BioBox UI Quickstart Guide

C. Perkins
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v1.1.0

This document provides the information on how to use the BioBox UI to interface with the BioBox system.

Change Log

+ Fan functionality included - fan start/stop/programming.
+ COM Send function bug fixed.
- Motor function buttons and facilities removed.

Contents

1 Introduction

BioBox is a containment system for biohazard group 2 viruses, allowing them to be placed safely in front of a beamline. The BioBox UI (this software) is the software component to interface with the BioBox system. The software is intended to communicated with an Arduino via COM ports, with the Arduino containing it's own control and safety code to directly interact with the motor drivers, relays, and sensor.

This document is the quick start guide for using the BioBox UI application. It contains the information necessary to install and use the software, as well as develop Arduino code to interface with the UI if necessary.

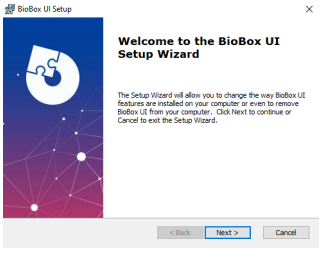
For more information please visit the repository on GitHub at https://github.com/Chaddyfynn/BioBox-Controller for the source code, or contact the developer by sending an email to charlie.perkins@student.manchester.ac.uk.

2 Quick Start Guide

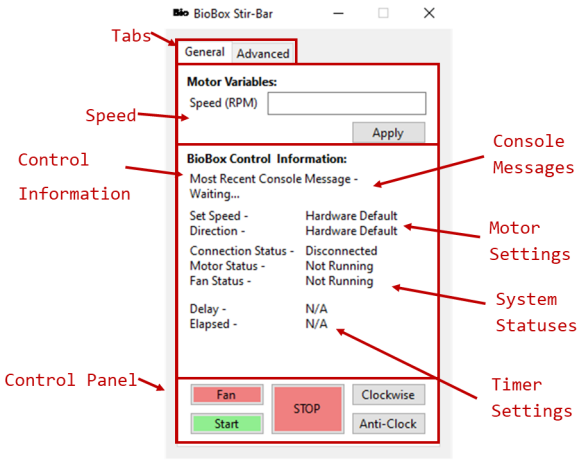
The Quick Start section is intended to give the user an easy tutorial for using the application. Detailed information about the logic and programming are contained within the Developer Information section (Section 3).

2.1 Installation

To install BioBox UI visit the GitHub repository release section from https://github.com/Chaddyfynn/BioBox-Controller/releases for the most recent release. This guide will show how to install v1.1.0, but the installation process is unlikely to change with future versions. From the GitHub release page select the most up-to-date release and click the BioBox.UI.Installer.msi link to download the installer. Open the installer and follow the on screen instructions. Once this is complete, you should be able to open BioBox UI from your start menu by searching for BioBox UI.



2.2 User Interface



The UI for BioBox is very minimalist, so there is not much the user needs to get used to. There are two main pages: General, and Advanced. The General page is where the user sends commands to the BioBox system by pressing on-screen buttons. All the buttons on the General page act instantly, so any changes will be instantaneous. The only exception to this is the Start button, which will act with a delay if the user has entered a valid argument. The Advanced page controls any non-instantaneous changes, such as port and timer settings.

The General page has three main areas - Motor Variables, BioBox Control Information, and the control panel.

The Motor Variables area contains an input box to control the frequency of rotation of the stir bar. The input box sanitises text, so only zero and positive numbers will be accepted as possible speeds. Changes will not be accepted until the user clicks Apply.

The BioBox Control Information area contains useful text detailing the current system properties.

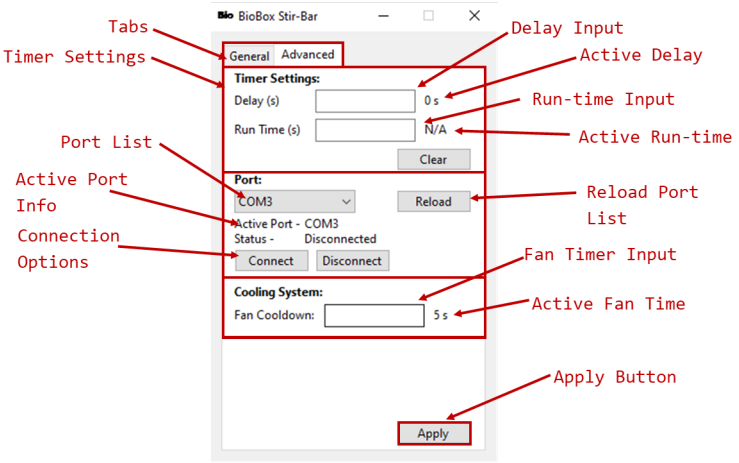
1. Most Recent Console Message: Displays debug messages that would be printed to the console if this were a debug release.
2. Set Speed: Displays the currently selected motor speed.
3. Direction: Displays the current spinning direction of the stir bar (Rotate mode).
4. Connection Status: Displays whether or not the application will send a request over the port to the Arduino.
5. Motor Status: Display what the application is currently controlling the motor to do. Options include (1) Not Running, (2) Running, (3) Delayed, (4) Finished, and (5) Cancelled. (1) only appears on start-up. (2) displays any time the software has sent a request to run the motor. (3) displays when the user has pressed Start, but a delay time was entered so the motor is currently idle, but imminently running. (4) displays when the motor has finished running either through user interruption (STOP button) or the run time has been fulfilled. (5) displays when the delay timer was counting down, but the user interrupted the countdown with STOP.
6. Fan Status: Displays whether

the last fan control message to the arduino was a running (T1) which shows 'Running' or not running (T0) message, which shows 'Not Running'.

7. Delay: Displays the amount of time until the motor begins running after Start has been pressed. This is only a valid item when the Motor Status is 'Delayed'.

8. Elapsed: Displays the current amount of time the motor has been running (valid when Motor Status is 'Running'), or displays the amount of time the motor ran on the last run (Motor Status is 'Finished').

From the control panel the user can choose to Start or Stop the motor, as well as change the direction of rotation or vibration. The Fan button allows the user to control whether or not the fan will run during the operation of the stir bar. When the button is green, the fan will turn on when the start button is pressed. When the button is red, the fan will not operate. The fan operates within a cooldown period to further cool the coils after the stirbar has stopped. Double clicking the stop button immediately stops the fan rotation - single clicking will use the cooldown timer.



The Advanced page has three main areas - Timer Settings area, and the Port settings area, and the Cooling System area . The top row in the Timer Settings area controls the delay settings. The user can input an *integer* number of seconds they would like the system to wait after Start has been pressed before the motor begins running. The currently set delay time in seconds is displayed to the right of the delay input box. The user can cancel the countdown by pressing STOP at any point during the delayed period. The next line down controls the Run Time settings. The text input box allows the user to restrict the duration of action of the motor to a given number of seconds. Likewise, it must be an integer. Decimal inputs are not accepted. After this amount of time, the BioBox UI will send a request to stop the stir bar motion. The user can still stop the stirring before the end of the timer by pressing STOP on the General page. The text to the right of the input box displays the currently selected run time in seconds. All changed settings must be updated by pressing Apply at the bottom before any changes are secured. The Clear button resets the Delay and Run Time to their defaults, 0s and indefinite respectively.

The Port settings section allows the user to connect to the BioBox system using COM ports. The BioBox UI checks what ports are currently active on loading of the application and displays them in the dropdown menu. If BioBox is connected to the computer after the application started then the ports list will need reloading using the Reload button to the right. The Active Port text below the ports list shows which port is currently selected and will be used to communicate. COM5 is usually used for Arduino communication. Check the Arduino IDE for the selected COM port if you have any doubts. The status text displays Connected, Disconnected, or User Abort. Though the text implies that this means BioBox UI is *currently* communicating over that port right now, this is false and this simply means whether or not the application will connect to the port when a request is made by pressing one of the buttons on the General page. The app does not 'connect' to the port until a request is made by pressing one of the buttons on General. For most purposes, the user will want to always click Connect upon opening the application and selecting the correct port. But often for debugging purposes it is useful to disable the connection request to stop BioBox UI from crashing after sending a request over a non-Arduino COM port. Upon clicking Connect, a dialog box will pop up to ensure the user is aware that they are about to remove the safety net over the General page that stops unintended requests being sent over COM ports.

The Cooling Settings area contains an input box to choose how long the fan should run for after the stir bar coils have stopped. The number cannot be 0 for safety reasons, and inputting so will revert the setting back to its default which is 5s.

2.3 Connecting to an Arduino

To connect to the Arduino, plug the Arduino into the USB port on the computer and have the port the Arduino uses to communicate handy. You can find this information in the Arduino IDE, or by contacting the BioBox Arduino programmer.

Open the BioBox application and open the Advanced page. Open the port dropdown menu and select the correct port. Click Connect. This will open up a dialog box to ensure you want to connect to the correct port. Click Yes to close the dialog if you are sure this is correct.

The Arduino should now be connected to the application. To check, go back to the General page and click Single Step to move the stir bar once. You should be able to tell upon visual inspection whether the Arduino has connected or not.

2.4 Simple Stirring

In this section we will create a simple stirring program to rotate the stir bar at 700 RPM for one minute.

To set up a simple stirring program, connect the Arduino as described in the last Section (Section 2.3). Travel to the Advanced page and type in a desired number of seconds for the stir bar to run in the Run Time input box. In this example we want a 1 minute run time so we will type 60. Then select Apply at the bottom of the interface.

Go back to the general page, then in the speed input box type 700. The default is 500. Then click Apply. You should not have to select a rotation

direction as the Arduino should be programmed to rotate clockwise by default - though this will not appear in the BioBox Control Information section unless the user has pressed Clockwise. Click on the Fan button and ensure it has turned green.

Finally, press Start. The Motor and Fan statuses should have changed to 'Running'. Similarly, you should see the Elapsed timer now tick about once a second (subject to PC performance) and the stir bar should be rotating clockwise. At 60s the software will automatically request the stir bar to stop rotating and the Motor Status will change to 'Finished'. At this time the Elapsed timer will continue to display '60 s' and the stir bar should have stopped. 5s after these events, the fan should turn off too, and the Fan Status will display 'Not Running'.

3 Developer Information

This section contains important information regarding the functionality of the software, such as potential errors, and serial port codes for the Arduino programmer to check for on the port connection.

3.1 Serial Port Codes

All serial port codes are formatted [LETTER][NUMBER(s)]. The letter signifies the action required, and the number details the specific setting. The baud rate is 9600.

c. Control

- 0: Stops the motor
- 1: Starts the motor

S. Speed

- NUM: Set rotation speed to NUM

r. Rotate/Direction

- 0: Rotate clockwise
- 1: Rotate anti-clockwise

T. Cooling

- 0: Fan off
- 1: Fan on

Current communication is only 1 way (BioBox UI to Arduino), but v1.2.0-beta intends to bring two-way communication to allow the Arduino to contain safety measures, checks, and live updates on the BioBox system to be displayed in the BioBox UI.

3.2 Known Bugs / Issues

As of writing this, there are two minor inconveniences. One minor inconvenience is that the input boxes accept C# int type only and do not round decimals. Inputting a decimal is treated the same as typing 'Why will this not take decimals?!!!!', and the program will disregard this input. The other minor inconvenience is that if the user incorrectly presses 'Yes' on the Connection dialog box without ensuring that the COM port is the correct one, then the program will crash and need closing in Task Manager.