers.



## Specification of PT-GM4036E

### ◆ Power Management System ; PMS-01ESM

#### - Patent No.10-1117306

- To monitor through LCD on PMS at once for all major equipment such as Li-Po Battery with BMS, PMHB Motor with Driver, Charger, DC/DC Converter and GPS.
- Integrated management of charge/discharge & distribution of Li-Po battery
- To distribute and supply e-power at all time (Stable system)
- To reduce the energy loss and minimize the demanded space through integrated power management
- Dimension : 280 x 150 x 84.2mm
- Weight : 5kg



### ◆ LiPo-Battery System (Included BMS)

#### ; GM-LiPo36K

- Connection Type : Serial (13S-1P) x 5
- Capacity : Over 150Ah, 3.7V based of 1S1P (MAX. 3C)
- Nominal Voltage : 48.1Vdc x 5 = 240.5Vdc
- Nominal Energy : 7.215 kWh x 5 = 36kWh
- Energy Density : Over 155Wh/kg, 330Wh/L (World highest technology)
- Battery life : Over 1000cycle@80%
- A physical dimension of package for Demo only ;
  - . Dimension of AL Case of String : 1464 X 586 X 550mm
  - . Total weight of 5 AL Modules with AL String Case for Demo : 420kg
- A physically minimized dimension of package for Real installation on boat ;
  - . Dimension of GFRP Case of String : 1320 X 510 x 550mm
  - . Total weight of Modules with GFRP String Case : 285kg

According to customer's requirement, our pre-proven power train can be combined and integrated with any applications to be transported through land and sea.

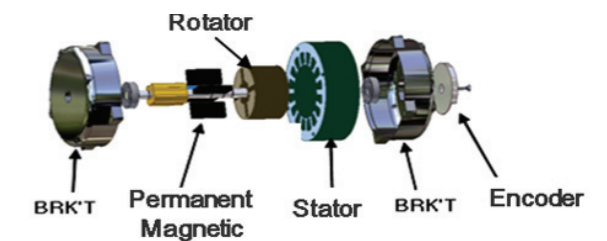
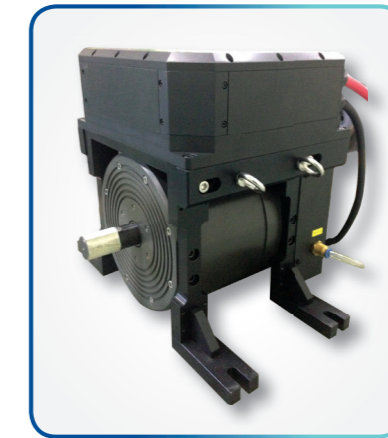
## Specification of PT-GM4036E

### ◆ PMHB Motor with Driver

#### ; GM-BDM40K

#### ; Permanent Magnetic Hybrid BLDC Motor

- Nominal Voltage : 240VDC
- Output : 40kW(53.6HP)
- Efficiency : Over 92%(motor+driver)
- Rated RPM : 0~4000rpm(Customized spec)
- Phase : 4
- Protection Degree : IP54
- Insulation Class : F
- Size : - 274 x 230.5 including drive
- Weight : 47kg including driver



### ◆ Charger ; GM-FEV38030

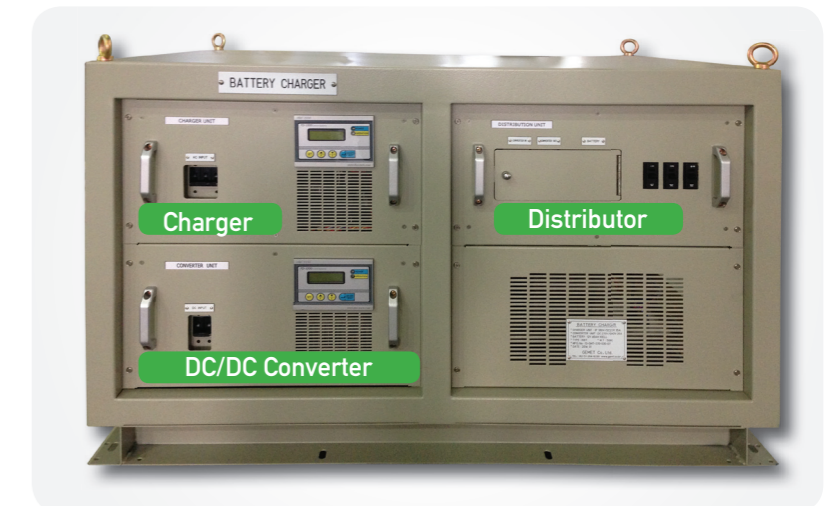
- Input : 3Ø 3 W 380V
- Output : DC 270V
- Output Current : 30A
- Outdoor
- IGBT & CAN Comms.
- Dimension : 553 x 520 x 275mm
- Weight : 45kg

### ◆ DC/DC Converter ; GM-CVT01

- DC270V/DC12V200W
- To supply DC12V to BMS, Stern-Drive and other for Boat's Use
- For charging an emergency 12V Lead-Acid Battery
- Size : 553 x 520 x 275mm
- Weight : 25kg

### ◆ Distributor ; GM-DSTR02

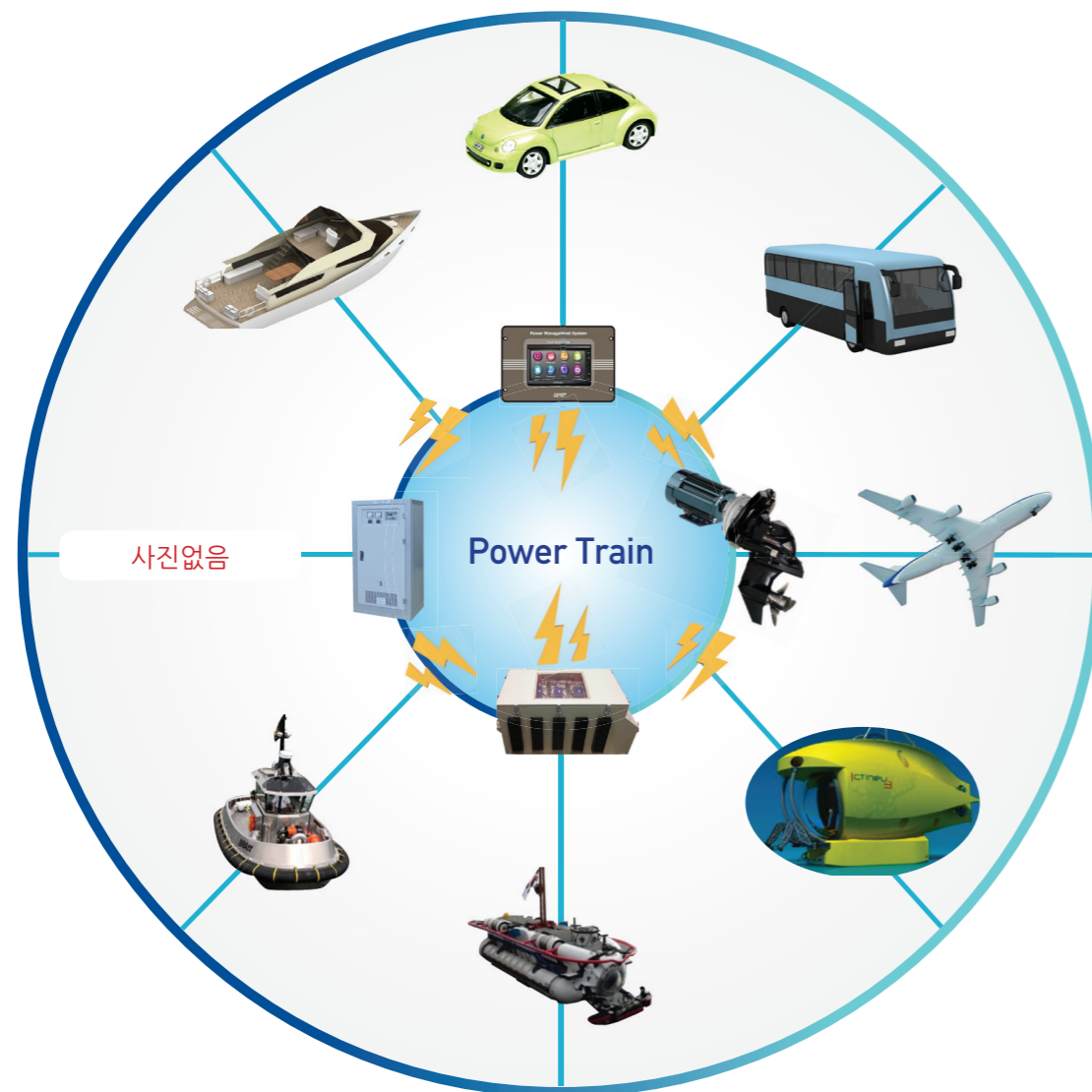
- To open, break and distribute the power to Battery, Charger, Motor, converter and other of 12V utilities
- Size : 553 x 520 x 275mm
- Weight : 30kg



## Applications

Our individual electric major equipment had been already introduced and applied to various vehicles and can be developed for any type of vehicles according to designated requirement of applications as follows

- EV ; Electric Vehicle & Bus – Li-Po Battery and PMHB Motor
- Leisure boat – GEMET's Power Train
- Racing boat & Car – GEMET's Power Train or individual
- Offshore Tug boat – GEMET's Power Train or individual
- Various UW Vehicles for special operation – GEMET's Power Train or Individual  
Manned or Unmanned Submarine, DSV, UUV, DSRV, SDV and ETC..
- Various Electric Aircrafts – Li-Po Battery System



\* The images above are good example of applications actually applied.

## PMS

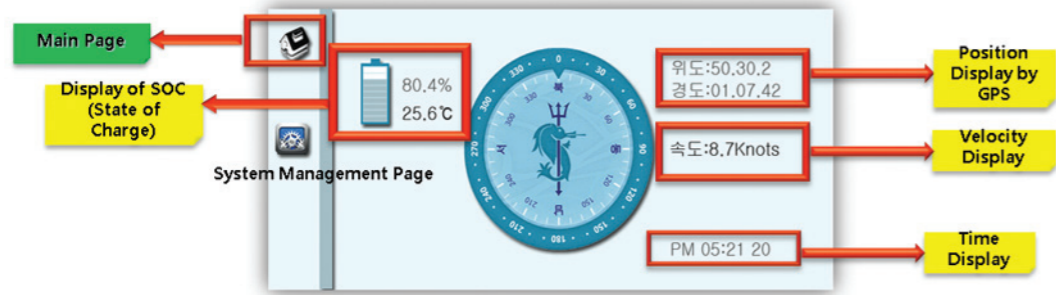
### General Special Feature

: GEMET's PATENT ; Patent No.10-1117306

- To monitor and control all electrics such as Power Conversion Equipment, Battery, Propulsion Motor, Charger, DC/DC Converter, GPS and others through LCD on PMS at once according to requirement
- Integrated management of charge/discharge & distribution of battery system
- To distribute and supply the e-power at all time (Stable system)
- To reduce the energy loss and minimize the demanded space through Integrated Power Management System
- To control remotely the driver of motor in next future development/phase.







Special Feature

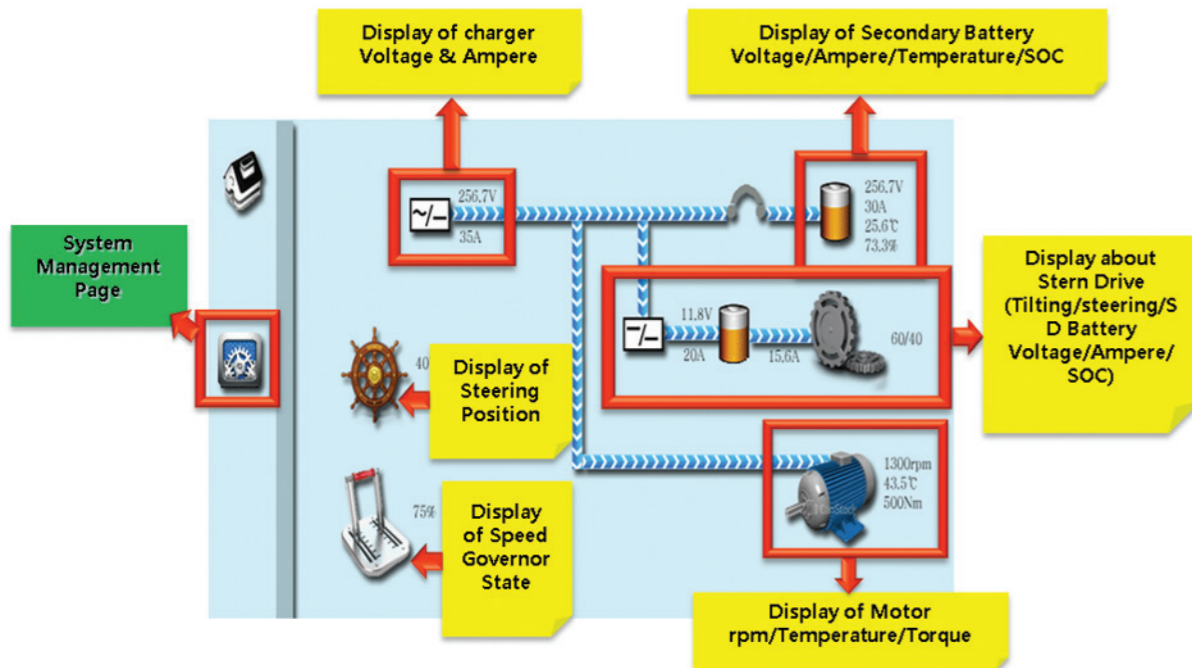
Div	Cell	Module
Pack	Pouch	Aluminum/GRP
Cur. Vol.(Nom)	Max 240Ah	Max 240Ah
Voltage(Nom)	3.7V	Various
C-Rate	Max 40C	Various
Image		



A sample of System or String

Special Technologies

- Very high Capacity - up to 240Ah per unit cell
- Very high C-rate - up to 40C
- Longer life cycle
- Excellent energy density – 130~200Wh/kg
- Enhanced safety - no leaking electrolyte
- Anti shock & vibration of packaging – customized & special molding process
- Special NMC (Nickel Manganese Cobalt) technology / Nano technology
- Polymer electrolyte technology
- Z-fold stacking technology
- Low impedance and heat generation for improved safety
- High charge/ discharge energy efficiency
- Low self-discharge rates
- The safety and reliability of each battery pack is guaranteed with the BMS.



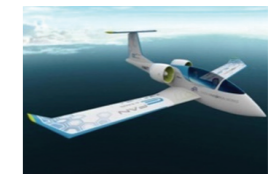
Electric speed boat power solution



Leisure Boat with various capacity of battery system



Deep Sea Rescue Vehicle



Fully electrically-powered Training Aircraft



Submarine for leisure



Electric Sports Car



Solar energy transportation



Electric Bus

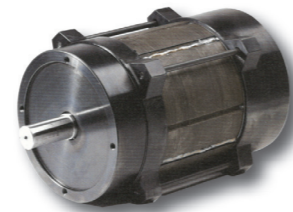
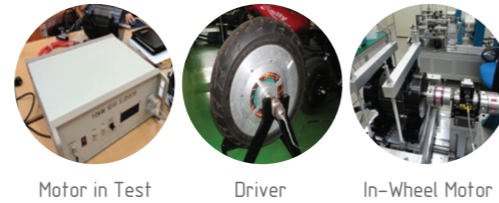
Special Feature

- Safety : Multi-Phase (Emergency Drive, Well-Fitted Motor)
- High Torque : Magnet, Dispersed Electric Power Control
- High Speed and Output : Linear Straight Acceleration (Dispersion Control)
- High Efficiency : Dispersion Structure (Motor, Drive)
- Small size with Simple Structure and Light-weight : Dispersion Structure
- Superior Durability (Mechanical, Electrical) : Simple Structure
- Keep the Stable Torque in wide ranges : Neodymium(Nd) Magnet

For Electric Vehicle

Our motor has high power density and design flexibility to apply various configuration such as in-wheel motor. And it secures the vehicle can be driven safely by providing continuous running without stop even case of partial trouble with its winding and/or drive system.

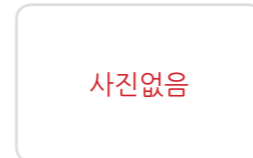
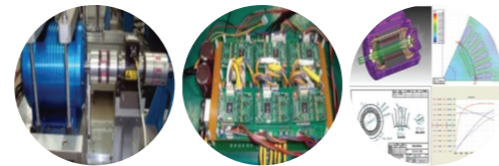
- High Efficiency and low cost by distributed power.
- Emergency operation owing to isolated connection.
- High power density.
- High efficiency over wide speed range.
- Excellent response characteristic.
- High regeneration efficiency thanks to good wave form (square) from regenerative brake.
- Maintenance-Free



For Marine Applications (Surface & Sub)

Our motor for machinery includes for commercial and military ships has been developed considering extreme condition from initial design stage to final test.

- Saving energy and space owing to High Efficient system.
- High reliability owing to distributed power.
- Economic driving according to load and speed with variable speed control.
- Robust and low noise design meeting with MIL requirement.
- Emergency operation owing to isolated connection.
- Maintenance-free



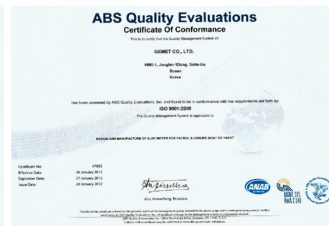
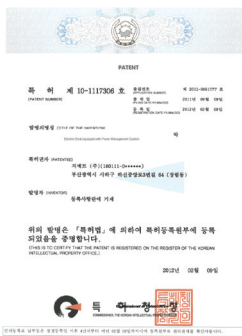
- Simple Design
- Selection of prime function
- Smart Digital
- Security/Safety
- Operate/error data save/management.
- Cutting-Edge Processor
- Communicate with BMS



Div.		Function & Description				
Applied by		KSC4402, ES-157, NEMA PE5, IEC146, IEC61000				
Temperature	Operation & Storage	Operate : -10°C ~ 50°C, Store : -20°C ~ 70°C				
Humidity		30%~ 90%				
Service Space		Indoor				
Rated Power	Constant & Frequency	3 Phases 47Hz ~ 63Hz				
	Rated Power	3 Phases 380V±10%				
Declared Power	Rated power	To choose as below				
	Rated Capacity	20A	35A	70A	100KW	More than 100KW – discussed
	Voltage Adjustment	Rated power : -20% ~ +5%				
	Voltage Regulation	± 0.5%				
	Current Limit	110%				
	Pulsation Factor	Basically 2% p-p (rms) or less				
Short Circuit		Output short circuit protection operates within 10ms				
Efficiency & power factor		Efficiency : Over 90%, Power factor : Over 90%				
Response Character		0~100% load change, below 100ms				
EMI & EMC		KS C CISPR 16-1 & IEC 61000-4-5,4-6				
Control type		IGBT high-frequency conversion PID control (DSP) – full digital				
Operation type & Comm. port		Auto control by program setup, RS-232, 422, CAN				



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