Hummingbird Connector API

Contents

Overview

HTTP protocol

The http protocol is used to send commands to and read sensor data from the Hummingbird Connector. To avoid browser security issues the local loopback address 127.0.0.1 must be used. The Hummingbird connector listens on port 30061 for connections.

The URL format is:

http://127.0.0.1:30061/hummingbird/<in|out>/<sensor|command>/<param1 >/…/ param n>/<device instance>

in: the value “in” represents a query into the hummingbird for a sensor value. The response will contain the current value of the sensor in text format.

out: the value “out” represents a command to the hummingbird. The response can be ignored. It will return 200 if the request successfully got processed by the server.

sensor: this can specify any sensor connected to hummingbird sensor ports 1-4 and also the micro:bit accelerometer, magnetometer, compass and buttons.

command: this specifies which on board feature to control such as LED, Tri-LED, servo motor, micro:bit LED display.

parameters: are specified in the order given by the command descriptions below. Each parameter is separated by the “/” path separator.

device instance: The Hummingbird Connector supports up to 3 devices. Each device is specified by the capital letter A, B, or C.

Single and Multiple Device Use Cases

In all cases, (except for the micro:bit Display command) the device instance is always the last parameter in the URL. This allows the single device use case not to require the device instance parameter. In the absence of the device instance parameter, the device instance defaults to device A. This is handled internally in the Hummingbird Connector.

To designate a device instance for the multiple device case, the device letter is simply appended to the URL.

Commands to Device

Hummingbird Position Servo

URL: http://127.0.0.1:30061/hummingbird/out/servo/<port>/<position>/*<device instance>*

Parameters

port: Type: integer. Specify integer port numbers 1 – 4

position: Specify range between 0 - 180 degrees.

device instance: The letter “A”, “B”, or “C” to designate Hummingbird device A, B, or C. This parameter is not required in the single device case

The input value must be restricted to between 0 – 180 and scaled by the following function so that it yields a 0 – 255 raw input value range:

```
degrees *= 254/180
```

Examples

Single device

Set hummingbird position servo on port 2 to 75 degrees:

```
int degrees = 75;
degrees *= 254/180
http://127.0.0.1:30061/hummingbird/out/servo/2/degrees
```

Multi-Device

Set hummingbird B position servo on port 1 to 125 degrees:

```
int degrees = 125;
degrees *= 254/180
http://127.0.0.1:30061/hummingbird/out/servo/1/degrees/B
```

Response: 200 if successful. 404 if URL is malformed.

Hummingbird Rotation Servo

URL: http://127.0.0.1:30061/hummingbird/out/rotation/<port>/<speed>/<*device* *instance*>

Parameters

port: Type: integer. Specify integer port numbers 1 – 4

speed: Specify range between -100 - 100. This corresponds to the percentage of forward and backward speed.

device instance: The letter “A”, “B”, or “C” to designate Hummingbird device A, B, or C. This parameter is not required in the single device case

The input must be restricted to between -100 – 100 and must be scaled by the following function. Note: there is a “dead spot” where the motor is stopped between -10 and 10:

```
If ((speed > -10) and (speed < 10))
     speed = 255;
Else
     speed = ((speed * 23)/100) + 122;
```

Examples:

Single device

Set hummingbird rotation servo speed on port 2 to 75 percent:

```
int speed = 75;
If ((speed > -10) and (speed < 10))
     speed = 255;
Else
     speed = ((speed * 23)/100) + 122;
```

http://127.0.0.1:30061/hummingbird/out/rotation/2/speed

Multi-Device

Set hummingbird B rotation servo speed on port 1 to -80 percent:

```
int speed = -80;
If ((speed > -10) and (speed < 10))
     speed = 255;
Else
     speed = ((speed * 23)/100) + 122;
http://127.0.0.1:30061/hummingbird/out/servo/1/speed/B
```

Response: 200 if successful. 404 if URL is malformed.

Hummingbird LED

URL: http://127.0.0.1:30061/hummingbird/out/led/<port>/<intensity>/*<device instance>*

Parameters

port: Type: integer. Specify integer port numbers 1 – 3

intensity: Specify range between 0 – 100 percent intensity.

The input value of 0 – 100 percent must be scaled by the following function so that it yields a 0 – 255 raw input value range:

```
intensity = intensity*(255/100);
```

device instance: The letter “A”, “B”, or “C” to designate Hummingbird device A, B, or C. This parameter is not required in the single device case

Examples

Single device

Set hummingbird LED on port 3 to 80 percent:

```
int intensity = 80;
intensity = intensity*(255/100);
http://127.0.0.1:30061/hummingbird/out/servo/3/intensity
```

Multi-Device

Set hummingbird device C LED on port 1 to 20 percent:

```
int intensity = 20;
intensity = intensity*(255/100);
http://127.0.0.1:30061/hummingbird/out/servo/1/intensity/C
```

Response: 200 if successful. 404 if URL is malformed.

Hummingbird Tri-LED

URL: http://127.0.0.1:30061/hummingbird/out/led/<port>/<red intensity>/<green intensity>/<blue intensity>/*<device instance>*

Parameters

port: Type: integer. Specify integer port numbers 1 – 2

intensity: Specify range between 1 – 100 percent intensity.

Each r, g, b input value of 0 – 100 percent must be scaled by the following function so that it yields a 0 – 255 raw input value range:

```
intensity = intensity*(255/100);
```

device instance: The letter “A”, “B”, or “C” to designate Hummingbird device A, B, or C. This parameter is not required in the single device case

Examples

Single device

Set hummingbird Tri-LED on port 1 to green to 80 percent intensity:

```
int green_intensity = 80;
green_intensity = green_intensity *(255/100);
int red_intensity = 0;
int blue_intensity = 0;
http://127.0.0.1:30061/hummingbird/out/servo/1/red_intensity/green_intensity/blue_intensity
```

Multi-Device

Set hummingbird device C Tri-LED on port 2 to purple:

```
int green_intensity = 0;
int red_intensity = 100;
red_intensity = red_intensity *(255/100);
int blue_intensity = 100;
blue_intensity = blue_intensity *(255/100);


http://127.0.0.1:30061/hummingbird/out/servo/2/red_intensity/green_intensity/blue_intensity/C
```

Response: 200 if successful. 404 if URL is malformed.

Micro:bit Print

URL: http://127.0.0.1:30061/hummingbird/out/print/<string>/*<device instance>*

Parameters

string: The string to print to the micro:bit LED array. The letters will flash one at a time.

device instance: The letter “A”, “B”, or “C” to designate Hummingbird device A, B, or C. This parameter is not required in the single device case

Examples

Single device

Print HELLO on the hummingbird / micro:bit LED display:

`http://127.0.0.1:30061/hummingbird/out/print/HELLO`

Multi-Device

Print HELLO on hummingbird / micro:bit device B LED display:

`http://127.0.0.1:30061/hummingbird/out/print/HELLO/B`

Response: 200 if successful. 404 if URL is malformed.

Micro:bit Display

This command takes 25 inputs each of which represent a single LED in the 5x5 matrix. The parameter ordering is by row and column going from left to right. For example:

- Parameter 1 represents row 1 column1.
- Parameter 5 represents row 1 column 5.
- Parameter 6 represents row 2 column 1.
- …
- Parameter 25 represents row 5 column 5.

Note: this is the only command which the device instance *must be specified in the single device case* and *is not specified at the end of the URL*.

Examples

Single device

URL: http://127.0.0.1:30061/hummingbird/out/symbol/*<device instance><parameter 1>…<parameter 25>*

Parameters

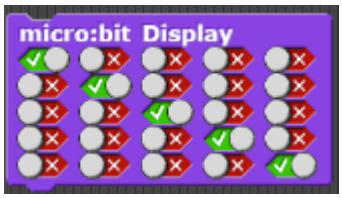
Each of the 25 parameters has the text “true” or “false” to specify whether to turn the LED on or off respectively.

Examples

Single device

A single device is designated as device “A”.

Create a diagonal line across the LED matrix:



http://127.0.0.1:30061/hummingbird/out/symbol/**A**/true/false/false/false/false/false/true/false/false/false/false/false/true/false/false/false/false/false/true/false/false/false/false/false/true/false/false/false/false/false/true

```
The parameter list for human readability:
Parameter 1: true
Parameter 2: false
Parameter 3: false
Parameter 4: false
Parameter 5: false

Parameter 6: false
Parameter 7: true
```

```
Parameter 8: false
Parameter 9: false
Parameter 10: false

Parameter 11: false
Parameter 12: false
Parameter 13: true
Parameter 14: false
Parameter 15: false

Parameter 16: false
Parameter 17: false
Parameter 18: false
Parameter 19: true
Parameter 20: false

Parameter 21: false
Parameter 22: false
Parameter 23: false
Parameter 24: false
Parameter 25: true
```

Multi-Device

Print the same diagonal line on device B:

http://127.0.0.1:30061/hummingbird/out/symbol/**B**/true/false/false/false/false/false/true/false/false/false/false/false/true/false/false/false/false/false/true/false/false/false/false/false/true/false/false/false/false/false/true

Response: 200 if successful. 404 if URL is malformed.

Acquiring Data from the Hummingbird Connector

Acquiring Sensor Data

Http requests are used to acquire sensor data. The format of the URL to fetch sensor data is:

Single Device

http://127.0.0.1:30061/hummingbird/in/sensor/<port>

Multi-Device

http://127.0.0.1:30061/hummingbird/in/sensor/<port><device instance>

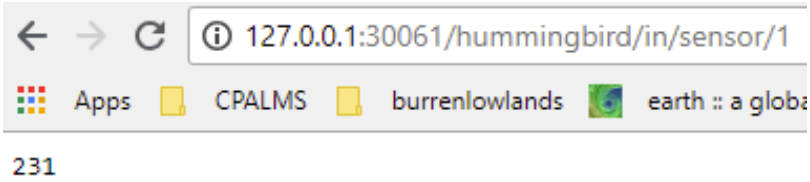
Parameters

port: Type: integer. Specify integer sensor port numbers 1 – 4

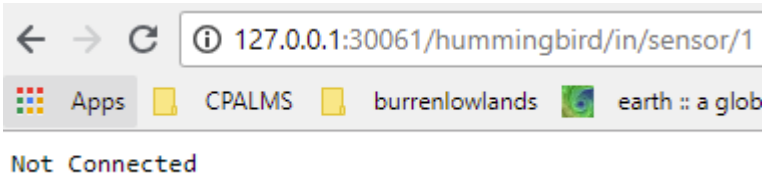
device instance: The letter “A”, “B”, or “C” to designate Hummingbird device A, B, or C. This parameter is not required in the single device case.

Response

The http response will contain the value of the sensor within the range 0-255.



If there is no device connected, the response will contain “Not Connected”.



Examples:

Single-device

Get the sensor value on Hummingbird port 3:

http://127.0.0.1:30061/hummingbird/in/sensor/3

Multi-device

Get the sensor value on Hummingbird device B port 3:

http://127.0.0.1:30061/hummingbird/in/sensor/3/B

TODO: List the supported Hummingbird sensors and their scaling factors here.

Accelerometer Data

Get the accelerometer data for a given axis.

URL:

http://127.0.0.1:30061/hummingbird/in/Acceleromenter/<dimension><device instance>

Parameters

dimension: The uppercase letter “X”, “Y”, or “Z” to specify the axis.

device instance: The uppercase letter “A”, “B”, or “C” to designate Hummingbird device A, B, or C. This parameter is not required in the single device case.

Response

The http response will contain the value of accelerometer axis within the range -19.6 – 19.6. This range represents 2 units of gravity given in units of meters per second^2 i.e. 1g = 9.8ms^2

If there is no device connected, the response will contain “Not Connected”.

Examples:

Single-device

Get the accelerometer X axis value:

http://127.0.0.1:30061/hummingbird/in/Accelerometer/X

Multi-device

Get the accelerometer X axis value on Hummingbird device C:

http://127.0.0.1:30061/hummingbird/in/Accelerometer/X/C

Magnetometer Data

Get the magnetometer data for a given axis.

URL:

http://127.0.0.1:30061/hummingbird/in/Magnetometer/<dimension><device instance>

Parameters

dimension: The uppercase letter “X”, “Y”, or “Z” to specify the axis.

device instance: The uppercase letter “A”, “B”, or “C” to designate Hummingbird device A, B, or C. This parameter is not required in the single device case.

Response

The http response will contain the value of Magnetometer data in micro Teslas (uT).

If there is no device connected, the response will contain “Not Connected”.

Examples:

Single-device

Get the magnetometer X axis value:

http://127.0.0.1:30061/hummingbird/in/Magnetometer/X

Multi-device

Get the magnetometer X axis value on Hummingbird device C:

http://127.0.0.1:30061/hummingbird/in/Magnetometer/X/C

Button Data

Get the state of whether either micro:bit button A or B is pressed

URL:

http://127.0.0.1:30061/hummingbird/in/button/<button><device instance>

Parameters

button : The uppercase letter “A” or “B to specify which button.

device instance: The uppercase letter “A”, “B”, or “C” to designate Hummingbird device A, B, or C. This parameter is not required in the single device case.

Response

The http response will return “true” if the button is pressed or “false” if otherwise.

If there is no device connected, the response will contain “Not Connected”.

Examples:

Single-device

Get the micro:bit button A state:

http://127.0.0.1:30061/hummingbird/in/button/A

Multi-device

Get the micro:bit button A state on device C:

http://127.0.0.1:30061/hummingbird/in/button/A/C

Compass Data

Get the compass heading in degrees.

URL:

http://127.0.0.1:30061/hummingbird/in/Compass/<device instance>

Parameters

device instance: The uppercase letter “A”, “B”, or “C” to designate Hummingbird deivce A, B, or C. This parameter is not required in the single device case.

Response

The http response will return the heading in degrees.

If there is no device connected, the response will contain “Not Connected”.

Examples:

Single-device

Get the Hummingbird compass heading:

http://127.0.0.1:30061/hummingbird/in/Compass

Multi-device

Get the Hummingbird compass heading on device B:

http://127.0.0.1:30061/hummingbird/in/Compass/B

Orientation Data

Get the orientation of the Hummingbird micro:bit. Possible orientations are:

- Screen Up
- Screen Down
- Tilt Left
- Tilt Right
- Logo Up
- Logo Down
- Shake

URL:

http://127.0.0.1:30061/hummingbird/in/orientation/<orientation><device instance>

Parameters

orientation: One of the following case sensitive orientation values: Screen Up, Screen Down, Tilt Left, Tilt Right, Logo Up, Logo Down, Shake. Note: the space contained in the parameter string must be included.

device instance: The uppercase letter “A”, “B”, or “C” to designate Hummingbird device A, B, or C. This parameter is not required in the single device case.

Response

The http response will return either “true” or “false” to indicate whether the actual orientation of the device meets the specified orientation parameter.

If there is no device connected, the response will contain “Not Connected”.

Examples:

Single-device

Determine whether the Hummingbird / micro:bit device is facing upwards:

http://127.0.0.1:30061/hummingbird/orientation/Screen Up *Note the space in “Screen Up” is required.

Multi-device

Determine whether Hummingbird / micro:bit device B is tilted to the rights:

http://127.0.0.1:30061/hummingbird/orientation/Tilt Right/B *Note the space in “Tilt Right” is required.