Lab 11: SPI in AVR ATmega

EE222: Microprocessor Systems

1 Administrivia

Learning Outcomes

By the end of this lab you will be able to;

1. Use SPI protocol to transmit/receive data on AVR ATmega

Deliverable

You are required to submit

- Appropriately Commented Code
- Explicit Calculations for Timer Values
- Issues in Developing the Solution and your Response

in the beginning of next lab

Hardware Resources

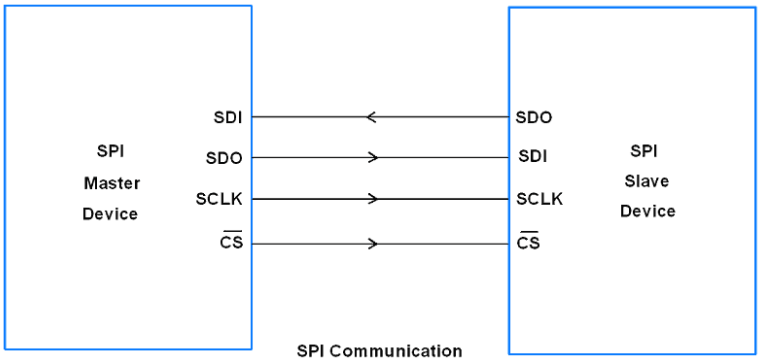
- ATmega16A Microcontroller Unit(s)
- Universal Programmer
- LEDs / Seven Segment Displays / LCD Screen

Introduction

The Serial Peripheral Interface (SPI) is a bus interface connection protocol originally started by Motorola Corp. It uses four pins for communication.

- **SDI** (Serial Data Input)
- **SDO** (Serial Data Output)
- **SCLK** (Serial Clock)
- **CS** (Chip Select)

It has two pins for data transfer called SDI (Serial Data Input) and SDO (Serial Data Output). SCLK (Serial Clock) pin is used to synchronize data transfer and Master provides this clock. CS (Chip Select) pin is used by the master to select the slave device.



SPI devices have 8-bit shift registers to send and receive data. Whenever a master needs **to send data**, it places data on the shift register and generates a required clock. Whenever a master wants **to read data**, the slave places the data on the shift register and the master generates a required clock. Note that SPI is a full-duplex communication protocol i.e. data on master and slave shift registers get interchanged at the same time.

ATmega16 SPI Communication

ATmega16 has an inbuilt SPI module. It can act as a master and slave SPI device. SPI communication pins in AVR ATmega are:

- **MISO** (Master In Slave Out)

  The Master receives data and the slave transmits data through this pin.

- **MOSI** (Master Out Slave In)

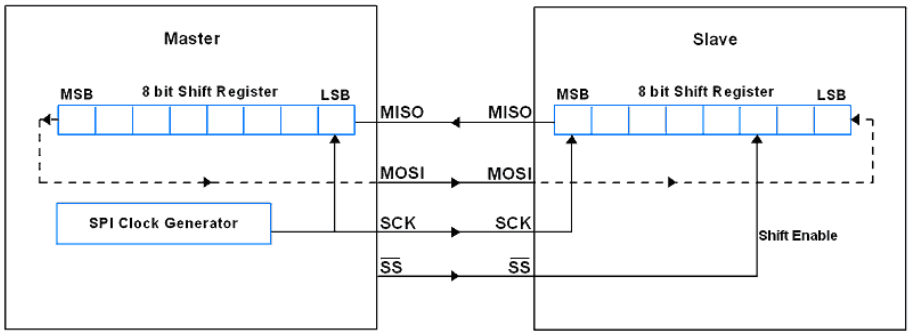
  The Master transmits data and the slave receives data through this pin.

- **SCK** (Shift Clock)

  The Master generates this clock for the communication, which is used by the slave. Only master can initiate a serial clock.

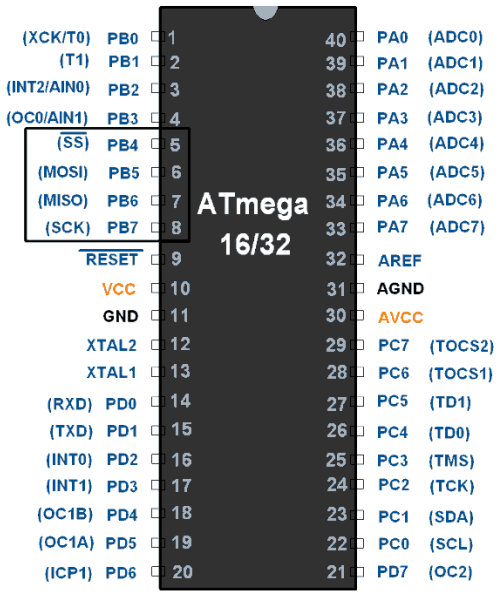
- **SS** (Slave Select)

  Master can select slaves through this pin.



SPI Master Slave Interconnection

AVR ATmega16/32 SPI Pins



AVR ATmega16 SPI Registers

AVR ATmega16 uses three registers to configure SPI communication that are:

- SPI Control Register
- SPI Status Register
- SPI Data Register.

Visit the Electronic wings to learn about these three registers:

www.electronicwings.com/avr-atmega/atmega1632-spi

AVR ATmega SPI Programming

Refer to the example provided in the link above to learn about the implementation of SPI communication in ATmega microcontrollers.

Deliverable Tasks

Lab Task

Implement the code in example above, to establish SPI communication on ATmega16. Patch the Hardware and demonstrate.

Takeaway Task

Use Proteus to implement the example 17-1 code using **AVR C** Programming.