

This is the Revision C version of the Servo4 module. The status of this project is that it has been replaced by the revision D version.

Servo4 Module (Revision C)

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1. Introduction

The Servo4 module allows for the control of up to 4 hobby grade servos.

2. Programming

The Servo4 module can independently control up to 4 servos. Each servo has 1) an enable bit and 2) a current position. The position is represented as an 8-bit number. Some experimentation is needed to determine how the 8-bit numbers correspond to actual servo positions. All servos are initialized to have the enable flags *off*.

The Servo4 commands are summarized in the table below:

Command	Send/ Receive	Byte Value								Discussion
		7	6	5	4	3	2	1	0	
Set High	Send	0	0	<i>h</i>	<i>h</i>	<i>h</i>	<i>h</i>	<i>s</i>	<i>s</i>	Set high order 4 bits of servo <i>ss</i> to <i>hhhh</i> and set the remaining 4 low order bits to zero.
Set Low	Send	0	1	<i>l</i>	<i>l</i>	<i>l</i>	<i>l</i>	<i>s</i>	<i>s</i>	Set the low order 4 bits of servo <i>ss</i> position to <i>llll</i> .
Increment	Send	1	0	0	<i>i</i>	<i>i</i>	<i>i</i>	<i>s</i>	<i>s</i>	Add <i>iii</i> to the position of servo <i>ss</i> .
Decrement	Send	1	0	1	<i>d</i>	<i>d</i>	<i>d</i>	<i>s</i>	<i>s</i>	Subtract <i>ddd</i> from the position of servo <i>ss</i> .
Set Position/Enable	Send	1	1	0	0	0	<i>e</i>	<i>s</i>	<i>s</i>	Select servo <i>ss</i> and set its position to <i>pppppppp</i> and enable flag to <i>e</i> .
	Send	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	
Set Enable Flag	Send	1	1	0	0	1	<i>e</i>	<i>s</i>	<i>s</i>	Select servo <i>ss</i> and set its enable flag to <i>e</i> .
Read Position	Send	1	1	0	1	0	0	<i>s</i>	<i>s</i>	Return the current position <i>pppppppp</i> for servo <i>ss</i> .
	Receive	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>	
Read Enable	Send	1	1	0	1	0	1	<i>s</i>	<i>s</i>	Return the enable bit <i>e</i> for servo <i>ss</i> .
	Receive	0	0	0	0	0	0	<i>e</i>		
Read Enables	Send	1	1	0	1	1	0	0	0	Return the enable flags <i>eeee</i> for all four servos.

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	Receive	0	0	0	0	e	e	e	e	
Set Enables	Send	1	1	0	1	1	0	0	1	Set enable flags for all four servos to <i>eeee</i> .
	Send	0	0	0	0	e	e	e	e	
Shared Commands	Send	1	1	1	1	1	c	c	c	Execute <u>shared command</u> <i>ccc</i> .

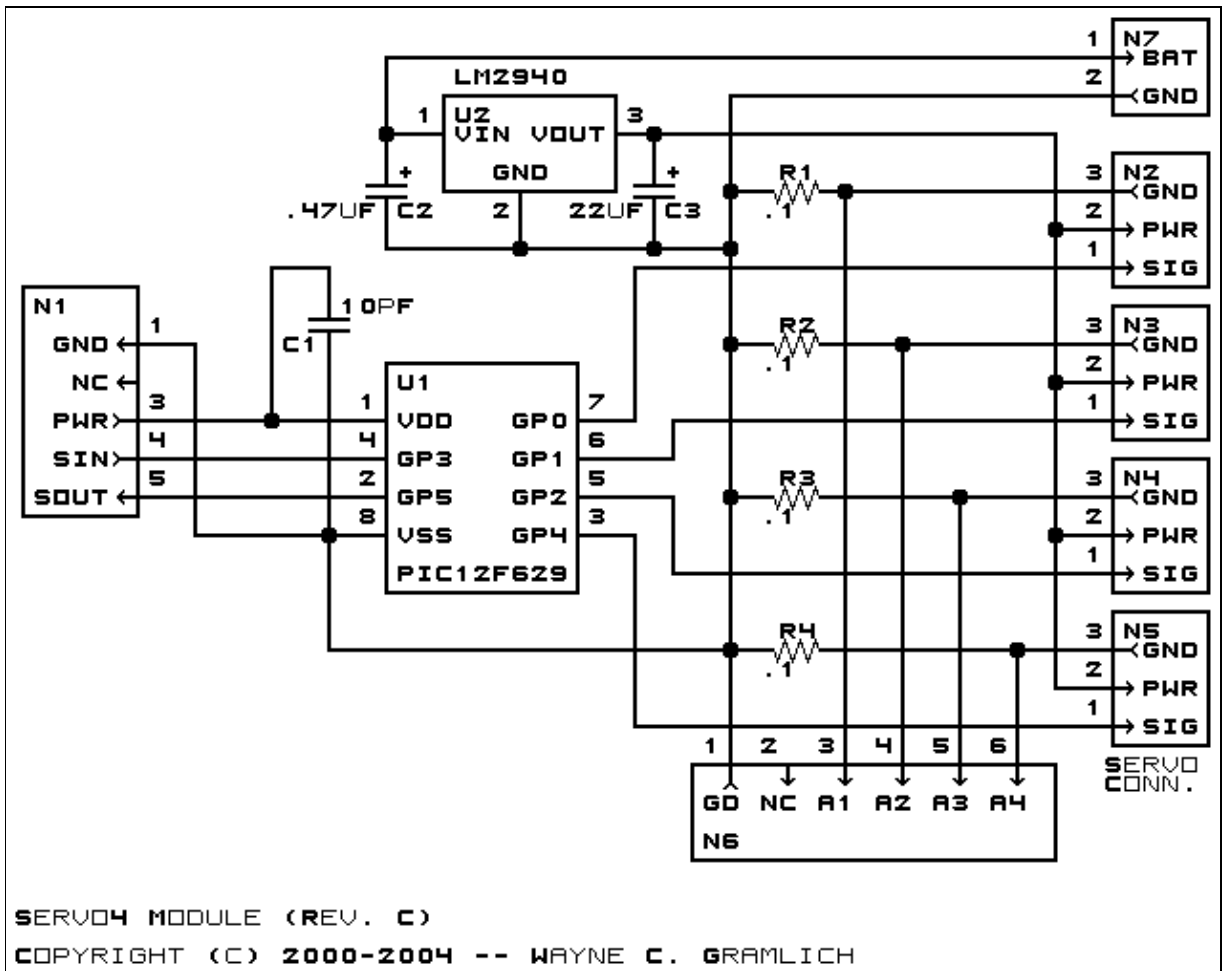
The Servo4 module does *not* know the minimum and maximum extent for each servo. This has to be determined by experimentation.

3. Hardware

The hardware consists of a circuit schematic and a printed circuit board.

3.1 Circuit Schematic

The schematic for the Servo4 module is shown below:



The parts list kept in a separate file --- [servo4.ptl](#).

3.2 Printed Circuit Board

The printed circuit board files are listed below:

[servo4_back.png](#)

The solder side layer is shown below:

[servo4_front.png](#)

The component side layer is shown below:

[servo4_artwork.png](#)

The artwork layer is shown below

[servo4.gbl](#)

The RS-274X "Gerber" back (solder side) layer.

[servo4.gtl](#)

The RS-274X "Gerber" top (component side) layer.

[servo4.gal](#)

The RS-274X "Gerber" artwork layer.

[servo4.drl](#)

The "Excellon" NC drill file.

[servo4.tol](#)

The "Excellon" tool rack file.

4. Software

The Servo4 software is available as one of:

[servo4.ucl](#)

The μ CL source file.

[servo4.asm](#)

The resulting human readable PIC assembly file.

[servo4.lst](#)

The resulting human readable PIC listing file.

[servo4.hex](#)

The resulting Intel[®] Hex file that can be fed into a PIC12C5xx programmer.

5. Issues

The following fabrication issues came up:

- There is a request for enhancement from William Hubbard for the ability to set "set points" and a command to "return to set point". Reasonable request; it might even fit.
- The holes for the voltage regulator are too small and need to be made larger.
- The capacitors are a little too close to the voltage regulator.
- It is unclear what the current sense resistor values should be.
- William Hubbard is requesting the ability to delay servo changes until a single command is sent. Reasonable request; it might be a tight fit.
- Module is mis-labeled as Servo4-B.

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