



# Orangutan LV-168 Robot Controller

## Quick-Start Sheet

### Overview

The Pololu Orangutan LV-168 robot controller is a complete control solution for small robots powered by two or three NiMH cells (or similar batteries). The small module includes a powerful Atmel mega168 microcontroller, two channels of bidirectional motor control, an 8-character x 2-line liquid crystal display, a buzzer, and three user pushbutton switches. Eight general-purpose I/O lines with up to eight analog input channels allow for adding sensors or expanding the system.

The Orangutan LV-168 incorporates a step-up voltage regulator that generates 5 V from the lower input voltage, enabling the mega168 to run at its full speed of 20 MHz and allowing the use of sensors that require 5 V. Two discrete H-bridges using low-voltage MOSFETs allow efficient control of two bidirectional DC motors drawing up to 2 A each (continuously).

### Contacting Pololu

You can check the Pololu web site at <http://www.pololu.com/> for additional documentation of the Orangutan robot controllers, including datasheets, color pictures, application examples, and troubleshooting tips.

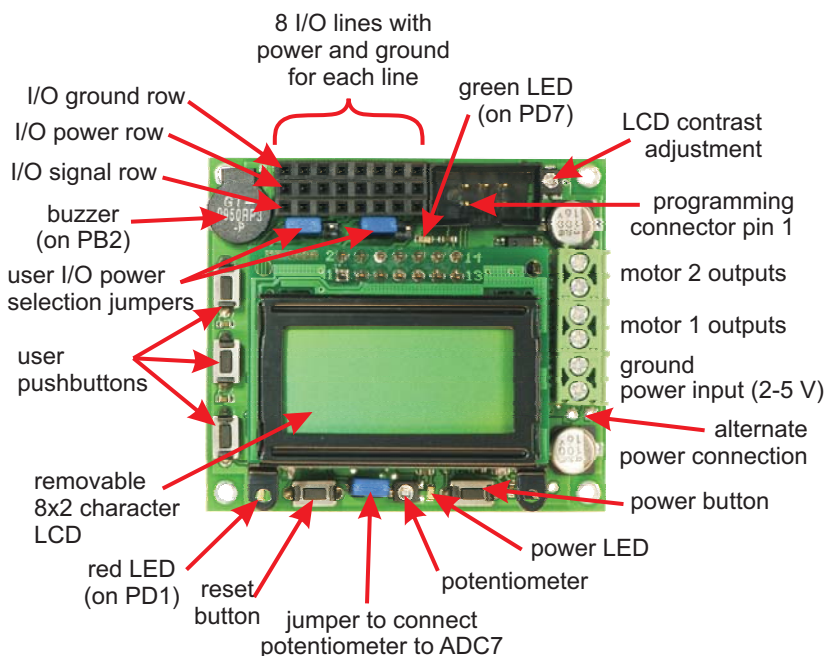
We would be delighted to hear from you about your project and about your experience with our product. You can contact us through our online feedback form or by email at [support@pololu.com](mailto:support@pololu.com). Please tell us what we did well, what we could improve, what you would like to see in the future, or anything else you would like to say!

### Programming the Microcontroller

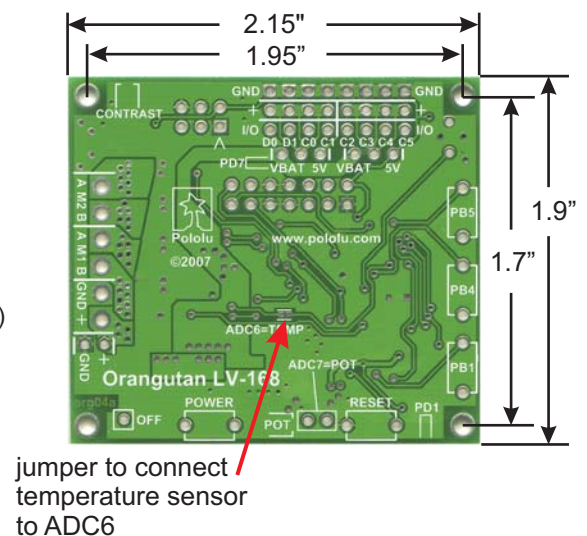
Orangutan LV-168 has a 6-pin programming connector on the upper right side; the robot controller is designed for an AVR ISP in-system programmer from Atmel or a compatible programmer, such as the Orangutan USB programmer available from Pololu. Pin 1 is the pin most toward the inside of the board.

### Orangutan LV-168 Layout

The main features of the Orangutan LV-168 module are labeled below. Most of the connections points are also indicated on the silkscreen on the back side of the PCB. The overall unit dimensions are 2.15" x 1.9", and four 0.086" mounting holes, suitable for #2 screws, are located 0.1" from the corners of the board (the top-left mounting hole is usually obscured by the buzzer).



back view of PCB



## Usage Notes

The power and motor connections are on the right side of the unit. The Orangutan LV-168 is designed to operate off of three NiMH cells, which corresponds to a voltage range of about 2.5–4.5 V. However, the unit can operate from two or four NiMH cells with some limitations. At lower voltages, the effectiveness of the motor drivers (H-bridges) will be reduced, and the 5 V step-up regulator's output current will be reduced. Beyond 5 V, the step-up regulator will cease operation and the input voltage will show up on the Vcc line; the components on the board can operate to 5.5 V, but some sensors you use might have a 5.25 V limit.

The eight user I/O lines each have associated power and ground connections for easy connections to sensors. The power connection can either be the direct battery voltage or the 5 V generated on the board; each bank of four power pins is connected to a selection jumper that controls the power setting for that bank. The total current available to the 5 V line is approximately 150 mA, but the exact amount depends on your input voltage.

The LCD, pushbuttons, and programming connector share I/O lines. To read the pushbuttons, the LCD lines must be in high-impedance mode (i.e. both the mega168 and the LCD should not be trying to write to the lines), with the internal pull-up resistors enabled. The Orangutan LV-168 is supplied with a removable 8x2 character LCD; a larger display can be connected instead with an appropriate cable.

The motor drivers can briefly deliver up to 5 A each, but each motor driver is protected by a 2 A resettable fuse that is triggered by excessive temperature. If the motors draw much more than 2 A for more than a few seconds, the voltage to the motors will be reduced, but normal operation will resume once the board has cooled down. An on-board temperature sensor can be connected to ADC6 for some (limited) feedback about the board temperature.

The motor drivers are controlled by the mega168's hardware PWM outputs on timers 0 and 2. One of those pins (PB3) is also used during programming as a SPI line (MOSI); the PWM line is gated with the reset line to prevent motor 2 from running during programming, but the PWM/SPI line multiplexing prevents usage of the hardware SPI port on the board.

## Orangutan LV-168 Schematic

