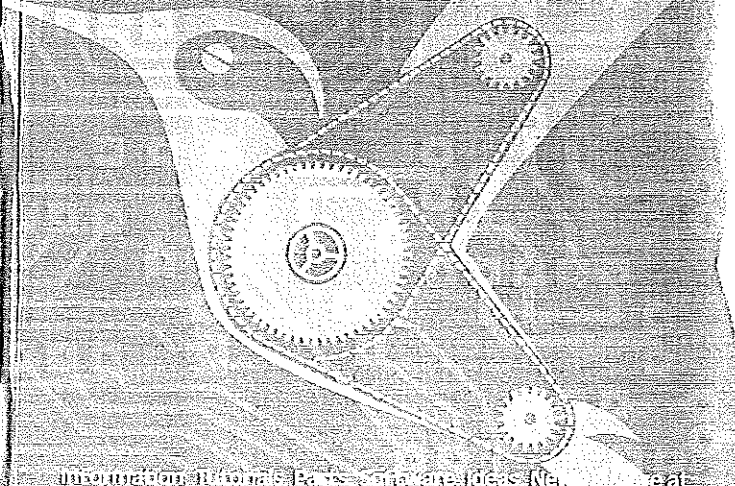


HUMMINGBIRD DUO USER GUIDE



Information | Manuals | Parts | Software | Accessories | Support

www.hummingbirdkit.com

Property of CA BOCES
ISS

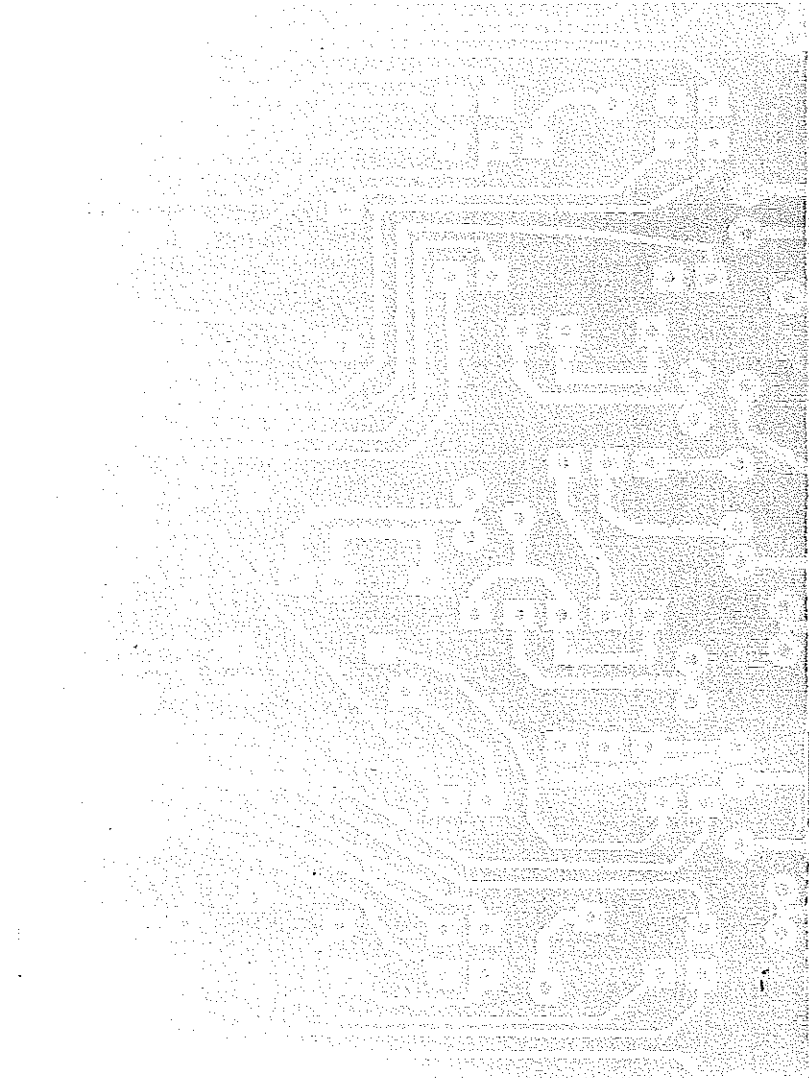


TABLE OF CONTENTS

	Warnings & Compliance
KIT	Kit Contents
BUILD	How to Build Your First Robot
CONNECT	Connecting Electronics
PROGRAM	Programming Your Bot!
NEXT	The Next Steps



BirdBrain Technologies LLC
1936 Fifth Ave, Pittsburgh, PA 15219
Phone: 888-371-6161 | Fax: 412-283-9134
www.hummingbirdkit.com
Email: support@hummingbirdkit.com

Hummingbird Duo controller made in Pittsburgh, USA. All other parts, packaging, and user manual made in China and/or the Philippines.

This product or portions thereof is manufactured under license from Carnegie Mellon University.

WARNINGS

The Hummingbird Robotics Kit is not a toy, adult supervision is required when used by children 13 and under.



CHOKING HAZARD: This product contains small parts. Not suitable for children under 3 years.

- Do not touch or hold any Hummingbird moving parts while they are operating.
- Keep non-kit conductive materials away from the Hummingbird controller.
- Always turn off the Hummingbird controller when you are done using it. Do not leave the controller powered and unattended.
- Hummingbird kit parts should never be used in or near any liquid or in any extremely hot or cold environments.
- Discontinue use of any Hummingbird parts that malfunction.

FCC COMPLIANCE

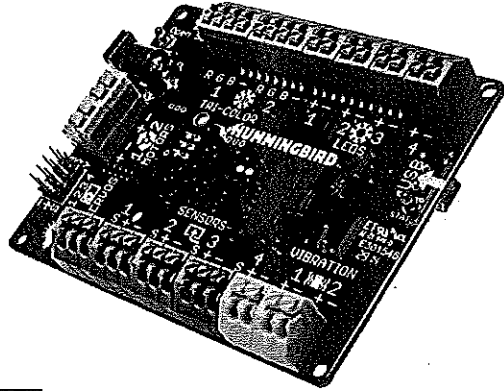
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate the device.

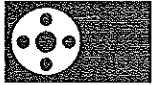


HUMMINGBIRD COMPONENTS



 Hummingbird Duo Controller

OUTPUT



Servo



DC Gear Motor



Vibration Motor



Single Color LED



Tri-Color LED

INPUT



Light Sensor



Temperature Sensor



Distance Sensor



Sound Sensor



Rotary Sensor

TOOLS & ACCESSORIES



5V/2A Power Supply



USB Cable



Servo Extension Cable



Terminal Tool



Standoffs





















Wheel Adapter



Plastic Block Adapter

KIT CONTENTS

Buy additional parts at hummingbirdkit.com/buy

Components		Controller	Base Kit	Premium Kit	Classroom Kit
	Duo Controller	x1	x1	x1	x4
	5V/2A Power Supply	x1	x1	x1	x4
	USB Cable	x1	x1	x1	x4
	Terminal Tool	x1	x1	x1	x4
	Standoff	x4	x4	x4	x16
	Single Color LED		x4	x4	x12
	Tri-Color LED		x2	x2	x8
	Servo		x2	x4	x10
	Servo Extension Cable		x1	x2	x6
	Gear Motor			x2	x4
	Wheel Adapter			x2	x4
	Plastic Block Adapter			x2	x4
	Vibration Motor			x2	x4
	Light Sensor		x1	x1	x4
	Temperature Sensor		x1	x1	x4
	Distance Sensor			x1	x2
	Sound Sensor			x1	x2
	Rotary Sensor			x1	x2
				5	6

A SMALL BOX IS A GREAT STARTING POINT FOR A SIMPLE, YET AMAZING FIRST ROBOT. ATTACH A SENSOR, TRI-COLOR LEDs AND A SERVO. ADD CRAFT MATERIAL AND YOUR IMAGINATION!

What You Need

1 Duo Controller 1 USB Cable 1 Power Supply

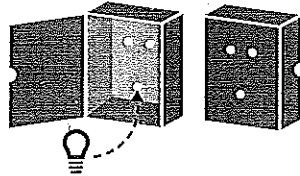
1 Light Sensor 2 Tri-Color LEDs 1 Servo

Other Materials: Box, scissors, ruler, utility knife, hot glue gun



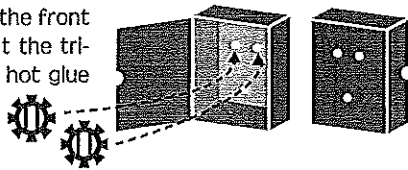
STEP 1 Attach Light Sensor

Cut out a hole in the front of the box and insert the sensor. Use hot glue to secure the parts. Remember to leave space for the wires to connect to the controller.



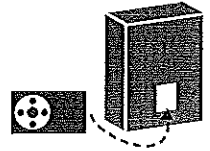
STEP 2 Attach Tri-Color LEDs

Cut out two holes in the front of the box and insert the tri-color LED lights. Use hot glue to secure the parts.



STEP 3 Attach Servo

Cut out a hole in the back of the box and insert the servo. Use hot glue to secure the parts. Make sure you have enough space around the perimeter to allow for the movable components.



TIP For a cleaner looking robot, place the Hummingbird Duo Controller inside the box and out of sight!

CONNECT & DECORATE YOUR ROBOT!






Connect all of your components to the Hummingbird Controller. Glue on fur or paint scales for an animal or imaginary monster. Add a tail with a popsicle stick or pipe cleaner and attach to the servo. Styrofoam balls make great eyes and diffuse LED light beautifully.



Get Inspired! Check out dozens of student-built robots and projects at our website: www.hummingbirdkit.com/learning/example-robots

EASY-TO-USE TERMINAL BLOCKS ALLOW YOU TO INSERT BARE WIRE DIRECTLY INTO THE TERMINAL WITHOUT THE NEED TO SOLDER OR CRIMP ON SPECIALTY CONNECTORS. JUST PRESS, INSERT WIRE & RELEASE.

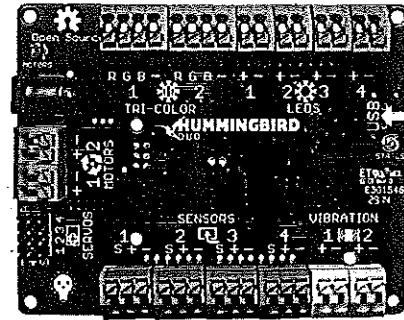
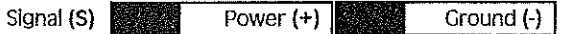
Sensors


-  **Distance Sensor**
Detects how far away something is (from 3" to 36")
-  **Light Sensor**
Detects the brightness of ambient light
-  **Temperature Sensor**
Detects air temperature
-  **Rotary Knob**
Detects how it has been rotated
-  **Sound Sensor**
Detects the noise level of the surrounding area

How To Connect The Sensors

All sensors connect the same way and should be placed into a sensor port on the controller (blue terminals - see image on right). Match the wires to their respective icons (see below). With your Terminal Tool, press down on each terminal block and insert the wire.

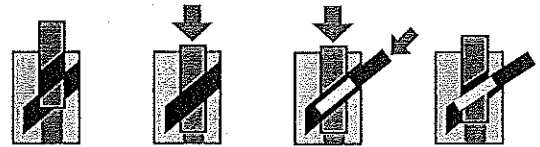
Wire Connections



 Insert sensor wires into the blue terminals of the Hummingbird Duo Controller (use the Terminal Tool).

Tips For Attaching the Wires to the Controller

Push down on the tab of the terminal you'd like to connect a wire to and hold the tab down as you push the wire into the terminal's hole. The wire should be inserted at a roughly 45 degree angle. Once the metal part of the wire is in the hole, stop pushing down on the tab and give the wire a light tug to ensure that it is secure.



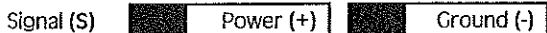
Scan to watch a video showing how to connect electronics or visit: www.hummingbirdkit.com/learning/tutorials/connecting-electronics

Motors



Servo
 Limited range motor with controls for specific angular positions - the servo is the only component that connects to the Hummingbird Duo Controller through a grid of metal posts (see right)

SERVO WIRE CONNECTIONS

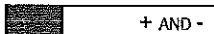


Motor
 An electric motor with speed control that can rotate in either direction - connects to the orange terminals (see right)



Vibration Motor
 A small motor that causes a shaking motion where you may control the intensity of the movement - connects to the yellow terminals (see right)

MOTOR WIRE CONNECTIONS



VIBRATION MOTOR WIRE CONNECTIONS



Motor and vibration motor wires are the same color. This means you can plug them in two ways. Switching them just changes the direction the motor rotates.

Make sure to connect the included power supply when using motors or servos; USB alone does not provide enough power to run these components.



Take Hummingbird to the next level!
 Use Arduino connectors to connect shields and modules made by dozens of companies.

LEDs



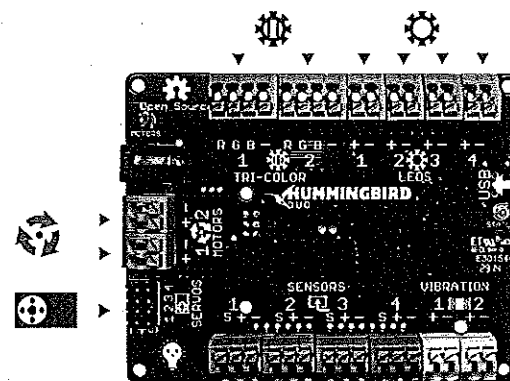
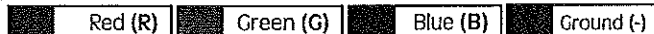
Single Color LED
 Light source with controllable brightness - the color of the wire indicates the color of the light - connects to the 4 right-most green terminals

SINGLE LED WIRE CONNECTIONS



Tri-Color LED
 Red-Green-Blue (RGB) light source capable of producing many colors of light - connects to the 2 left-most green terminals

TRI-COLOR LED WIRE CONNECTIONS



PROGRAMMING THE DUO IS EASY!

Here are the three most popular ways to program Duo:

CMU CREATE Lab Visual Programmer

Designed for use with the Hummingbird Kit, Visual Programmer is an excellent first environment for those with no prior programming experience. A novel story-boarding approach to programming allows students to quickly get their robots moving about and responding to sensory input. The Export to Arduino option allows students to view and edit the text code behind their programs, as well as download these programs to the Duo controller and untether it.

Scratch 2.0 & Snap!

Scratch 2.0 is a blocks-based visual programming environment used by students all over the world to program games and animations. Hummingbird support for Scratch allows student-made programs to jump out of the computer and into the real world by allowing Scratch to read Hummingbird sensors and control motors and LEDs. Snap! is a Scratch-inspired interface that adds recursion, more advanced creation of custom blocks, and first-class lists. Snap! is an excellent way to introduce computer science concepts within a framework that young students can use. The Hummingbird Duo must be connected to a computer via USB while running Scratch or Snap! programs.

Arduino and Ardublock

The Arduino programming language is used by millions of artists, makers, and students to program Arduino-compatible microcontrollers. Students can transition to Arduino via the CREATE Lab Visual Programmer's Export to Arduino option, or through Hummingbird support for Ardublock, a Scratch-like blocks-based environment that integrates directly with the Arduino environment. Arduino programming is an ideal next step for students who understand basic computer science concepts. Arduino programs download to the Hummingbird controller, allowing it to run independently of a computer.

More Programming Options!

We have developed support for programming Hummingbird in Python, Java, and Processing, as well as for using it as a Raspberry Pi daughter-board. We are continuing to add new programming options; please drop us a line to suggest your favorite programming option, or inquire about our incentive program for developers who add support for Hummingbird Duo in a new language or environment.

All Software Is Free To Download & Open Source



To download programs or access source code for Hummingbird Duo, scan or visit:
www.hummingbirdkit.com/learning/software

Dozens of Programming Tutorials Online



Check out our programming tutorials to get started. We've created dozens of screencasts and tutorials demonstrating how to create programs with each of the Hummingbird programming environments. Get started blinking LEDs, spinning motors, reacting to sensors, and much more by scanning or visiting: www.hummingbirdkit.com/learning/tutorials

Once you've built and programmed your first robot, there are many directions you can take Hummingbird. We've provided tutorials for some fun expansion activities, like using Hummingbird with MaKey-MaKey, squishy (playdough) circuits, Vernier sensors, or Raspberry Pi. Turn Hummingbird sensors into controllers for games in Snap/Scratch, see if you can max out the Duo controller and use every single port, try out our support for Python or Java, or add third-party Arduino shields to your creation to give the Duo even more powers.

Learn Using Our Tutorials Online!



Scan to find the tutorials described above as well as many more or visit www.hummingbirdkit.com/learning/tutorials.

Notes section with horizontal lines for writing.