Lab 1: Soldering Xplained Mini Board

Lab 2: Digital outputs

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January 22nd, 2018

Development Board Setup

Development Board Setup has three steps

1. Soldering connectors for Xplained Mini kit
2. Soldering connectors for LCD
3. Putting everything together on the breadboard

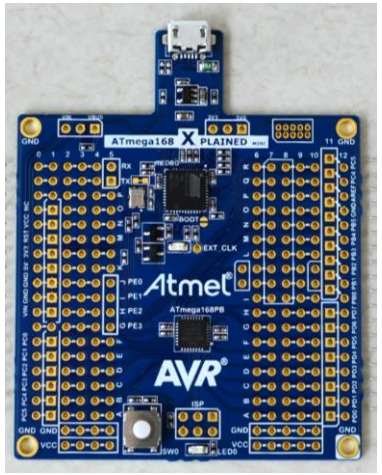
Source: Presentation from Marten Van Dijk

Basics of Soldering

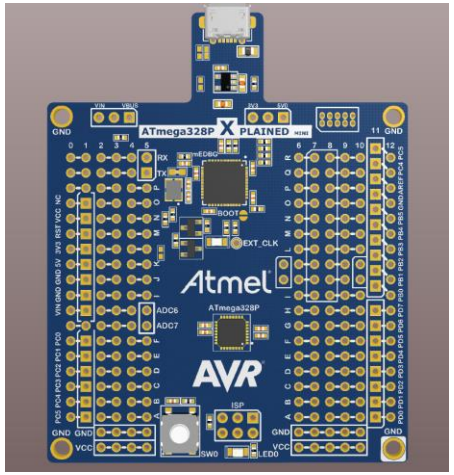
1. Heat the iron to 700F.
2. The LED will stop blinking once the iron has reached the desired temperature.
3. Heat the pad briefly.
4. With the iron sitting on the pad, push solder into the tip of the soldering iron.

Source: Presentation from Marten Van Dijk

ATmega328P Xplained Mini kits



ATmega168PB Xplained Mini



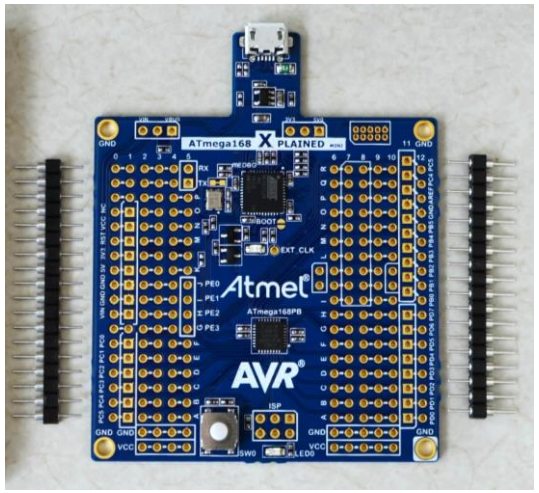
ATmega328P Xplained Mini

- Almost everything is similar except “Availability” ☹
- We will be using ATmega328P kit!
- However setting up either of the two kits involves same steps.

Source: Presentation from Marten Van Dijk

Soldering connectors for Xplained Mini kit

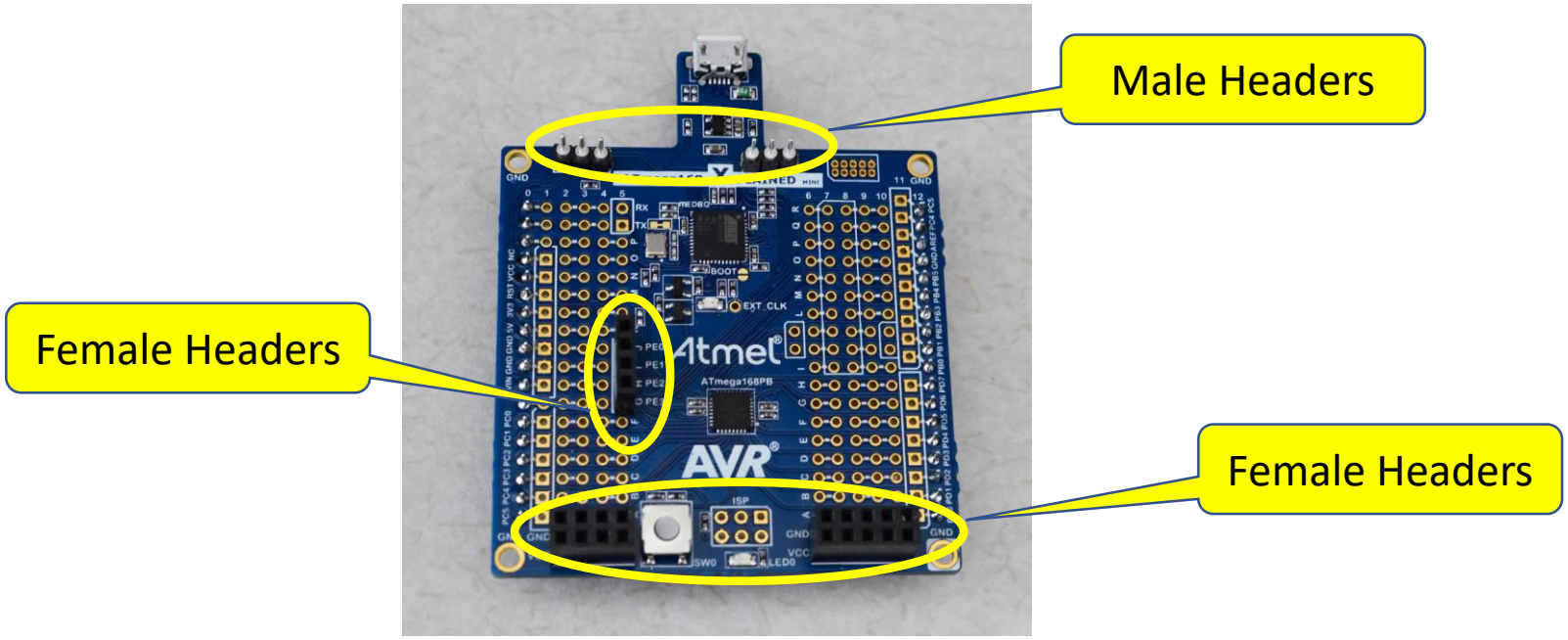
- Take 2 male headers each of 18-pins.
- Insert the thin side of the headers to outermost ports on both left and right side as shown in the bottom view of Xplained Mini.
- Solder the headers to the Xplained Mini pads from the top.



Source: Presentation from Marten Van Dijk

Soldering connectors for Xplained Mini kit

- Insert two 3-pin male headers from the top as shown, and solder from the bottom.
- Similarly Insert the three female headers from the top and solder from the bottom.



Source: Presentation from Marten Van Dijk

Initial board setup

- Setup Atmel studio
  - Atmel Studio is available for download at the following link: http://www.atmel.com/tools/ATMELSTUDIO.aspx
  - You need to download "**Atmel Studio 7 Installer"** which is the first one in the list of available downloads
- As general guidelines for installation and getting familiar with Atmel Studio, please follow the Getting_Started_with_ATmega168PB_Application_Note.pdf document (from page 7 onward) posted under General Resources section.
  - Although this document targets ATmega168PB Xplained Mini kit, the exact same steps apply for ATmega328P Xplained Mini kit.
- Before you start soldering the board make sure the board is working fine.
  - Get the test code provided on the next slide working for your board.

Source: Presentation from Marten Van Dijk

Connections: For today

- Complete the soldering of the board as instructed in Lab 1 and from slide 1 to 9
- Make the connection as depicted in Fig. 1. of next slide.
- Connection requires 8 LEDs and 8 resistors
- Port D will be connected to the LED arrays. Port D has pins from PD0 to PD7
- Resistors are with the value of 330Ω
- Be cautious about the polarity of LEDs and value of the resistors.
- Also connect ground to the common point of the resistors

Connections

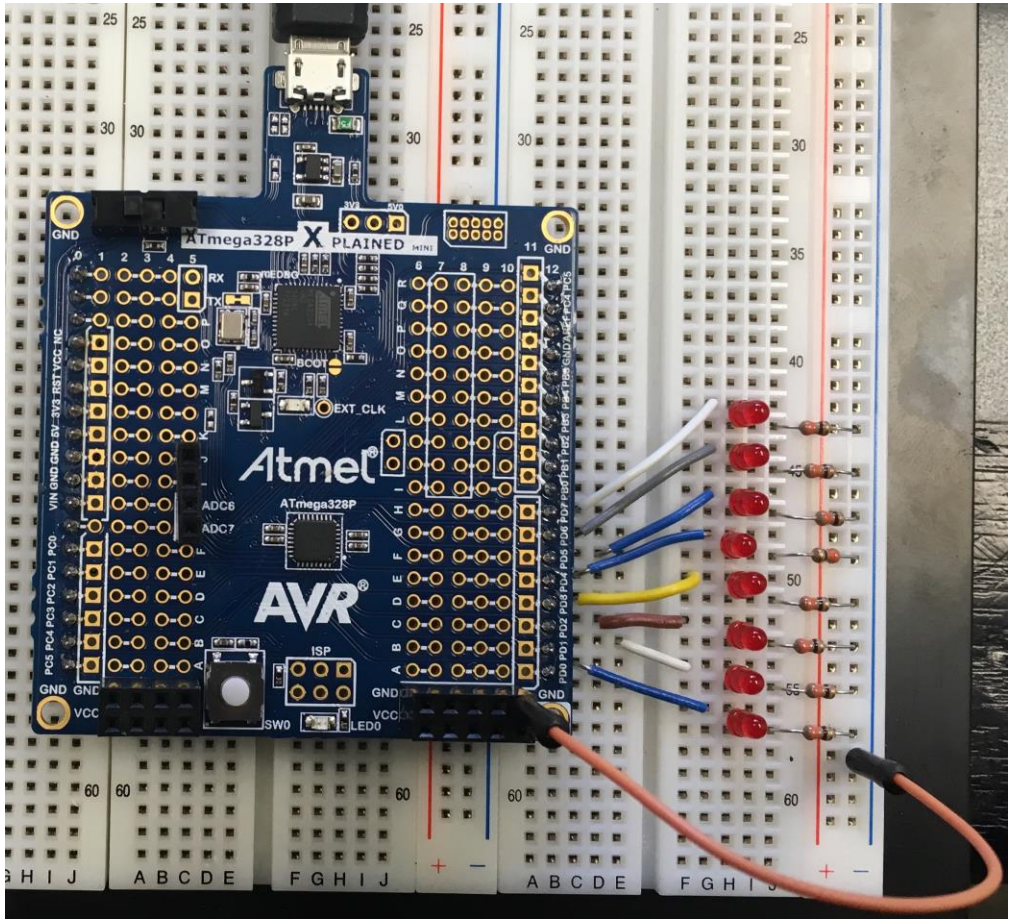


Fig1. Connections for digital outputs

Test code

```
#include <avr/io.h>
int main(void)
{
//configure LED pin as output
DDRB |= 1<<DDB5;
  while(1)
   {
      /* check the button status (press - 0 , release - 1 ) */
      if(!(PINB & (1<<PINB7))) {
                  /* switch off (0) the LED until key is pressed */
                  PORTB &= ~(1<<PORTB5);
      }
      else {
                  /* switch on (1) the LED*/
                  PORTB |= 1<<PORTB5;
      }
   } return 0;
}
```

Source: Presentation from Marten Van Dijk

Programming practice

- Blink the built-in LED of Port B using the program in the text book of chapter 3
- Now make a program to blink the LEDs connected to port D.

Test Code

```
// ------- Preamble -------- //
#define F_CPU 16000000UL                /* Tells the Clock Freq to the Compiler. */
#include <avr/io.h>           /* Defines pins, ports etc. */
#include <util/delay.h>       /* Functions to waste time */
int main(void) {
   // -------- Inits --------- //
   /* Data Direction Register D: Setting Port D as output. */
                  DDRD = 0b11111111;
   // ------ Event loop ------ //
   while (1) {
      PORTD = 0b01010101;  /* Turn on alternate LEDs in PORTD */
      _delay_ms(1000);         /* wait for 1 second */
      PORTD = 0b10101010;  /* Toggle the LEDs */
      _delay_ms(1000);         /* wait for 1 second */
   } /* End event loop */
   return (0); /* This line is never reached */
}
```

Source: Presentation from Marten Van Dijk

Task 1: Blinking a single LED

- Blink a single LED at two different rates based on a push switch.
  - When the switch is not pressed, LED should blink at 2Hz frequency.
  - As long as the switch is pressed, LED should blink at 8Hz frequency.
- The blinking duty cycle should be 50%
  - E.g. for 2Hz frequency, the LED should be on for $1/4^{th}$ of a second, then off for next $1/4^{th}$ of a second and so on.
- You may use the on-board LED and push switch for this task.

Source: Presentation from Marten Van Dijk

Task 2: Blinking 8 LEDs one after another

Extend the Task1 with another switch which activates the blinking to loop through all 8 LEDs one after another.

- When the system starts, LED 0 is active and blinks at 2Hz.
- As long as switch 1 is pressed, the currently active LED blinks at 8Hz. Otherwise it blinks at 2Hz.
- As long as switch 2 is pressed, the currently active LED keeps shifting towards left at the frequency depending upon the position of switch 1, and starts from 0 again.
  - E.g. if LED 0 is active currently, pressing switch 2 shifts the blinking to LED 1, 2, 3, … , 7 and then again LED 0 and so on.
- When switch 2 is released, the last active LED should keep blinking without anymore shifting.

Source: Presentation from Marten Van Dijk