



# E-Power Train for Personal e-Mobility Devices

**innobile**

Smart Vehicle Control based on  
Advanced Motor Control Technology  
and CAN Communication

**INNObILE**

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# INNOBILE OVERVIEW



❖ Company Name

INNOBILE CO., LTD

❖ CEO

KIM TAE YONG

❖ Founded

April, 2014

❖ Address

Head Office : Room 635, 62, Seongseogongdan-ro 11-gile,  
Dalseo-gu, Daegu, Korea

China Office : Room 612, No. 36, South Yutian Road, Jiading  
District, Shanghai, China

❖ Business Areas

- Automotive electric parts manufacture and sale
- General machinery electric components manufacture and sale
- General machinery motor parts manufacture and sale

❖ Core Technology

- Motor control
- ECU development(Hardware & Software)
- Automotive communication(CAN, LIN, etc.) and Wireless communication
- Machinery components design

❖ Development  
Capabilities

- Electric Water Pump(EWP), Motor Controller of Automotive Electronic Parts(Cooling Fan, Electric Vacuum Pump)
- Personal e-Mobility e-Power Train(Motor Controller, Cluster)

# Platform Introduction





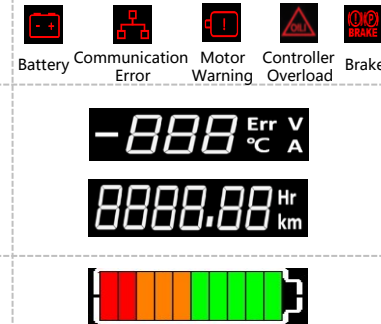
- CAN-based Communication
    - > Harness minimization
    - > Simplified connection between the upper and lower parts of the vehicle
  - Vehicle driving options (start mode, speed pattern, etc.) : selection program provided
    - > Option requirement satisfied for each customer
  - Connected thru communication modules
    - > Transfer car internal information
- The figure consists of three parts:

  - Top Left Graph:** A line graph showing current (A) on the y-axis (0 to 10) versus time (min) on the x-axis (0 to 60). The current starts at 0, rises sharply to about 8A at 10 minutes, and then remains constant.
  - Top Right Bar Chart:** A bar chart showing power consumption (W) on the y-axis (0 to 100) for various components. The components are: Power window, Power mirror, Power seat, Power door lock, Power window, Power mirror, Power seat, Power door lock, Power window, Power mirror, Power seat, Power door lock. The power consumption is highest for Power window (approx. 80W) and Power mirror (approx. 60W).
  - Bottom Table:** A table showing power consumption (W) for different components. The table has 4 columns: Power window, Power mirror, Power seat, Power door lock. The data is as follows:
 


Power window	Power mirror	Power seat	Power door lock
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32
33	34	35	36
37	38	39	40
41	42	43	44
45	46	47	48
49	50	51	52
53	54	55	56
57	58	59	60
61	62	63	64
65	66	67	68
69	70	71	72
73	74	75	76
77	78	79	80
81	82	83	84
85	86	87	88
89	90	91	92
93	94	95	96
97	98	99	100
















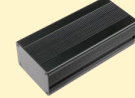
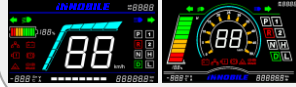
- Faults display via various icons
  - > To alert driver to ensure safe driving
- To identify the faults causes by CAN message (error code "Err") : A/S convenience
- To check status of voltage, current, etc.
- To display vehicle identification number(vehicle started)
- Mileage and driving time
- Battery capacity with 10 columns
  - > Qualified for certification requirement




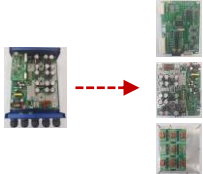




## ❖ Remarkable Motor Control Technology

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>• Safe driving           <ul style="list-style-type: none"> <li>-&gt; To identify abnormal status of overvoltage, overcurrent, overload etc.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>- Fault diagnosis result output to cluster : driver taking actions</li> <li>- System automatic self-reaction</li> </ul> |
| <ul style="list-style-type: none"> <li>• Excellent climbing ability and non-slip at heavy gradient</li> </ul>  |   |
| <ul style="list-style-type: none"> <li>• Vector control for sinusoidal motor control method</li> </ul>   | <ul style="list-style-type: none"> <li>- Torque control based on self-developed encoder</li> <li>- Regenerative braking, charging</li> </ul>                   |

## Development Status and Roadmap

Development Items		2019		2020		2021	
Applications		<div> Electric Wheel Chair</div> <div> Electric Motorcycle    Three-Wheel Electric Vehicles</div>		<div> Micro Electric Vehicle</div>		<div> Electric Compact Light Truck    Electric Minivan</div>	
Components / Solutions	Body Controller	<div> Body Control Unit (BCU)</div>		<div> Vehicle Control Unit (VCU)</div>			
	Motor Control Unit (MCU)	<div>200W Servo Motor Controller</div> <div> Encoder</div> <div>4kW BLDC Motor Controller</div> <div></div>		<div> 7.5kW Motor Controller</div>		<div> 15kW Motor Controller</div>	
	DC-DC Converter			<div> DC-DC Converter (40~96V-&gt;12V)</div>			
	Cluster	<div>Customizing Cluster</div> <div></div>					

# Products Summary

Item	Product Picture	Product Features	Specification	Remark
Motor Control Unit (MCU)	 <p>(IBM6040-SDTZ)</p>	<ul style="list-style-type: none"> <li>Rated power 4kW(Maximum 8kW)</li> <li>BLDC motor controller</li> <li>Trapezoidal control</li> <li>Self-diagnosis and display               <ul style="list-style-type: none"> <li>Overvoltage, overcurrent, overload</li> </ul> </li> <li>Non-slip at heavy gradient</li> </ul>	<p>(Based on IBM6040-SDTZ)</p> <ul style="list-style-type: none"> <li>Input voltage range : 42 ~ 86V</li> <li>Rated / Maximum current : 80A / 150A(30sec)</li> <li>Rated / Maximum power : 4kW / 8kW</li> <li>Communication : CAN2.0A (500kbps), UART</li> <li>Operating temperature : -20 ~ 85°C</li> </ul>	<ul style="list-style-type: none"> <li>Internal structure               <div>  <p>CPU Module</p> <p>Inverter Module</p> <p>Power Module</p> </div> </li> <li>-&gt; Inverter and power modules can be shared with one board according to power grade</li> <li>-&gt; CPU Module can be altered according to software control technique</li> </ul>
Digital Cluster		<ul style="list-style-type: none"> <li>Customizing User-Interface</li> <li>Battery remaining capacity with 10 columns</li> <li>Vehicle driving status</li> <li>Various information               <ul style="list-style-type: none"> <li>Vehicle system error, voltage, current</li> <li>Mileage, driving time and vehicle identification number</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>32bit CPU</li> <li>Input voltage range : 9 ~ 18V(12V)</li> <li>Power consumption : 50W</li> <li>Communication : CAN2.0A (500kbps)</li> <li>EX_IO : 8bit Input / 16bit Output</li> </ul>	<ul style="list-style-type: none"> <li>Active view area (mm) : 108 x 61</li> </ul>
Vehicle Control Unit (VCU)		<ul style="list-style-type: none"> <li>Vehicle system control based on CAN communication with cluster, MCU and BMS</li> <li>Regenerative braking, charging cooperation control</li> <li>Vehicle driving status measurement based on IMU(Inertial Measurement Unit)</li> </ul>	<ul style="list-style-type: none"> <li>TI 32bit CPU</li> <li>Input voltage range : 9 ~ 18V(12V)</li> <li>Standby current : 100mA</li> <li>DI/O : Input 16ch / Output 16ch</li> <li>Analogue input 8ch, PWM output 4ch</li> <li>Communication : CAN2.0A, SPI, I2C</li> </ul>	<ul style="list-style-type: none"> <li>High-tier vehicle controller for micro-EV</li> </ul>
Body Control Unit (BCU)		<ul style="list-style-type: none"> <li>Vehicle input and output signal processing               <ul style="list-style-type: none"> <li>Left and right indication</li> <li>Forward and backward</li> <li>Speed regulation and braking</li> </ul> </li> <li>CAN Communication               <ul style="list-style-type: none"> <li>Easy to identify the causes of I/O problems</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Input voltage range : 9 ~ 18V(12V)</li> <li>Power consumption : 50W</li> <li>Process time : 10ms</li> <li>Communication : CAN2.0A (500kbps)</li> <li>DI/O : Input 12ch / Output 12ch</li> <li>AI/O : ADC 12bits / 6ch</li> </ul>	<ul style="list-style-type: none"> <li>Basic body controller for two-wheel electric bikes, three and four-wheel electric vehicles</li> </ul>
DC-DC Converter		<ul style="list-style-type: none"> <li>150W grade high frequency transformer</li> <li>Converter circuit : PUSH-PULL topology</li> <li>Soft start, reduced ripple noise</li> <li>Power stability ensured for protection function</li> </ul>	<ul style="list-style-type: none"> <li>Operating voltage range : 40 ~ 96V</li> <li>Output / Maximum current : 10A / 15A</li> <li>Control method : Half-Bridge PWM</li> <li>Protection : Overvoltage, overcurrent, overtemperature</li> </ul>	<ul style="list-style-type: none"> <li>Sample to be released in 3Q of 2020</li> </ul>



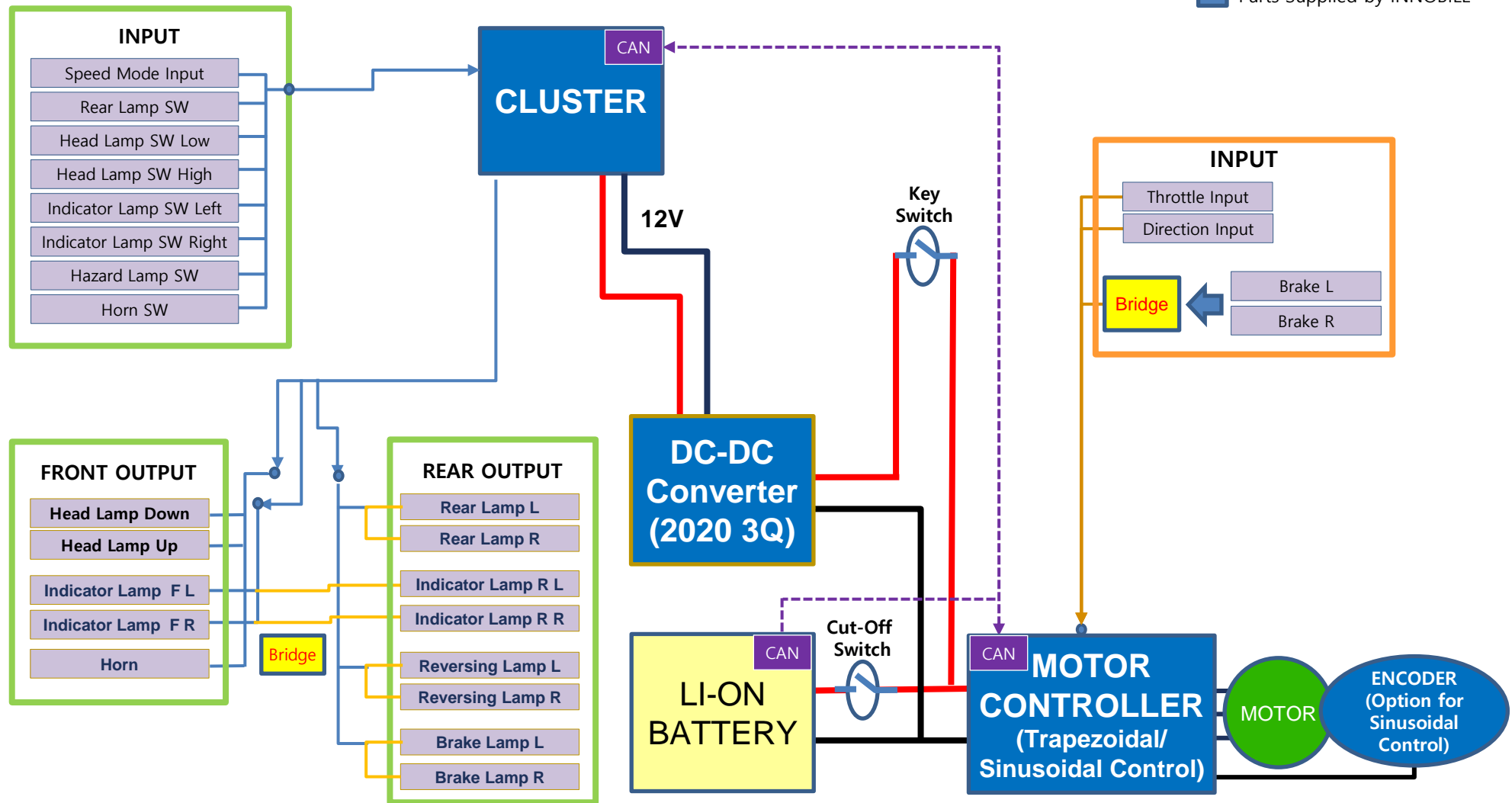
# Motor Control Unit (MCU) Specification

## ❖ Highlights

## ❖ Specification(Current Products Line-up)

Performance	Description	Product Name	IBMC2402-ENSS	IBMC6040-SDTZ IBMC6040-ENSS	IBMC7240-SDTZ IBMC7240-ENSS	IBMC7275-SDTZ IBMC7275-ENSS
Applications	<ul style="list-style-type: none"> <li>Driving motor control for e-mobility and micro-mobility vehicles</li> </ul>	Rated Power	200W	4kW	4kW	7.5kW
Features	<ul style="list-style-type: none"> <li>Hardware design following automotive electronic parts standard(main electronic components by automotive grade)</li> <li>High-efficiency motor control : 90%↑(Sinusoidal), 85%↑(Trapezoidal)</li> <li>Vector control for sinusoidal motor control : FOC (Field Oriented Control)               <ul style="list-style-type: none"> <li>Self-developed encoder based torque control, speed control, position control</li> </ul> </li> <li>Customized motor control solution provided based on motor specification and performance requirement</li> </ul>	Rated Voltage	24V	48V / 60V	48V / 72V	60V / 72V
		Input Voltage Range	18V~29V	42V~86V	42V~92V	60V / 96V
		Rated Current	15A	80A / 65A	80A / 55A	150A / 100A
		Maximum Current	30A	150A / 130A	150A / 100A	360A / 280A
		Operating Temperature	-20℃~85℃	←	←	←
Functions	<ul style="list-style-type: none"> <li>CAN communication based system linkage with motor, battery and cluster</li> <li>System fault diagnosis and display (connection with cluster) : A/S convenience</li> <li>Self-inspection and countermeasure : overvoltage, overcurrent, overload</li> <li>Safe driving : non-slip at heavy gradient, speed control for downhill</li> <li>Regenerative braking, charging</li> </ul>	Storage Temperature	-40℃~120℃	←	←	←
		Motor Control	Trapezoidal	Trapezoidal Sinusoidal	Trapezoidal Sinusoidal	Trapezoidal
		Communication	CAN 2.0A	←	←	←
		SOP	2018	2020 2Q	2019 development completed	Sample to be released in 4Q of 2020

## CAN-based Independent Cluster System : Two, Three and Four-Wheel Electric Vehicles

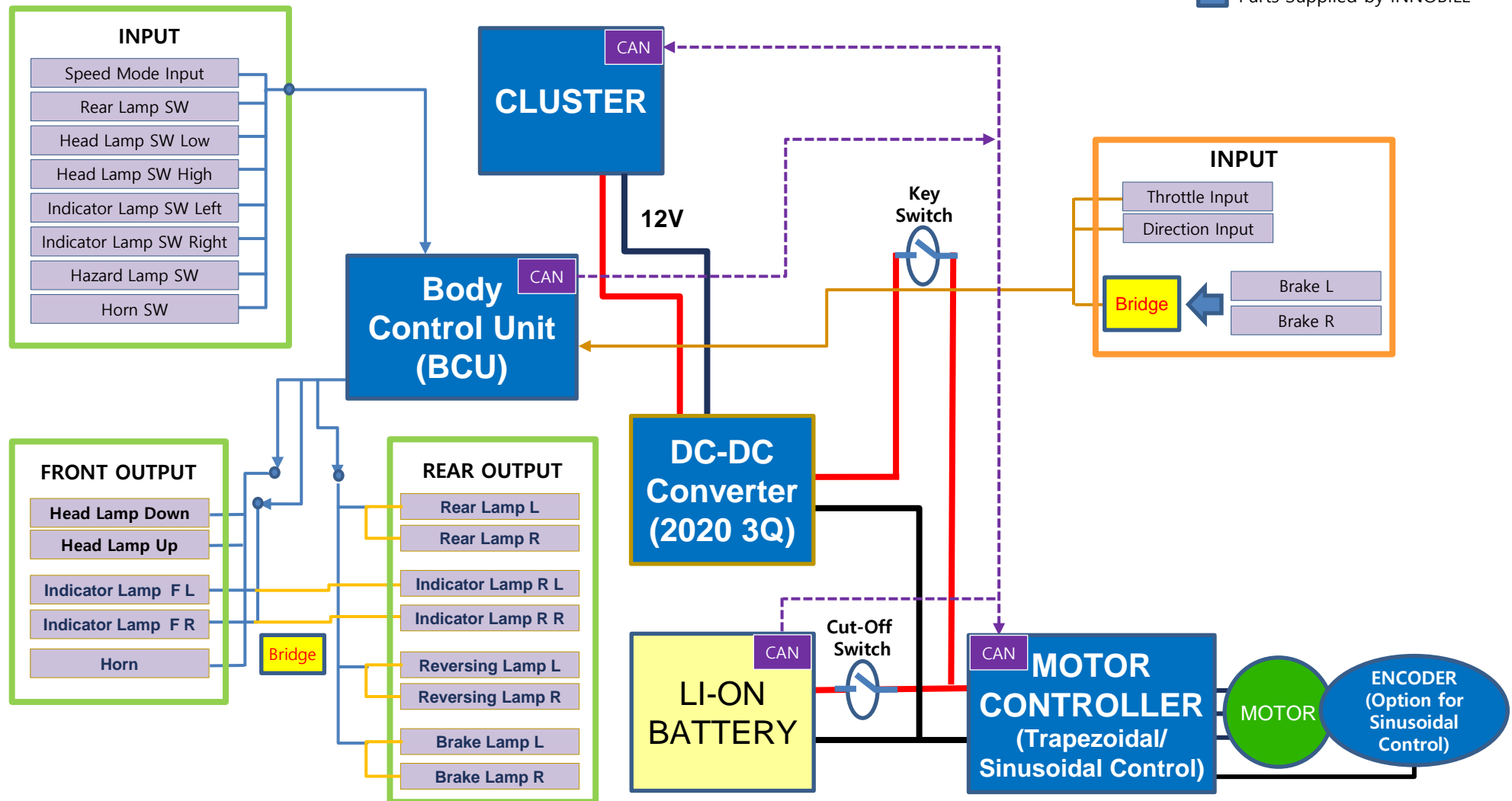
 Parts Supplied by INNOBILE


\*\* Illustration : Above system is based on Lithium-ion Battery.  
CAN Communication is not applied for Lead Acid Battery system.



# CAN-based Body Control Unit System : Two, Three and Four-Wheel Electric Vehicles

Parts Supplied by INNOBILE

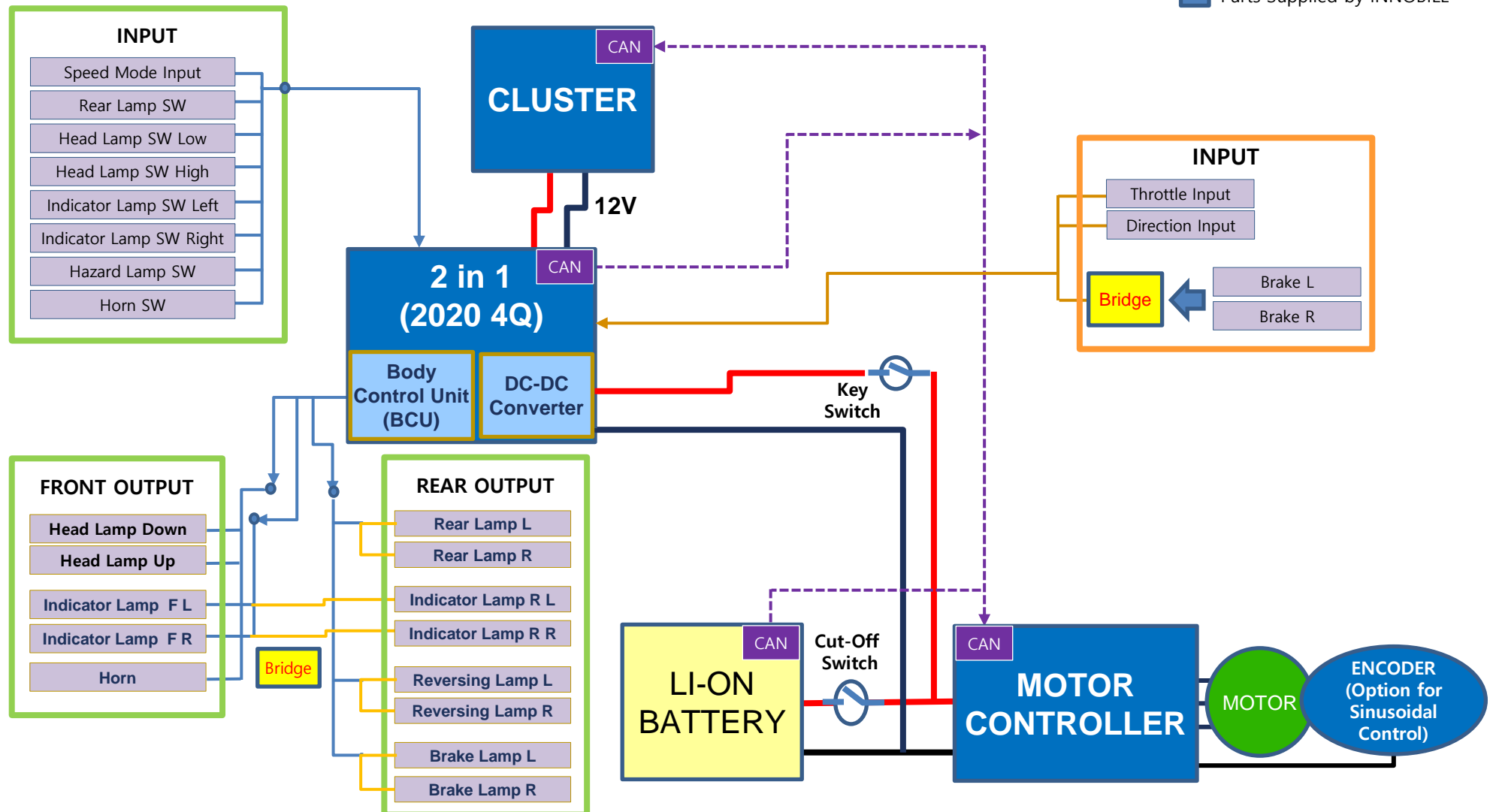


\*\* Illustration : Above system is based on Lithium-ion Battery.

CAN Communication is not applied for battery and motor controller in Lead Acid Battery system.

# CAN-based 2 in 1 System : Two, Three and Four-Wheel Electric Vehicles

Parts Supplied by INNOBILE



\*\* Illustration : Above system is based on Lithium-ion Battery.

CAN Communication is not applied for battery and motor controller in Lead Acid Battery system.

# Customizing Development System

## Vehicle Types

Electric Vehicle  
Micro-EV

## Motor Classification

Motor Power  
Motor Types

## Battery

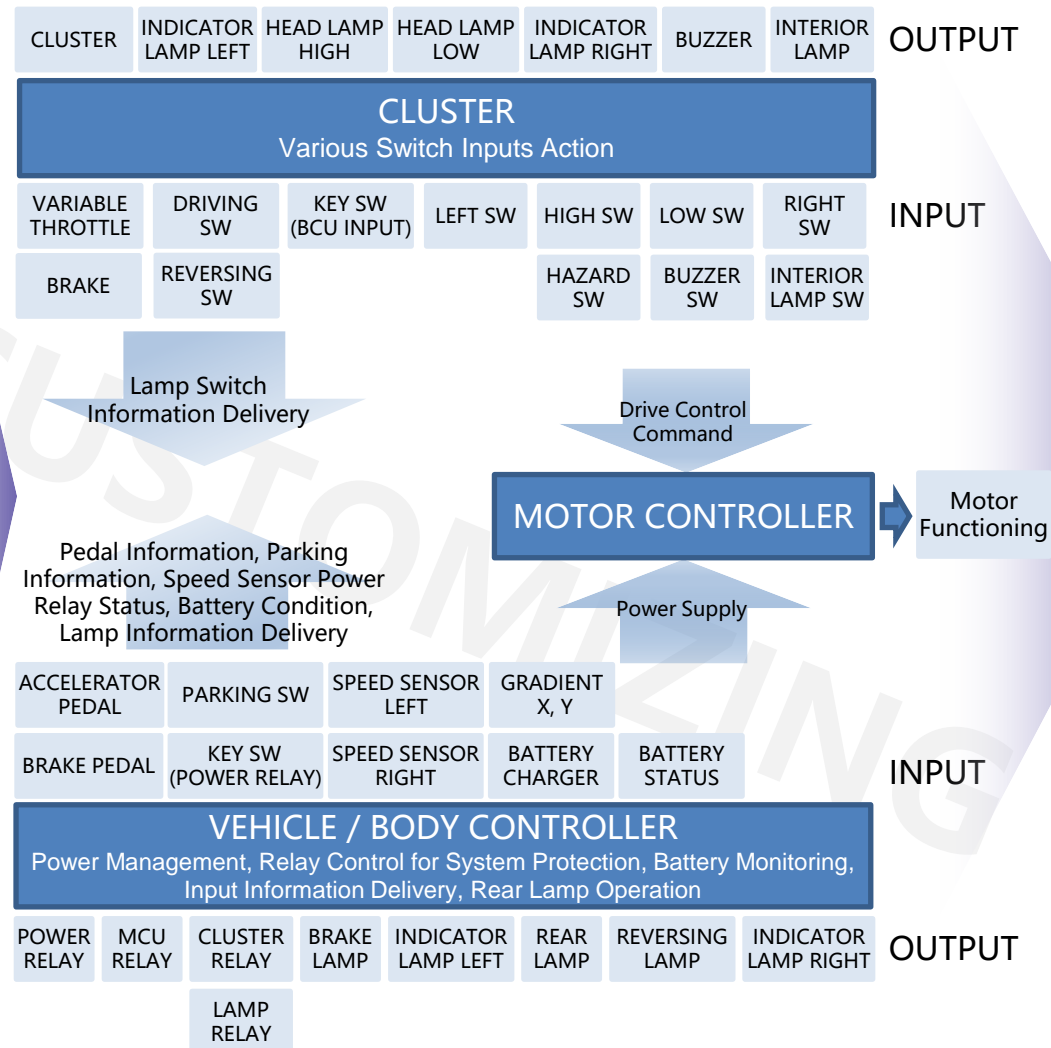
Lead Acid Battery  
Lithium-ion Battery

## Communication System

CAN  
Others

## Other Functions

Multimedia  
Cluster  
Communication module





**T**HANK YOU