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COMP140 Individual Creative Computing Project

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COMP140: Individual Creative Computing Project
1: Hardware Interfaces

Register Attendance

Figure 1: Attendance monitoring is in place. It is your responsability to ensure that you have signed yourself in.

Learning Outcomes

After this session you will be able to:

- ► **Select** the appropriate method for communication
- ► **Outline** the difference between I2C and SPI
- ► **Implement** a hardware interface between the Arduino and a sensor

What is Serial Communication?

► Arduino to Multimedia Computer (retro term alert)
► Arduino to Arduino
► Arduino to sensors

Some kind of picture?

Types of Serial Communications

- ► **I2C**
- ► RS232
- ► **USB**
- ► R2422
- ► CAN
- ► Microwire
- ► RS485
- ► **SPI**
- ► **TTL**

Protocols

A protocol is the language that governs communication between systems or devices.

- ► Midi
- ► DMX-512
- ► X10
- ► USB
- ► RS485
- ► UDP/IP
- ► TCP/IP

Physical Agreement

Timing Agreement

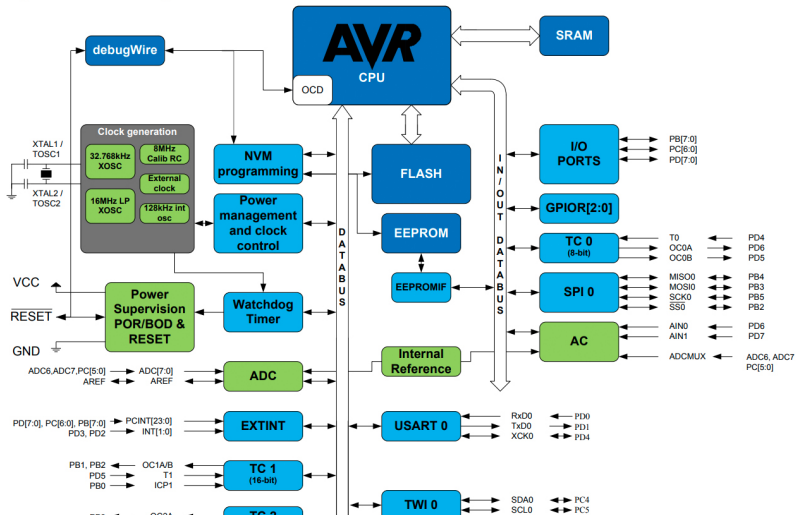Interfaces require

Electrical Agreement

Package Size

Hexadecimal

Serial vs. Parallel

**Block Diagram**

Figure 4-1. Block Diagram

Serial/UART

- ► This is how an Arduino talks to a computer
- ► Arduino has an onboard UART to Seral Converter
- ► Requires an agreed baud rate: Serial.begin(9600)
- ► Two communication lines - RX to receive and TX to transmit
- ► TX connects RX, RX to TX
- ► Used by some peripherals such as Bluetooth modules

When Time Goes Wrong

Inter-Intergrated Circuit (I^{2}C)

- ► Pronounced I Square C
- ► Uses a clock Signal
- ► Two communication lines - SDA (data) and SCL (clock)
- ► Multiple I^{2}C devices can communication on the same data lines (bussed)
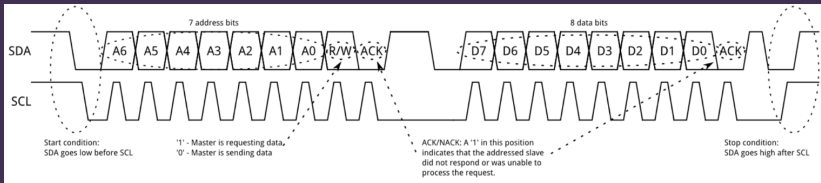- ► Slave devices have an address

I²C Bus Example
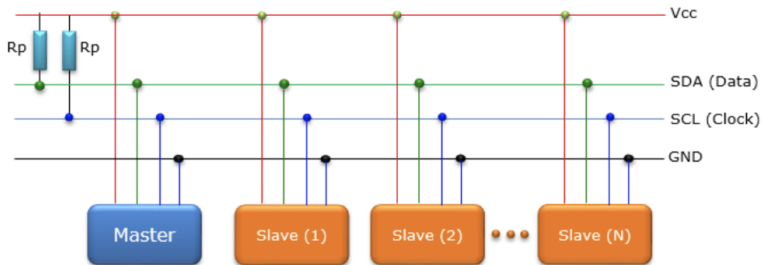
Wire Library

- ► I^2C Library for Arduino
- ► Arduino can be either host of slave
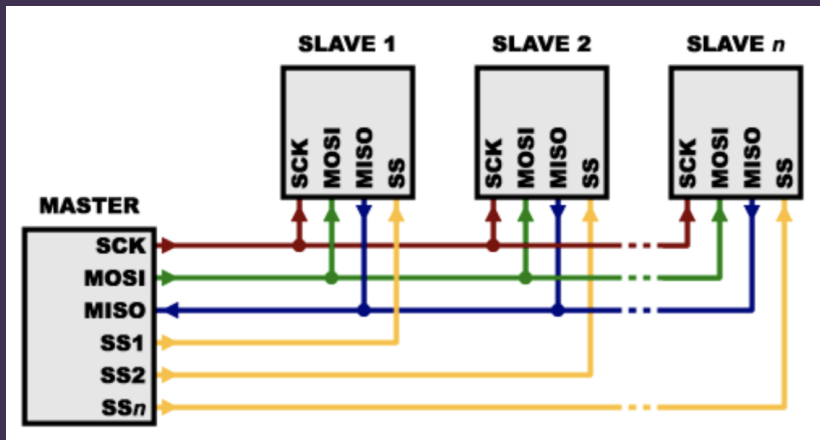- ► Particularly useful for wired Arduino-to-Arduino communication

I²C Communication Example
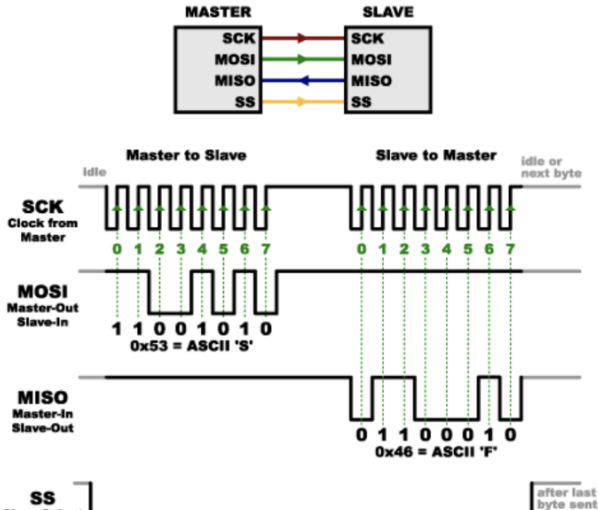
Serial Peripheral Interface (SPI)

► Uses a clock signal
► Requires 4 lines
► MISO - master in slave out
► MOSI - master out slave in
► SCK - serial clock
► CS - chip select
► Not addressed - each slave device requires a discrete chip select line.
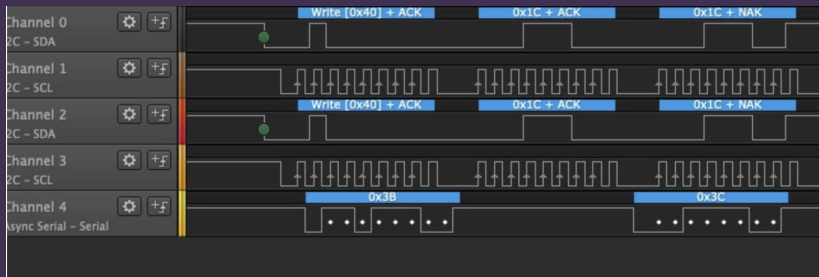
SPI Bus Example

SPI COMMUNICATION EXAMPLE

Logic Analysers

- ► Not doing what you expect? Spy on them!
- ► Logic analysers are the digital equivelant of an oscilloscope
- ► Can have up to 8 signal capture lines
- ► Capture digital logic (HIGH or LOW)
- ► Easy to connect to existing circuits
- ► USB connection for data capture
- ► We have a couple in the Games Academy
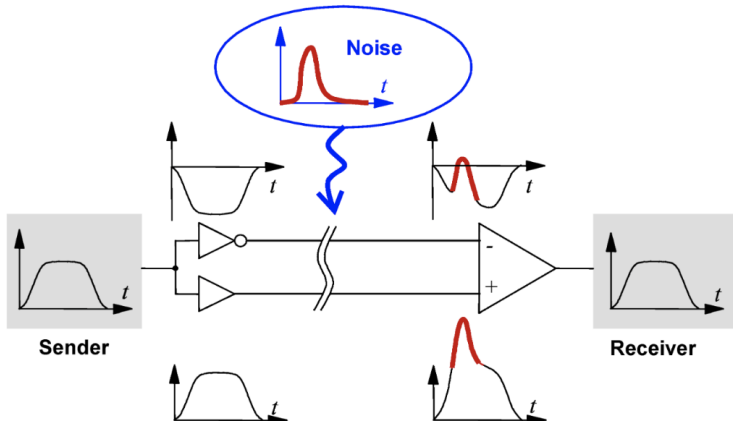
Logic Analyser Software

Differential Signal

► Low voltage signals are susceptible to noise over long distance
► Noise can turn a digital 1 into a 0
► Differential Signal is one solution
► Used by USB and in professional audio
► The hardwork is done for you: PCA9615 chip converts I^2C to diff

How does Differential Signal Work?

- ► Two lines carry the same signal, but one is inverted
- ► The two lines cancel each other out
- ► All that is left is the noice
- ► The noise is then cancelled out

Activity - MPU-6050