



## SSC32 SERVO SEQUENCER GUIDE

## CHAPTER 1

## **1 Overview 3**

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<b>INTRODUCTION.....</b>	<b>4</b>
<b>USER INTERFACE.....</b>	<b>5</b>
<b>CONNECTING.....</b>	<b>6</b>
CONNECTING VIA SERIAL CABLE.....	6
<b>SERVO CONTROLS.....</b>	<b>7</b>
SERVO CONFIGURATION.....	8
<b>CONTROL PANEL.....</b>	<b>9</b>
HELP.....	9
EMERGENCY STOP.....	10
CALIBRATION.....	10
ANALOG INPUTS.....	10
CONSOLE.....	11
FIRMWARE UPDATE.....	11

## CHAPTER 2

## **2 Sequencer 12**

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<b>PATTERNS.....</b>	<b>13</b>
PATTERN LIST.....	13
PATTERN MANAGEMENT.....	13
SAVING PATTERNS.....	14
LOADING PATTERNS.....	14
CLEAR ALL.....	14
<b>FRAMES.....</b>	<b>15</b>
ADDING AND DELETING.....	15
TIMELINE LOCKING.....	15
MOVING AND RESIZING.....	15
RECORDING TO A FRAME.....	16
COPY AND PASTE.....	17
PAUSE BEFORE FRAME.....	17
REMOVE GAPS BETWEEN FRAMES.....	17
REVERSE FRAMES.....	17
PATTERN PLAYBACK.....	18
PLAYBACK CONTROL.....	18

# 1

# Overview

THE SSC32 SERVO SEQUENCER PROJECT

# Introduction

This guide explains how to use the FlowBotics Studio SSC32 Servo Sequencer project.

If you have not already done so you'll need to read the FlowBotics Studio user guide and be familiar with how to launch the SSC32 Servo Sequencer project from the FlowBotics Studio Project Browser.

The FlowBotics Studio user guide is available from the Help button in FlowBotics Studio.

If you need information on how to assemble your robotics kit you can find it here:

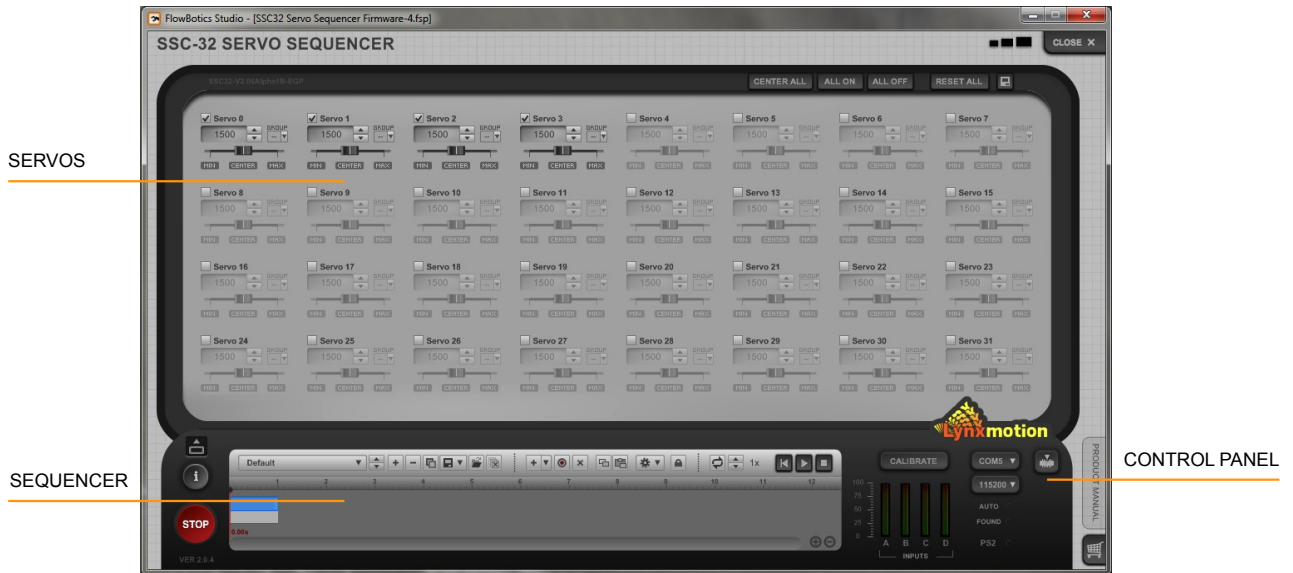
<http://www.lynxmotion.com/s-2-assembly-guides.aspx>

# User Interface

When you open the SSC32 Servo Sequencer project you'll see the interface is essentially broken into two main areas, the Servo Controls and the Control Panel.

The Servo Controls allow you to set the position of each servo on the SSC32 individually

The Control Panel contains elements for connecting to the robot, changing it and for sending and receiving data. However, the biggest part of the Control Panel is the Sequencer which allows you to program a series of movements.



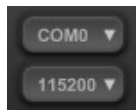
# Connecting

Before we go any further we'll talk about how you connect your robot to the PC so that it can communicate with FlowBotics studio projects.

## Connecting Via Serial Cable

The simplest way to connect is directly using an RS232 to USB cable. Here are the steps you need to follow in order to set this up.

- STEP 1** Connect the RS232 connector to the SSC-32 board on your robot
- STEP 2** Plug the USB connector into the PC
- STEP 3** Power on the robot
- STEP 4** Run FlowBotics Studio and open the project. The Project is set to automatically detect the COM port.
- STEP 5** The software will automatically search for the SSC-32. The Auto light will flash while this is happening. When the SSC-32 has been detected both the Auto and Found lights will illuminate to indicate this. Your robot is now connected and ready to be controlled and programmed by FlowBotics Studio
- STEP 6** If you wish you can select a COM port manually from the COM port list. You can also override the default baud rate.



Now that you know how to connect we will continue with our tour of the project user interface.

# Servo Controls

The Servo Controls are an array of sliders and push buttons that give you control over each individual servo. Each servo control has a slider for setting the position. You can hold CTRL and click to reset the slider to the centre position or you can click the Center button.



## Finer Control

Fine adjustments to the position of the servo can be made using the push buttons.

If you click and hold these buttons they will auto repeat, that is to say that they will continually nudge the servo in the applicable direction until the mouse button is released.

The numerical displays show the absolute position of the servo. For high precision control you can click on these and change them.

## Restricting Range

You can restrict the range of the slider so that it moves between a narrower set of limits. To do this move the slider to one extreme and click the Min or Max button. The slider will no longer be moveable past this limit point.

To remove a range restriction simply click the Min or Max button a second time.

## Disabling a Servo

You can switch a servo off by clearing the check box. The servo data will no longer be sent to the board allowing communications to be more streamlined.

## Renaming a Servo

You can change the name of a servo to something more appropriate to your application. For example, for a robot arm you might want to name servos as 'base', 'shoulder', 'hand' etc. Just click on the name and you can type in a new one.

## Grouping Servos

You can tie several servos together so that when you move one the other ones all move as well. To do this click on the Group control for each of the servos and set it to the same number. When you move one of them all the others will move in sync.

## Servo Configuration

Across the top of the servo controls you'll see a toolbar with a number of buttons on it.



From here you can perform a number of operations that affect the configuration of all servos. You can center them all and switch them all on or off with one click. You can also reset all servos to their standard default settings.

The disk button allows you to save and load servo configurations for use in the future. This is handy if you have created a servo setup for a particular application that you use often.



# Control Panel

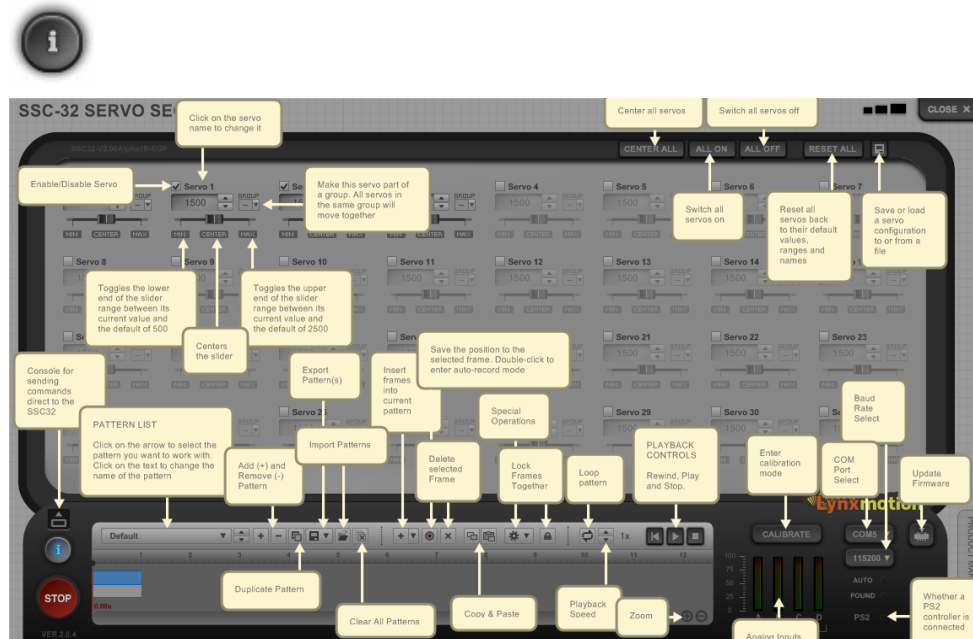
The Control Panel has several functions. It provides some essential configuration controls for things like COM port connection and calibration.

It also houses the sequencer. This is the biggest element in the panel and as such we deal with it in its very own chapter.

For now we'll focus on the other elements and we'll deal with them one-by-one starting with in-project help.

## Help

There are a large number of buttons and controls on the project interface so if you ever need a quick reminder of what a particular control is for you can quickly call up the in-project Help overlay. Just click the button shown below to toggle the overlay on and off.



## Emergency Stop

On very rare occasions you may need to stop your robot in its tracks. For this purpose we've added an emergency stop button. Click here and the software will immediately stop all servos and kill all communications.



## Calibration

Small differences in robot orientation are inevitable. Even if the same person built the same kit twice in a row there would always be some small differences between the two. In order to compensate for this we have a calibration facility.

Click the Calibration button to enter calibration mode.



This will display a number of knobs on the interface. Click and drag these to alter the servo position. You'll need to have the robot connected in order to see the servos adjust as you move the knobs.

The knobs are zero at the vertical position. If you hold the CTRL key on your keyboard and click on a knob it will reset it to zero.

## Analog Inputs

There are four input meters that indicate the state of the 4 analog inputs on the SSC-32 board. These are labeled A,B,C and D just like they are on the SSC-32.



## Console

You can talk directly to the SSC-32 using the Console. To access this click on the Console toggle button which is above the help button to the left of the sequencer.



The console will pop open. You can click here and type commands. Click the Send button to to send the commands to the board. Any returned data is shown below the command input box.



Please refer to the SSC32 user manuals to find out more about supported commands.

## Firmware Update

The software allows you to update the SSC32 firmware. First connect to the board then press the Firmware button (shown below).



You will be asked to provide the software with a firmware file (ending .abl). After the update is complete you will need to power off the board, then power it on again and re-connect.

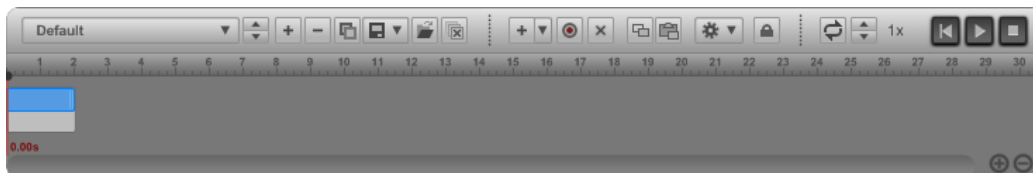
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# Sequencer

ORCHESTRATING MOVEMENT

# Patterns

The sequencer allows you to make your robot move over time by transitioning from one position to another. Each transition we call a frame and a sequence of frames we call a pattern.



You can create as many patterns as you like. You can play patterns back manually or, as you'll see in the Programming Guide you can program them to run depending on some other action or outcome.

This section describes the pattern management functions of the Sequencer.

## Pattern List

The pattern list is the first control on the sequencer. If you click on the arrow on the right-hand edge you'll see a list of the patterns that have been created and by selecting one you can move to that pattern. You can also scroll through the list one-by-one using the up and down arrow buttons.



Clicking on the name of a pattern will allow you to change this. Simply type in the box then press the Return key or click away.

## Pattern Management

### Add Pattern

To add a pattern click the add button. A new pattern will appear in the list and its name will open for editing.



### Remove Pattern

Click the remove pattern button to delete the currently selected pattern from the list. This action is irreversible so you will be asked for confirmation.



### Duplicate Pattern

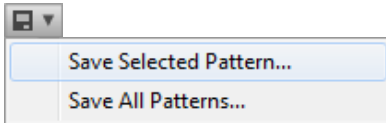
If you want to make a new pattern based on an existing one then you can duplicate it.



## Saving Patterns

**IMPORTANT:** If you want to keep any patterns you create then you must export them otherwise they will be lost when you return to the project browser.

To do this click the export button.



You can choose whether to export all your patterns or just the currently selected one. Patterns are saved to files so you'll need to pick a filename and folder to save to. If a pattern uses sub patterns these will be saved even if you choose only to save the selected pattern.

## Loading Patterns

If you have saved patterns that you want to restore then click the Import button. You will be asked to choose a previously saved pattern file.



The patterns in the file will be added to the list. They do not replace the pattern list. Also it doesn't matter how many patterns the file contains, all of them will be imported.

## Clear All

If you want to start from scratch you can clear all the patterns from the list using the clear all button.



# Frames

We now know how to manage patterns now lets see how you build one. As we said earlier a pattern is made up of frames. A frame represents a transition between robot states over time.

In addition to frames, you can also add other patterns to a pattern. This allows quite complex series of movements to be built up very quickly and easily.

## Adding and Deleting

To add a frame click the Add button. A new frame will be added at the end of the pattern. The duration of the frame will be whatever the last frame duration was. The frame will record whatever position the robot is currently set to.



You can add a sub pattern to the pattern by clicking the arrow to the right of the Add button. A drop list of the available patterns will appear. Select one and it will be added to the end of the pattern.

To delete a pattern or frame from a pattern, click the Delete button



## Timeline Locking

The timeline is locked by default. This means that frames will automatically run from one to the next – you cannot create space in between. Moving a frame past another one will move it along the order in the timeline.

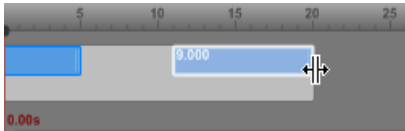
If the timeline is unlocked then you can move frames independently of each other and also create gaps of time in between.

## Moving and Resizing

To move a frame on the timeline, simply click on it and drag it to the time you want it to start. The start time will be displayed as you drag. How frames move relative to each other is determined by whether the timeline is locked (see previous section).



To resize a frame grab the right-hand edge and drag it.



When moving or resizing the mouse snaps to the nearest unit on the timeline. If you hold SHIFT while moving or resizing no snap will be applied.

When the timeline is unlocked then if you hold CTRL while dragging or resizing a frame all frames to the right of the selected frame will be moved so that the time interval between the selected frame and the next one is maintained.

## Recording to a Frame

When you add a frame it will record the state that the robot is currently in. If you want to change this state first select the frame by clicking on it. Next move the robot to the position you want to record. When you're happy press the record button.



The frame will flash to indicate that it has been updated.

### Auto Record

If you want changes you make to be automatically recorded you can lock the record button in place by double-clicking on it. Now whenever you change the robot position the currently selected frame will be updated.



The record button will light up to show that auto record is on.

To switch auto record off, double-click on the record button again.



## Copy and Paste

Sometimes you might want to copy the robot state from one frame to another. To do this we have copy and paste. To copy the data from a frame, select it then click the Copy button.



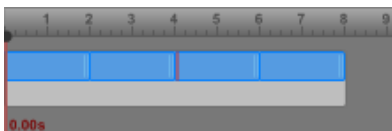
To duplicate the data on another frame, select the target frame and click the Paste button.



## Pause Before Frame

You can insert a pause before a frame commences. This is useful if you want the sequencer to stop and wait for some external event before continuing. First select the frame then click the Operations button and select Toggle Pause Before Frame. A red line will show at the start of the frame to show the pause.

To remove the pause select the frame again and select Toggle Pause Before Frame after clicking on the Operations button.



## Remove Gaps Between Frames

If the timeline is unlocked then you can instantly remove all the gaps between frames and push them up against each other by clicking the Operations button and choosing Remove Gaps Between Frames from the menu.



## Reverse Frames

It's useful to be able to reverse the order of frames in a pattern. To do this click the Operations button and choose Reverse Frames.



## Pattern Playback

Once you have some frames in a pattern you can try playing it. Click the Play button to start the sequencer playing the current pattern.



The play button lights up in green when the sequencer is playing.

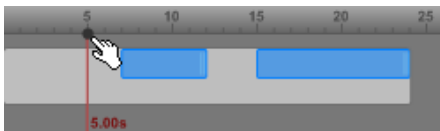
To stop playing click the Play button again or click the Stop button.



You can reset the play position to the start by clicking the Reset button.



You can also move the play position manually. Click on the black handle at the top of the playback position line and drag to move it.



## Playback Control

You can change the speed of playback by changing the speed multiplier. Click the up and down arrows to alter this.



Normally a pattern plays to the end then stops. However, sometimes you want a pattern to repeat. You can toggle this by clicking the Loop button.

