

LAB 1-2

DELAY WITH INSTRUCTIONS

OBJECTIVE:

- Execute instructions to create delays using subroutines.
- Perform communication with shift registers.

REFERENCES:

- Lab manual chapter 1-2.

EXPERIMENT 1:

- a) Use the following program:

```
.include "m324PAdef.inc"
.org    00
        ldi r16,0x01
        out    DDRA, r16
start:
        sbi    PORTA,PINA0
        cbi    PORTA, PINA0

        rjmp  start
```

Connect PA0 to a measurement channel on the TEST STATION and measure pulse forms using an oscilloscope.

EXPERIMENT 2:

- a) Write a subroutine Delay1ms and use it to write a program to generate a 1KHz square wave on PA0.
- b) Use this subroutine to write subroutines Delay10ms, Delay100ms, and Delay1s.
- c) Use the Delay1s subroutine to write a program to blink/turn off an LED connected to PA0.

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EXPERIMENT 3:

- a) Connect the necessary signals from an AVR port to the control signals of the shift register on header J13. Connect the output of the shift register to a LED bar.
- b) Using the sample programs from the experiment guide, write a program to create a gradually lit LED effect from left to right, then gradually turn them off from left to right after every 500ms.

LAB REPORT

Class Group:

Group:
Subject:

EXPERIMENT 1:

1. Answer the following questions:
 - a. Capture a pulse waveform on PA0.
 - b. What is the frequency, duration of the high signal, and duration of the low signal?
 - c. Explain the measured results.

EXPERIMENT 2:

1. Answer the following questions:
 - a. How to calculate the number of machine cycles needed to execute the Delay1ms subroutine. Present a simulation image.
 - b. Image of a 1KHz square wave on PA0.
 - c. What is the error?
2. Source code for 2.c with comments.

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EXPERIMENT 3:

1. Answer the following questions:
 - a. Describe the connections on the experimental kit.
 - b. According to the datasheet of 74HC595, what is the highest clock frequency it can operate at?
 - c. How do you expand the display to 16 LEDs?
2. Source code with comments.

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