

# Welcome to Apollo

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## Arduino Pins

### Digital Pins

digitalWrite  
digitalRead  
pinMode

### Analog Pins

analogRead  
digitalRead

## Default Code

Sensor  
Pins

Motor  
Pins

D49

LED

A15

Motor Battery  
Level

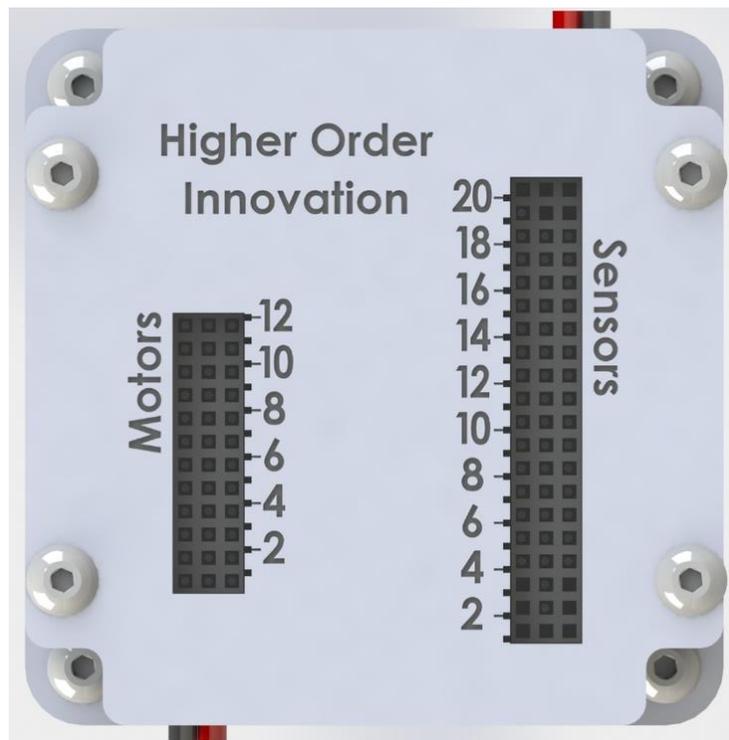
A16

Micro Battery  
Level

Microcontroller  
Power ↓

D22  
D23  
D24  
D25  
D26  
D27  
D28  
D29  
D30  
D31  
D32  
D33

M12  
M11  
M10  
M9  
M8  
M7  
M6  
M5  
M4  
M3  
M2  
M1



↑ Motor  
Power

S20  
S19  
S18  
S17  
S16  
S15  
S14  
S13  
S12  
S11

A4  
A5  
A6  
A7  
A8  
A9  
A10  
A11  
A12  
A13

S10  
S9  
S8  
S7  
S6  
S5  
S4  
S3  
S2  
S1

D43  
D42  
D39  
D34  
D35  
D36  
D37  
D40  
D41  
D38

# Apollo

## Out of the Box

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The kit contains a PS3 controller, USB Bluetooth dongle, USB-Mini cable, and Apollo control system.

The controller must be paired with Apollo. This does not have to be done every time.

1. Power the microcontroller.
2. Install the Bluetooth dongle and wait at least 5 seconds.
3. Remove the Bluetooth dongle and replace it with a USB cable between the controller and Apollo. Wait 10 seconds.
4. Replace the Bluetooth dongle.

Each time that you wish to remote control your robot, you must link the controller to Apollo.

1. Power the microcontroller.
2. Press the PS button to begin linking. All four lights on the controller will blink together. When the link is completed, the remote controller will vibrate, the USB dongle will glow solid blue, and Apollo will glow green.



Motor	Inversion Port	Speed Port	Direction 1	Direction 2
M1/M9	S1	S11	Right Joystick Up*	Right Joystick Down*
M2/M10	S2	S12	Left Joystick Up*	Left Joystick Down*
M3/M11	S3	S13	Triangle	Cross
M4/M12	S4	S14	Up (D-pad)	Down (D-pad)
M5	S5	S15	L1	L2*
M6	S6	S16	R1	R2*
M7	S7	S17	Circle	Square
M8	S8	S18	Left	Right

\* - Indicates an Analog Command

The default code maps twelve motor ports to sixteen actions on the PS3 controller. In addition to controlling motors, the default code will display remote control battery level across the top of the controller. Jumper clips in Inversion Ports will cause a motor to spin the opposite direction. A jumper clip in a Speed Port will cause a motor to move 30% slower.



# Apollo

## Firmware 2.0

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The version of firmware can be determined upon powering the controller. The green light will flash four times if this is the installed default code. This light pattern will happen every time the controller is reset.

Changes:

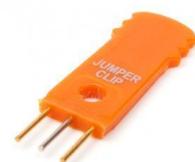
- Motors M1-M4 are cloned to M9-M12. Ex. Pushing the right joystick up will cause M1 and M9 to act the same.
- Introduced Speed Ports. Ex. A Jumper Clip installed in S13 will cause motor M3 to move at 70% of it maximum speed. This is helpful when moving an arm for instance is too fast normally.
- If the Apollo senses an abnormally long time between PS3 messages (a dropped signal), the controller will reset itself. The green light will flash four times and the Bluetooth Dongle will reset itself as well.



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# Programming Guide

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## The Integrated Development Environment (IDE)

The Apollo control system can be reprogrammed via the USB-mini port. The program can be loaded through several different integrated development environments. The Arduino IDE (<http://arduino.cc/en/main/software>) is a basic environment and a good place to get started. When your code grows too large and becomes difficult to manage. Atmel Studio with the VisualMicro plugin is a great option. It provides many more features that are found in advanced IDEs.

## The Library

There are several layers of functionality built into the PS3-arduino software base. These functions provide access to all of the features of the controller. These features include the battery level, vibration, LED readout, button reading, joystick reading, and orientation angle. NOTE: In order to access these functions, libraries need to be added to the Arduino software. The up to date libraries can be downloaded from [https://github.com/felis/USB\\_Host\\_Shield\\_2.0](https://github.com/felis/USB_Host_Shield_2.0). Download the zip file containing the library, the download button will be on the right side of the page. From inside the Arduino IDE, go to Sketch->Include Library->Add zip Library and find the newly downloaded USB\_Host\_Shield\_2.0 zip file. Select it and the library will be added to your installation.

# Adding Apollo to Arduino

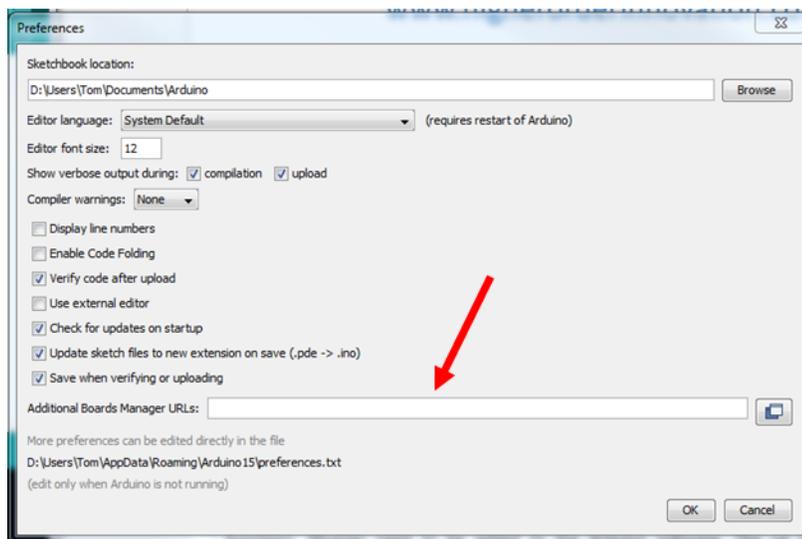
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## The Board

The Apollo is based on the same microcontroller as the 'Sparkfun Mega Pro' board with the 'ATMEGA 2560 (3.3V/8MHz)' processor. If this board is not included in your Arduino development environment, follow the instructions below to add it.

1. Download Arduino 1.6.5+ from Arduino.cc if you are not up to date.
2. Open the IDE and go to File->Preferences.
3. Near the bottom is a textbox for Additional Boards Manager URLs. Enter Sparkfun's URL, 'https://raw.githubusercontent.com/sparkfun/Arduino\_Boards/master/IDE\_Board\_Manager/package\_sparkfun\_index.json'. Exit the preferences window.



4. Go to Tools->Boards->Boards Manager. Scroll down to the Sparkfun AVR Boards by Sparkfun Electronics and install this package.
5. Restart the IDE and the 'Sparkfun Mega Pro' board with the 'ATMEGA 2560 (3.3V/8MHz)' processor will be available for targeting.
6. To test that you can successfully reprogram Apollo, open File->Examples->Basics>Blink. Change the '13' in lines 20, 35, and 37 to '49'. Pin 49 is the pin that a green LED is mounted to on the board. Upload the code by pressing the green arrow in the top left corner. A green light should blink out from Apollo's case.

# Apollo

## Competition Kit

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Apollo is the result of feedback and observations over the course of several years. This is an Arduino based control system that is more complete and more functional than any other system.

Great for:

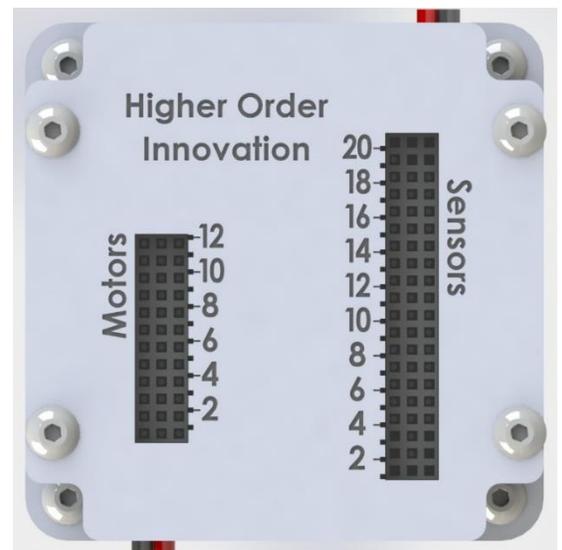
- Classroom based instruction on topics from basic programming concepts to full robotic control
- Projects that need a remote control. Who doesn't like to be in control?
- Controlling your competition robot

Features:

- Ease - Ready to use out of the box (Default code comes preloaded)
- Built in three pin interface for 12 motors and 20 sensors
- PS3 controller support
- Fully reprogrammable
- Advanced access - shield compatible pins for direct module addition

Contents:

- Apollo
  - 256Kb of program memory
  - Reprogrammable
  - 3-pin Keyed Connector Interface
  - Protective Case
- Sony PS3 Remote Controller
- USB Bluetooth Dongle
- USB-mini cable



Higher-order Innovation has done all the work to put together this high quality, functionally rich control system. We strive to constantly improve the experience of those working with our kits. This board represents the culmination of several years of development and is the smallest and most functional control system to date.