

Kelly Small Series/PM Motor Controller User's Manual

Devices Supported:

**KDS24050E
KDS24100
KDS24200
KDS24100E
KDS24200E
KDS36050E
KDS36100
KDS36200
KDS36100E
KDS36200E
KDS48050E
KDS48100
KDS48200
KDS48100E
KDS48200E
KDS72050E
KDS72100
KDS72100E
KDS72200
KDS72200E**

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Chapter 1 Introduction

1.1 Overview

The manual introduces Kelly motor controllers' features, installation and maintenance. Read the manual carefully and thoroughly before using the controller. If you have any questions, please contact the support center of Kelly Controls, LLC.

Kelly's small series/PM motor controllers provide efficient, smooth and quiet controls for electrical tricycle, electric motorcycle, pump motor, and industry motor speed control. It uses high power MOSFET, synchronous rectification, fast PWM to achieve high efficiency.

Chapter 2 Main Features and Specifications

2.1 General functions

- (1) Extended fault detection and protection. LED flashing code indicates fault source.
- (2) Monitoring battery voltage. Stop driving if battery voltage is too high or too low.
- (3) Built-in current loop and over current protection.
- (4) Motor temperature input and protection. Configurable range.
- (5) Cutting back current at low temperature and high temperature to protect battery and controller. The current will ramp down quickly if controller's temperature is higher than 90°C, and shut down at 100°C. Low temperature current ramping down usually starts at 0°C.
- (6) Configurable to limit max reverse speed to half of max forward speed
- (7) 0-5V throttle input.

2.2 Features

- Provide power supply (5V) for hall sensors and other sensors.
- High current metal bar
- Small size
- Easy to use
- Used with PM or series motor
- Low cost
- Super high efficiency "E" model available
- Intelligence with powerful microprocessor.
- Synchronous rectification, ultra low drop, and fast PWM to achieve very high efficiency.
- Voltage monitoring on voltage source 12V and 5V.
- Current control loop.
- Hardware over current protection.
- Support torque mode operation.
- Low EMC.
- Battery protection: current cutback, warning and shutdown at configurable high and low battery voltage.
- Rugged aluminum housing for maximum heat dissipation and harsh environment.
- Rugged high current terminals, and rugged aviation connectors for small signal.
- Thermal protection: current cut back, warning and shutdown on high temperature.
- Configurable high pedal protection: Disable operation if power up with high throttle.

2.3 Specifications

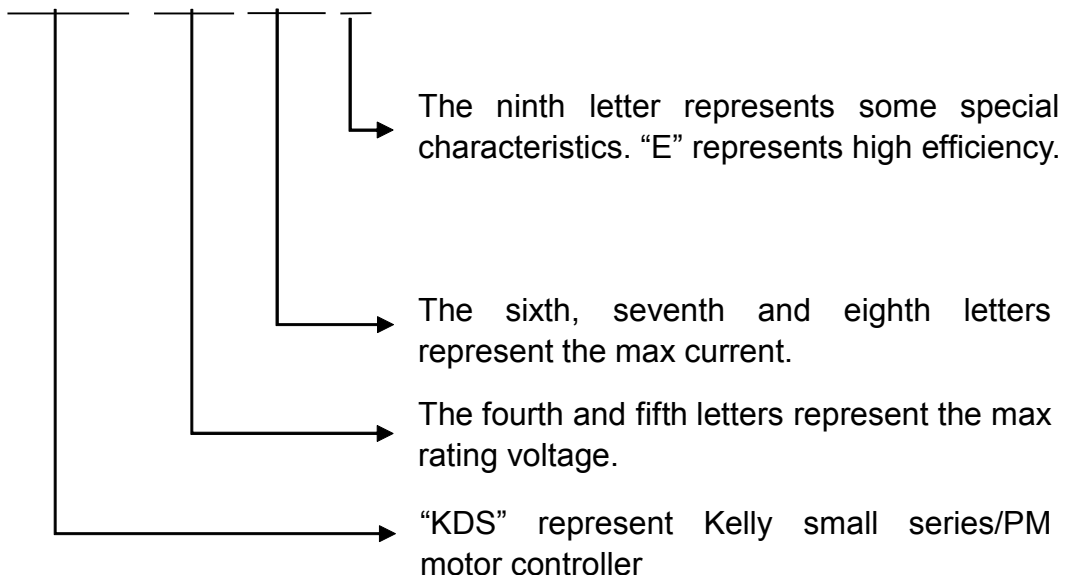
- Main Contactor Coil Drive, 2A.
- 5V Supply Output, 30mA.
- Frequency of Operation: 16.6kHz.
- Standby Current: less than 3mA.
- Standard Throttle Input: 0-5 Volts(3-wire resistive pot), 1-4 Volts(hall active throttle).
- Meter/Alarm output: 100mA.
- Full Power Operating Temperature Range: 0°C to 50°C (controller case temperature).

- Operating Temperature Range: -30°C to 90°C, 100C shutdown (controller case temperature).
- Peak Current, 1 minute: 50- 200A, depending on the model.
- Continuous current: 30-120A, depending on the model.

2.4 Models

The naming regulations of the motor controller model:

KDS36200E



Kelly Small DC Motor Controller			
Model	1 Minute Current(Amp)	Continuous Current(Amp)	Voltage(Volt)
KDS24050E	50	30	12-24
KDS24100	100	40	12-24
KDS24200	200	80	12-24
KDS24100E	100	60	12-24
KDS24200E	200	120	12-24
KDS36050E	50	30	24-36
KDS36100	100	40	24-36
KDS36200	200	80	24-36
KDS36100E	100	60	24-36
KDS36200E	200	120	24-36
KDS48050E	50	30	24-48
KDS48100	100	40	24-48
KDS48200	200	80	24-48
KDS48100E	100	60	24-48
KDS48200E	200	120	24-48
KDS72050E	50	30	24-72
KDS72100	100	40	24-72
KDS72100E	100	60	24-72
KDS72200	200	80	24-72
KDS72200E	200	120	24-72

- 1.24V model: range of the max operating voltage is 8-30V.
- 2.36V model: range of the max operating voltage is 18-45V.
- 3.48V model: range of the max operating voltage is 18-60V.
- 4.72V model: range of the max operating voltage is 18-90V.

Chapter3 Wiring and Installation

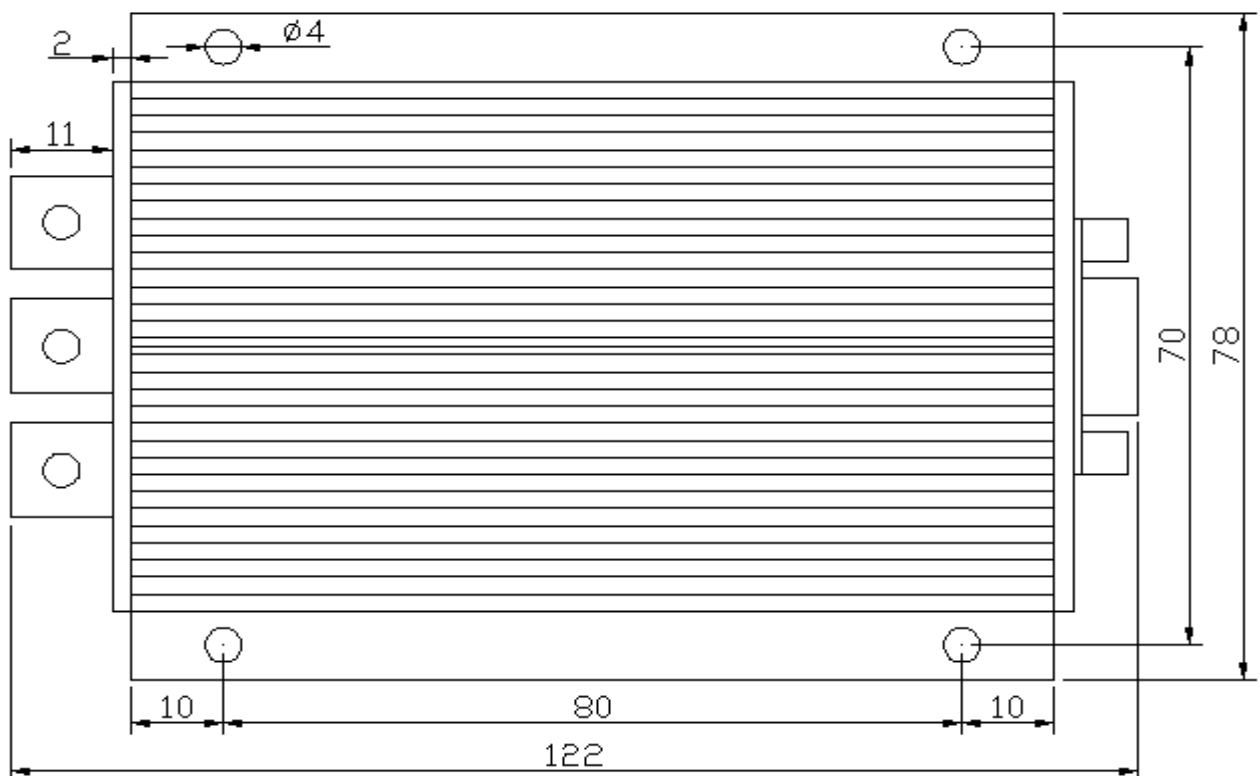
3.1 Mounting the Controller

The controller can be oriented in any position as clean and dry as possible, or shield with a cover to protect it from water and contaminants.

To ensure full rated output power, the controller should be fastened to a clean, flat metal surface with four screws. A thermal joint compound can be used to improve heat conduction from the case to the mounting surface. The case outline and mounting holes' dimensions are shown in Figure 1.

Caution:

- **RUNAWAYS** — Some conditions could cause the motor to run out of control. Disconnect the motor, or jack up the vehicle, and get the drive wheels off the ground before attempting any work on the motor control circuitry.
- **HIGH CURRENT ARCS** — Electric vehicle batteries can supply very high power, and arcs can occur if they are short circuit. Always turn off the battery circuit before working on the motor control circuit. Wear safety glasses, and use properly insulated tools to prevent short circuit.



Tall: 41mm

Figure 1: mounting holes' dimensions (dimensions in millimeters)

3.2 Connections

3.2.1 Front Panel of Serial or PM Motor Controller:

3 metal bars are provided for connecting to the battery and motor in the front of the controller shown as Figure 2.

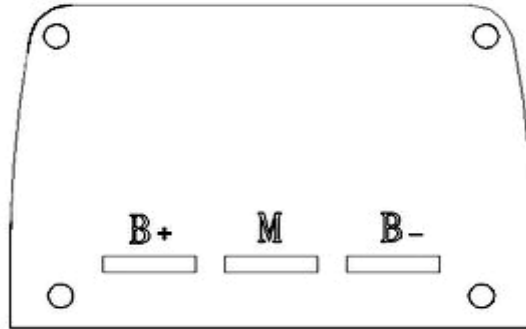


Figure 2: Front panel of Serial or PM Motor Controller

M: output to armature negative

B+: battery positive and armature positive

B-: battery negative

Caution: Make sure all connections are correct before applying power. Otherwise it may damage the controller! Please securely wire B- before applying power. It's preferred to place contactor or breaker on B+. Please place precharge resistor on any breaker! It can cause damage without it!!!

3.2.2 Back Panel of Serial or PM Motor Controller:

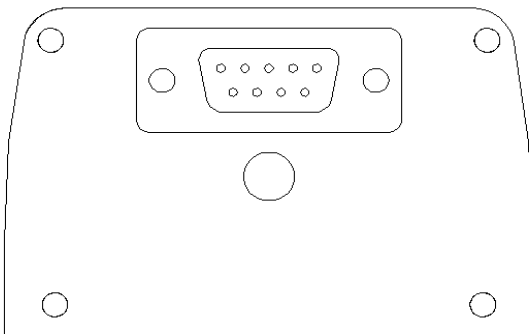


Figure 3: Back Panel and SCI Port

A SCI port is provided to communicate with RS232 of host computer for calibration and configuration. Please note only a special SCI Converter provided by Kelly Controls can be used. Please use straight RS232 cable to connect with PC

Download and setup the configuration software:

<http://www.kellycontroller.com/support.php>



Figure 4: SCI Converter

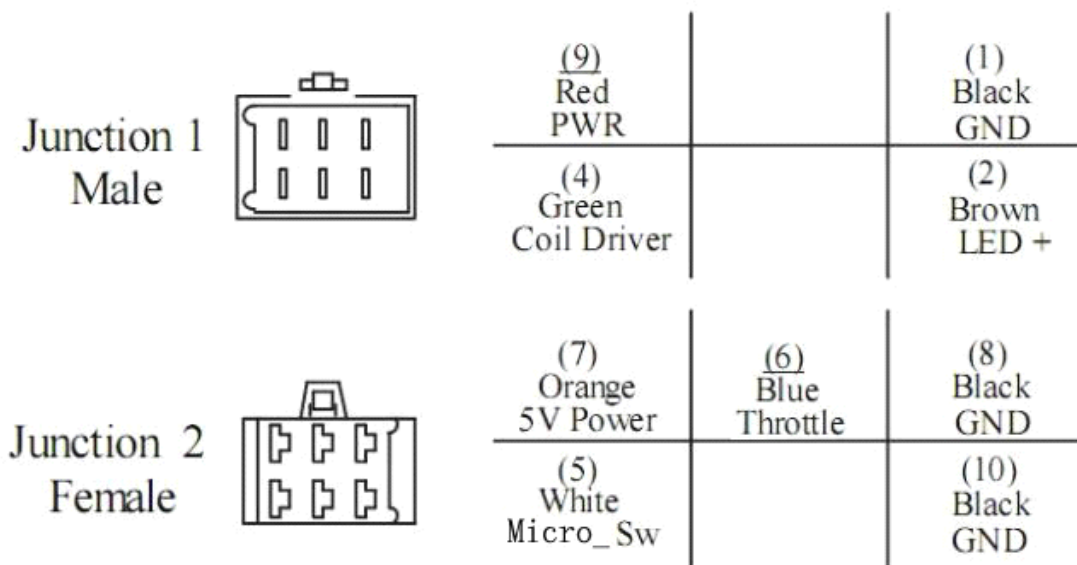


Figure 5: Definition of Controller's junction

(9)PWR(red): Controller power supply, usually to key switch.

(1)GND(black): LED cathode and sensor return.

(4)Contactor Coil Driver(green): It's a low side driver. Please use PWR as the coil high side.

(2)LED(brown): To anode of LED.

(7)Throttle 5V power source(orange): 0-5V throttle power input.

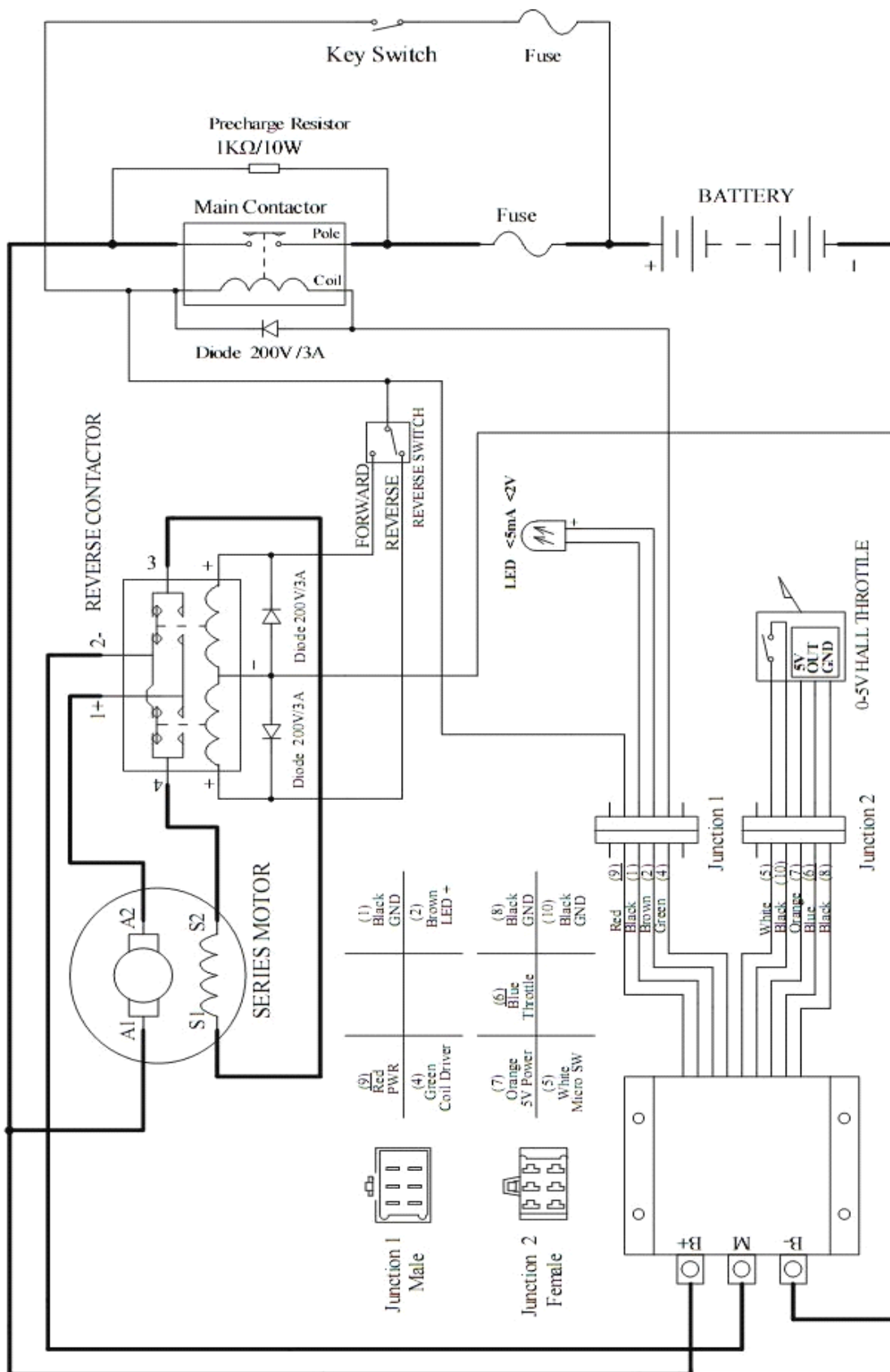
(6)Throttle(blue): 0-5V throttle input.

(8)GND(black): TPS return and switch ground.

(5)Micro_SW (white): Close to GND to activate. Default as throttle switch.

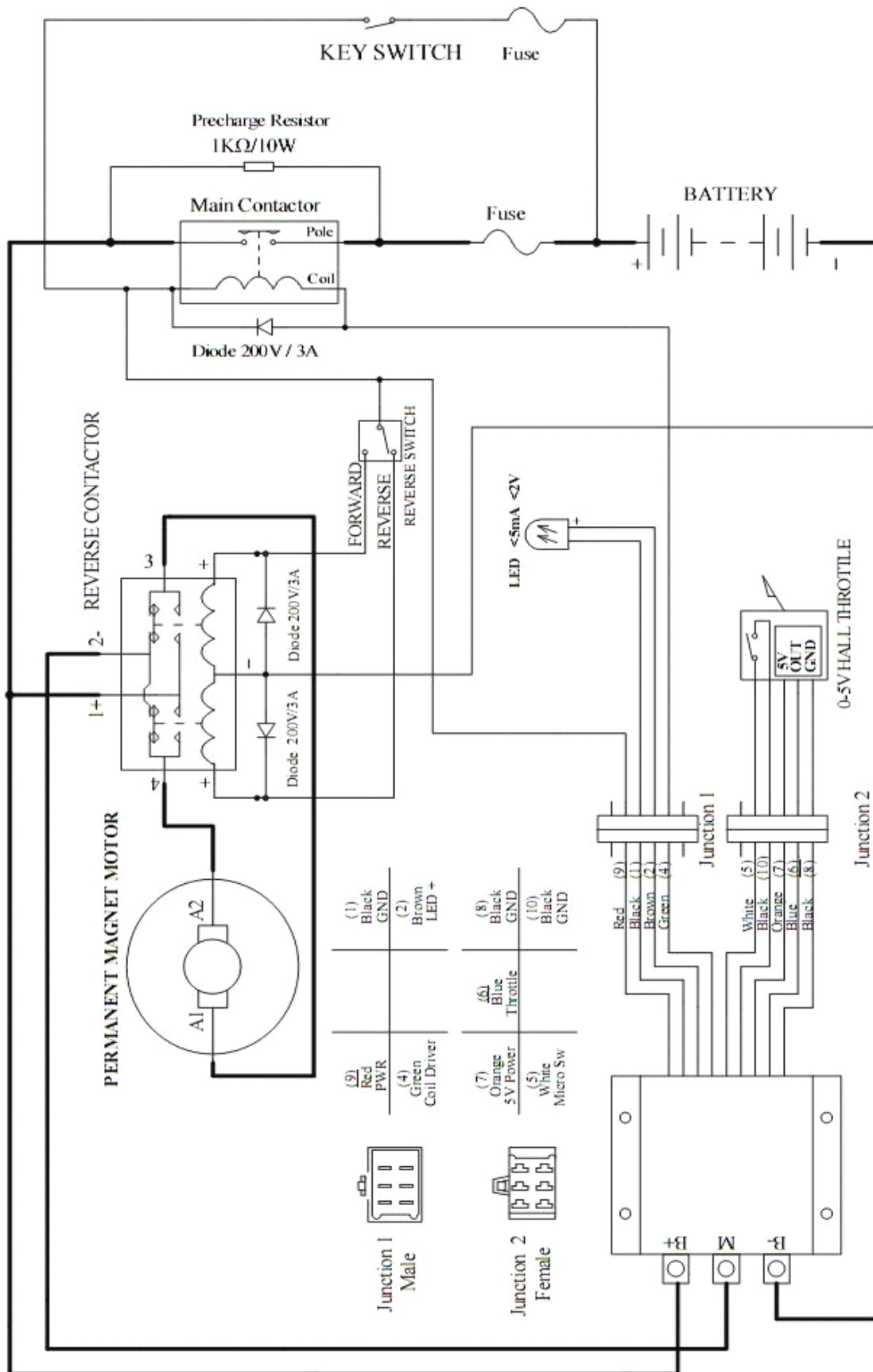
Notes: All of the above GND pins are internally connected.

3.2.3 Standard Wiring of Series and PM Motor Controller



NOTE: Potentialmeter can be used to output 0-5V.
Please securely wire B- before any other wiring. Never put contactor or break on B-.

Figure 6: Series motor controller standard wiring



NOTE: Potentiometer can be used to output 0-5V.
Please securely wire B- before any other wiring. Never put contactor or break on B-

Figure 7: PM motor controller standard wiring

3.3 Installation Checkout

Before operating the motor, complete the following checkout procedures. Use LED code as a reference. The LED codes are listed in Table 1.

Caution:

- Put the vehicle up on blocks to get the drive wheels off the ground before beginning these tests.
- Do not allow anyone to stand directly in front of or behind the vehicle during the checkout.
- Make sure both the PWR switch and the brake are off.
- Use well-insulated tools.

- Make sure the wire is connected correctly.
- Turn the PWR switch on. The LED should blink, then keep on when the controller operates normally. If this does not happen, check continuity of the PWR switch circuit and B-connection.
- The fault code will be detected automatically at restarting.
- Close the switch and operate the throttle. The motor should spin. If it does not operate, check the voltage at controller terminals. The motor should run faster with increasing throttle. If not, refer to Table 1 LED code, and correct the fault according to the code.

Chapter 4 Maintenance

There are no user-serviceable parts inside the controllers. Do not attempt to open the controller, or you will damage it. However, clearing the controller exterior periodically should be necessary.

The controller is inherently a high power device. Proper safety precautions should be taken before any work. These include, but are not limited to, proper training, wearing eye protection, avoiding loose clothing and jewelry, and using insulated tools.

4.1 Cleaning

Although the controller requires actually no maintenance after properly installed, the following minor maintenance is recommended in certain applications.

- Remove power by disconnecting the battery.
- Discharge the capacitors in the controller by connecting a load (such as a contactor coil or a horn) across the controller's B+ and B- terminals.
- Remove any dirt or corrosion from the bus bar area. The controller should be wiped down with a moist rag. Be sure it is dry before reconnecting the battery.
- Make sure the connections to the bus bars are tight. Use two wrenches for this task in order to avoid stressing the bus bars; the wrenches should be well insulated.

Table 1: LED CODES

LED Code		Explanation	Solution
Off	■■■■■	No power or no operating	<ol style="list-style-type: none"> 1. Check whether the connection is correct. 2. Check fuse and power supply switch.
On	□□□□□	Normal operating	That's great! You got solution!
1,2	■ ■■	Over voltage error	<ol style="list-style-type: none"> 1. Battery voltage is higher than max operating voltage of the controller. Please check the battery voltage. 2. The controller will attempt to clear the fault code automatically after 5 second if voltage returns to normal.
1,3	■ ■■■■	Low voltage error	<ol style="list-style-type: none"> 1. The controller will attempt to clear the fault code automatically after 5 second if voltage returns to normal. 2. Check the battery voltage. 3. Charge battery if necessary.
1,4	■ ■■■■	Temperature warning error	<ol style="list-style-type: none"> 1. When controller's temperature is over 90°C, the current will cut back threshold. Release or reduce throttle to ensure the temperature fall.
2,1	■■ ■	Throttle sensor fault	<ol style="list-style-type: none"> 1. Check whether the connecting is correct. 2. Check whether the throttle type is correct. 3. If configured 0-5V hall throttle, check whether the voltage is over 5V. 4. Whether connects to the front panel or the back panel conform to configured throttle type.
2,2	■■ ■■	Internal voltage fault	<ol style="list-style-type: none"> 1. Check whether the B+ and PWR voltage are correct. 2. Please check load on 5V supply. 3. The controller is damaged.
2,3	■■ ■■■	Over temperature error	<ol style="list-style-type: none"> 1. When controller's temperature is over 100°C, it will stop driving in order to protect itself. 2. Stop driving and wait for temperature fall. Once temperature falls below 80 °C the controller will restart driving.
2,4	■■ ■■■■	Throttle error at power-on	<ol style="list-style-type: none"> 1. The throttle outputs non-zero signal at power on 2. Step on throttle while turn power on. Then the fault is recoverable.
3,1	■■■ ■	The controller resets frequently	<ol style="list-style-type: none"> 1. The fault will disappear after restarting.
3,2	■■■ ■■	Internal reset	Reset caused by over current or so. It is normal if occurring occasionally.

The LED flashes once at power on, then keeps on for normal operation. "1, 2" means it flashed once, then flashes twice after 0.5 second. The time between two flashes is 0.25 second. The pause time between one error code and another error code is 1 second.

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