This is the Revision A verion of the AnalogIn8 RoboBrick. The status of this project is work in progress.

AnalogIn8 Robobrick (Revision B)

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This document is also available in PDF format.

1. Introduction

The AnalogIn8 RoboBrick allows for the input of up to 4 analog voltages between 0 and 5 volts with a resolution of 8 bits.

2. Programming

The AnalogIn8 RoboBrick is continuously reading the analog inputs from its four A/D pins. The controlling program can just read the results of the digital conversion, or it can have the result down converted into a single binary bit. Each pin has has a threshold high and threshold low register that is used for the down conversion. Whenever the digital conversion exceeds the high threshold register, the down coversion results in a 1. Whenever the digital conversion is lower than the low threshold register, the down conversion results in a 0. A hysterisis effect can be introduced by having some spread between the high and low threshold values.

There AnalogIn8 RoboBrick operates in either regular mode or Vref mode. In regular mode, all four inputs are A/D converted between 0 and 5 volts. In Vref mode, input 1 is used as Vref, the highest expected input voltage, and there remaining three inputs are A/D converts betweeen 0 and Vref.

After the down coversions to binary bits, the result is 4−bits of binary data. A complement mask can be used to selectively invert individual bits in the 4−bit data.

The AnalogIn8 RoboBrick supports RoboBrick Interrupt Protocol for those lines that are being used as inputs. The interrupt pending bit is set whenever the the formula:

    L&(~I) | H&I | R&(~P)&I | F&P&(~I)

is non−zero, where:

- I is the current input bits XOR'ed with the complement mask (C)
- P is the previous value of I
- L is the low mask

- H is the high mask
- R is the raising mask
- F is the falling mask

and

- ~ is bit−wise complement
- | is bit−wise OR
- & is bit−wise AND

Once the interrupt pending bit is set, it must be explicitly cleared by the user.

In addition to the common shared commands and the shared interrupt commands, the AnalogIn8 RoboBrick supports following commands:

Command	Send/ Receive	Byte Value								Discussion
		7	6	5	4	3	2	1	0	
Read Pin	Send	0	0	0	0	0	0	*b*	*b*	Read pin *bb* and respond with 8−bit value *vvvvvvvv*
	Send	*v*	*v*	*v*	*v*	*v*	*v*	*v*	*v*	
Read Binary Values	Send	0	0	0	0	0	1	0	0	Return the binary values *abcd* (after XOR'ing with complement mask)
	Receive	0	0	0	0	*a*	*b*	*c*	*d*	
Read Raw Binary	Send	0	0	0	0	0	1	0	1	Return the raw binary values *abcd* (no XOR with complement mask)
	Receive	0	0	0	0	*a*	*b*	*c*	*d*	
Reset	Send	0	0	0	0	0	1	1	0	Reset everything to zero
Read Complement Mask	Send	0	0	0	0	1	0	0	0	Return and return the complement mask *cccc*
	Receive	0	0	0	0	*c*	*c*	*c*	*c*	
Read High Mask	Send	0	0	0	0	1	0	0	1	Return and return the high mask *hhhh*
	Receive	0	0	0	0	*h*	*h*	*h*	*h*	
Read Low Mask	Send	0	0	0	0	1	0	1	0	Return and return the high mask *llll*
	Receive	0	0	0	0	*l*	*l*	*l*	*l*	
Read Raising Mask	Send	0	0	0	0	1	0	1	1	Return and return the raising mask *rrrr*
	Receive	0	0	0	0	*r*	*r*	*r*	*r*	
Read Falling Mask	Send	0	0	0	0	1	1	0	0	Return and return the falling mask *ffff*
	Receive	0	0	0	0	*f*	*f*	*f*	*f*	
Read Vref Mode	Send	0	0	0	0	1	1	0	1	Read and return the Vref mode bit *v*
	Receive	0	0	0	0	0	0	0	*f*	
Set Vref Mode	Send	0	0	0	0	1	1	1	*v*	Set the Vref mode to *v* (0=regular 1=Vref Mode)
Read High Threshold	Send	0	0	0	1	0	0	*b*	*b*	Read and return high threshold for pin *bb* of *hhhhhhhh*
	Receive	*h*	*h*	*h*	*h*	*h*	*h*	*h*	*h*	
Read Low Threshold	Send	0	0	0	1	0	1	*b*	*b*	Read and return low threshold for pin *bb* of *llllllll*
	Receive	*l*	*l*	*l*	*l*	*l*	*l*	*l*	*l*	
Set High Threshold	Send	0	0	0	1	1	0	*b*	*b*	Set high threshold for pin *bb* to *hhhhhhhh*
	Send	*h*	*h*	*h*	*h*	*h*	*h*	*h*	*h*	

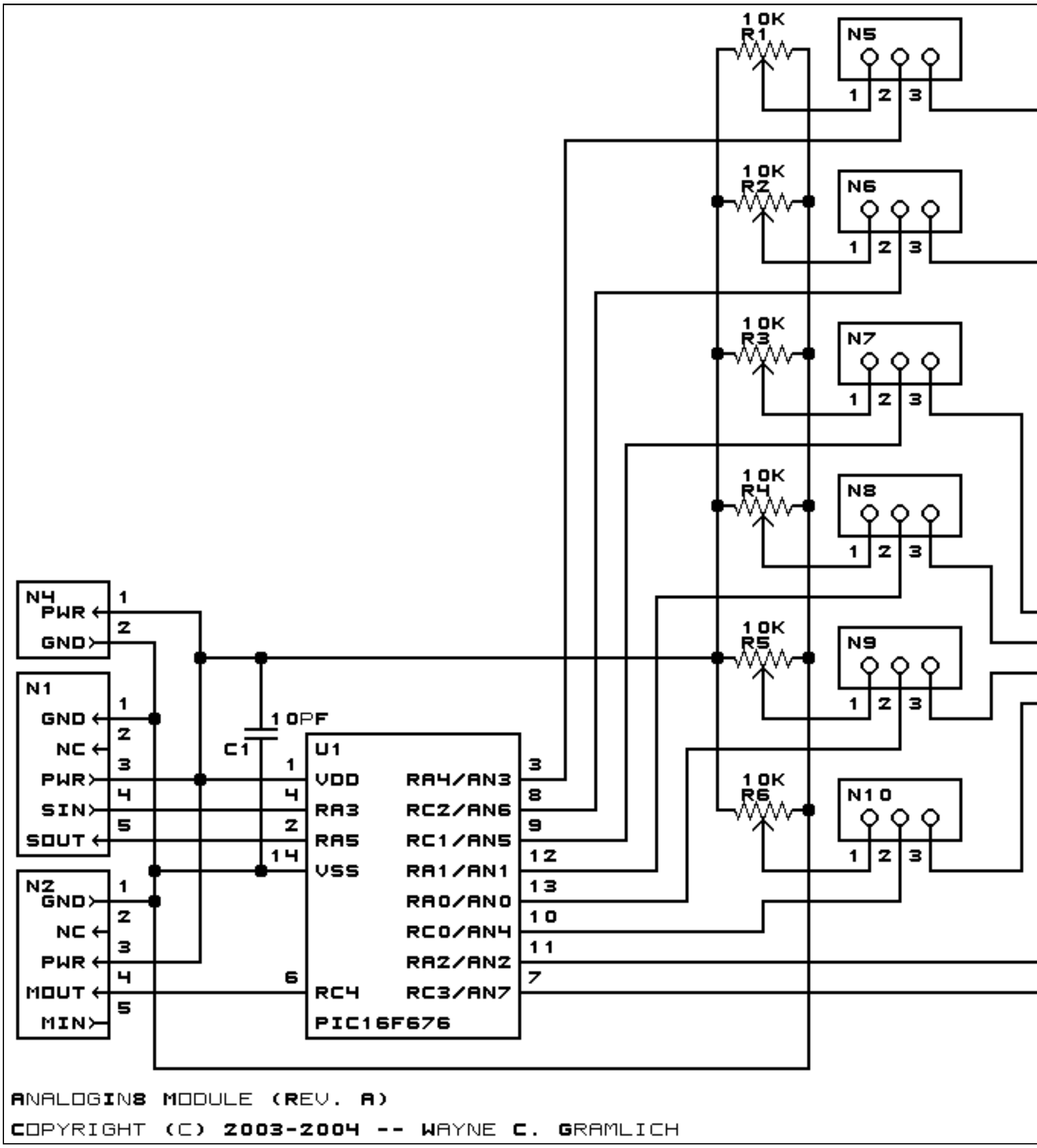
Set Low Threshold	Send	0	0	0	1	1	1	*b*	*b*	Set low threshold for pin *bb* to *llllllll*
	Send	*l*	*l*	*l*	*l*	*l*	*l*	*l*	*l*	
Set Complement Mask	Send	0	0	1	0	*c*	*c*	*c*	*c*	Set complement mask to *cccc*
Set High Mask	Send	0	1	0	0	*h*	*h*	*h*	*h*	Set high mask to *hhhh*
Set Low Mask	Send	0	1	0	1	*l*	*l*	*l*	*l*	Set low mask to *llll*
Set Raising Mask	Send	0	1	1	0	*r*	*r*	*r*	*r*	Set raising mask to *rrrr*
Set Falling Mask	Send	0	1	1	1	*f*	*f*	*f*	*f*	Set falling mask to *ffff*
Read Interrupt Bits	Send	1	1	1	0	1	1	1	1	Return the interrupt pending bit *p* and the interrupt enable bit *e*.
	Receive	0	0	0	0	0	0	*e*	*p*	
Set Interrupt Commands	Send	1	1	1	1	0	*c*	*c*	*c*	Set Interrupt Command *ccc*.
Shared Commands	Send	1	1	1	1	1	*c*	*c*	*c*	Execute common shared command *ccc*

3. Hardware

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

3.1 Circuit Schematic

The schematic for the AnalogIn8 RoboBrick is shown below:



The parts list kept in a separate file −− analogin8.ptl.

3.2 Printed Circuit Board

The printed circuit board files are listed below:

analogin8_back.png
The solder side layer.
analogin8_front.png

The component side layer.

analogin8_artwork.png
The artwork layer.

analogin8.gbl
The RS−274X "Gerber" back (solder side) layer.

analogin8.gtl
The RS−274X "Gerber" top (component side) layer.

analogin8.gal
The RS−274X "Gerber" artwork layer.

analogin8.drl
The "Excellon" NC drill file.

analogin8.tol
The "Excellon" tool rack file.

3.3 Construction Instructions

The construction instructions are in separate file to be a little more printer friendly.

4. Software

The AnalogIn8 software is available as one of:

analogin8.ucl
The µCL source file.

analogin8.asm
The resulting human readable PIC assembly file.

analogin8.lst
The resulting human readable PIC listing file.

analogin8.hex
The resulting Intel® Hex file that can be fed into a PIC12C5xx programmer.

The following AnalogIn8 test software is available:

analogin8_test.ucl
The µCL source file.

analogin8_test.asm
The resulting human readable PIC assembly file.

analogin8_test.lst
The resulting human readable PIC listing file.

analogin8_test.hex
The resulting Intel® Hex file that can be fed into a PIC16F84 programmer.

5. Issues

Any fabrication issues that come up will be discussed here.

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