# ECET330 Lab4 Procedures

# Title: Introduction to Tower Module

# I. OBJECTIVES

1. To set up the Tower System
2. Become familiar with programming and using the Tower Module
3. Become familiar with I/O port programming

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## II. PARTS LIST

###### Equipment: IBM PC or compatible with Windows 2000 or higher

CodeWarrior v. 5.1

Freescale TWR-S12G128 Tower Kit

# INTRODUCTION

The Freescale Tower Module is used in this lab. The microcontroller on this module is a 100-pin MC9S12G128. It has 128K bytes of Flash, 4K bytes of EEPROM, and 8K bytes of RAM. The bus frequency is 6.25MHz by default.



Figure 1: Tower Module

The Tower Setup Tutorial describesa step-by-step process of connecting and using this tower system.

The FreeScale TWR-S12G128 Tower Kit includes the following items.

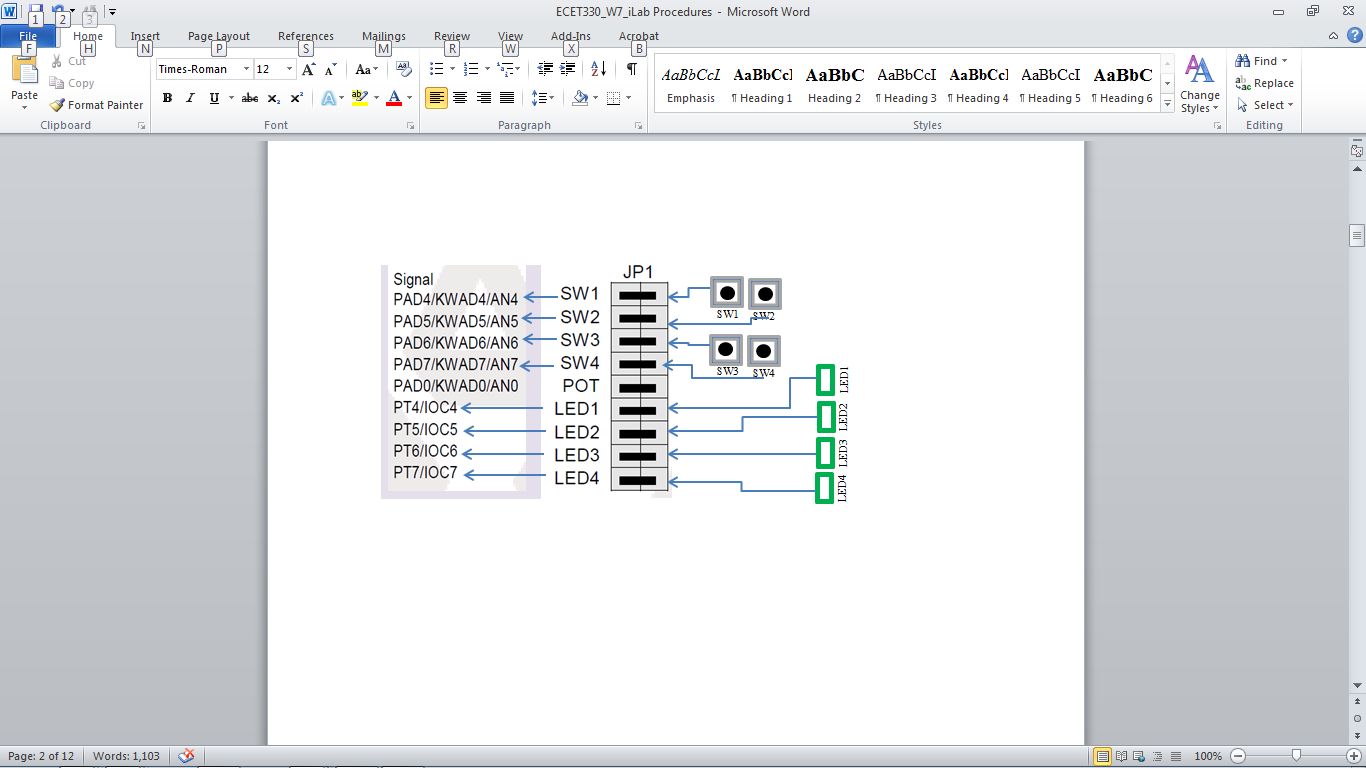
* TWR-S12G128 Processor Module
* Two Elevator Boards (one primary and one secondary)
* A USB cable
* A DB9 to IDC 2X5 Socket Header
* A CodeWarrior Development Studio for HC(S)12 Special Edition

**Tower LEDs**

The Tower Module has four green LEDs connected to Port T.The following figure shows the existence of jumpers JP1 between LEDs/pushbuttons and the pins of ports. Make sure that the jumpers are as shown. These four LEDs are connected to PT4-PT7 bits of Port T. You must define the direction of Port T as output port. The following instructions define PTT as an output port.

LDAA #$FF

STAA DDRT ; Define Port T as an output



Each LED is configured for active low operation. In other words, to turn the LED on, a 0 is sent to it.

ABSENTRY Entry ; Application entry point

INCLUDE 'derivative.inc'

ORG $2000

; Data is defined HERE

ORG $C000

Entry:

\_Startup:

LDAA #$FF

STAA DDRT ; Define Port T as an output

LDAA #$50

STAA PTT ; Turns LED4 and LED2 ON

Back BRA Back ; End of main

ORG $FFFE

DC.W Entry ; Reset Vector

## PROCEDURE

1. Set up the Tower Module and connect it to the PC. Read the Tower Tutorial in Doc Sharing.
2. Write a program to turn LED4 and LED1 ON. LED2 and LED3 must be OFF.
3. Cut and paste the source code.
4. Single step the code. After executing the line that sends the pattern to PTT, cut and paste the Memory Window showing the value of PTT. The Memory Address of PTT is $270. Right-click on Memory Window and select address. Type 270 in the address field.
5. Write a program to continuously turn all four green LEDs ON and OFF (toggle). There should be a one-second delay between each toggle.
6. Cut and paste the source code.
7. Show the delay calculation.
8. Run the program on the board by pressing the Reset button on the Tower. Describe the values of LEDs.
9. Write a program that displays values from 0 to 15 sequentially, with a 0.75-second delay in between each display. After the count value reaches 15 (i.e. all LEDs are ON), the program should stop.
10. Cut and paste the code.
11. Show the delay calculation.
12. Run the program on the board by pressing the Reset button on the Tower. Describe the values of LEDs.
13. Use BSET and BCLR instructions to TurnLED2 ON and OFF continuously with a 0.5-second delay between each change.
14. Cut and paste the source code.
15. Show the delay calculation.
16. Run the program on the board by pressing the Reset button on the Tower. Describe the values of LEDs.
17. Change the delay to 1ms and run the program. Describe the values of LEDs.