

## PMSM Controller HA2X Family



## Key Features

- On-site parameters setting & provide PC software
- Self-checking function after system power-on
- Energy regenerative braking
- Brake, cruise, and 3-modes speed selection port
- Integrate waterproof terminal port
- PWM output port
- High-current output port, to connect with relay & contactor
- Display port
- LED indication for operation and fault status
- Ultra-thin shape design, to be installed inside the vehicle easily

| MODEL           | Rated Voltage (DC)   | Peak Current |
|-----------------|----------------------|--------------|
| LBMC048152HA2XL | 24V/36V/48V          | 160A         |
| LBMC048202HA2XL | 24V/36V/48V          | 240A         |
| LBMC072152HA2X  | 48V/60V/72V          | 140A         |
| LBMC072202HA2X  | 48V/60V/72V          | 210A         |
| LBMC096202HA2X  | 48V/60V/72V /84V/96V | 150A         |

## Descriptions

• The product is the latest PMSM(Permanent Magnet Synchronous Motor) controller made by Wuxi Lingbo Electronic Technologies Co.,Ltd, which can output 1.5KW/2.0KW power. It's designed with FOC(Field Oriented Control) algorithm in which SVPWM is used to drive the power device so that it injects sinusoidal current to the three-phase of motor. Meanwhile, we use a 32-bit microprocessor which integrates the latest ARM core, it exhibits excellent operational capability and task processing ability. The system can handle several close loops which include torque, flux, speed loop and other high demands of real-time task operations at the same time. Through these control methods, the system can achieve the following performance: maximum torque control, constant power control, speed closed loop control and energy feedback control while braking. Compared with traditional DC motor (BLDC) controller, the PMSM controller has significant advantages as follows:

## Comfortable driving

• Direct torque control, smooth start-up, excellent acceleration performance, especially in medium and high speed stages, which approximates to the performance of fuel motorcycle.

## Smooth & Silent

• Vector control sinusoidal current injection and smooth motor output torque, which fully suppresses the low frequency noise caused by the fluctuations of motor torque.

## Flexible configuration

• Provide PC software(GUI), by which can configure hundreds of parameters, so will improve the flexibility of on-site application.

- Monitor the operating status in real-time.
- Have UART (standard equipment) or CAN BUS, Bluetooth communication interface (user option).
- Make the function interfaces of different types of products compatible.

## Perfect protection

• Have Signal integrity detection (e.g. motor interface signal, control signal, etc.).

- With Over-current protection, over or under voltage protection & over-heat protection.
- Provide motor temperature-control interface.

**Specifications**

| Maximum Ratings & Main parameters |                                     |       |               |       |                           |
|-----------------------------------|-------------------------------------|-------|---------------|-------|---------------------------|
| Rated Input Voltage               | 24V/36V/48VDC                       |       | 48V/60V/72VDC |       | 48V/60V/72V<br>/84V/96VDC |
| Rated Input Current               | 60A                                 | 80A   | 60A           | 80A   | 60A                       |
| Max Output Current                | 160A                                | 240A  | 140A          | 210A  | 150A                      |
| Rated Output Power                | 1.5KW                               | 2.0KW | 1.5KW         | 2.0KW | 2.0KW                     |
| Operating Temperature Range       | -20°C~100°C                         |       |               |       |                           |
| Storage Temperature Range         | -55°C~85°C                          |       |               |       |                           |
| Motor Control Mode                | FOC (Field Oriented Control)        |       |               |       |                           |
| Standby Power Consumption         | 20~40mA                             |       |               |       |                           |
| Max. Motor Speed Limitation       | Depended on Motor and configuration |       |               |       |                           |
| Driving Method                    | Direct Torque Control               |       |               |       |                           |

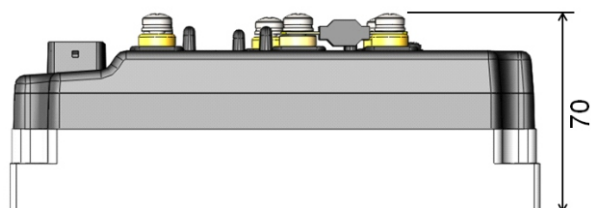
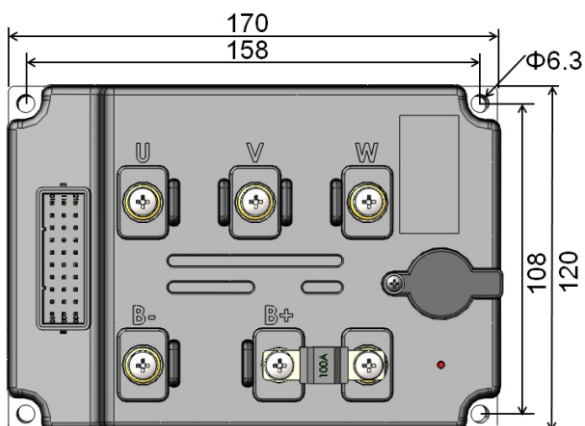
| System Protection Characteristics      |  | LED Blinking Times |
|--|--|--------------------|
| Over-voltage protection                | Battery voltage is higher than default value                     | 1                  |
| Under-voltage protection               | Battery voltage is lower than default value                      | 2                  |
| Motor over-current protection          | Motor phase is short-circuit or phase to ground is short-circuit | 3                  |
| Stalling protection                    | Motor stalling time is over default value                        | 4                  |
| Hall Sensor protection                 | Hall input is abnormal   | 5                  |
| MOSFET protection                      | MOSFET self-checking is abnormal                                 | 6                  |
| Phase winding disconnection protection | One of the motor phase is disconnected                           | 7                  |
| Self-checking error protection         | Self-checking is abnormal if internal system power-on            | 10                 |

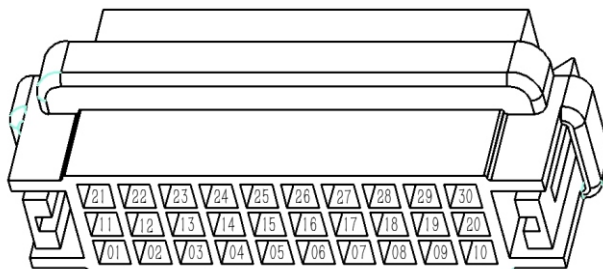
|                                    |   |    |
|------------------------------------|---|----|
| Controller over-heat protection    | Controller operation temperature is higher than default value | 11 |
| Throttle protection                | Throttle input is abnormal                                    | 12 |
| Motor over-heat-protection         | Motor Temperature is higher than the value of configuration   | 13 |
| Throttle non-Idle state protection | Throttle is not in the idle state when System Power On        | 14 |
| Braking indication                 | Indicating Braking Mode                                       | 15 |

#### Communication Characteristics

|                         |  |
|-------------------------|--|
| UART Communication      | UART interface: parameter configuration and working state monitoring               |
| CAN Communication       | CAN interface: parameter configuration and working state monitoring                |
| Bluetooth Communication | Bluetooth wireless interface: parameter configuration and working state monitoring |
| LED Indicator           | Indicate current working or fault state  |

#### Dimension



**Connector Wiring**


| Terminal No. | Terminal Descriptions                        | Remarks                        |
|--------------|--|--------------------------------|
| 1            | NC/CANL                                      | CAN Bus L                      |
| 2            | NC/CANH                                      | CAN Bus H                      |
| 14           | Power Supply for Hall Sensor inside Motor    | Connected to Motor Hall Sensor |
| 13           | Hall Sensor U                                |                                |
| 12           | Hall Sensor V                                |                                |
| 11           | Hall Sensor W                                |                                |
| 21           | Ground                                       |                                |
| 9            | Power Supply for Digital stage of Controller | Power ON/Off                   |
| 10           | Power Supply for Digital stage of Controller | Power ON/Off                   |
| 16           | Low level braking input                      | Braking                        |
| 15           | High level braking input (+12V Input)        |                                |
| 26           | Throttle Ground                              | Throttle                       |
| 27           | Throttle Signal                              |                                |
| 28           | Throttle Power+                              |                                |
| 7            | Cruising Control (Active Low)                | Cruising                       |
| 5            | Ground                                       |                                |

| Terminal No. | Terminal Descriptions                  | Remarks            |
|--------------|--|--------------------|
| 17           | Reverse Control (Active Low)           | Reverse Control    |
| 5            | Ground                                 |                    |
| 20           | High Gear Input (or Button Input)      | 3-Gear Control     |
| 4            | Ground                                 |                    |
| 24           | Low Gear Input                         |                    |
| 23           | HALL Speed Shown On Display            | Display Indication |
| 19           | Reserved                               |                    |
| 6            | Reserved Ground                        |                    |
| 22           | Reserved Input                         |                    |
| 25           | Reserved Input                         |                    |
| 30           | Reserved Input                         |                    |
| 3            | Reserved (Motor Temperature Interface) |                    |
| 8            | Reserved OC Output (Max.500mA)         |                    |
| 18           | Reserved OC Output (Max.50mA)          |                    |
| 29           | Reserved 5V Output (Max.20mA)          |                    |