# Signatures, and programming the ATmega328 Microprocessor

Sam McDiarmid-Sterling
*CU Boulder ECEE Department*

## Executive Summary

I created a board profile, that will allow students to do Lab 10 without changing any values "under the hood". This should streamline the bootloading lab, and allow students to focus on learning the relevant skills for the "Golden Arduino".

## Overview

Inconsistencies between the expected signature for the Arduino Uno (Atmega328P) and the microprocessors given to us for lab 10 (Atmega328) cause errors when programming. In essence, the programmer is expecting an Atmega328P, and so programming fails.

**28.3 Signature Bytes**

All AVR microcontrollers have a three-byte signature code which identifies the device. This code can be read in both serial and parallel mode, also when the device is locked. The three bytes reside in a separate address space. For the ATmega48A/PA/88A/PA/168A/PA/328/P the signature bytes are given in Table 28-10.

**Table 28-10. Device ID**

| | Signature Bytes Address | | |
|---|---|---|---|
| **Part** | **0x000** | **0x001** | **0x002** |
| ATmega48A | 0x1E | 0x92 | 0x05 |
| ATmega48PA | 0x1E | 0x92 | 0x0A |
| ATmega88A | 0x1E | 0x93 | 0x0A |
| ATmega88PA | 0x1E | 0x93 | 0x0F |
| ATmega168A | 0x1E | 0x94 | 0x06 |
| ATmega168PA | 0x1E | 0x94 | 0x0B |
| ATmega328 | 0x1E | 0x95 | 0x14 |
| ATmega328P | 0x1E | 0x95 | 0x0F |

Figure 1: Excerpt from the Atmega328 Datasheet

- *In class solution:* Change the configuration file, so that the Arduino IDE thinks it should expect 0x1E9514 for an Atmega328P (instead of the proper 0x1E950F)

  PROs: This will work if implemented properly

CONs: The configuration file contains many (similar) entries, and several students accidentally edited the wrong one.

CONs: Once we're done with this lab, the value must be changed back in order to use our lab-kit Arduino Uno

- **My solution:** Create a new board profile, with the Atmega328 as the processor

  PROs: Will work, and doesn't require students to change any values "under the hood". Also, it doesn't effect the usability of our lab-kit Arduino Uno, The board profile can be downloaded through the board manager, and it is easy to add additional board profiles for future labs

  CONs: Upfront engineering cost

## Directions

1. Add the board manager link under Arduino–Settings (or Preferences):
   https://raw.githubusercontent.com/SamMcD-S/328BB/refs/heads/main/package_328bb_index.json
2. Install the board: Tools–Board–Board Manager and search for ECEN 3730
3. When programming the bare-bones processor (or burning the bootloader), select the board: Atmega328 Bare Bones Arduino – ECEN3730 328BB