USB Data Acquisition and Control System

Jason Droke
Advisors:
Dr. Schertz
Mr. Gutschlag
12/05/06

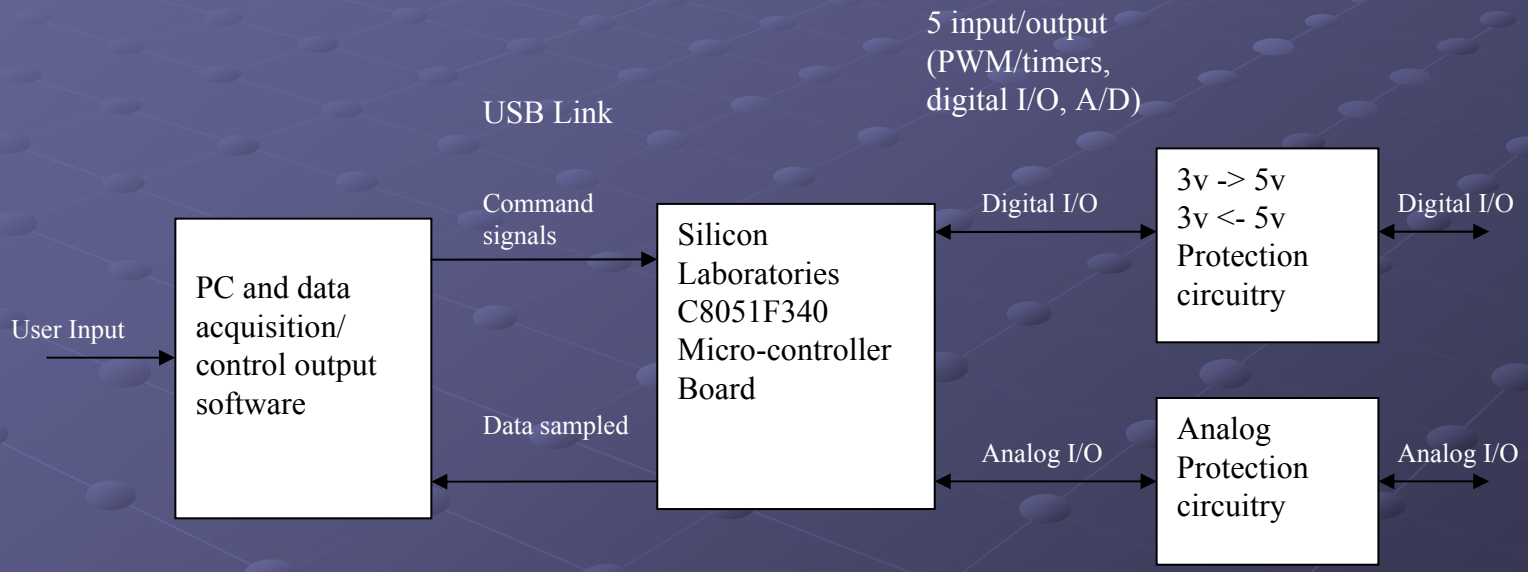
Outline

- Project Summary
- Functional Description, Block Diagram, Requirements, and Performance Specifications
- Data Sheets
- Preliminary Work
- Equipment and Parts List
- Schedule of Tasks

Project Summary

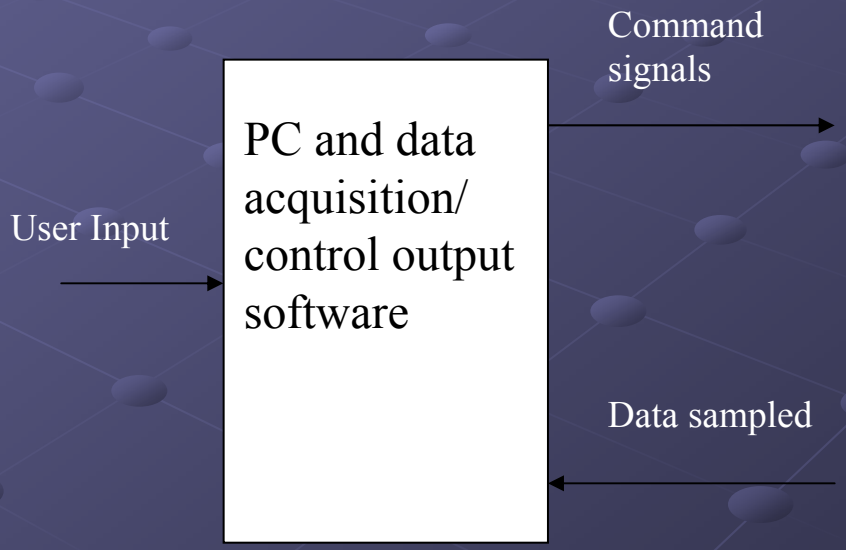
- The objective of the USB data acquisition and control system project is to interface a PC to a microcontroller using a USB link to record data taken from the inputs on the microcontroller and output control signals via commands sent over the USB link.

Complete System Block Diagram



PC Subsystem

- Inputs
- Outputs
- Specifications (USB Packets and Timing)

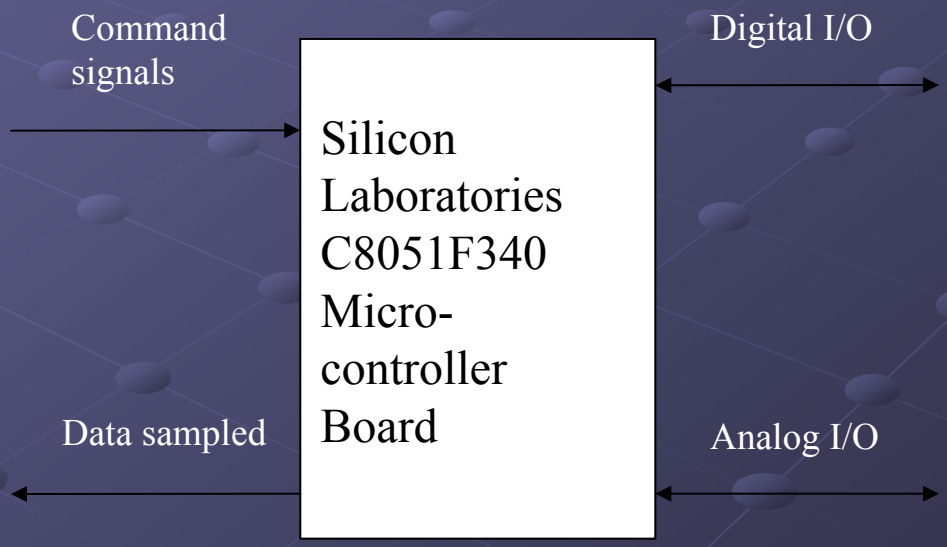


Command Packets

Task	Command	Response
Take A/D sample	A(Channel)	A(channel)(value)
Set PWM Duty Cycle and Period	P(Duty)(Period)	ACK
Set PWM Duty Cycle	P(Duty)	ACK
Set Digital Output	DO(port)	ACK
Take Digital Sample	DI(port)	DI(port)(value)
Acknowledge	ACK	--------
Measure Time (period or width)	T(P or W)(port)	T(P or W)(port)(value)

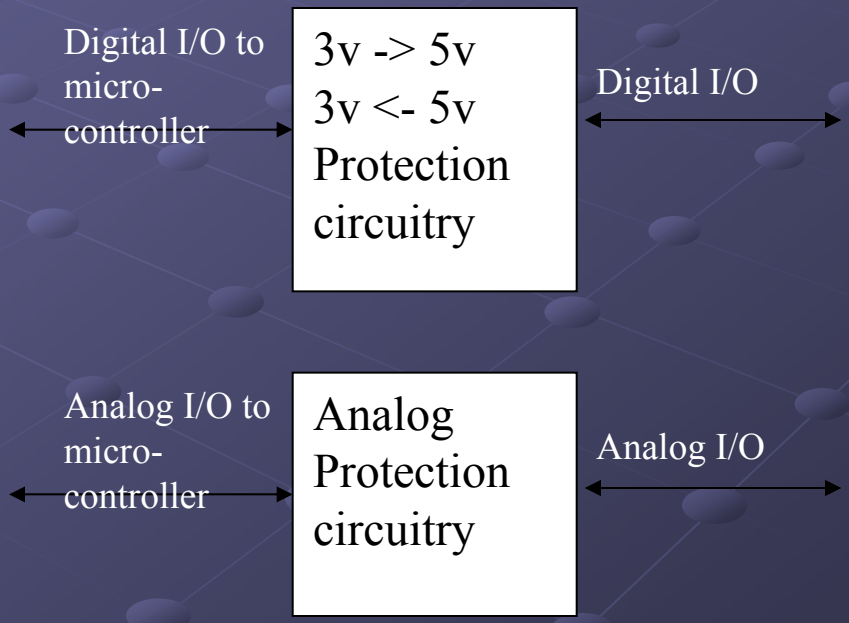
Microcontroller Subsystem

- Inputs
- Outputs
- Specifications (Timing)



Development Board Protection Circuitry Subsystem

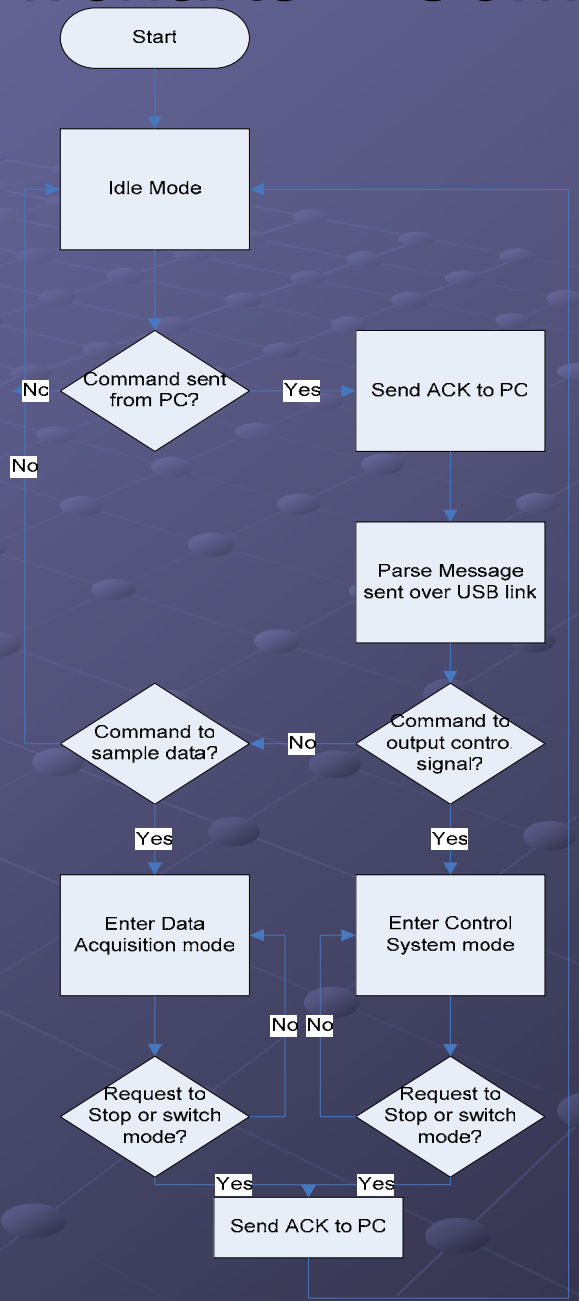
- Inputs
- Outputs
- Specifications



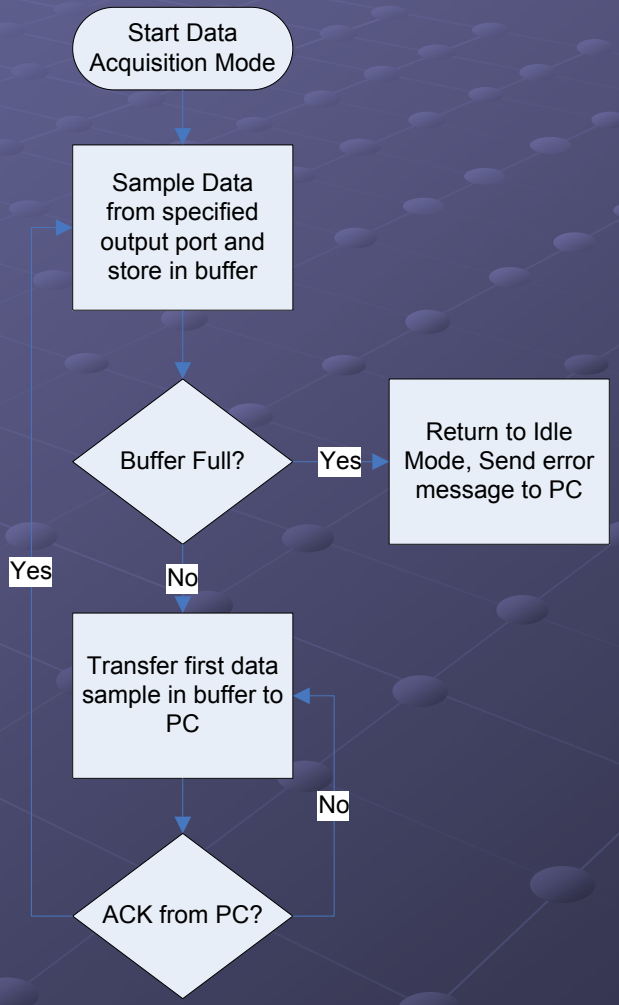
Data Acquisition and Control System Inputs/Outputs

- 4 channels of A/D conversion (10-bit, 200Ksps max), 1ms(1Ksps) samples
- 1 PWM Generation Unit (Timer 0)
- 1 Timing and Time Measurement Unit (PCA, period and pulse width measurement)
- 8 Digital Inputs
- 8 Digital Outputs

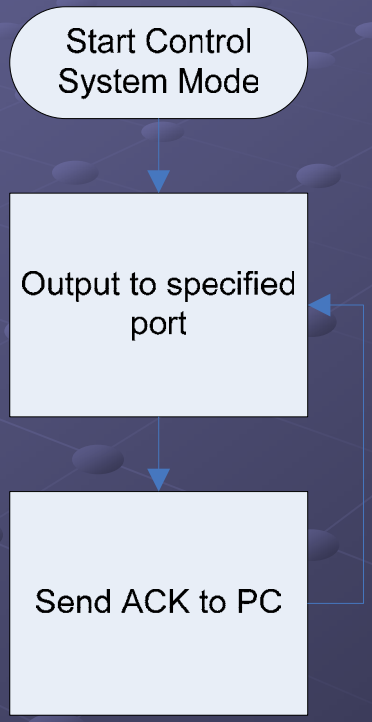
Software Flowcharts – Complete System



Software Flowchart – Data Acquisition Mode

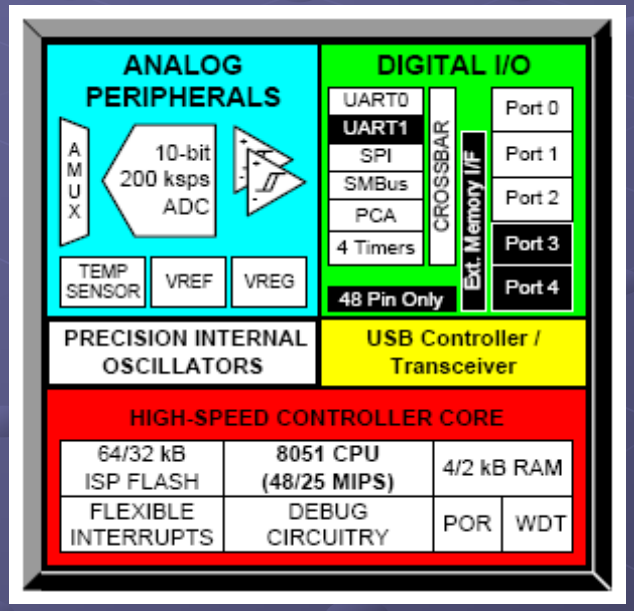


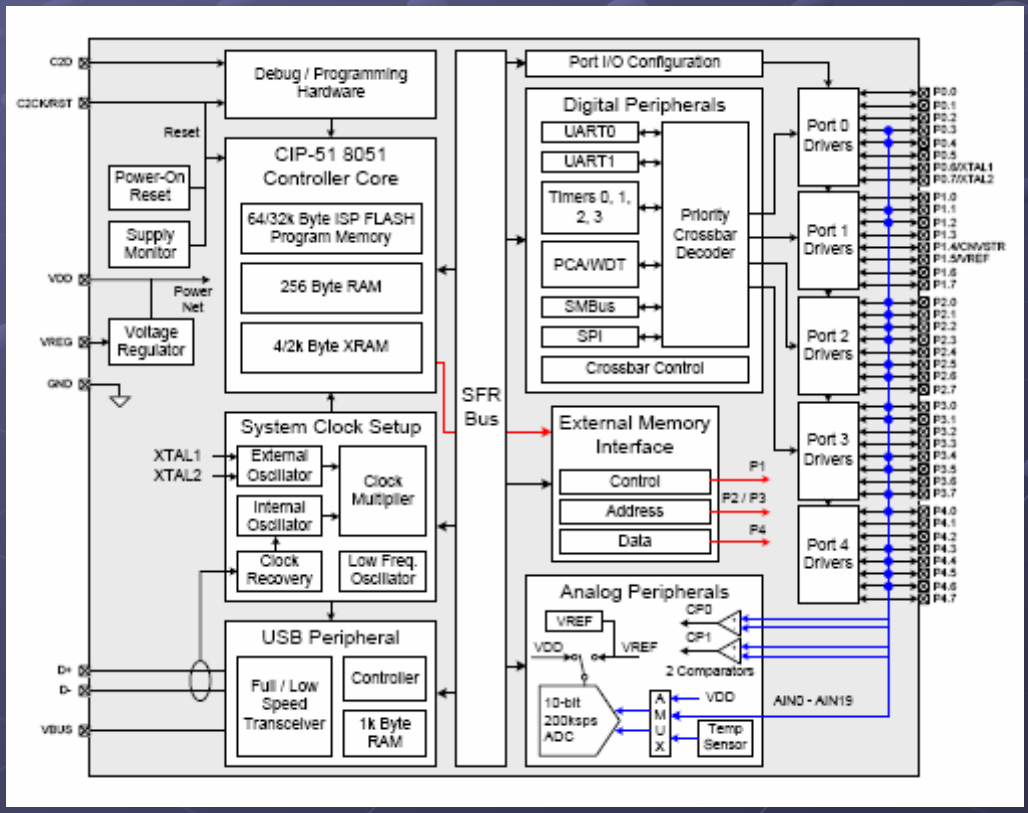
Software Flowchart – Control System Mode



Data Sheets - Microcontroller

- C8051F340





Data Sheets - Microcontroller

- Microcontroller Crossbar

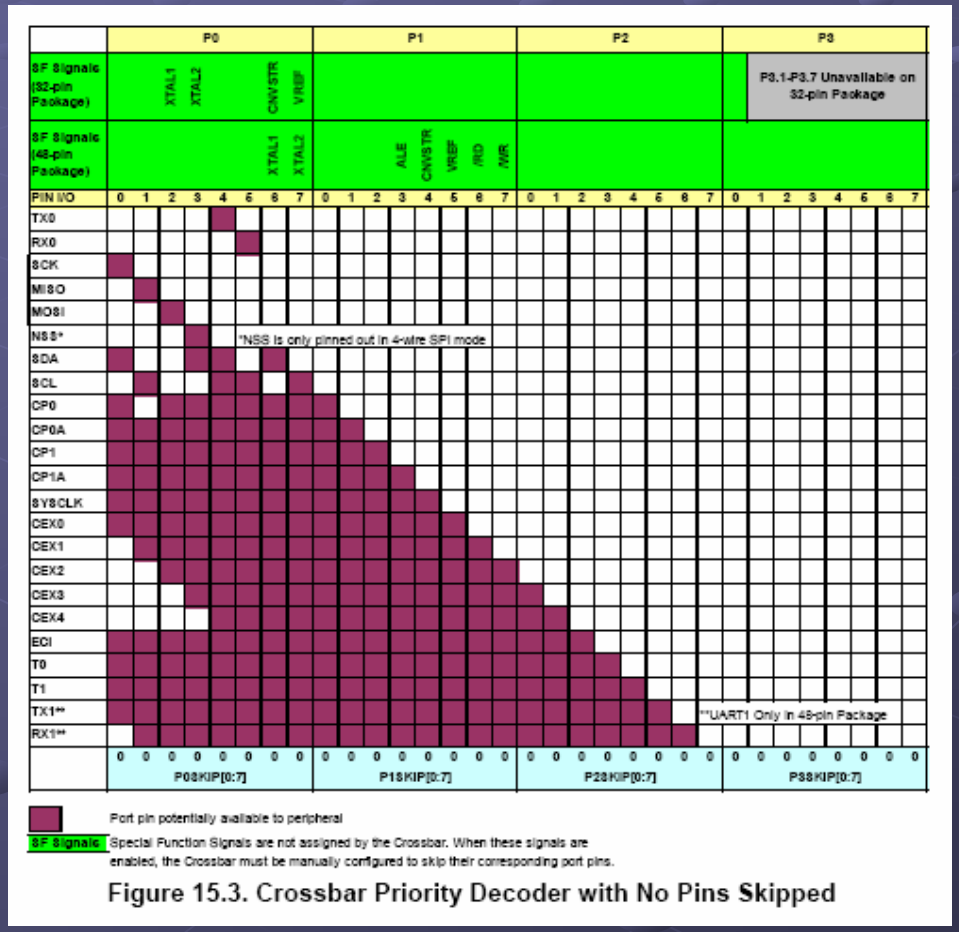
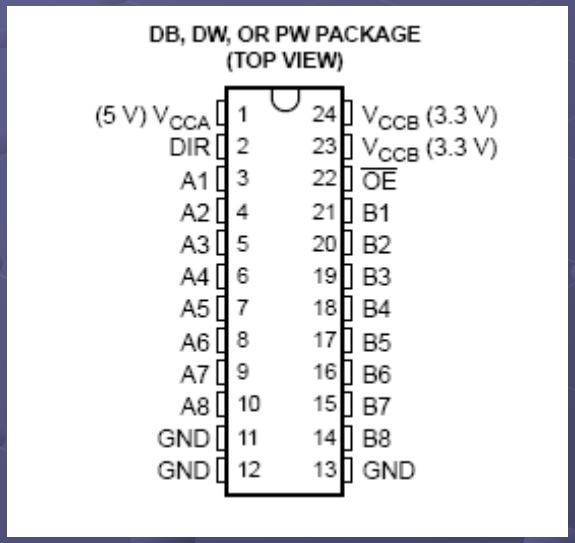


Figure 15.3. Crossbar Priority Decoder with No Pins Skipped

Data Sheets – Protection Circuitry

- Texas Instruments 74LVC4245 Octal Bus Transceiver



MIN	MAX	UNIT
4.5	5.5	V

MIN	MAX	UNIT
2.7	3.6	V

FUNCTION TABLE

INPUTS		OPERATION
$\overline{OE}$	DIR	
L	L	B data to A bus
L	H	A data to B bus
H	X	Isolation

Preliminary Work

- Research
  - Microcontroller
    - Peripherals
    - Crossbar
    - USB
  - IDE
    - Basic Use
    - Port Configuration
    - USB
  - Protection Circuitry
    - 74LVC4245

Equipment List

- Silicon Laboratories C8051F340 Microcontroller Development Board
- 741LVC4245 Octal Bus Transceiver – 2
  - $.90 ea. (min. order – 1, Digi-Key)
  - $.399 ea (min. order – 2000, Digi-Key)

Schedule of Tasks

- Weeks 1-4
  - Microcontroller Subsystem Software
  - Troubleshooting
- Weeks 5-9
  - PC Subsystem Software
  - Troubleshooting
- Week 10,11
  - Integration of PC and Microcontroller Subsystems and Troubleshooting
- Week 12
  - Transceiver Implementation
- Week 13
  - Oral Presentation
- Week 14
  - Final Report

Questions?