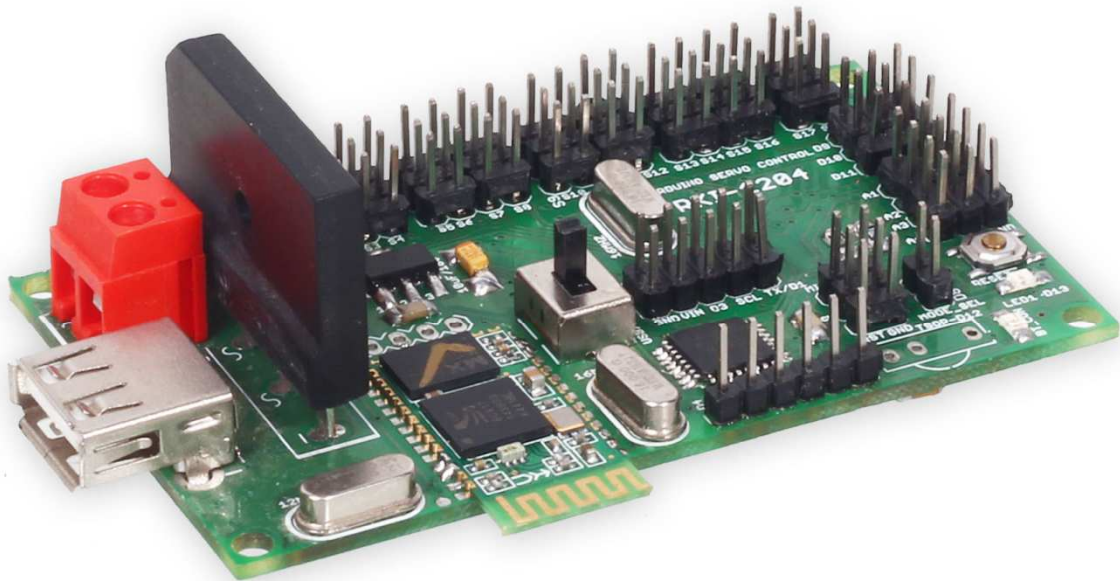# ARDUINO UNO R3 BASED BLUETOOTH + USB 18 SERVO CONTROLLER
[RKI-1251 and RKI-1252]

User Manual

ROBOKITS INDIA

Arduino Uno R3 based USB 18 Servo Controller/Bluetooth + Arduino Uno R3 based USB 18 Servo Controller is ideal for making Autonomous and PC based systems which run over 18 Hobby Servo motors. There are two versions of the Product available one is having only USB Connectivity for Controlling the Motors i.e. RKI – 1251 and other one is having the USB + Bluetooth Connectivity i.e. RKI-1252.

This Product is backed up by PC software which controls all servos and helps generating motion sequences. The software helps to develop the complex sequences in real time on the hardware like robotic arms, walkers, bipeds and any other servo controlled system. It also generates Arduino based code for the developed sequence which can be deployed on the controller on board thereby making the robot autonomous.

The board holds two chips configured as Master and Slave. Major servo motor positioning and servo related calculations are done by the slave chip. The Master chip i.e. Atmega 328 which is preloaded with Arduino Uno bootloader communicates with the software serially and send commands to the slave chip through I2C making the Master CPU available for other tasks. Various sensor and wireless devices like TSOP-1738 etc can be interfaced with the master making the robot wirelessly controlled.

Servo motor configurations like Center, Offsets, Maximum, Minimum, servo directions and speed can be individually set. The servo configurations set can be saved to the on board controller. Additionally servo sequence functions can be created through software itself. Moreover Groups of servos can be rotated simultaneously for creating accurate and easy angular movements.

The servo controller is compatible with USB 1.1 and USB 2.0 standards, and driver support will initially be available for Windows 98 through Windows 8.

The Package Includes:

1. Arduino Uno R3 based USB 18 Servo Controller/Bluetooth + Arduino Uno R3 based USB 18 Servo Controller
2. USB Cable
3. Software CD

Features:

- Bluetooth interface for wireless control of robots. (Optionally with RKI-1252)
- Controls 18 hobby servos from PC and Microcontroller
- USB interface
- Comes Pre-loaded Arduino Uno bootloader
- Software exports servo sequences to Arduino Uno for running servo sequences
- Independent range setting for each servo
- Independent offset, Maximum, Minimum and Direction setting for each servo
- 0.5-microsecond resolution
- 50 Hz update rate
- Small size of 80 X 47 mm
- Plug and Play, Auto detection of hardware
- Easy to use software
- Servo sequencer with speed, delay, goto and many other features
- Home and neutral position setting
- Easy to install USB driver and Application software
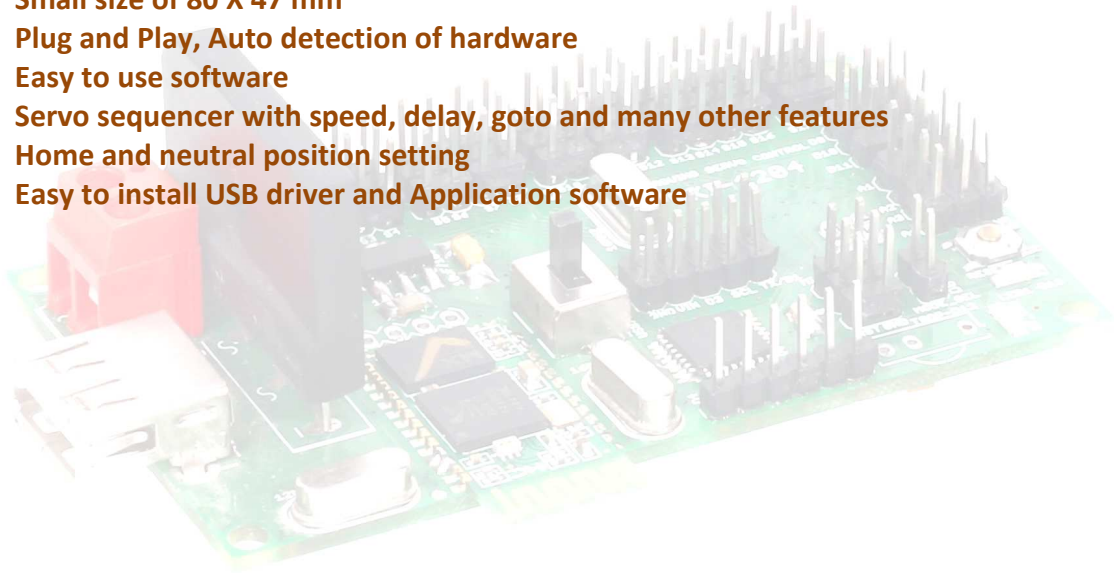
THE SERVO CONTROLLER HARDWARE:
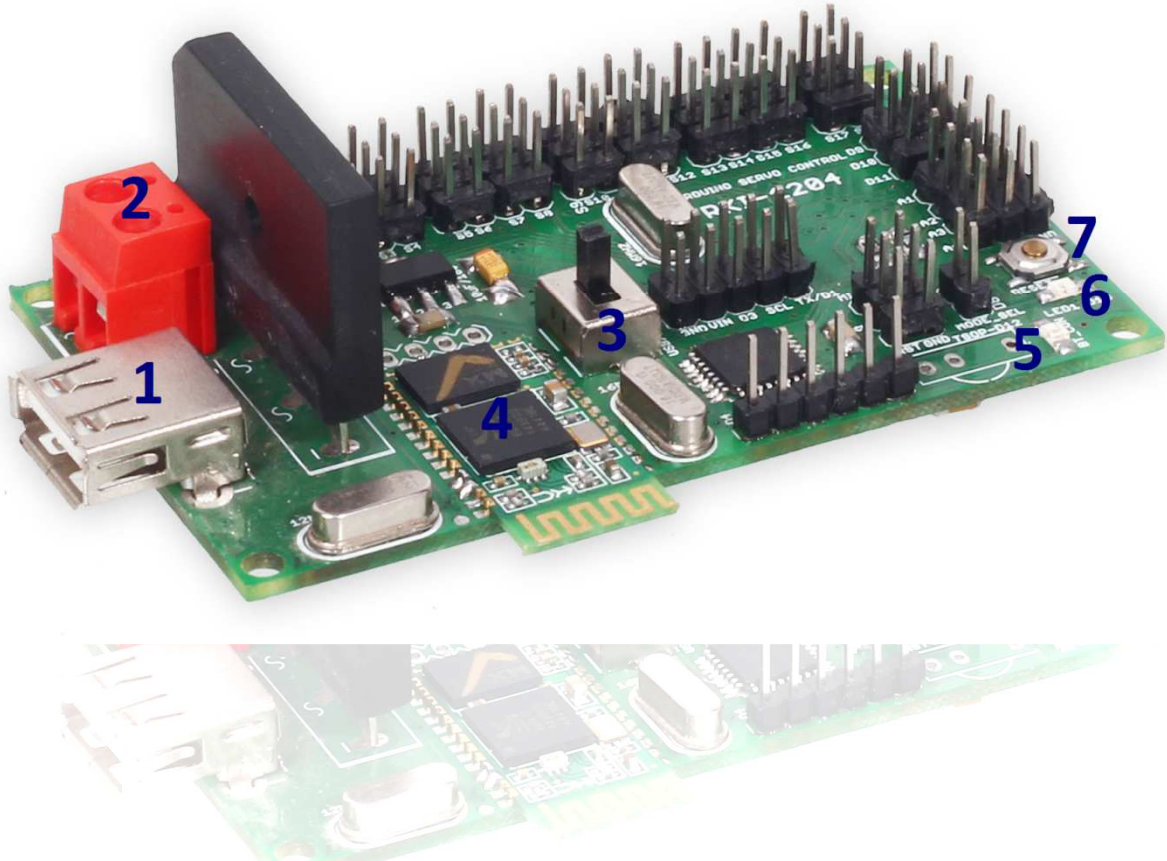
1.	USB Connector for connecting USB Cable to PC
2.	Power Connector 5 - 7.5 V DC
3.	Switch for Switching Between Bluetooth and USB Mode. (Must be on USB Side for RKI-1251)
4.	Bluetooth Module (Only with RKI - 1252)
5.	Bluetooth Status LED
6.	LED on Pin 13 of Circuit Board as in Arduino
7.	Reset Switch

Connecting Servos to Controller:

All standard servo motors have 3 wire connector for connecting to any device. 2 Wires are for Power that is VDD and GND, VDD is +4.8V to 6V (Max 7V) GND is for Ground. General wire colors are as follow:

Signal	VDD (+4.8 V DC to 7 V DC)	GND
White	Red	Black
Orange	Red	Brown
Yellow	Red /Orange	Black/Brown
Orange	Red	Black
Blue	Red	Black

Servos can be connected in the way shown in below figure.
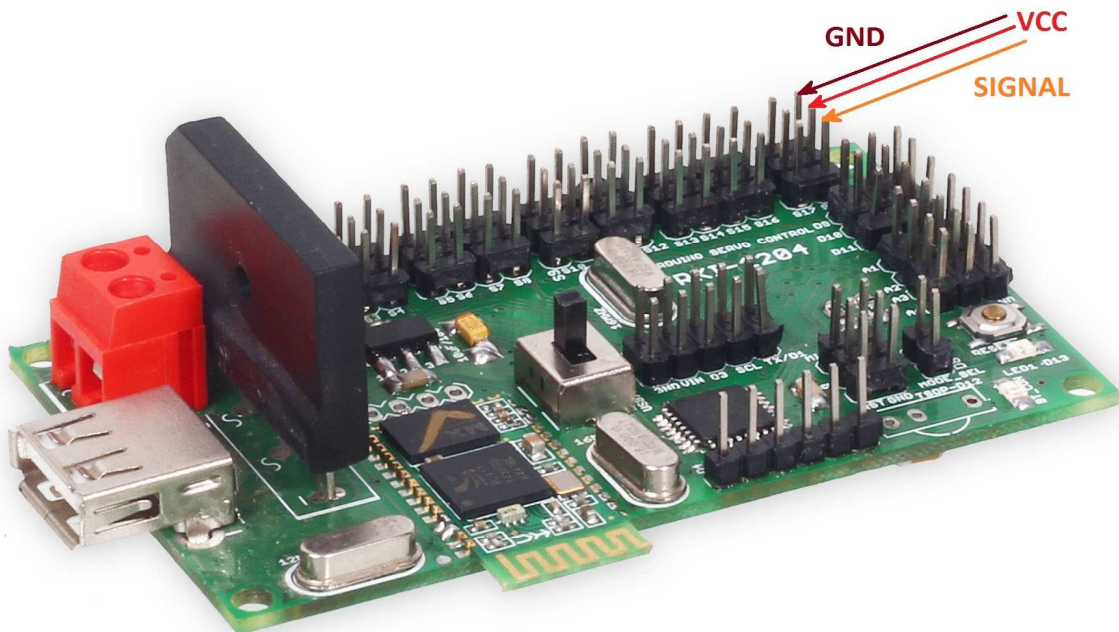
Connecting Power Supply

Most recommended power source for servo controller is between 4.8 to 6VDC. However sometimes a 7.5 V source is also used. You can connect the Power Source to the Power Connector (See Page 4).

Installation and Usage

Software:

1. You can Install the Software : Robokits_USB_BT_ServoCon_Setup.exe given in the CD with the Product or you can also download it from the Product page on Our Website. In this case you will need to install .net framework 4.0 if it is not installed already.
2. Keep clicking Next Button unless the Setup is Complete.

USB Drivers:

1. USB Drivers are Provided in the CD with the Product.

Bluetooth Setting:

1. The Setting shown here are for Windows 7. Click on Devices and Printers in the Start Menu.
2. Make sure that your PC's Bluetooth is On and the Servo Controller is powered up. Also the Switch Provided on the Controller is on the Bluetooth Side.
3. Click on Add Device in the Devices and Printers Section.

4. **Below Dialog Box will appear when you Click on Add Device. This Box will show you the available devices.**
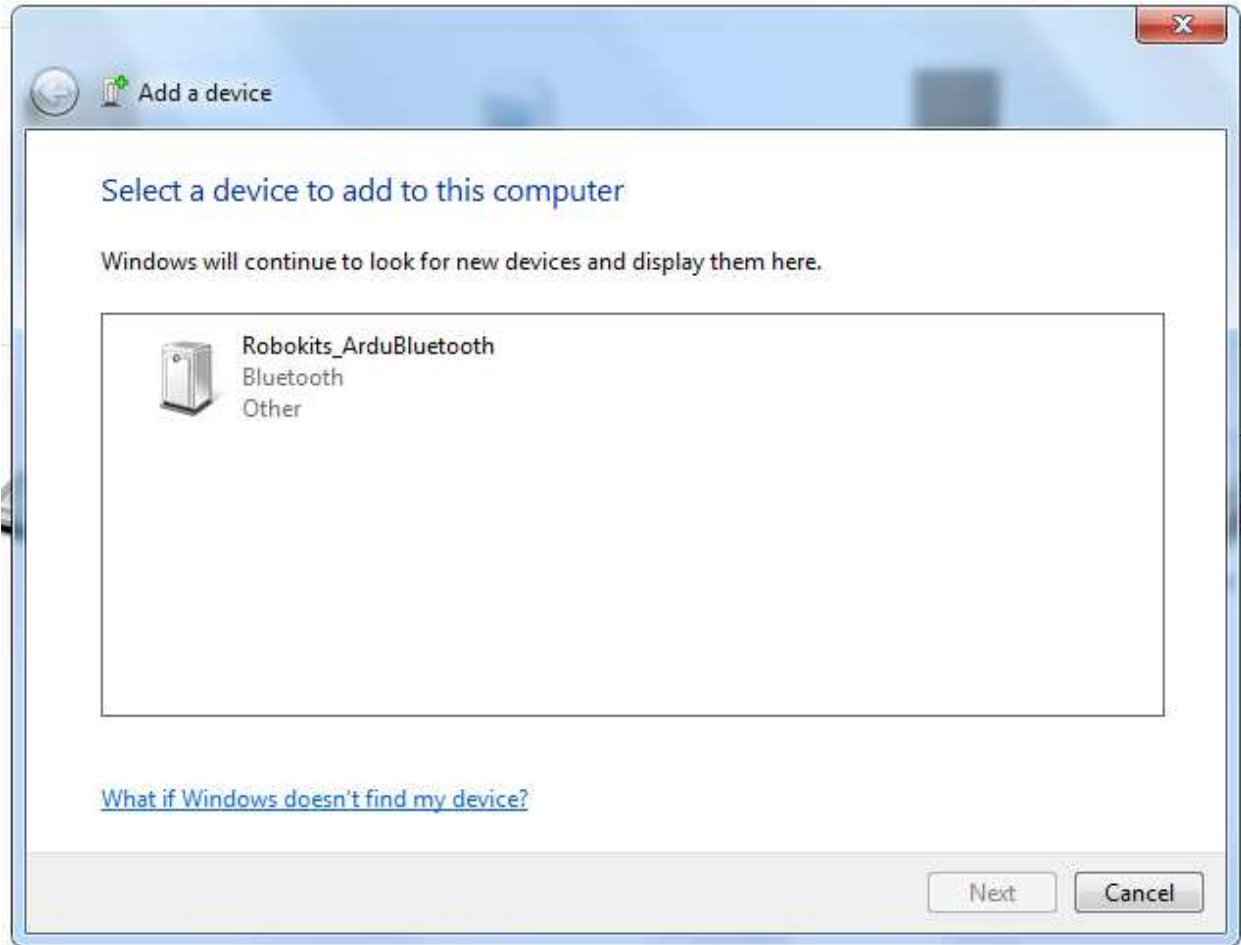
5. **Select Robokits_ArduBluetooth and click on Next Button. On some PCs the dialog box may show some different name such as Other Device. You can select that device and click on Next Button.**

6. **After Clicking on Next Button the dialog box will ask you for pairing the Bluetooth Device. You can Click on Enter the device's pairing code option.**

7. **Now you can enter the pairing Code 0000 in the Dialog Box as shown below. After entering the code you can click on Next Button.**
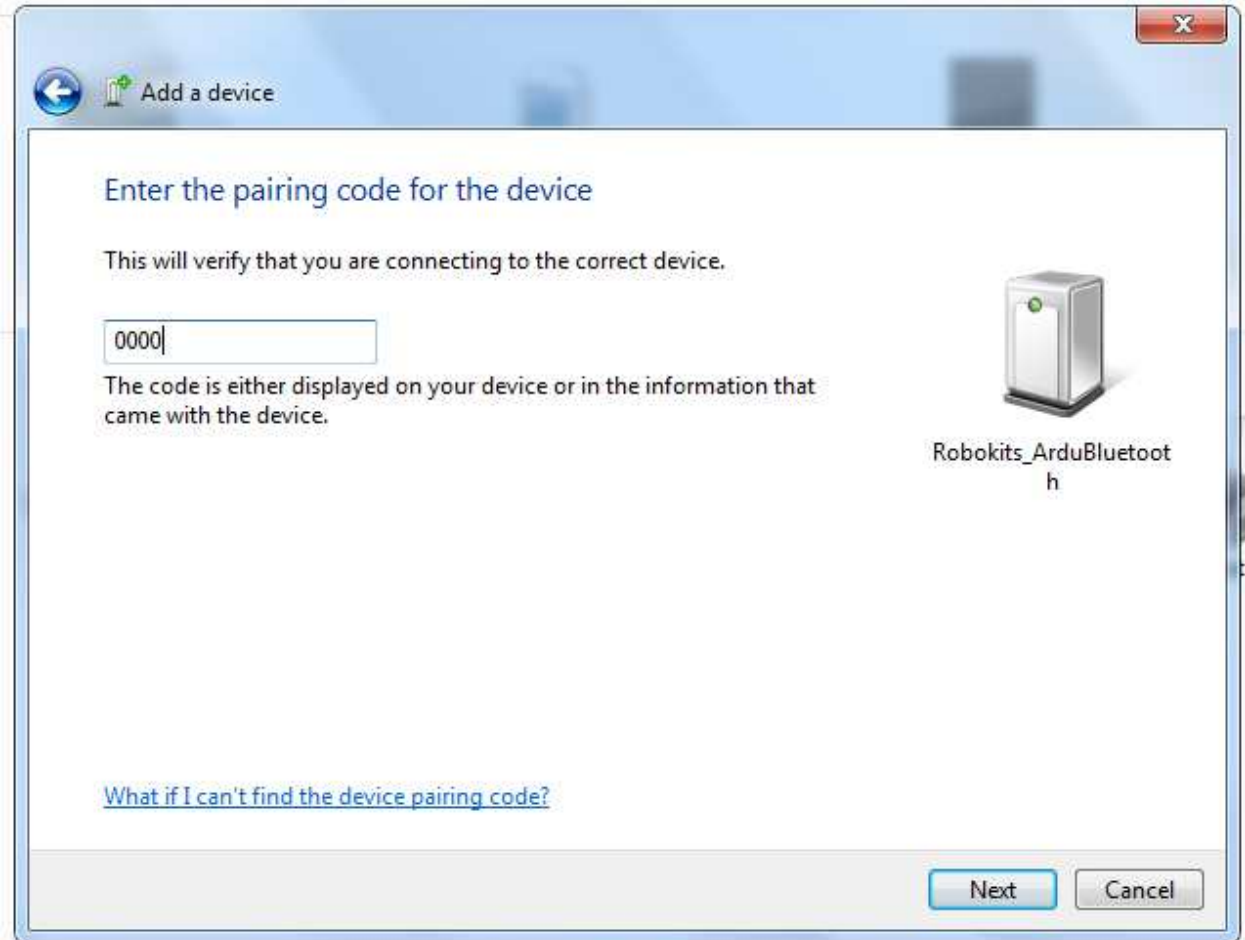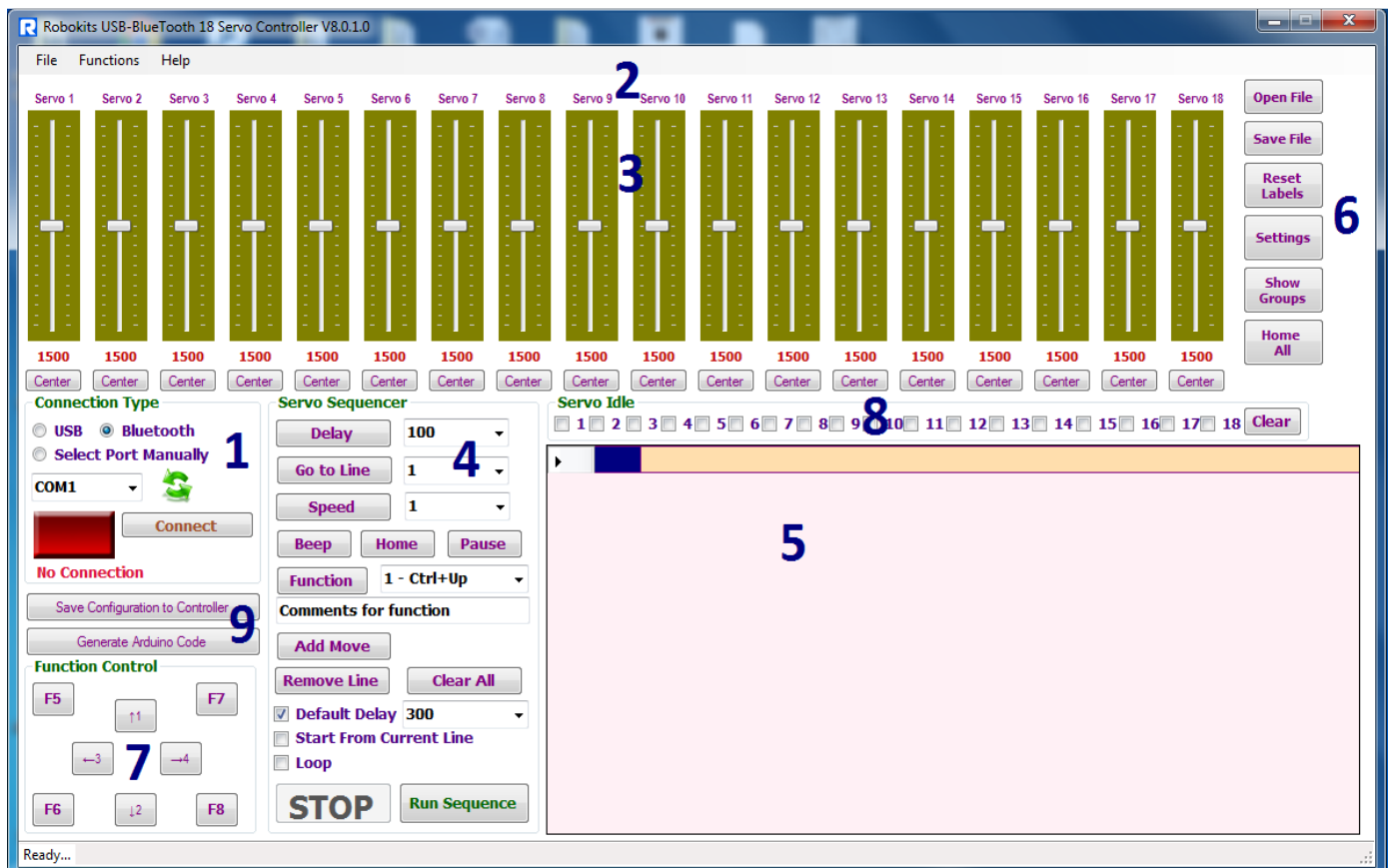
8. **Below Dialog Box will appear after clicking on Next Button. This Dialog Box shows that the device has been successfully added to the computer.**
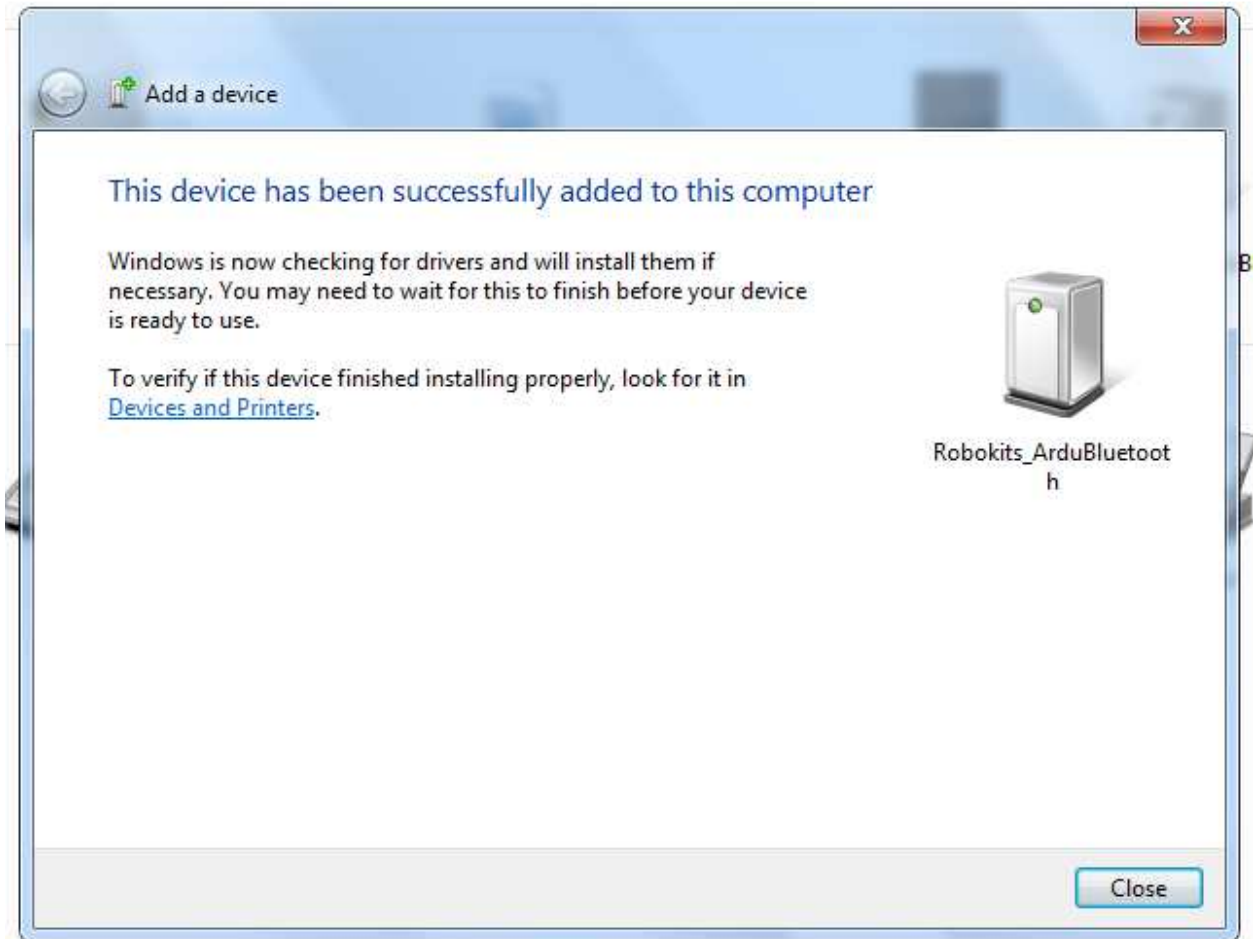
Using Servo Controller Software

Once the all the softwares and drivers are installed you can open the Servo Controller Software installed on your PC. The Software Screen will appear as below:

The Function of different Parts is explained as below:

1. Servo Controller Connection Section:

This Sections is for Connecting the Hardware i.e. Servo Controller with the Software. The Product comes with 2 variants one is having only USB Connection and other one is having USB + Bluetooth Connection. By default it is configured to connect in Bluetooth Mode but you can select any option as required.

First of all make sure that the all the drivers are installed properly. Power up the hardware and connect the USB Cable to Hardware. Click on **USB** and then Click on **Connect** Button as shown below.

Similarly if you want to connect the hardware through Bluetooth then select **Bluetooth** and Click on **Connect** Button as shown Below.

Now the Software will search for the available Ports depending on the Connections type you have selected.

If everything is fine the Connection will be established.

There is an option in the Connection Section provided for Selecting Port Manually. Here if you know the COM PORT and want to establish the Connection to that port only you can select the **COM** Port from the Drop Down Menu and then Click on **Connect** Button. The Menu will show the COM Ports Available. Select dedicated port and connect the device in the similar fashion.

2. Servo Label Section:

This Section is Servo Label Section which contains the Label for each Servo Motor. You can Change the Label by Clicking on the respective Label.

3. Servo Control Section:

This Section Controls the Servo Motors. For each Servo Motor there is a Slider provided so that the user can slide the Slider and control the Servo Motor when it is connected to Servo Controller. At the Bottom of this Section the values shows the current position of Sliders or Motors. Also there is a Center Button provided for each Servo to make the position of Slider or Motor to the Center Position.

Make sure that the Connection is established between Servo Controller and Servo Controller Software which is explained in the next Step. This is because you can only control the Servo Motors by sliding the Sliders after establishing the Connection.

4. Servo Sequencer Section:

The Servo Sequencer Section is shown as below:
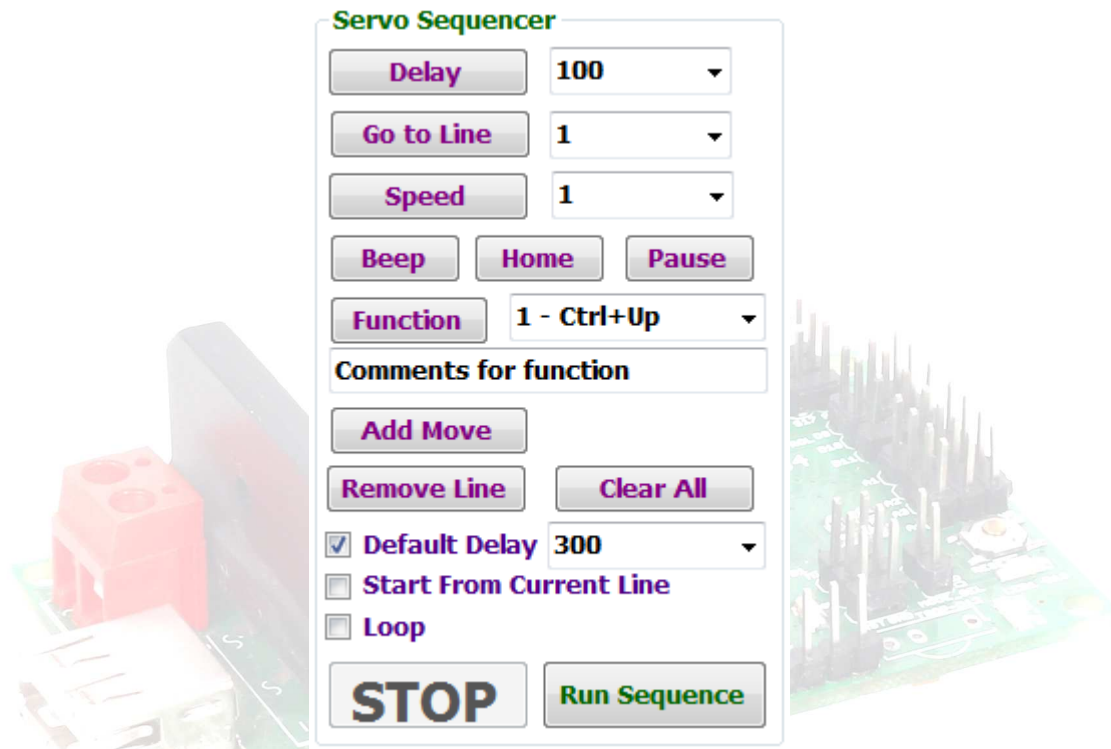
The Servo Sequencer Section is used to create Programs or Sequences and also used to modify them. The Function of each Button is explained below:

Delay:
To add a delay of specified time in milliseconds in running program. Possible values are between 100 to 2000 ms. If more delay is needed, multiple delay lines can be added.

Go To Line:
Go to a specific line in program. This function helps creating jumps or looping in program.

Speed:
Changes the speeds of servo. Higher the number more is the speed. 1 is Minimum speed, 100 is maximum speed.

Beep:
Rings 'Beep' from computer speaker. Sounds could be different for different themes set on PC.

Home:
Sets all servos to home position.

Pause:
Pause the program until a function is called or certain action is done.

Function:
Up to 8 different functions can be created and named for certain actions. For example you can program different functions for walk forward, walk backward, turn left, turn right and dance in sequencer for a biped. After creating functions you can call them with a hot key or clicking buttons on screen and run the programmed actions.

It's advisable to use pause at end of every function so that program doesn't end.

ADD Move:
Add move Add the current servo positions for all 16 servos to program. By default move is added in the last line but it can be added anywhere. When a line is selected before adding move new line will be added before currently selected line. After a line is added numbering of lines will change, this can affect in Go to line command.

Some servos can be excluded by selecting their numbers in servo idle box so that they will remain unaffected while the move is performed.

Remove:
Removes the Selected Line.

Clear All:
Clears the Program Window.

Default Delay:
Add specified amount of delay between every line. This is required when program is running on speed 1 as there will be no time for servos to complete action because before the servo reaches specified angle next command is sent.

Start from Current Line:
Start running program from selected line. This is useful when a specific part of program needs to be run or for testing while developing sequence.

Loop:
Starts program again from line 1 after end.

Run Sequence:
Start running program.

Stop:
Stop running Program.

5. Sequence Window/ Program Window:

All the Sequences which are generated or modified using the Servo Sequence Sections can be seen in this Window. Moreover for running the specific Step you can double click the Line in this Window to Run that step.

6. Servo Settings and other Options:

The different Buttons in this Section are explained below:

Open File:
To open already saved file.

Save File:
To save Current File.

Reset Labels:
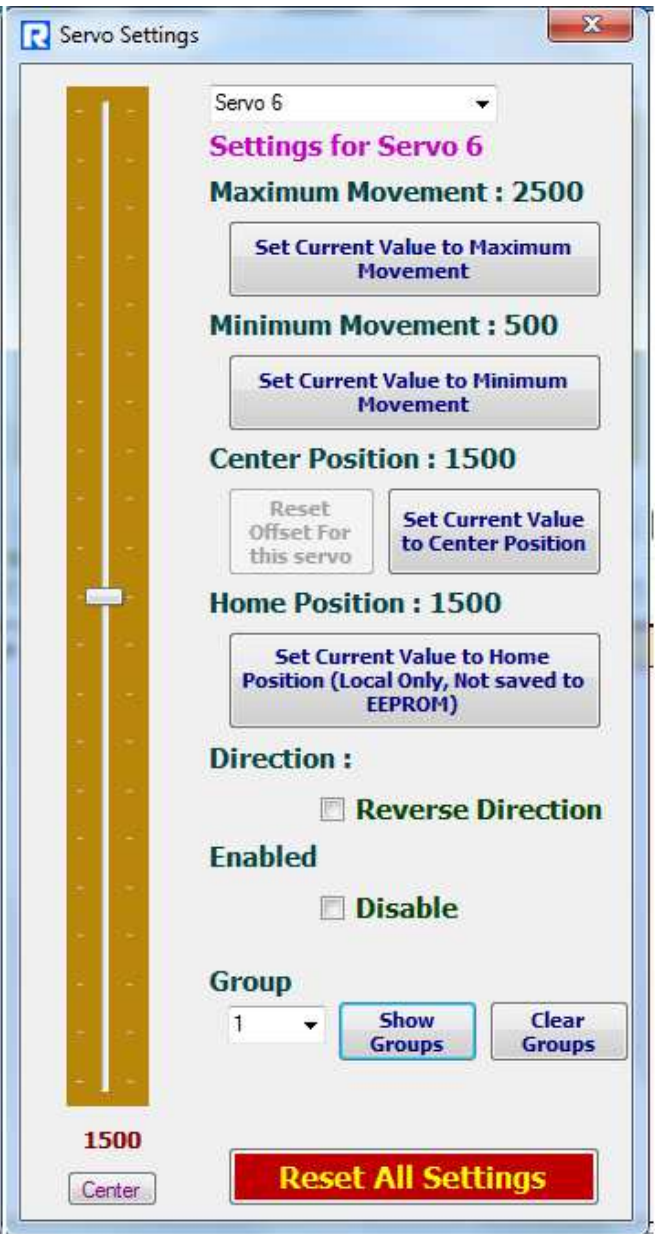Reset the Labels of the Servos given by the User.

Settings:

This Menu is the very important with the view point of controlling the Servos. On Clicking on this Button will open a new Window as shown below.

- Slider in settings menu is same as main screen. Moving it will move selected servo.

- Servo numbers can be selected from dropdown menu on top.

- Servo controller shows movements in large range. It's obvious that all servos have slightly different operation range and higher and lower movement limits depending upon types and manufacturer. Here we can set maximum and minimum movement of servo so that motor doesn't reach the limit. It's also required to restrict movement when in an assembly servo movement is obstructed by some other part.

- By default Center position is 1500. This can be changed as per requirement and servo type. The Offset for this servo can also be reset using Reset Offset for this Servo Button.

- Home position is the position which puts servos in default state. This can be used to move servo selected in the Drop Down Menu in certain position. This can also be called in program.

- Checking 'Reverse Direction' checkbox will reverse direction of servo. This is useful function while programming sequence for robots like bipeds or hexapods where mirror movements are needed for left and right legs.

- Checking 'Disable' will disable the particular Servo.

- Before explaining the function of Show Groups Button it is important to understand the topic of creating the Groups. Let's see how to Create Groups:

  ➢ There is a very important feature in the Settings which is called Grouping of Servos. Using this feature will create a group of motors which we need to run at a time. It is very easy to create a group and one can create the maximum of 9 Groups.

  ➢ Groups can be created from the Settings Menu itself. Let's create the Group of two Servo motors say 1 and 6. Select Servo 1 from the Drop Down Menu. Then go to Group Drop Down menu in the Bottom of the Settings menu. Select 1 from Drop Down Menu as we are creating the first group. This will create a Group 1 with Servo 1 in it. Now we need to add Servo 6 to this Group. Select Servo 6 from the Drop Down Menu. Then again go to Group Drop Down menu. Select 1 from it. This will add Servo 6 to Group.
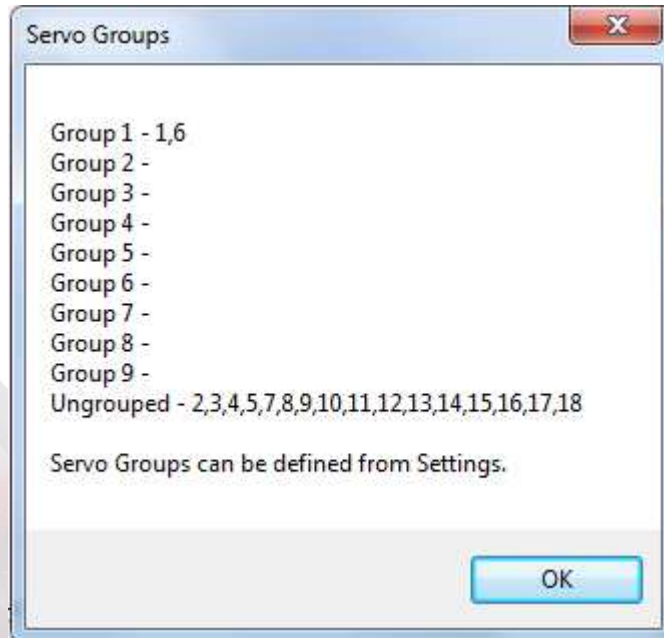
Servo 1 added to Group 1   Servo 6 added to Group 1

➢ **Once the Groups are created they can be viewed by Clicking on Show Groups Button. For example we have just created Group1 containing Servo 1 and 6. See below image:**

➢ **This Dialog Box will open when clicked on Show Groups Button. Currently it is showing that Servo 1 and 6 are in Group 1. All the other Servo Motors are showing ungrouped.**

- **One can also clear the Groups by clicking on Clear Groups Button.**

- **One can reset all the Setting by Clicking on 'Reset All Settings' Button.**

Show Groups:
This Button is same as given in the Settings menu. One can view the Grouped and ungrouped Servos. Note that Groups can only be created in Settings Menu.

Home All:
All the Servos can be moved to Default State by Clicking on 'Home All' Button

7. Function Control Section:

While generating the sequences one can also create the Functions as per the requirement. For example in Biped Robot one can generate different functions for Forward, Reverse etc. Once the functions generated you can directly call the required function from this Section.

8. Servo Idle Section:

By default when executing servo movement commands like double clicking on code line or while running a program, servo controller will update values of all 18 servos. In some cases this can be problem specially while using functions.

For example there a robot with 4 servo motors, 2 are for driving wheels and 2 are for wrist and gripper. This robot is connected to servo controller with Bluetooth for wires operation and it needs to be controlled manually by using functions. Now say there are different functions for pick, place, and move forward-back-left-right. What happens here is if servos are hardcoded while moving forward or backward gripper servos will also operate. Or while opening or closing gripper wheeled servos will operate. To avoid this we can idle gripper servos while moving and idle wheeled servos while gripping operation.

In Servo Idle box any servo can be chosen to idle while adding move. Idle servo will appear as 'X' in program.

## 9. Saving Configuration and Generating Arduino Code:

In this Section the first Button is of **Save Configuration to Controller**. The Configurations Settings made for each Servo (for example: Center Position, Maximum Position , Minimum Position etc) can be directly saved to Controller by clicking on this Button.

Once the sequence is generated for the required application and the file is saved you can generate the Arduino Code for your sequence which can directly be deployed into the same Servo Controller Board as it is Arduino based Controller. This will make your robot autonomous means you don't need PC Software for running the same sequence generated by you. Let us see how to generate the Arduino Code.

**Suppose the sequence is generated as shown below image in the Red Box:**
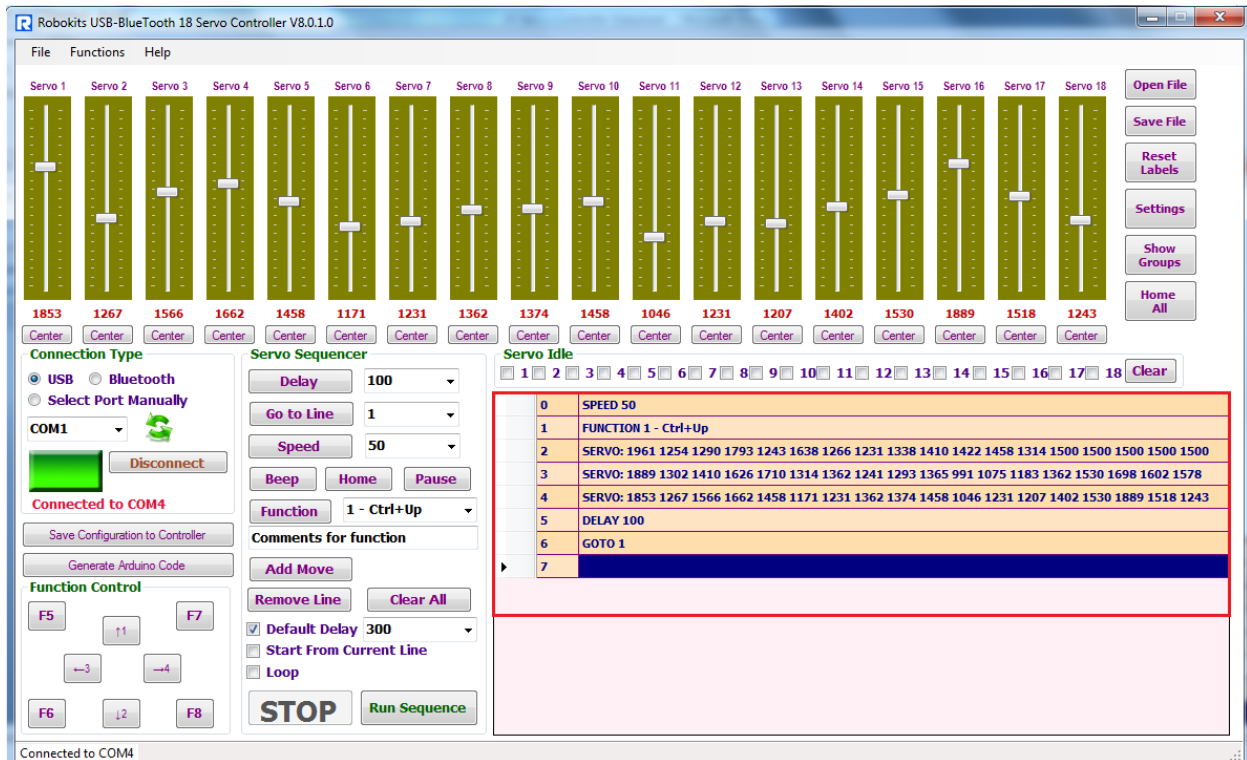
Now Click on Generate Arduino Code Button for generating the Arduino Code for that Sequence. Once the Button is clicked below Dialog Box appears on Screen:
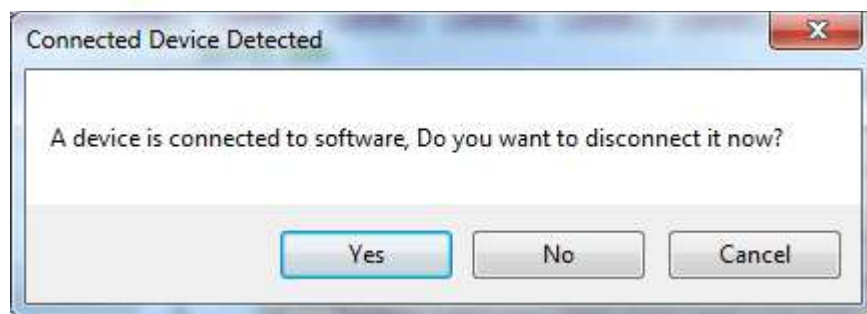
Click on Yes Button. It will Disconnect the Device connected.

Once the device is disconnected the Arduino Code is generated successfully and Code Generation Success Dialog Box will appear as shown Below:
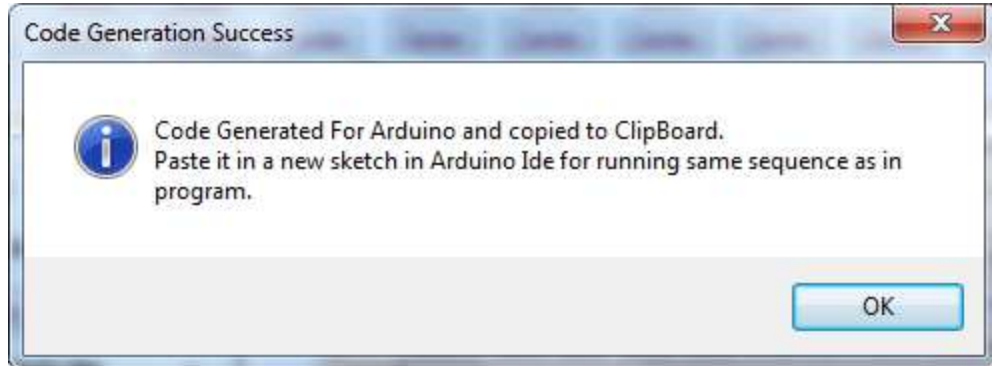
This Dialog Box shows that the Code for Arduino is generated and copied to Clipboard. Paste this code to the New Sketch in Arduino IDE for running the same sequence. Now Click on OK Button.

The Arduino Code is already generated. Open Arduino IDE on your PC (if not installed please install it from the CD provided). Open a New Sketch and press CTRL+V to paste the generated code to Arduino IDE. Save the Code and the Code is now ready for being uploaded to Servo Controller Board.