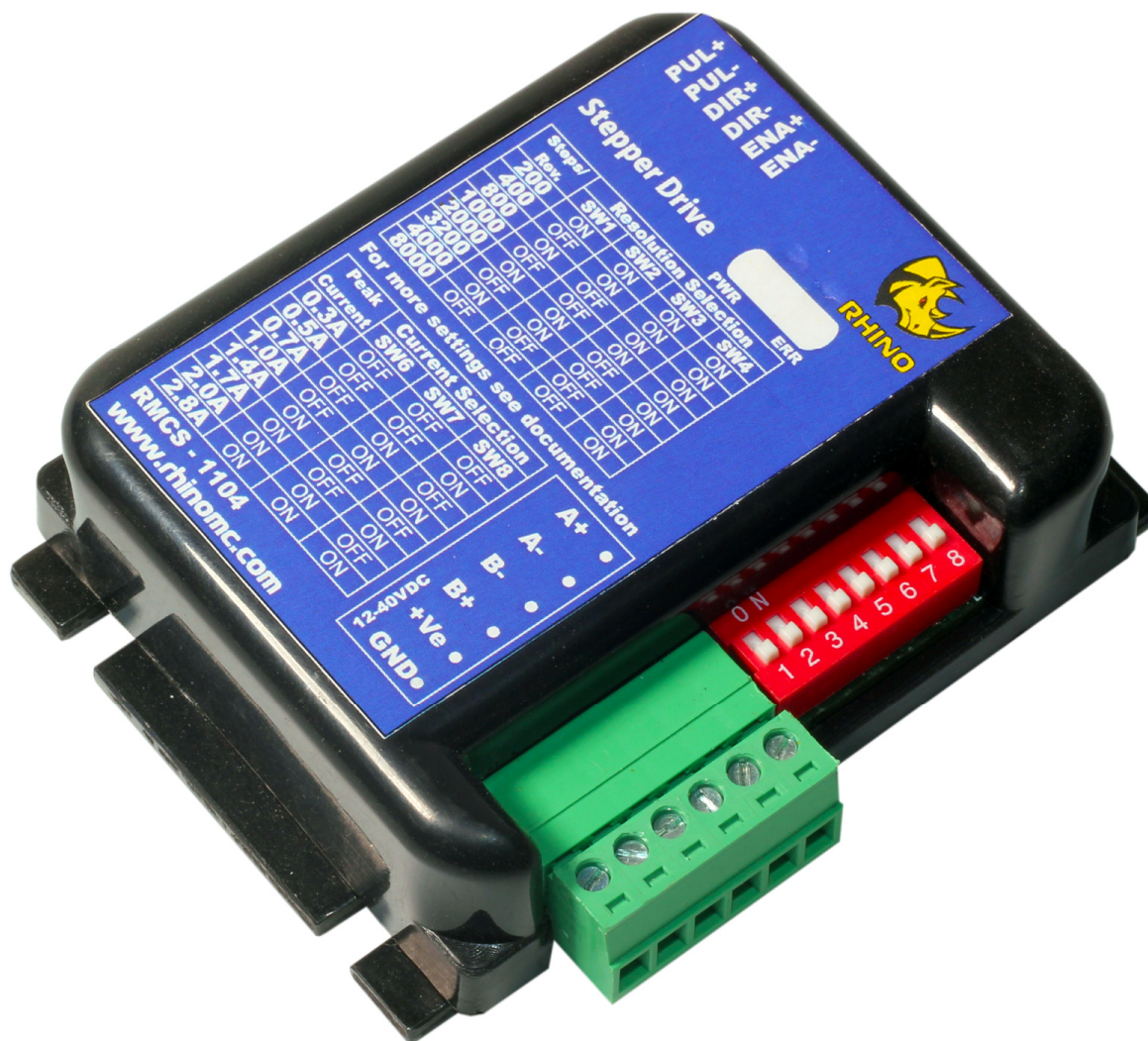


# RHINO MOTION CONTROLS

RMCS-1104  
Micro-Stepping Motor Driver  
(Max. 40Vdc and 3A per phase)



## Installation Manual and Datasheet

<http://www.rhinomc.com>

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## Key Features

- Smooth and quiet operation at all speeds and extremely low motor heating
- Industrial grade performance for 2-Phase Bipolar and Uni-polar Stepper Motors
- Input supply voltage from 15VDC to 40VDC
- Selectable peak coil current from 0.25A to 2.8A
- Selectable half-current during motor standstill to further reduce motor heating
- Selectable micro-steps up to 20000 steps per rotation for a 1.8deg stepper motor
- Higher motor torque and higher speeds achievable due to advanced loop control algorithm
- PULSE, DIRECTION and ENABLE inputs with 2-wire opto-isolated interface
- Short-circuit protection for the motor outputs, over-voltage and under-voltage protection
- LED indication for power and error states

## Description

Thank you for purchasing RMCS-1104, Stepper Motor Driver. RMCS-1104 is Rhino Motion Controls low-cost but advanced micro-stepping drive designed for smooth and quiet operation without compromising on torque and control at higher speeds. It has short-circuit protection for the motor outputs, over-voltage and under-voltage protection and will survive accidental motor disconnects while powered-up.

The RMCS-1104 achieves micro-stepping using a synchronous PWM output drive and high precision current feedback and this is absolutely silent when the motor is stopped or turning slowly. It virtually eliminates stopped-motor heating regardless of power supply voltage.

The RMCS-1104's closed-loop control gains are calibrated on start-up based on motor characteristics and also adjusted dynamically while the motor is in motion. This control algorithm makes it capable of achieving better torque at higher speeds in comparison to comparable drives in its range.

The PULSE/STEP, DIRECTION inputs are optically isolated. Both inputs work with 2.5V, 3.3V or 5V logic drive signals. The input drive current is 5mA at 2.5V so almost all logic family (74LS, 74HC, etc.) can be used to drive these inputs. Each input provides individual anode and cathode connections to the opto-isolator allowing for multiple input drive interfaces.

The RMCS-1104 stepper motor drive is warranted to be free of manufacturing defects for six months from the date of purchase. Please see the section on service, support and warranty at the end of this document.

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**Micro-Stepping Motor Driver [RMCS-1104]**

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## Technical Specifications

| Specification          | Min  | Max | Units    | Comments                              |
|------------------------|------|-----|----------|---------------------------------------|
| Supply Voltage         | 12   | 40  | Volts DC | Between +Ve and GND                   |
| Phase Current          | 0.25 | 2.8 | Amps     | As per switch selection table         |
| Auto Current Reduction | 50%  | 70% | —        | Motor stand-still for more than 100ms |
| Power Dissipation      | 0    | 5   | Watts    | —                                     |
| Short-Circuit Current  | 3    | 5   | Amps     | In case of motor terminal short       |
| PUL and DIR Voltage    | 2.5  | 7   | Volts DC | Between + and – input pins            |
| Ambient Temp.          | 0    | 70  | Celsius  |                                       |
| Humidity               | 0    | 95% |          | Non condensing                        |
| Step Frequency         | —    | 200 | kHz      |                                       |
| Direction Setup time   | 500  | —   | ns       | Steps is clocked on positive edge     |

## Mechanical Specifications

| Specification          | Details                             |
|------------------------|-------------------------------------|
| Dimensions (L * W * H) | 67mm * 56mm *15mm                   |
| Weight                 | 50gms                               |
| Heat Sink              | PCBA only, Heat Sink Plate optional |
| Mounting Screw Holes   | 3.6 mm maximum diameter             |

## Caution

- Read this document carefully before installing and using you drive
- Inputs voltage to the drive must not exceed the maximum of 50VDC or it may damage the drive
- Reversing polarity power supplied to the drive will damage the drive or power supply
- Connecting the power supply wires to the terminals outputs of the motor coils will damage the drive
- Short-circuiting the motor terminals to +Ve power or to each other or to GND may damage the drive
- Excess humidity or condensation on the drive may damage the drive
- Voltage in excess of 7V between the PULSE+ and PULSE- or DIR+ and DIR- input terminals may damage the opto-isolators
- Reverse voltage in excess of 7V between the PULSE- and PULSE+ or DIR- and DIR+ input terminals may damage the opto-isolators
- Heat sink is designed to dissipate heat from the drive circuitry as long as the ambient temperature is less that 70 degrees Celsius. Ambient temperature in excess of that may damage the drive
- Do not un-plug the terminals of the motor while the drive is powered up and running

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## Power and Motor Terminal Assignments

| Terminal No. | Terminal Name | Description                             |
|--------------|---------------|---|
| Terminal 1   | GND           | Power Ground or Power -Ve               |
| Terminal 2   | +V            | Power +Ve (15VDC to 40VDC Max wrt. GND) |
| Terminal 3   | A+            | Motor Coil Phase A+                     |
| Terminal 4   | A-            | Motor Coil Phase A-                     |
| Terminal 5   | B+            | Motor Coil Phase B+                     |
| Terminal 6   | B-            | Motor Coil Phase B-                     |

## Pulse, Direction and Enable Input Assignments (White Connector)

| Terminal No. | Terminal Name | Description  |
|--------------|---------------|--|
| Terminal 1   | ENA-          | Enable -Ve signal connected to cathode of opto-isolator        |
| Terminal 2   | ENA+          | Enable +Ve signal connected to anode of opto-isolator          |
| Terminal 3   | DIR-          | Direction -Ve signal connected to cathode of opto-isolator     |
| Terminal 4   | DIR+          | Direction +Ve signal connected to anode of opto-isolator       |
| Terminal 5   | PUL-          | Step or Pulse -Ve signal connected to cathode of opto-isolator |
| Terminal 6   | PUL+          | Step or Pulse +Ve signal connected to anode of opto-isolator   |

## Switch Selection Table for Motor Coil Current Setting

| Peak Current | SW6 | SW7 | SW8 |
|--------------|-----|-----|-----|
| 0.25A        | OFF | OFF | OFF |
| 0.50A        | OFF | OFF | ON  |
| 0.70A        | OFF | ON  | OFF |
| 1.00A        | OFF | ON  | ON  |
| 1.40A        | ON  | OFF | OFF |
| 1.70A        | ON  | OFF | ON  |
| 2.00A        | ON  | ON  | OFF |
| 2.80A        | ON  | ON  | ON  |

Switch (6-8): (Sets the max current per phase)

Peak Current = RMS Current \* 1.4

Switch in downward positions is ON

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# RHINO MOTION CONTROLS

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## Switch Selection Table for Step Resolution Setting

| Steps/Rev | SW1 | SW2 | SW3 | SW4 |
|-----------|-----|-----|-----|-----|
| 200       | ON  | ON  | ON  | ON  |
| 400       | OFF | ON  | ON  | ON  |
| 800       | ON  | OFF | ON  | ON  |
| 1000      | OFF | OFF | ON  | ON  |
| 2000      | ON  | ON  | OFF | ON  |
| 3200      | OFF | ON  | OFF | ON  |
| 4000      | ON  | OFF | OFF | ON  |
| 8000      | OFF | OFF | OFF | ON  |
| 1600      | ON  | ON  | ON  | OFF |
| 6400      | OFF | ON  | ON  | OFF |
| 10000     | ON  | OFF | ON  | OFF |
| 12000     | OFF | OFF | ON  | OFF |
| 12500     | ON  | ON  | OFF | OFF |
| 12800     | OFF | ON  | OFF | OFF |
| 16000     | ON  | OFF | OFF | OFF |
| 20000     | OFF | OFF | OFF | OFF |

Switch (1-4): (Sets the micro-steps per revolution)

Switch in position towards drive is ON

Switch (5): Sets Low Power Mode

SW5 ON - Half-Current when RPM < 1

SW5 OFF - Full-Current when RPM < 1

## Power Supply Selection

The general rule of thumb to get the most out of the motor is to drive it with a supply voltage that is at least 3 to 4 times its rated supply voltage. A DC regulated power supply with good low-ESR decoupling capacitors on its output is recommended for best performance of this drive.

## LED Status and Error Codes

There is a single LED on this drive for power and error status messages. In case the LED is blinking or flickering please check all connections and powered-down, wait for 5 seconds and then power-up the drive once again.

| LED State               | Message   |
|-------------------------|---|
| LED ON and steady       | Powered up and calibrated   |
| LED Flickering randomly | Error in pulse and direction input signals                                |
| LED blinking            | Short circuit on motor terminals or drive damaged due to connection error |

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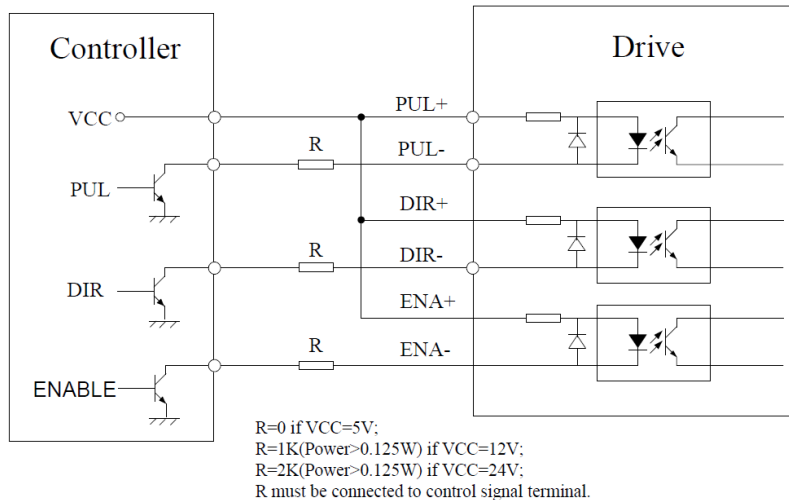


## Guide to General Problems

| Problem Symptom   | Possible Reasons and Solutions  |
|---|---|
| Motor is not rotating                                   | Drive is not powered up<br>Motor is not connected properly to the drive<br>Drive is in an error state, check LED status<br>Pulse and Direction inputs are not connected properly or are not supplying enough current  |
| Motor rotates in the wrong direction<br>LED is blinking | Motor Phase connections may be reversed<br>Check LED status messages in this document and check connections and voltages accordingly  |
| Drive is not powering up (no LED)                       | Drive might be damaged due to incorrect installation or handling<br>Check that the connectors to the drive are tightly plugged in<br>Check the supply voltage is adequate and in correct polarity<br>Drive might be damaged due to incorrect installation or handling   |
| Erratic Motion on Motor                                 | Power supply voltage not stable or regulated<br>Motor Coil damaged or not connected to the drive correctly<br>Current setting on the motor too high<br>Control signals of Pulse or Direction are not connected properly or not supplying enough voltage and current<br>Control signal interference due to power supply or environmental noise |
| Motor stalls during accelerating                        | Motor load is too high<br>Acceleration is too high<br>Current setting is too low of the Motor<br>Power Supply is too low for Motor or Speed   |
| Excessive Motor or Drive Heating                        | Current is set too high for the Motor<br>Drive is damaged<br>Power supply voltage is too high<br>Not enough cooling or ventilation for motor or drive   |

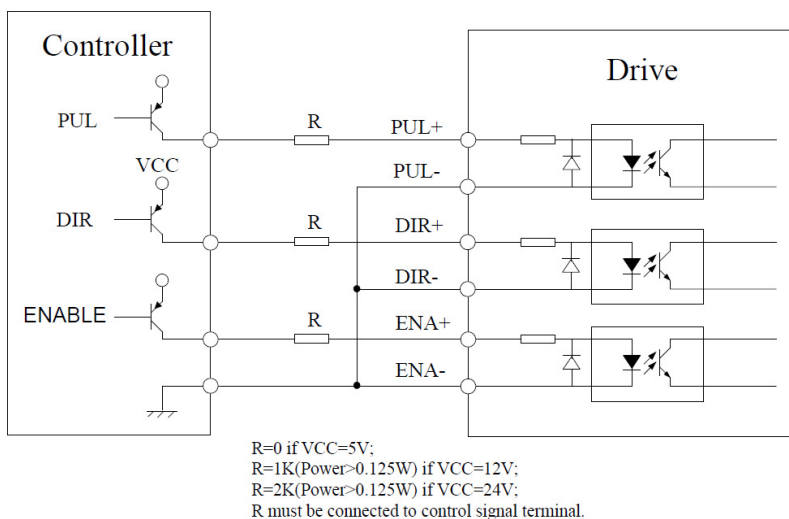
## Control Signal Connection NPN pull-down

In this connection technique all the signal +ve inputs are connected to a common high voltage VCC. The opto-isolators LED is turned-on by a pull-down on the -ve terminals by an NPN-transistor output



## Control Signal Connection PNP pull-up

In this connection technique all the signal -ve inputs are connected to a common low voltage GND. The opto-isolators LED is turned-on by a pull-up on the +ve terminals by a PNP-transistor output





# RHINO MOTION CONTROLS

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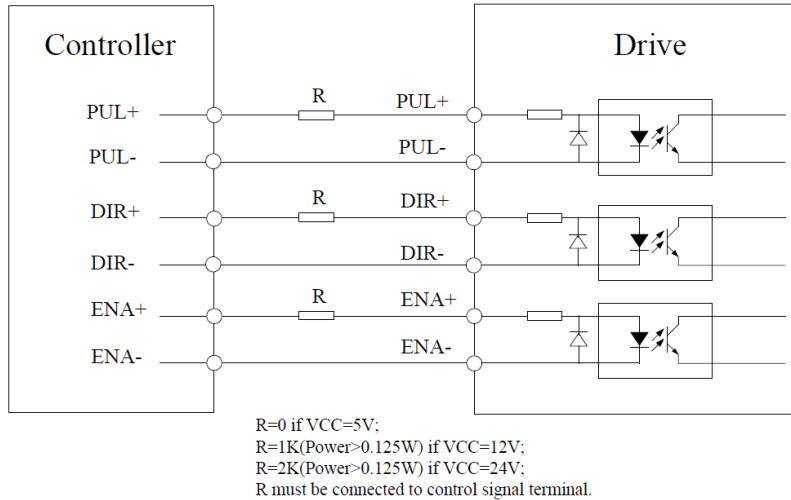
Micro-Stepping Motor Driver

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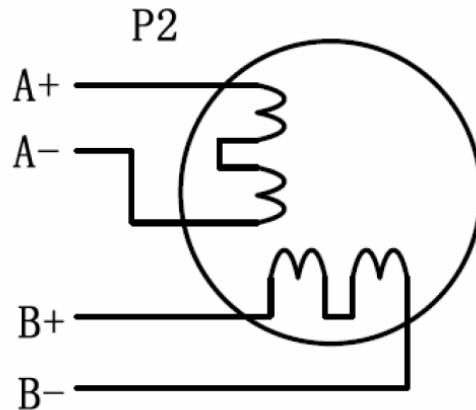
## Control Signal Connection Differential

In this connection technique each input is differential controlled and no necessity for a common voltage



## 2-phase, 4-lead Motors Connections

4 lead motors are the least flexible but easiest to wire. Speed and torque will depend on winding inductance. In setting the drive output current, multiply the specified phase current by 1.4 to determine the peak output current.



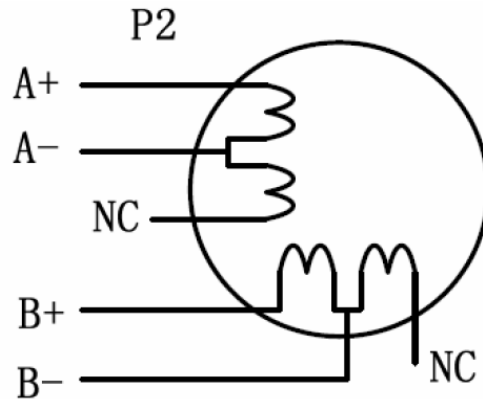
## 2 phase, 6-lead Motors Connections

Like 8 lead stepping motors, 6 lead motors have two configurations available for high speed or high torque operation. The higher speed configuration, or half coil, is so described because it uses one half of the motor's inductor windings. The higher torque configuration, or full coil, uses the full windings of the phases.



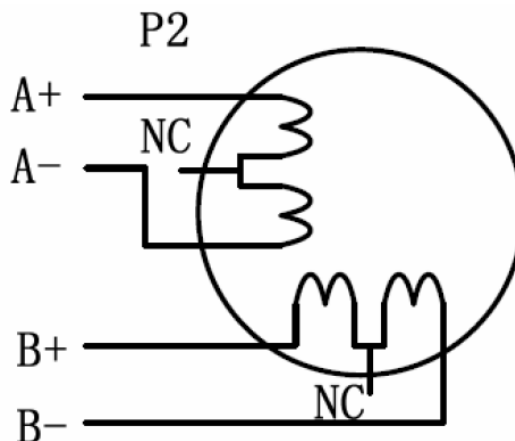
## Half Coil Configurations

As previously stated, the half coil configuration uses 50% of the motor phase windings. This gives lower inductance, hence, lower torque output. Like the parallel connection of 8 lead motor, the torque output will be more stable at higher speeds. This configuration is also referred to as half chopper. In setting the drive output current multiply the specified per phase (or uni-polar) current rating by 1.4 to determine the peak output current.



## Full Coil Configurations

The full coil configuration on a six lead motor should be used in applications where higher torque at lower speeds is desired. This configuration is also referred to as full copper. In full coil mode, the motors should be run at only 70% of their rated current to prevent over-heating.

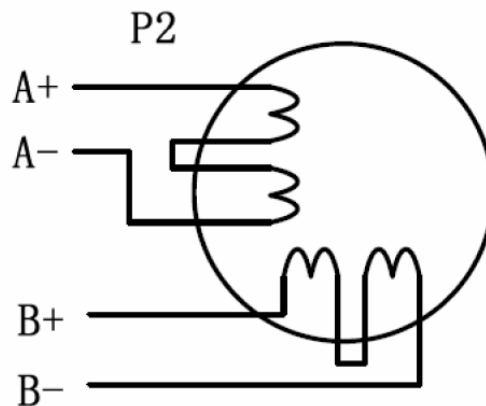


## 2 phase, 8-lead Motors Connections

8 lead motors offer a high degree of flexibility to the system designer in that they may be connected in series or parallel, thus satisfying a wide range of applications.

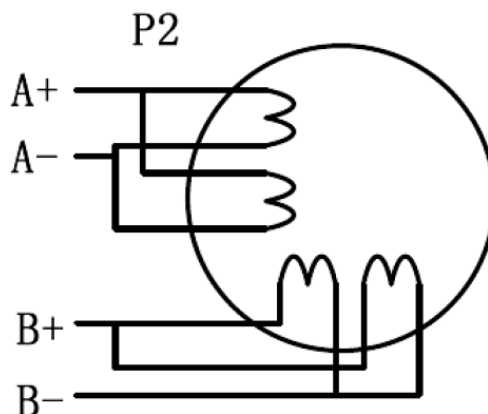
### Series Connections

A series motor configuration would typically be used in applications where a higher torque at lower speeds is required. Because this configuration has the most inductance, the performance will start to degrade at higher speeds. In series mode, the motors should also be run at only 70% of their rated current to prevent over-heating.



### Parallel Connections

An 8 lead motor in a parallel configuration offers a more stable, but lower torque at lower speeds. But because of the lower inductance, there will be higher torque at higher speeds. Multiply the per phase (or unipolar) current rating by 1.96, or the bipolar current rating by 1.4, to determine the peak output current.



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## Service and Support

Service and support for this product are available from the Rhino Motion Controls Web site (<http://www.rhinomc.com>) and our customer service email: [info@rhinomc.com](mailto:info@rhinomc.com)

## Six-Month Warranty

Rhino Motion Controls ([rhinomc.com](http://rhinomc.com)) warrants its products against defects in materials and workmanship for a period of 6 months from shipment delivery. During the warranty period, Rhino Motion Controls will either, at its option, repair or replace products which proved to be defective.

## Exclusions

The above warranty does not extend to any product damaged by reasons of improper or inadequate handlings by customer, improper or inadequate customer wirings, unauthorized modification or misuse, or operation beyond the electrical specifications of the product and/or operation beyond environmental specifications for the product.

## Obtaining Warranty Service

To obtain warranty service, please contact our customer service department at [info@rhinomc.com](mailto:info@rhinomc.com) before returning product for service. Please make sure that you have gone through this entire installation manual and datasheet before deciding that your product is liable for replacement or repair under this 6-month warranty. Customer shall prepay shipping charges for products returned to Rhino Motion Controls for warranty service, and Rhino Motion Controls shall pay for return of products to customer.

## Warranty Limitations

Rhino Motion Controls makes no other warranty, either expressed or implied, with respect to the product. Rhino Motion Controls specifically disclaims the implied warranties of merchantability and fitness for a particular purpose. Some jurisdictions do not allow limitations on how long and implied warranty lasts, so the above limitation or exclusion may not apply to you. However, any implied warranty of merchantability or fitness is limited to the 6-month duration of this written warranty.

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