MyMakerTools™

Maker Power™
Brick Controller ONE

Features
Powered by Maker Power™ Brick Power
Alternate power from any 9 VDC source
Controls up to 4 independent motors
Controls up to 4 independent LEDs
Direct control by PC or Mobile device
Simple visual script language

Applications
Control Lego 9V Motors
Control Lego 5V Motors
Control complex Lego Machines

Description
The Brick Controller ONE is a small controller module designed to control up to four independent motors and four independent LED type devices. The controller module can be controlled directly thorough either a PC via the USB interface or by a mobile device through the Bluetooth LE interface. Additionally it can be controlled through the visual scripting language available on both the PC and Android applications. Power is supplied either through the 6 pin connector by a **Maker Power**™ Brick Power module and the supplied cable. Also 9 VDC can be applied directly to through the external power connector which is a simple punch down connector.

Electrical Characteristics

Parameter	Min	Max	Unit
External Power Input Voltage	8.5	9.5	VDC
Motor Output Current (per pin)[1]	0	500	mA
LED Output Current (per pin)[1]	0	50	mA
USB current	10	100	mA
5 VDC Motor Current [2]			

Note 1. Total current out is dependent on the power source. Total current out cannot exceed current/power capability of the power source.
Note 2. 5 VDC voltage output is entirely dependent on the USB power supply and the load placed on it.

Figure 1 Brick Controller Side View
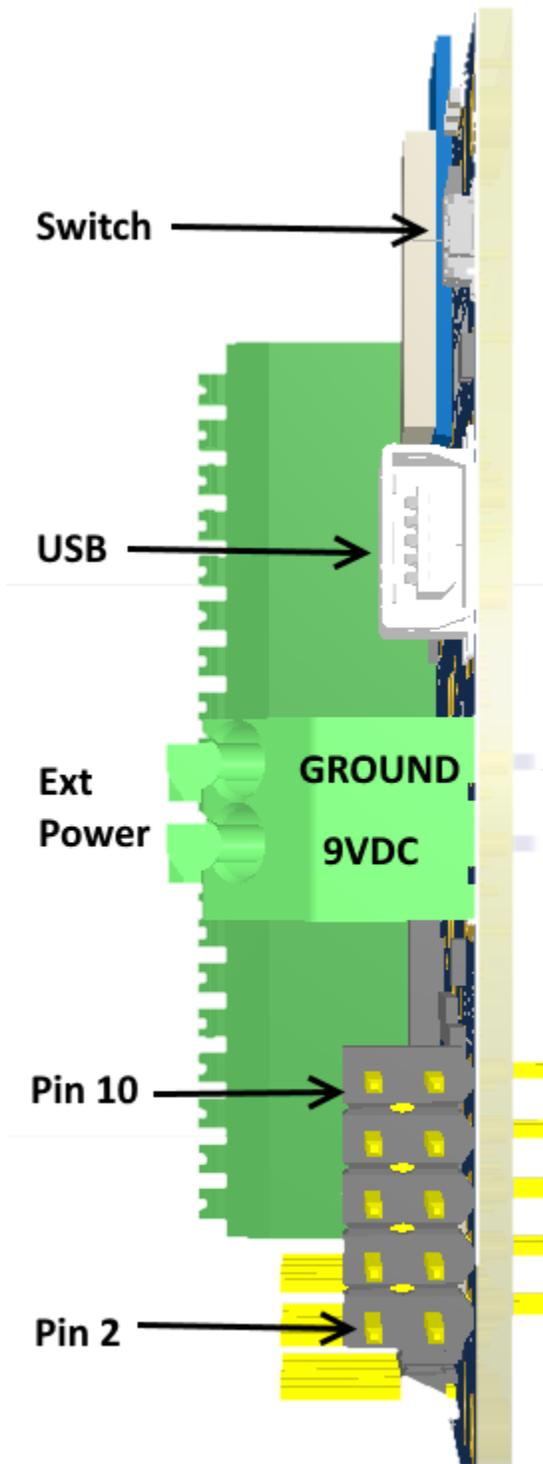
Revision 1

Pin	Function
1	9 VDC IN
2	9 VDC IN
3	No Connection
4	No Connection
5	5 VDC IN
6	5 VDC IN
7	3.3 VDC IN
8	3.3 VDC IN
9	GND
10	GND

Table 1 Ten Pin Power Connector

(Revsion 1)

CAUTION

Use either the two pin External power connector of the 10 Pin header to supply power to Brick Controller module. Do NOT use both as this will result in unpredictable results.

WARNING

Do not apply more than 9 VDC to the External Power connector. This voltage can be applied directly to the motors, depending on the state of JP1.
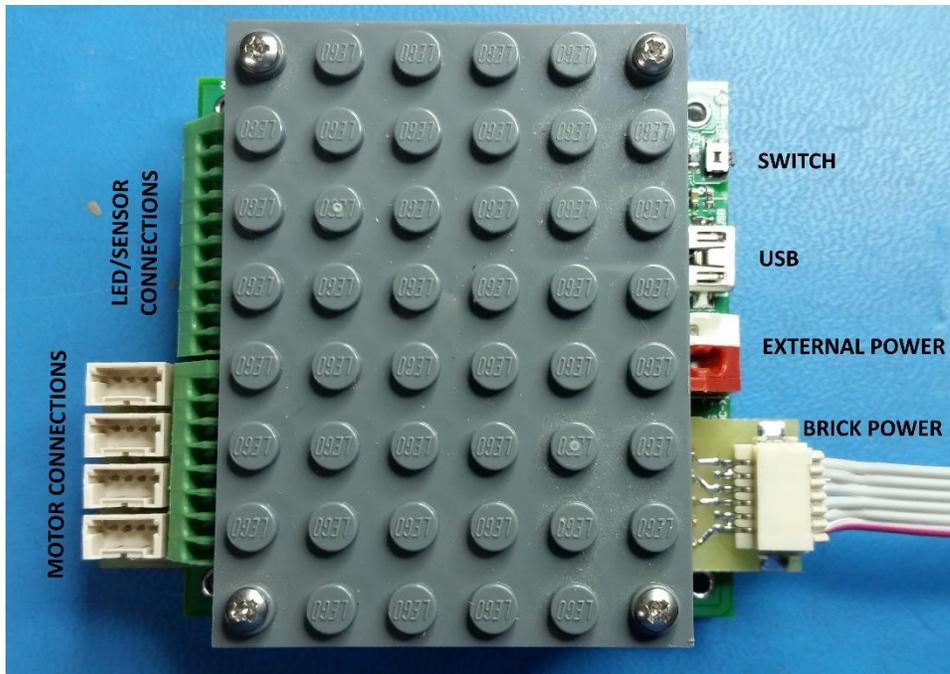
Figure 2 Brick Controller ONE Revision 2

Motor and LED Connection

There are 4 motor connections in the 8 pin punch down block as indicated in Table 2. Every motor is different, thus you will have to determine what is forward and what is reverse. Swapping the leads at the connector will reverse the sense.

CAUTION

While it is possible to connect multiple motors to one drive point, total motor current for each drive point should be limited to 500mA. Exceeding this number can cause permanent damage to the motor drive circuits.

In Revision 2 (as shown in Figure 2) there are 4 connectors that use MyMakerTools motor cables. These cables plug into the four connectors and connect directly to a motor. The bottom connector is Motor 1 and the top connector is Motor 4.
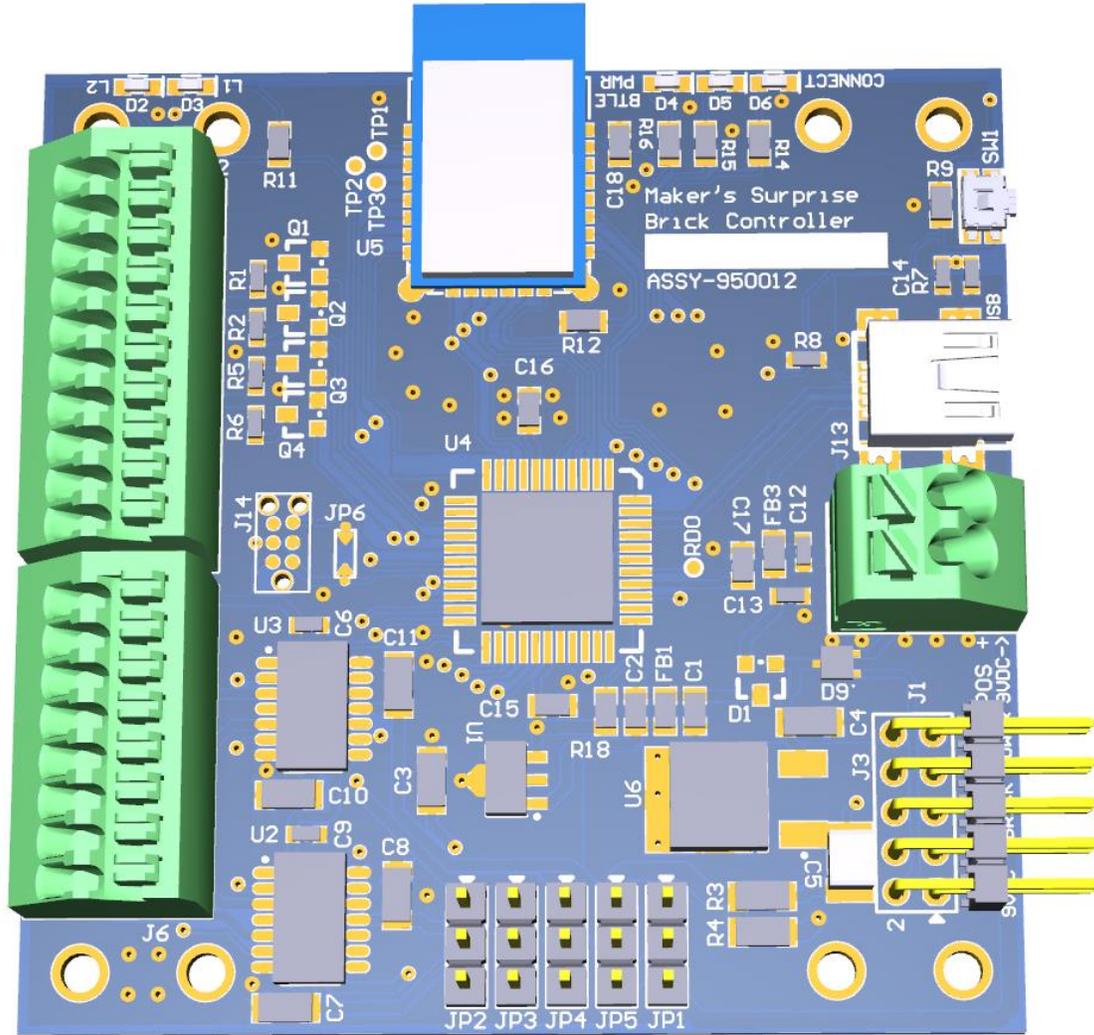
Figure 3 Brick Controller Reference (Revision 1)

There are 4 LED connections in the 10 pin punch down block as shown in Table 3. Under normal conditions, the LED is connected between the pin labeled 5VDC and one of the four pins labeled LED1, LED2, LED3 or LED4. The LED pins provide the ground connection for the LED and have a 100 ohm resistor in the path to limit the current.

CAUTION
Limit the total LED current to 200mA.

NOTE
Total resistance required will be a function of the LEDs used. Please consult the information provided by the LED manufacturer.

PIN	Function
1	Motor 1 (+)
2	Motor 1 (-)
3	Motor 2 (+)
4	Motor 2 (-)
5	Motor 3 (+)
6	Motor 3 (-)
7	Motor 4 (+)
8	Motor 4 (-)

Table 2 Eight Pin Punch Down Connector

Pin	Function
1	5 VDC
2	5 VDC
3	LED #1
4	LED #2
5	LED #3
6	LED #4
7	Sensor #1
8	Sensor #2
9	Sensor #3
10	Ground

Table 3 Ten Pin Punch Down Connector

Jumper	PINS 1-2	PINS 2-3
JP1	9 VDC from 10 pin connector	9 VDC from Ext Power Connector
JP2	Motor #1 5 VDC	Motor #1 9 VDC
JP3	Motor #2 5 VDC	Motor #2 9 VDC
JP4	Motor #3 5 VDC	Motor #3 9 VDC
JP5	Motor #4 5 VDC	Motor #4 9 VDC

Table 4 Motor Voltage Control

There are five Jumpers that control the voltage delivered to each motor as shown in Table 4. Each motor is controlled individually. Jumper JP1 determines the source of the 9 VDC. Either it is supplied from the External Power connector or is supplied from the Brick Power Connector.

NOTE

 5 VDC for motor power is only available when the Brick Power connector is used. If you want 5 VDC and wish to only use the External Power connector, contact My Maker Tools on how to add a 5 VDC regulator to the PCB assembly.

Brick Controller Operation

The Brick Controller will control up to 4 independent motor and four independent LED type devices. The Brick Controller can be controlled by either a PC through the USB connector or across the Blutetooth LE interface. Available controls are

- Motor On or Off
- Motor Forward or Reverse – these are momentary contact switches
- LED Off, On, Flashing or Pulsing
- Sensor Inputs – these must be held between ground or 3.3VDC

NOTE

When using the Motor On/Off button, the direction used last is the direction the motor will run.

The PC interface can be used to enter a Script. Once a script is constructed, it can either be saved on the PC or stored in the connected brick controller. It is highly recommended to save all scripts on the PC, since no save feature is available on the Android Application.

Sensor Inputs

Contact MyMakerTools for proper care, feeding and usage of the Sensor inputs.

Brick Controller Status LEDs

These are the two LEDs to the right of the Bluetooth Device labeled L1 and L2. There are 3 possible states and they are indicated by the blue and yellow LEDs on the side next to the button as shown in this table.

State	Blue LED	Yellow LED
Connected to and recognized by the PC (Power)	Flashing	ON
Standalone	OFF	ON
Standalone and script running	ON	Flashing

Bluetooth Status LEDs

These are the three LEDs to the left of the Bluetooth Device. These LEDs have two functions. They indicate the state of the Bluetooth connection or can be controlled by the firmware. Once they are controlled by the firmware, they will no longer indicate the state of the Bluetooth connection until the power is cycled or the connection is broken. The table below shows meaning of the different states.

State	Blue LED	Red LED	Green LED
Power applied to BT module	ON	N/A	N/A
Connected to another BT device	ON	N/A	ON

| RED Option selected on Android Application | N/A | On | N/A |

Using Scripts

Scripts are a set of time sequenced commands. When entering a script, at each time interval (0.1 sec resolution) you indicate what action should happen. For example

at 1.0 seconds Motor 2 begins running in reverse
at 2.3 seconds LED3 turns on, Motor 1begins running in forward
at 5.2 seconds LED3 turns off
at 7.5 seconds Motor2 begins running in forward, Motor 1 stops
at 11.0 seconds Motor2 stops
at 11.5 seconds the script stops

Once the script is entered into the PC, it must be stored in the Brick Controller by using the Store option on the Script Action menu. Scripts can also be stored on the PC by using the Save option. One simple way to build a script is to construct a table of the different options and then indicate what is to happen at each time interval. Here is an example

Time	CMD	Motor 1	Motor 2	Motor 3	Motor 4	LED 1	LED 2	LED 3	LED4
1.1	Motor/LED	FWD	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1.2	Motor/LED	FWD	RVS	OFF	OFF	ON	OFF	OFF	OFF
3.4	Motor/LED	RVS	FWD	OFF	FWD	ON	OFF	OFF	OFF
5.7	Motor/LED	OFF	FWD	OFF	FWD	OFF	OFF	OFF	OFF
8.9	Motor/LED	OFF	FWD	OFF	FWD	OFF	OFF	OFF	OFF
11.3	Motor/LED	OFF	FWD	OFF	FWD	OFF	OFF	OFF	OFF
15.6	Motor/LED	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
20.1	RESET	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF

Using the MyMakerTools Brick Buddy App

When starting the App the splash screen will appear followed by the Application Screen, as shown below. Pressing the menu button in the upper left will present the following choices:
- Application (Home Screen)
- Motor Control (individual Motor control)
- LED Control (individual LED control)
- Script (enter/edit/store/retrieve/halt scripts)
- Setup (device/App setup)
- Close (exit the App immediately)

Quick Start

The first time you start the App you must go to the setup screen. This is depicted below. The quick start process is to turn Auto Connect ON and press SCAN. The App will look for available Brick Buddy devices. If only one is found it will connect. If more than one is found, then it will present the ID for each and allow you to choose which one.

> **Note**
> The App cannot discern between different MyMakerTools devices.
> Each device will have it's name followed by a unique 4 digit number. In this case choose B-Buddy-nnnn.

If a script was loaded using the PC program and the USB interface, go back to the Application screen and press the Arm System button and the message "System is armed!" to indicate it is ready to run the script. Then press Start Script and the loaded script will start to run.

Application Screen
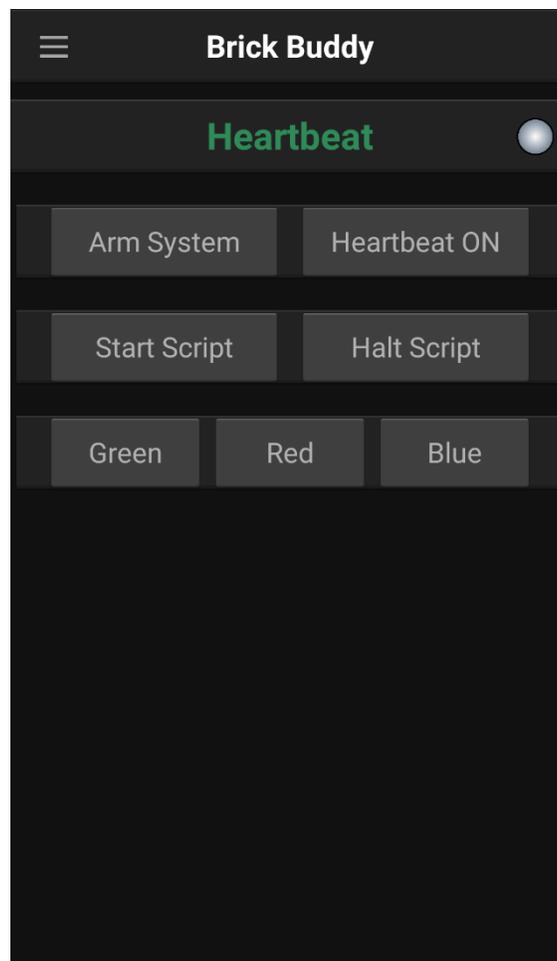
Arm System – Pressing this enables the script system and the other buttons on this screen as indicated by the message "System is armed!". Additionally this action displays the state of the music player, On or Off. Pressing this button a second time, disables all of the buttons and the script system as indicated by the message "System is off!".

Heartbeat ON – When the Heartbeat function is enabled by pressing the Heartbeat ON button, the text will fade in and out to indicate that the "I am alive" message has been received. Pressing the button a second time, disables the Heartbeat function.

Start Script – Will start the execution of any script loaded into the device from the beginning.

Halt Script – Will immediately stop execution of the script.

Green/Red/Blue – Will change the state of these three LEDs. When the button is the color of the LED, the LED will be on. When the button color is gray, the LED will be off. These buttons can be used to control the script by using the "wait event" command.

Messages - Various informational messages are displayed here, depending on the App revision level. Swiping to the left will clear the field.
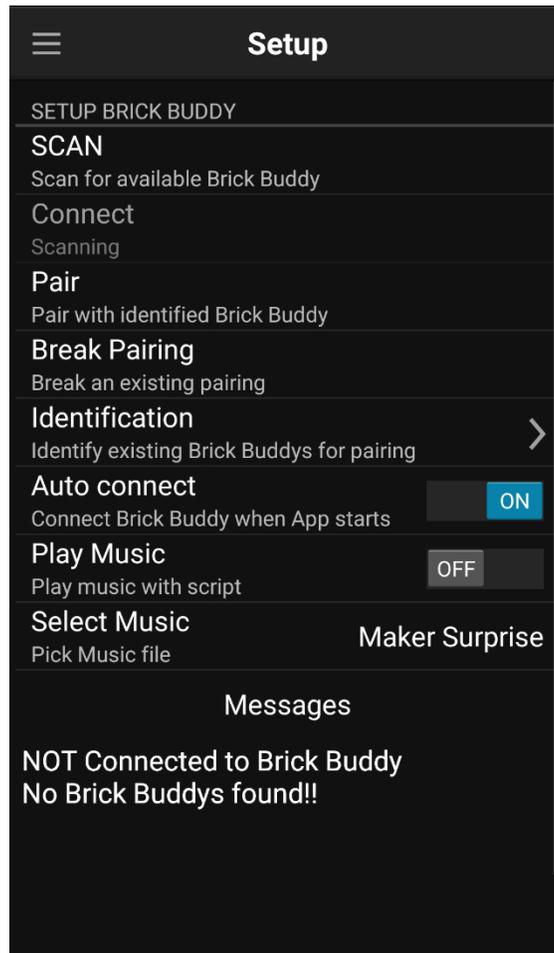
Scan – Pressing SCAN will start the Bluetooth scanning process looking for valid devices. If it finds one, it will display the B-Buddy label followed by a unique 4 digit number (B-Buddy-34:56). If Auto Connect is enabled, it will automatically connect to the Brick Buddy device. If more than one is found, the list will be presented for you to choose which device you wish to connect to.

Connect – Pressing Connect will connect to the device found and selected during the scan process. This is for manual connection. If the Auto Connect is enabled this is bypassed and a connection established. Once a connection is established this selection is grayed out and cannot be used.

Pair – Pressing Pair will present a list of Brick Buddy device names entered into the App. Selecting one of the device names will pair this name with Brick Buddy device. In the future the name will appear instead of the "B-Buddy-34:56". If no names have been entered through the Identification setup (see below), then an error message will appear, "No devices available to pair". If the device is already paired, then another error message will appear, "This Brick Buddy device is already paired".

Break Pairing – Pressing Break Pairing will break the link between the selected device and the name. If no paring exists, an error message will appear, "You must be paired to break pairing".

Identification – Pressing Identification will bring up another screen where you can enter the names of Brick Buddy devices that you have. This makes it convenient to identify multiple devices. They can be named for where they are in the system or some other identifier you put on them. You could use the Bluetooth status LEDs to discriminate between devices. Tapping on the top of the screen where indicated will bring up a dialog box to enter the name. Once entered a long tap on the name will present an option to delete the name. A double tap on the name will bring back the dialog box and allow you to change the name.

Auto Connect – Pressing Auto Connect will allow the App to complete the connection process automatically. When the App is started, it will automatically scan for valid devices. If only one is found it will automatically connect. If more than one is found, the list will be presented for you to choose the device you want to use.

Note

Regardless of how the connection is achieved, you will still be required to go the application screen and arm the system if you intend to use a script.

Play Music – Pressing Play Music will cause the standard music player in the mobile device to play the song shown once the script starts. This allows the Brick Buddy to perform to music.

Select Music – Pressing Select Music will bring up a list of all songs on the mobile device. Scroll through the list and pick the one you want the script to follow along to.

Messages – Various informational messages are displayed here, depending on the App revision level. Swiping to the left will clear the field.

Motor Control Screen
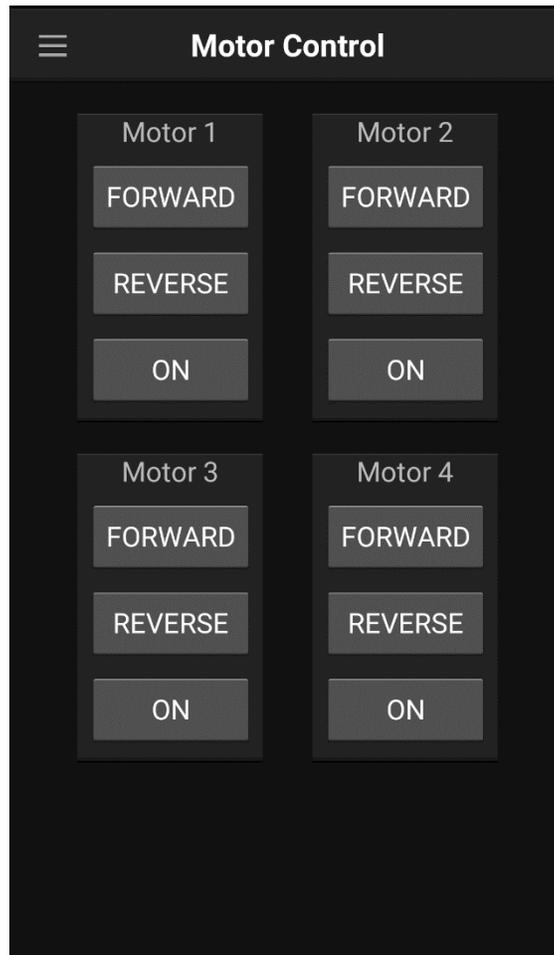
Forward – Pressing the Forward button will cause the selected motor (1-4) to run in the forward direction as long as the button is depressed.

Reverse – Pressing the Reverse button will cause the selected motor (1-4) to run in the reverse direction as long as the button is depressed.

ON/OFF – Pressing the ON button will cause the selected motor (1-4) to run continuously in the last selected direction (forward/reverse). Also the text will change from ON to OFF, to indicate what action will happen next when you press the button. When OFF is displayed, pressing the button will stop the selected (1-4) motor.

LED Control Screen
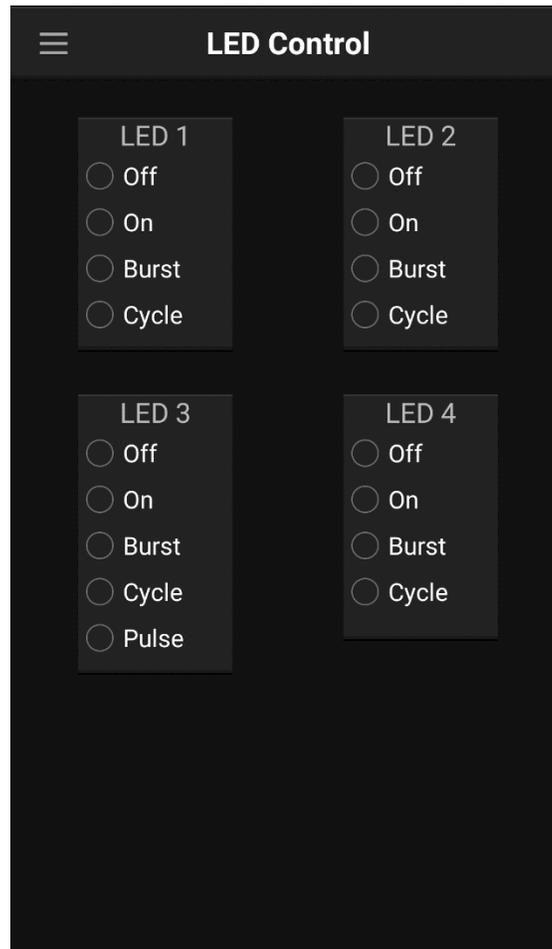
Each LED has a minimum of 4 states except LED 3 which has five. These states are mutually exclusive, that is the LED can only be in one state at any given time. They are described below.

Off – The LED is off.

On – The LED is on.

Burst – The LED flashes in a series of short pulses for 2-3 seconds. The design intent is to represent a laser canon.

Cycle – The LED flashes on and off at a 50% duty rate.

Pulse – The LED flashes at random intensity for random length of times. The design intent is to represent a sparking generator or lightning.

Script Menu

Pressing the Script menu item will show four choices

1. Script Edit – pressing this menu item will show the mobile device script editor. This allows you to either enter a new script into the editor and then store it in the connected device. Or you can edit an existing script in the connected device by retrieving it. More on the editor is below.

2. Script Store – pressing this menu item will store the script in the mobile device script editor in the non-volatile memory of the connected device.

3. Script Retrieve – pressing this menu item will retrieve the script stored in the connected device and load it into the mobile device script editor.

4. Script Halt – pressing this menu item will immediately halt the script in the connected device.

Script Editor Screen

Time Stamp – Enter a time in tenths of seconds (2.0, 12.6, 34.8, etc). This is the time from the beginning that this command will execute, that is what action should happen at this time.

Line Number – This indicates what step is shown.

Total Lines – How many commands are in the script.

Memory Left – How many more commands can be entered.

Motor 1-4 – Choose the state of the motor for this time period.

LED 1-4 – Choose the state of the LED for this time period.

Command – Choose which command will be executed as follows

1. Motor/LED will set the state of the motors and LEDs as determined by the radio buttons.

2. Wait will wait for the specified event to happen before the script can continue. The script does a conditional halt waiting for the event to happen.

3. Reset Script will cause the script to go back to the beginning and start over.

4. Stop Script will cause the script to cease running.

Previous – this will move the script editor to the previous command. If the button is grayed out, then the editor is at the first script command.

Next – this will move the script editor to the next script command. If the button is grayed out, then the editor is at the last script command.

Insert After – this will insert a blank script command after the current script command.

Delete – this will delete the current script command.

Wait – these radio buttons select which event the Wait command will use. The three LED events are controlled by the LED buttons on the Application screen. The sensor inputs ae described earlier in this document.