COMP140 Individual Creative Computing Project

COMP210: Interfaces & Interaction

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

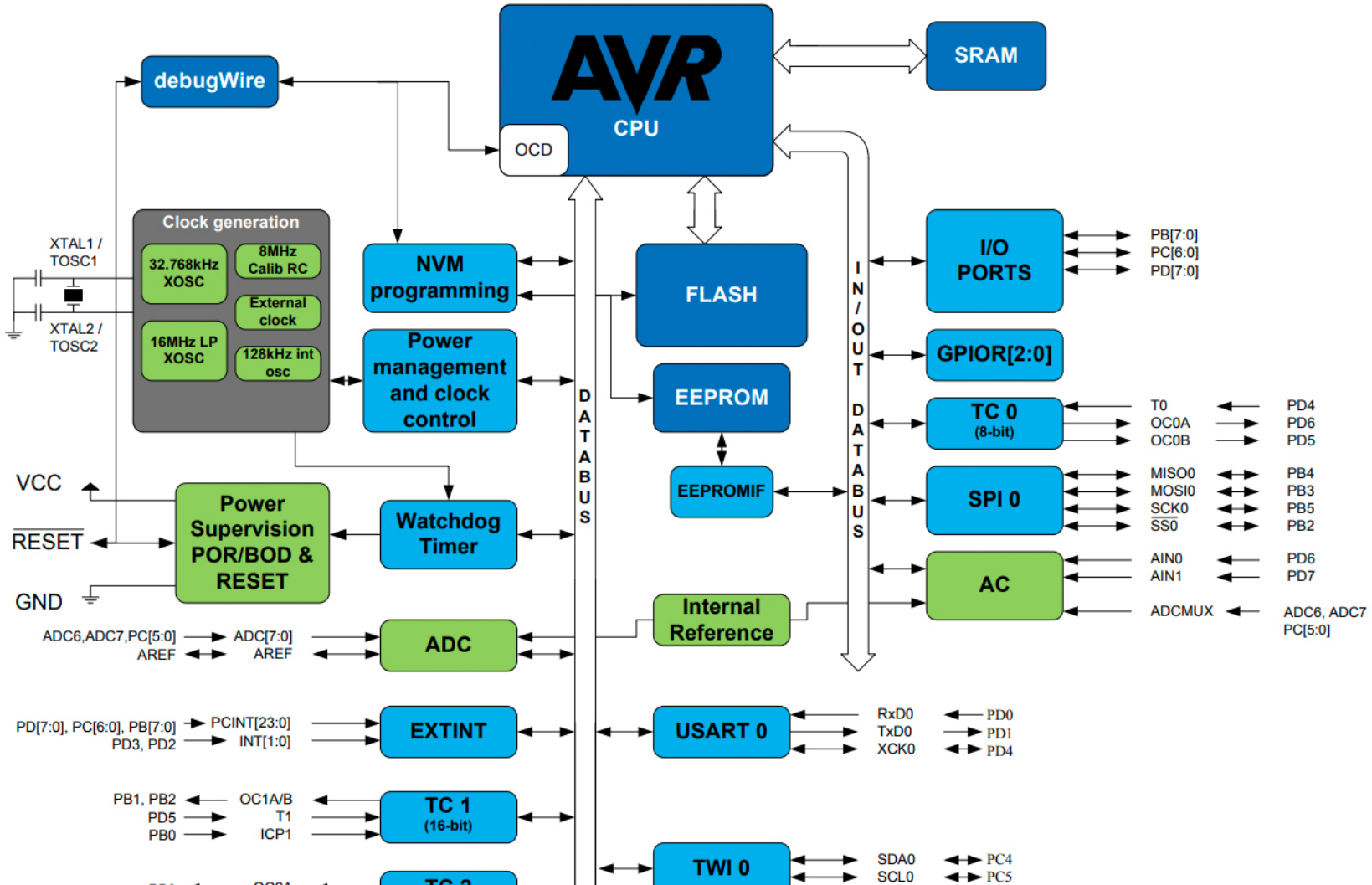
% ## Package Size

% ## Serial vs. Parallel

Universal asynchronious Receiver/transmitter (UART)

Block Diagram

Figure 4-1. Block Diagram



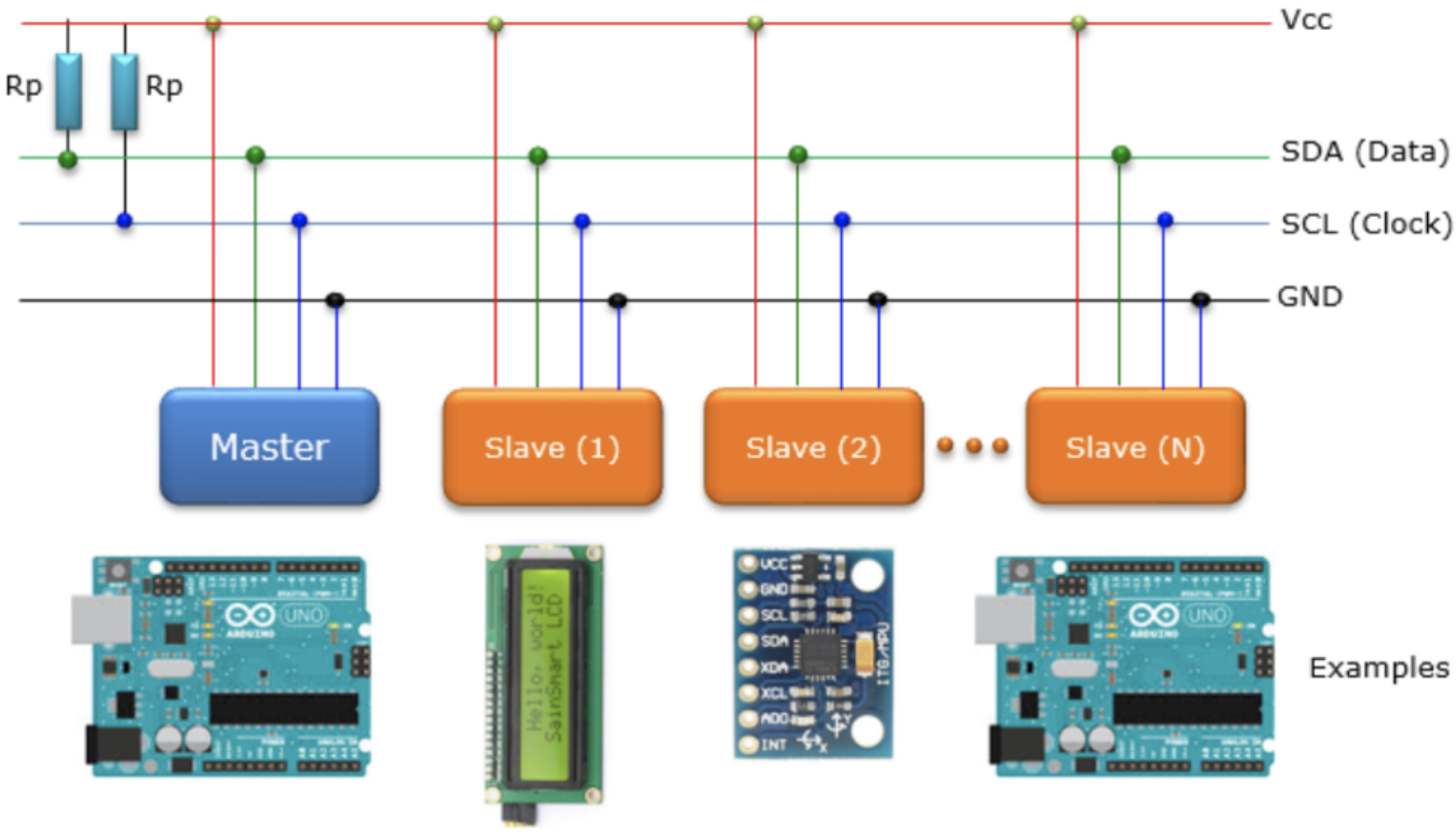
Serial/UART

- 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

Inter-Intergrated Circuit (I^2C)

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

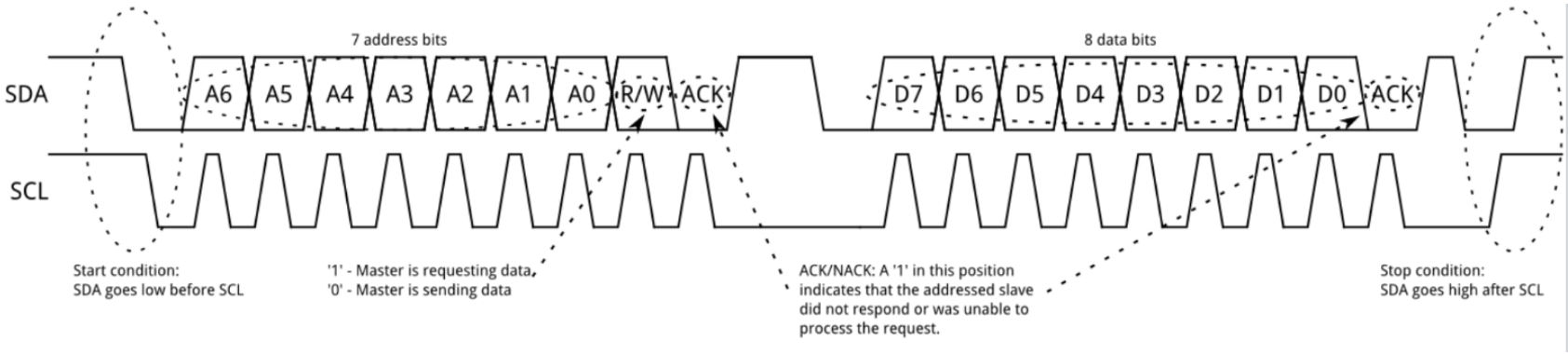
I²C Bus Example



Wire Library

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

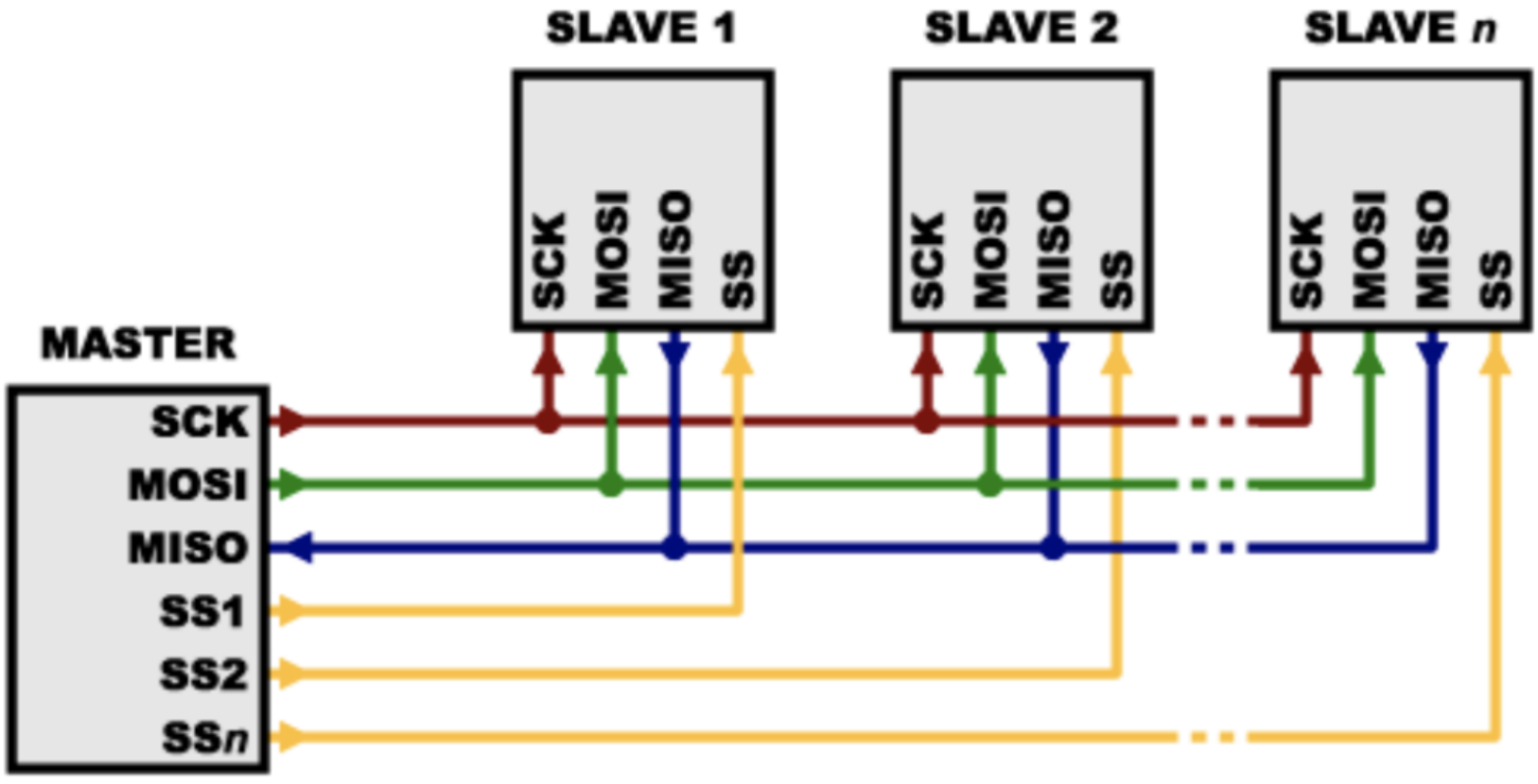
I²C Communication Example



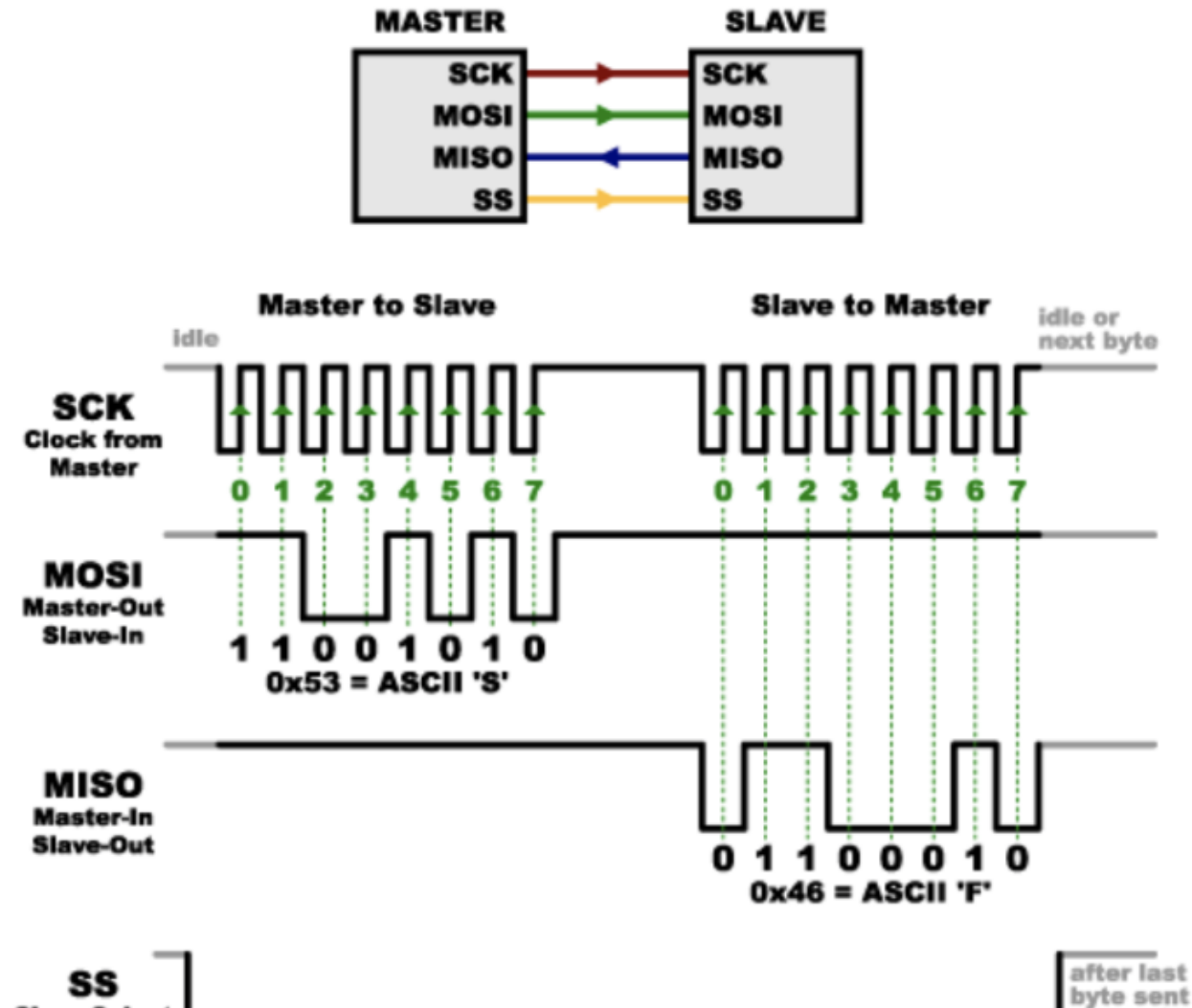
Serial Peripheral Interface (SPI)

- 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



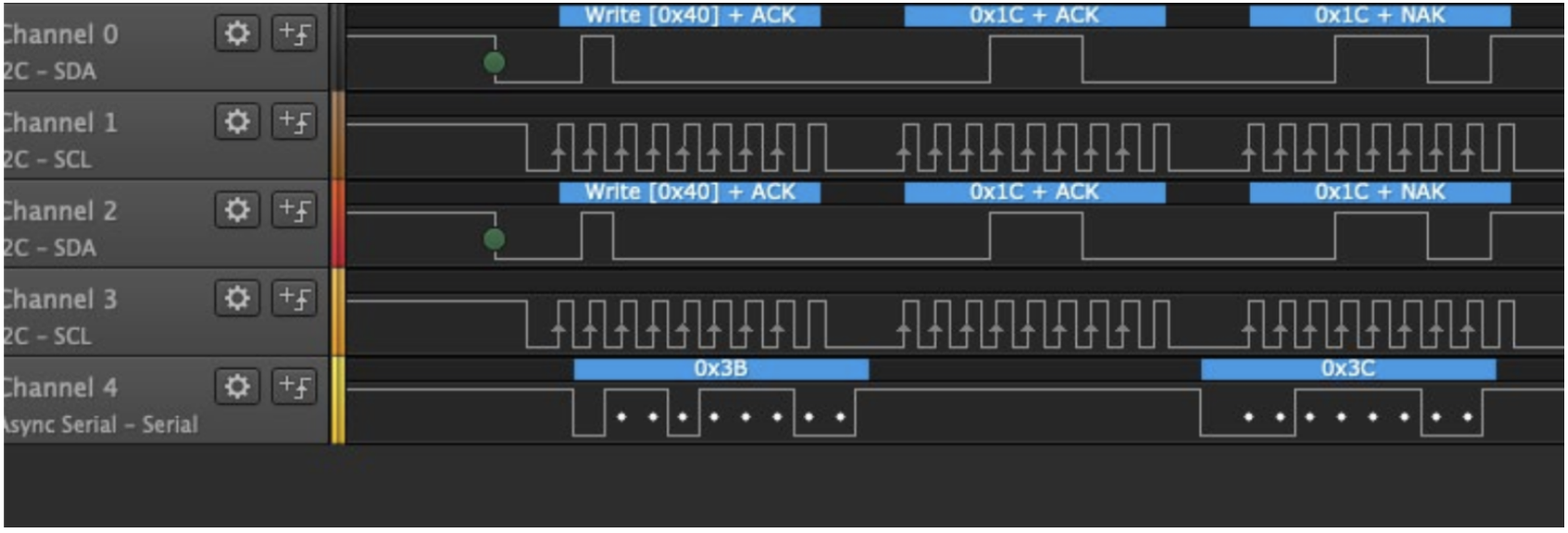
SPI Communication Example



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